CREATIVE SELF-EFFICACY AND PERSONALITY: FROM IMAGINATION TO CREATIVITY

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

August 2018

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Blackmon, Kristen N. Creative Self-Efficacy and Personality: From Imagination to Creativity. Doctor of Philosophy (Educational Psychology), August 2018, 94 pp., 6 tables, 3 figures, references, 115 titles.

Imagination and creative self-efficacy are important components of the creative process and outcomes but are rarely investigated together. To explore the relationship between personality factors, imaginative thinking, and creative self-efficacy, survey responses were gathered from university students in a southwestern region in the United States (n = 1,731). Personality was measured using the International Personality Item Pool (IPIP), imagination was measured using the Imaginative Capability Scale (ICS), and creative self-efficacy was measured using items based on reliability in previous studies. Participants were asked to complete the three surveys along with demographic information through an online format. Confirmatory factor analysis (CFA) was conducted first to confirm measurements used. After fit indices confirmed measurement models used, subsequent analyses were conducted using structural equation modeling (SEM). The model of best fit supported creative self-efficacy as a strong predictor of all three factors of imagination. Additionally, the model indicated a strong relationship between conscientiousness and conceiving imagination as well as other notable relationships with personality factors.
ACKNOWLEDGEMENTS

UNT has been home for me, and in many ways, has seen me through my most transformative years. I could not ask for a more supportive alma mater. To my ‘EPSY’ family, my cubby buddies, my colleagues, and friends, I am so grateful for the humor, the conversations, and the friendships.

I’d like to extend special thanks to my dissertation committee. You supported me, you pushed me, and perhaps most importantly, you gave wings to my ideas. Dr. Amarie Carnett, you showed me a unique perspective and helped me visualize the possibilities in front of me. Dr. Darrell Hull, “go run the models again” changed the course of my career. You pushed me when I didn’t want to be pushed; I know why now, and I am a better researcher because of it. Dr. Anne Rinn, you’ve helped me find myself. Thank you for advocating for me (and teaching me how to do that for myself). Most of all, thank you for always leaving the door open and the countless hours of simply being there. Dr. Todd Kettler, your unshakeable faith in my capabilities set me on this path. Thank you for always believing in me. You’ve been my mentor and my friend, a voice of reason and inspiration, throughout this journey. Most importantly, thank you for showing me the power of an idea. I also want to extend a special thank you to my friends who graciously responded to, “I have a question” countless times throughout this process; you know who you are.

Finally, I would like to thank my family and friends for their support and encouragement in my endeavors; you keep me going. Above all else, I would like to extend a heartfelt thank you to a little girl who has patiently waited long enough. This is our moment, Kinsey. I love you to the moon.
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CREATIVE SELF-EFFICACY AND PERSONALITY: FROM IMAGINATION TO CREATIVITY

Creativity is the substance upon which an individual’s transformation from expert to creative producer is built (Olszewski-Kubilius, Subotnik, & Worrell, 2016); it has been linked to outstanding performance and achievement (Subotnik, Olszewski-Kubilius, & Worrell, 2011) and lifelong success (Hong & Ditzler, 2013; Plucker et al., 2004). Imagination and creativity drive innovation, and it is the imaginative individuals and the creative producers who usher in the great movements, advancements, and revolutions in our world (Liang, Hsu, Chang, & Lin, 2012; Renzulli, 2012). In 2016, Olszewski-Kubilius et al. re-examined and expanded their talent development model to emphasize creative eminence as the desired goal for talented individuals in the 21st century. They asserted that thinking, producing, and performing creatively have become critical as individuals face increasingly complex issues characteristic of the 21st century (Olszewski-Kubilius et al.). In 1977 and again in 2012, Renzulli stressed creativity as a crucial developmental skill in students and special education programs positing creative production as a baseline criterion for success as an adult. However, creativity cannot happen devoid of imagination (Lin & Tsau, 2012; Liu & Liang, 2014), and should be considered when investigating creativity. Decades later, Renzulli’s initial postulations carry as much weight, if not more, as they did 30 years ago – in a world rapidly evolving in automation, information, and technology, developing strong creativity skills can demarcate the extraordinary from the ordinary.

Guilford's legendary 1950 APA presidential address sparked interest in creativity as an important psychological construct, inducing research on creativity in psychology, organizations, and education (Plucker, 2000). As a result, studies in creativity vary broadly by topic and
construct. Some studies have focused on personality and the creative person (Feist, 1998; Mackinnon, 1965; Puryear, Kettler, & Rinn, 2017; Simonton, 2009); some have examined the creative process (Amabile, 1983; Kaufman & Beghetto, 2009; Torrance, 1970), with others looking at the creative product or performance (Amabile, 1983; Baer, Kaufman, & Gentile, 2004; Besemer & Treffinger, 1981; Hennessy & Amabile, 1999). However, limited research exists on imagination and its role in the creative process (Forgeard & Kaufman, 2016; Liang et al., 2012), and next to none exists regarding imagination and creative self-efficacy (Puente-Díaz & Cavazos-Arroyo, 2017). Further, imagination is often disregarded in educational settings because it is often perceived as a daydreamer’s distraction from what many teachers typically practice in the classroom—rote memorization (Beghetto, 2008). However, research has come a long way in recognizing the benefits and value of creativity (Plucker, Beghetto & Dow, 2004), the vital role personality plays in creativity (Feist, 1998, Puryear et al., 2017), and elucidating imagination as a measurable construct (Chang, Wang, Liang, & Liang, 2014; Liang, Chang, & Hsu, 2013; Liang & Lin, 2015).

While personality plays a significant role in creativity, self-efficacy may be more important in determining creative task engagement and production (Ford, 1996; Tierney & Farmer, 2002). Additionally, Puente-Díaz and Cavazos-Arroyo (2017) found a positive relationship between creative self-efficacy and reproductive and creative imagination. The link between self-efficacy, creativity, and imagination is important when considering the development of an individual’s creative skills. Thus, while personality factors may be more static, creativity and associated constructs, like creative self-efficacy (Beghetto, 2006; Karwowski, 2012; Tierney & Farmer, 2002) and imagination (Beghetto, 2008; Chang & Lin, 2013;
Karwowski & Soszynski, 2008) are malleable, and malleable constructs, as well as associated and desired outcomes, can be influenced and changed.

There is More to Being Creative than Being Creative

Creativity is “the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context” (Plucker et al., 2004, p. 90). Moreover, creativity is a personal pursuit, in most cases driven by personal interests and motivations and is most efficient when an individual (or group of individuals) works in an area where interest is peaked to the point of pursuit (Amabile & Pillemer, 2012). Creativity should be at its peak when an intrinsically motivated individual with expertise in a specific discipline finds himself or herself in an environment conducive to creativity (Amabile, 1983; 1996). However, that circumstance exists within ideal conditions – task engagement is not always certain, and while an individual may be highly creative, other factors may determine creative outcomes.

Creative self-beliefs (CSB) are convictions that individuals possess about their creative abilities (Karwowski & Lebuda, 2016). Creative self-beliefs provide insight into why, how, and what an individual creates. More importantly, creative self-beliefs can reveal why individuals do not create. Creative self-beliefs extend beyond practicality and provide insight into self-fulfillment (Karwowski & Kaufman, 2017). For example, research has investigated the role of creative self-beliefs as predictors of creative practice and achievement (Beghetto, 2006; Ivcevic & Nusbaum, 2017; Jaussi, Randel, & Dionne, 2007; Karwowski, 2011; Karwowski & Lebuda, 2016; Pretz & McCollum, 2014; Tierney & Farmer, 2002) as well as the mediating and
moderating effects that creative self-beliefs can have on the relationship between creative ability and creative practice or achievement (Karwowski & Lebuda, 2016; Tierney & Farmer, 2002). In short, an individual’s creative self-beliefs play a crucial role in creative talent trajectories, performances, and achievements. Further, an individual’s creative self-efficacy, a type of creative self-belief, can influence an individual’s choice to engage and produce or perform creatively.

Creative Self-Efficacy

Tierney and Farmer (2002) were among the first to develop a measurable construct for creative self-efficacy in the workplace while also field testing the influence of self-efficacy perceptions on employee creativity. Creative self-efficacy is an individual's belief in his or her own “ability to produce creative outcomes” (Tierney & Farmer, 2002, p. 1138). Results from the Tierney and Farmer study indicated that while elevated levels of creative self-efficacy predicted employees' likelihood to be creative in their work, this process was unique to the setting. They found that feedback from supervisors operated as a mediator in the relationship between creative self-efficacy and creative performance. These findings were also generalized to student populations, to show that the way in which an employee or a student viewed feedback as supportive or critical affected his or her creative outcomes.

Others have supported this conclusion—creative self-efficacy serves as a crucial component of creative task engagement and performance (Beghetto, 2006; Farmer & Tierney, 2017; Karwowski, 2012). In situational and environmental contexts, individuals must assess their capabilities to engage in and perform a creative task that activates creative self-efficacy
beliefs, and the level of these beliefs affects task engagement or task avoidance (Beghetto & Karwowski, 2017). The practical implication of these findings is that creative self-efficacy beliefs influence task engagement, perhaps even more than an individual’s creative personal identity (Karwowski, 2012). These beliefs are profoundly informed and significantly impacted by environmental factors such as climate and feedback from authority figures.

Creative self-efficacy, like general self-efficacy, is malleable, and gains in self-efficacy perceptions persist over time (Krueger & Dickson, 1994). For instance, environmental factors, such as teacher and supervisor feedback on creative ability, have been found to be positively related to student and employee creative self-efficacy (Beghetto, 2006; Tierney & Farmer, 2002), and it is possible that supportive work and learning environments bolster levels of creative self-efficacy (Chong & Ma, 2010; Farmer & Tierney, 2017; Jaussi et al., 2007; Karwowski, 2011; Tierney & Farmer, 2002). Additionally, positive relationships between levels of creative self-efficacy and performance may occur when supervisors and educators exhibit higher expectations for creative output from employees and students (Beghetto, 2006; Farmer & Tierney, 2017; Tierney & Farmer, 2002). Supportive climates and constructive feedback are essential in cultivating high levels of creative self-efficacy, and it is the way in which environmental factors influence creative self-efficacy that may influence individuals' creative outcomes the most.

Challenges, failures, and obstacles are inevitable when acting upon creative ideas. Creative self-efficacy plays a role in motivating and sustaining the individual in ongoing perseverance to reach one’s goal (Farmer & Tierney, 2017; Ivcevic & Nusbaum, 2017). Creative achievement and performance demand that individuals have courage, independent judgment,
and perseverance in creative achievement (Tierney & Farmer, 2002; Torrance, 1970). Creative self-efficacy beliefs enhance an individual’s persistence and facilitate the necessary coping skills when faced with challenges (Tierney & Farmer, 2002). An individual’s creative self-efficacy may be the difference in the birth or death of an idea, the source of motivation to try, or the deciding factor in one’s tenacity to press on in the creative process. Indeed, creative self-efficacy has been connected to motivational beliefs held by students (Beghetto, 2006), and has been marked a “key determinant of creative outcomes” (Hass, Katz-Buonincontro, & Reiter-Palmon, 2016, p. 438). Emphasizing research and the development of skills toward creative self-efficacy is warranted and a much-needed shift within creativity research.

Personality

The relationship between personality, creativity, and creative self-beliefs has been widely investigated (Amabile & Pillemer, 2012; Feist, 1998; Karwowski & Lebuda, 2016; Karwowski, Lebuda, Wisniewska, & Gralewski, 2013; Puryear et al., 2017; Silvia, Nusbaum, Berg, Martin, & O’Connor, 2009), and research has often emphasized the uniqueness of creative individuals (Feist, 1998; Puryear et al., 2017). Less commonly found in personality and creativity research are studies using a higher-order general personality factor (Musek, 2007), and the “Huge Two,” which are higher-order factors, or meta-traits, of the Big Five personality factors (Digman, 1997). The general factor of personality is associated with overall well-being, life satisfaction, self-esteem, motivation, and social likeability (Musek, 2007). In personality, it operates similarly to Spearman’s g in intelligence. The Huge Two comprise two meta-traits: plasticity (openness to experience and extraversion) and stability (agreeableness,
conscientiousness, and emotional stability, or the reverse of neuroticism (DeYoung, 2006; Silvia et al., 2009). Plasticity reflects an individual's inclination to engage in exploration and flexible thinking while stability reflects an individual's inclination to avoid emotional, social, and motivational disruptions (DeYoung, 2006; Silvia et al., 2009). Higher-order factors of personality—plasticity and stability—"subsume the five factors" and can be used to "predict outcomes associated with behavioral variability, impulsiveness, and control" (Silvia et al., 2009, p. 1087).

Plasticity traits. Openness to experience is often found to be more closely related to creativity than any other personality trait (Hennessy & Amabile, 2010; Karwowski & Lebuda, 2016; Sawyer, 2012; Silvia et al., 2009), with extraversion being closely related as well (Feist, 1998; Karwowski et al., 2013; Puryear et al., 2017; Silvia et al., 2009). Additionally, people who are open to experiences tend to exhibit higher divergent thinking skills and creative achievement (Batey, Chamorro-Premuzic, & Furnham, 2009; Plucker, 1999; Sternberg & Lubart, 1996). Further, Silvia et al. (2009) found that plasticity (mostly openness to experience with extraversion having small effects) predicted everyday creativity, creative achievement, and creative self-concept while stability had opposing effects on creative achievement and everyday creativity. Openness to experience (Farmer & Tierney, 2017) and plasticity (Karwowski & Lebuda, 2016) have also been positively linked to higher levels of creative self-efficacy. Because plasticity has consistently been associated with creative self-beliefs, identities, and production (Feist, 1998; Karwowski & Lebuda, 2016; Silvia et al., 2009), the present study considers the association between plasticity, creative self-efficacy, and imagination.
Imagination

Vygotsky (2004) asserted that imagination is an “important component of absolutely all aspects of cultural life, enabling artistic, scientific, and technical creation alike” (p. 9). Imagination, he stated, serves as a “basis of all creative activity” (p. 9). In a recent literature review, Forgeard and Kaufman (2016) revealed nine themes among the explicit reasons provided by researchers studying imagination, innovation, and creativity: (a) job satisfaction, (b) business, economics, and productivity, (c) education, (d) individual achievement and performance, (e) social, political, and historical progress, (f) health and well-being, (g) problem-solving and cognition, (h) communication, collaboration, and interpersonal skills, and (i) intrinsic value. Liu and Noppe-Brandon (2009) posited that imagination is required for any conceptual breakthrough and developing imagination is important for the promising future of society. However, despite the unifying claim of imagination as an important construct, and a necessary component of the creative process, it is often an unwelcome guest in the classroom (Fettes, 2013).

Imagination has been defined as a higher mental function, the ability to conceive the inconceivable (Liang & Chia, 2014; Liang et al., 2013), and the ability to invoke and create new realities and possibilities (Liu & Noppe-Brandon, 2009). Liang and Chia (2014) posited that imagination is composed of three factors: initiation, conception, and transformation. Initiating imagination occurs when individuals “explore the unknown and productively originate novel ideas” (Liang & Chia, p. 111). Conceiving imagination is “mentally grasp[ing] the core of a phenomenon using personal intuition and sensibility, and the capability to formulate effective ideas for achieving a goal through concentration and logical dialectics” (p. 111). Transforming
imagination means “crystalliz[ing] abstract ideas and reproducing mental images from less accurate recollections of reality, across different domains and in various situations” (p. 112). In short, initiation imagination creates new possibilities, conceiving imagination forms goal-oriented ideas by using intuition, and transforming imagination makes new connections by recreating mental images using vague and sometimes unrelated memories (Liang & Chia, 2014).

Theoretical Framework

This exploratory investigation of creative self-efficacy, personality, and imagination is framed under the guidance of two theories: Amabile’s componential theory of creativity (1983, 1996) and Bandura’s social cognitive theory (1989, 1997). Amabile’s componential theory provides a basis for the creative process by accounting for intrinsic and extrinsic factors that impede or facilitate creative behaviors. Bandura’s social cognitive theory provides a foundation for social factors and, more specifically, one of the main constructs under investigation in this study: creative self-efficacy.

The componential theory of creativity is comprised three intra-individual components: (a) domain-specific skills, such as technical skills, talents, and expertise, (b) creative characteristics, such as personality traits, flexible thinking styles, and persistence, and (c) intrinsic task motivation, or an individual’s motivation from within. Amabile (1983) also considers the influence of one’s social and environmental factors and how they inhibit or elicit creative thinking and behaviors. These factors can then influence the three intra-individual components with intrinsic task motivation being more commonly influenced by the environment (Amabile & Pillemmer, 2012).
Amabile’s (1983) theory also considers creativity as a stage-like process, although she acknowledges that the process serves as an artifice and points out that real-life creative processes are much messier. The sequence has five stages: (a) problem or task identification, where the individual sees the need to solve a problem or take on a new task, (b) preparation, in which the individual enlists his or her domain-specific skills to gather information or acquire skills relevant to stage one, (c) response generation, where the individual responds or posits solutions, (d) response validation, or the individual’s reliance on his or her domain-specific skills to evaluate whether generated responses are novel or useful, and finally (e) outcome, where the individual communicates his or her response and the outcome is evaluated. The outcome of the process (success or failure) determines whether the individual re-enters the process at stage one (Amabile & Pillemer, 2012). The componential theory of creativity accounts for empirically supported phenomena in creativity research by acknowledging the influence of an individual’s talent, education, cognition, personal interests, personality, and motivation (Amabile, 1988).

According to social cognitive theory, people are guided by their perceived self-efficacy beliefs in their capabilities to perform given tasks (Bandura, 1997). Exerting this type of assessment and control leads to the development of agency which Bandura (1997) describes as the intentional actions individuals pursue. Perceived self-efficacy beliefs are crucial determinants of agency (Bandura, 1997).

Social cognitive theory provides insight for predicting behaviors through a process called triadic reciprocal causation, or the idea that future behaviors from an individual’s agency derive from three interrelated factors (Bandura, 1989). These are environmental, behavioral, and
internal factors, such as cognitive, affective, and biological factors. Social cognitive theory states that an individual's agency (the ability to choose and plan and the motivation and ability to regulate the execution of those plans) is influenced by three environments: (a) imposed, (b) selected, and (c) constructed (Bandura, 2006). An imposed environment is one in which individuals find themselves by no choice of their own. The selected environment comes when the individual chooses to activate potential within the environment. The constructed environment is that which is shaped to exert more control over one’s life (Bandura, 1989). Self-efficacy under the social cognitive theory addresses the birthing of self-efficacy beliefs, their varied effects, and how they operate. It also addresses the mechanism by which self-efficacy beliefs are developed and appointed for personal and social change (Bandura, 1997, 2012). Applying Bandura’s social cognitive theory to creativity research implies that creativity, creative thinking, and the practice and production of creativity are shaped through events and environmental factors; if nurtured, the agent can exert influence over his or her own creative capacity and thus, creative output.

Research Questions

The present study investigated imagination by utilizing the imaginative capability scale developed by Liang et al (2012). Another aim of this study was to explore the connection between imagination and creative self-efficacy, as well as mutual interactions between the constructs of imagination, creative self-efficacy, and personality. This study also considered research supporting the huge two – higher-order factors of the Big Five that group together to form the meta-factors plasticity and stability – to investigate relationships between personality,
creative self-efficacy, and imagination (Karwowski & Lebuda, 2016; Silvia et al., 2009). Finally, this study explored the possibility of moderation effects between plasticity, creative self-efficacy, and imagination (Bandura, 2012; Farmer & Tierney, 2017; Tierney & Farmer, 2002).

The following research questions and hypotheses guided this study:

1. What is the magnitude and direction of the effect for each factor of imagination on creative self-efficacy?
   - Hypothesis 1: Creative self-efficacy will predict conceiving imagination.
   - Hypothesis 2: Creative self-efficacy will predict initiating imagination.
   - Hypothesis 3: Transforming imagination will predict creative self-efficacy.

2. What is the magnitude of the effect of personality on imagination?
   - Hypothesis 4: Plasticity (openness to experience and extraversion) will have a positive relationship with initiating imagination.

3. What is the magnitude of the effect of personality on creative self-efficacy?
   - Hypothesis 5: Plasticity (openness to experience and extraversion) will have a positive relationship with creative self-efficacy.

4. Does plasticity serve as a moderator in the relationship between the three constructs of imagination and creative self-efficacy?
   - Hypothesis 6: Plasticity (openness to experience and extraversion) will moderate the relationship between conceiving and initiating imagination and creative self-efficacy.

Method

Participants

Participants were recruited through convenience sampling from a large public university in the southwestern region of the United States. Recruitment was sent through email via the university student listserv and each participant could enter a drawing for one of two $20
Amazon gift cards upon completion of the survey. The total number of participants was 1,731
(n = 1,731; 66% females and 34% males). Participants ranged in age from 18 to 49, with the
average age being 25 years (SD = .181). 57.3% identified as Caucasian or White, 17.2% as
Hispanic or Latino, 9.1% as Asian, 9% identified as two or more races, 6.6% as African American
or Black, <1% as American Indian or Alaska Native, and <1% as Native Hawaiian or other Pacific
Islander.

Instruments

Participant responses were collected through an online questionnaire which included
demographic questions such as age, sex, and major as well as questions from each of the
instruments listed below.

*Personality IPIP Instrument*

Personality was measured using the 50-item personality inventory from the IPIP
(International Personality Item Pool) based on the NEO-PI (Costa & McCrae, 1995). This
Personality Inventory contained five positively keyed and five negatively keyed items for each
of the Big Five. Negatively keyed items were reverse coded. As indicated by prior studies
(Goldberg, 1992; Gow, Whiteman, Pattie, & Deary, 2005), reliability was supported in this study
as indicated by Cronbach’s alpha for each subscale: neuroticism, (α = .87); extraversion, (α =
.82); openness to experience, (α = .84); agreeableness, (α = .82); conscientiousness, (α = .79).
These personality constructs were used to form the personality meta-factors, plasticity and
stability (Silvia et al., 2009).
Creative Self-Efficacy Scale

Items measuring creative self-efficacy were reproduced from the Tierney and Farmer (2002) study. Tierney and Farmer constructed three creative self-efficacy items based upon Amabile’s position that general creativity skills lead to creativity. Items on the Tierney and Farmer scale demonstrated good internal consistency in their 2002 study (α > .77). Subsequent studies have used and/or adapted the three items used in the Tierney and Farmer study and have reported good internal consistency as well (α = .86, Beghetto, 2006; α > .86, Hass et al., 2016; α = .78; Karwowski, 2011). Creative self-efficacy was measured through a 7-point Likert scale ranging from 1 (very strongly disagree) to 7 (very strongly agree). Following Tierney and Farmer’s example, the three items measuring creative self-efficacy were used in this investigation with no alterations to the phrasing. Participants were instructed to respond to generally worded items in terms of their current, primary role at work or school. The Cronbach’s alpha for creative self-efficacy in this study supported reliability (α = .78). Sample questions included: “I have a lot of good ideas” and “I have confidence in my ability to solve problems carefully.”

Imaginative Capability Scale

Imagination was measured using the Imaginative Capability Scale (Chang et al., 2014; Liang & Chia, 2014). The Imaginative Capability Scale measures the construct of imagination using a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree) and comprising 29 items. Previous studies using this scale supported reliability under the three-factor structure: initiating imagination (α = .92); conceiving imagination (α = .88); and
transforming imagination (α = .90; Chang et al., 2014; Liang & Chia, 2014). In this study, Cronbach’s alpha for each of the three factors supported reliability: initiating imagination (α = .90); conceiving imagination (α = .85); and transforming imagination (α = .87). Initiating imagination items included characteristics such as novelty, productivity, and exploration. Conceiving imagination included items pertaining to sensibility, intuition, concentration, effectiveness, and dialectics, and transformation imagination included items attributed to crystallization, or experiential learning and the transformation of those experiences or knowledge (Liang & Chia, 2014).

Procedures

Data Collection Procedures

Participant responses were collected using Qualtrics, an online survey tool. Participants were informed that their responses were anonymous and provided informed consent using agree/disagree radio buttons at the beginning of the survey. Participants not providing consent were navigated away from the survey. Participants were also informed of the approximate time commitment before beginning the survey and were not permitted to continue to the next section until completing each question in preceding sections. Based on previous pilot administrations, the approximate time commitment for the survey was 20 minutes, and the average length of time participants took to complete the survey averaged 26 minutes (SD = 5.02) for the participants. After providing consent, participants answered seven demographic questions before responding to personality items, creative self-efficacy items, and imagination items. Because research studies have found demographic effects, such as small gender effects
(Karwowski et al., 2013), demographic questions of age, race/ethnicity, sex, and discipline of study were included. Participants were reminded that responses were anonymous and were asked to answer honestly and as they currently viewed themselves, not how they wished to be in the future.

**Analytic Approach**

This investigation used hypothesis testing to confirm the proposed theoretical model that fits the sample data. Therefore, data were analyzed by first confirming each measurement model used in this study, and contingent upon good fit, by using structural equation modeling (SEM; Schumaker & Lomax, 2010). Because SEM can encounter multiple issues when using an extensive number of indicators for latent variables, parcels were created (Little, Cunningham, & Shahar, 2002).

**Table 1**

*Full Measurement Model of Factors: Ms, SDs, Factor Loadings, and Error Variances*

<table>
<thead>
<tr>
<th>Factors/Item Parcels</th>
<th>M</th>
<th>SD</th>
<th>Standard Coefficient</th>
<th>Error Variance</th>
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<tr>
<td><strong>Neuroticism</strong></td>
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<tr>
<td>Parcel 1</td>
<td>2.87</td>
<td>.959</td>
<td>0.908</td>
<td>0.009</td>
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<tr>
<td>Parcel 2</td>
<td>2.53</td>
<td>1.03</td>
<td>0.818</td>
<td>0.011</td>
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<tr>
<td>Parcel 3</td>
<td>2.86</td>
<td>.883</td>
<td>0.772</td>
<td>0.012</td>
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<td><strong>Conscientiousness</strong></td>
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<td>0.932</td>
<td>0.007</td>
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<tr>
<td>Parcel 2</td>
<td>3.77</td>
<td>.749</td>
<td>0.817</td>
<td>0.011</td>
</tr>
<tr>
<td>Parcel 3</td>
<td>3.29</td>
<td>.924</td>
<td>0.826</td>
<td>0.010</td>
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*(table continues)*
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<th>Factors/Item Parcels</th>
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<th>SD</th>
<th>Standard Coefficient</th>
<th>Error Variance</th>
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<td><strong>Agreeableness</strong></td>
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<td>Parcel 1</td>
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<td>Parcel 2</td>
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<td>Parcel 3</td>
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<tr>
<td>Parcel 2</td>
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<tr>
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<td>.933</td>
<td>0.876</td>
<td>0.009</td>
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<tr>
<td>Parcel 2</td>
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<td>Parcel 3</td>
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<td>0.008</td>
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<tr>
<td>Parcel 2</td>
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<td>0.012</td>
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<tr>
<td>Parcel 3</td>
<td>4.50</td>
<td>.776</td>
<td>0.868</td>
<td>0.010</td>
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<td><strong>Transforming Imagination</strong></td>
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<td></td>
</tr>
<tr>
<td>Parcel 1</td>
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<td>.896</td>
<td>0.673</td>
<td>0.020</td>
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<tr>
<td>Parcel 2</td>
<td>4.54</td>
<td>.953</td>
<td>0.767</td>
<td>0.015</td>
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<tr>
<td>Parcel 3</td>
<td>4.76</td>
<td>.879</td>
<td>0.736</td>
<td>0.017</td>
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<tr>
<td>Parcel 4</td>
<td>4.58</td>
<td>.910</td>
<td>0.805</td>
<td>0.013</td>
</tr>
</tbody>
</table>

The creation of parcels helps to improve reliability. Item-level data can be unreliable as participant responses to survey items can be unstable (Kline, 2011; Little et al., 2002); therefore, by focusing on aggregate-level data, issues such as a high number of indicators and
response biases, can be reduced when evaluating possible relationships between constructs. Moreover, parceling items increases parsimony and decreases loading error and sampling error (Little et al., 2002). Parcels were created following the recommendations of Little et al. (2002).

Parcels for each subscale of personality were created through random assignment as well as combining positively worded items and negatively worded, or reverse coded items, within each parcel. Each factor of personality contained three parcels (two parcels were composed of three items and one parcel was composed of four items). The same procedures were followed for creating parcels for the Imaginative Capability Scale; however, this scale only contained positively worded items. Initiating Imagination contained three parcels with three items each, Conceiving Imagination contained three parcels with four items each, and Transforming Imagination contained four parcels with two items each. Standard coefficients and descriptive information for parcels can be found in Table 1. No parcels were created for the creative self-efficacy scale as it contains three items. Parceled items were used in the subsequent confirmatory factor analyses as well as in structural equation modeling.

SEM elaborates upon possible latent variable relationships by including measurement and structural models and extends multiple regression by allowing simultaneous estimation of various regression models (Kline, 2011; Lei & Wu, 2007; Schreiber et al., 2006). Additionally, SEM permits testing of theoretical ideas regarding theoretical links between constructs and the direction of significant relationships and is recommended as a suggested practice in educational research as it allows latent variables to covary (Kline, 2011; Schreiber et al., 2006). Because model fit indices are susceptible to bias, best practice indicates using a selection of fit indices when making decisions pertaining to model fit in SEM models (Kline, 2011; Schumaker & Lomax, 2010).
Model fit indices used in this study were root mean square error approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square residual (SRMR). Chi square, Akaike’s information criterion (AIC), and Bayesian information criterion (BIC) were used to make comparisons between models and support decisions made regarding which model should be retained (Muthén & Muthén, 2012). To examine construct relationships addressed in research questions one and two, standardized coefficients were used (Kline, 2011; Schumaker & Lomax, 2010). Data were analyzed using SPSS (Version 25.0) and MPlus (Muthén & Muthén, 2012).

Results

Participant responses were downloaded from Qualtrics and evaluated for missing data. Due to forced item response, there were no missing data. However, survey responses were evaluated for erroneous entries (i.e. answering with all ones or all fives) and removed before analyses. The final sample analyzed was 1,661 (n = 1,661). Data met normality assumptions.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) with maximum likelihood estimation with robust standard errors (MLR) was conducted to test the validity of the factor structure for each of the three measurement models (personality, creative self-efficacy, and imagination). RMSEA with 95% confidence intervals, CFI/TLI, AIC/BIC, and SRMR indicators were used to examine model fit. Fit indices were evaluated based on the following recommendations: CFI and TLI ≥ .95, SRMR ≤ .08, and RMSEA ≤ .05 (Hu & Bentler, 1999; Kline, 2011). Because large samples can produce statistically significant Chi-square results even when effect sizes are inconsequential,
Chi-square was used more as a supplementary measure as recommended by Kline (2011). AIC and BIC were used as evaluative measures as well. Regarding personality, when using the meta-factors plasticity and stability, the model failed to converge. However, when using the five-factor structure, the model indicated good fit ($\chi^2 = 731.228$, $df = 80$, $p < 0.001$, RMSEA = 0.070 (0.065 – 0.075), SRMR = 0.061, CFI = 0.948, TLI = 0.931, AIC = 47459.410, BIC = 47757.245).

When conducting the CFA for creative self-efficacy alone, the model was just identified, meaning there were just as many knowns as unknowns in the model (Muthén & Muthén, 2012). This could be due to the low number of total items; therefore, a CFA could not be conducted on creative self-efficacy measures. The CFA for Imagination also indicated good fit ($\chi^2 = 221.604$, $df = 32$, $p < 0.001$, RMSEA = 0.060 (0.052 – 0.067), SRMR = 0.025, CFI = 0.977, TLI = 0.967, AIC = 31047.263, BIC = 31225.963). A final CFA was conducted with all three measurement models together which confirmed good fit ($\chi^2 = 1502.031$, $df = 263$, $p < 0.001$, RMSEA = 0.053 (0.051 – 0.056), SRMR = 0.061, CFI = 0.949, TLI = 0.936, AIC = 82679.482, BIC = 83296.812). Results from each of the CFAs can be found in Table 2, and measurement models can be found in Figure 1 (personality) and Figure 2 (imagination).

Table 2

Goodness of Fit Indices of Measurement Models of the Observed Variables

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>$df$</th>
<th>$\chi^2/df$</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
<th>SRMR</th>
<th>AIC</th>
<th>BIC</th>
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</thead>
<tbody>
<tr>
<td>Personality</td>
<td>731.228</td>
<td>.00</td>
<td>80</td>
<td>9.14</td>
<td>0.070</td>
<td>0.948</td>
<td>0.931</td>
<td>0.061</td>
<td>47459.410</td>
<td>47757.245</td>
</tr>
<tr>
<td>Imagination</td>
<td>221.604</td>
<td>.00</td>
<td>32</td>
<td>6.93</td>
<td>0.060</td>
<td>0.977</td>
<td>0.967</td>
<td>0.025</td>
<td>31047.263</td>
<td>31225.963</td>
</tr>
<tr>
<td>All Three</td>
<td>1502.031</td>
<td>.00</td>
<td>263</td>
<td>5.71</td>
<td>0.053</td>
<td>0.949</td>
<td>0.936</td>
<td>0.061</td>
<td>82679.482</td>
<td>83296.812</td>
</tr>
</tbody>
</table>

Note. $p < .05$ for $\Delta \chi^2$. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker Lewis index; SRMR = standardized root mean square residual; AIC = Akaike's information criterion; BIC = Bayesian information criterion.
Figure 1. The results of the confirmatory factor analysis for the five-factor model of personality. N1, N2, N3, C1, A1, E1, O1... = item parcels.

Figure 2. The results of the confirmatory factor analysis for the three-factor model of imagination. I1, I2, I3, C1, T1... = item parcels.

Model Testing

Following the confirmation of factors used in the measurement models, structural models were assembled and tested using maximum likelihood with robust standard error (MLR) in MPlus (Muthén & Muthén, 2012). The structural models were formulated according to the five-factor model of personality (McCrae & Costa, 1987) because the model failed to converge
using the two higher-order factors of stability and plasticity initially proposed in this study. Additionally, a structural model was formulated and explored using a general factor of personality (GFP; Rushton & Irwing, 2008). Fit indices used included RMSEA with 95% confidence intervals, CFI/TLI, AIC/BIC, and SRMR.

This study used structural equation modeling to explore the magnitude and direction of possible relationships between creative self-efficacy, personality, and imagination. Models were formulated based on previous studies (Chang et al., 2014; Karwowski et al., 2013; Karwowski & Lebuda, 2016; Liang et al., 2013; Liang & Lin, 2015; Musek, 2007; Puente-Díaz & Cavazos-Arroyo, 2017; Silvia et al., 2009) and iteratively tested or conducted by evaluating components separately before adding the next piece. This process led to Model 5 which indicated the best overall fit (see Table 3). Iterative models used were Model 1, Model 2, and Model 3. Model 1 estimated the effects of the Big Five personality factors on creative self-efficacy, initiating and conceiving imagination on creative self-efficacy, and creative self-efficacy on transforming imagination. Model 2 differed in that it estimated the effects of the three factors of imagination on creative self-efficacy and the Big Five personality factors on creative self-efficacy. Both models produced good fit (see Table 3). Model 3 estimated the effects of the three factors of imagination on creative self-efficacy and estimated the Big Five factors based on findings from studies examining the Huge Two (Karwowski & Lebuda, 2016; Silvia et al., 2009). Extraversion and openness to experience (plasticity related factors) were estimated on creative self-efficacy, transforming imagination, and initiating imagination while stability related factors (conscientiousness, neuroticism, and agreeableness) were estimated on creative self-efficacy, transforming imagination, and conceiving imagination.
Table 3

*Goodness of Fit Indices for Competing Structural Model of the Latent Variables*

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>$df$</th>
<th>$\chi^2/df$</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
<th>SRMR</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2093.185</td>
<td>.00</td>
<td>321</td>
<td>6.52</td>
<td>0.058</td>
<td>0.929</td>
<td>0.916</td>
<td>0.062</td>
<td>91703.263</td>
<td>92315.178</td>
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<tr>
<td>2</td>
<td>1696.804</td>
<td>.00</td>
<td>314</td>
<td>5.40</td>
<td>0.051</td>
<td>0.945</td>
<td>0.933</td>
<td>0.059</td>
<td>91265.050</td>
<td>91914.871</td>
</tr>
<tr>
<td>3</td>
<td>2130.986</td>
<td>.00</td>
<td>322</td>
<td>6.62</td>
<td>0.058</td>
<td>0.928</td>
<td>0.915</td>
<td>0.063</td>
<td>91748.490</td>
<td>92354.989</td>
</tr>
<tr>
<td>4</td>
<td>2283.567</td>
<td>.00</td>
<td>335</td>
<td>6.82</td>
<td>0.059</td>
<td>0.922</td>
<td>0.912</td>
<td>0.10</td>
<td>91880.654</td>
<td>92416.756</td>
</tr>
<tr>
<td>5</td>
<td>2074.199</td>
<td>.00</td>
<td>317</td>
<td>6.54</td>
<td>0.058</td>
<td>0.930</td>
<td>0.916</td>
<td>0.062</td>
<td>91693.800</td>
<td>92327.376</td>
</tr>
</tbody>
</table>

*Note.* $p < .05$ for $\Delta \chi^2$. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker Lewis index; SRMR = standardized root mean square residual; AIC = Akaike’s information criterion; BIC = Bayesian information criterion.
Model 3 indicated good fit as well (see Table 3). Model 4 tested the effects of the three factors of imagination on creative self-efficacy and a general personality factor on creative self-efficacy (still allowing the Big Five to correlate). This model also supported good fit (see Table 3). Model 5 estimated the effects of conceiving imagination on creative self-efficacy, initiating imagination on creative self-efficacy, creative self-efficacy on transforming imagination, and the Big Five factors on creative self-efficacy and conceiving, initiating, and transforming imagination. After comparing all five models, the final decision between Model 4 and Model 5 was guided by the theoretical importance of the five-factor model. For this investigation, it was determined that the five-factor model provided more nuanced information regarding predictors and associated relationships (Rushton & Irwing, 2008). Model 5 demonstrated the best overall fit in comparison to the other models while also allowing examination of a greater number of theoretical relationships (see Figure 3; \( \chi^2 = 2074.199, \text{df} = 317, p < 0.001, \text{RMSEA} = 0.058 (0.055 - 0.060), \text{SRMR} = 0.062, \text{CFI} = 0.930, \text{TLI} = 0.916, \text{AIC} = 91693.800, \text{BIC} = 92327.376 \)). For example, instead of only estimating global personality on creative self-efficacy as in Model 4, or extraversion and openness to experience on initiating imagination as in Model 2, Model 5 estimated paths between all latent variables in the analysis while maintaining good overall fit. In other words, Model 5 permitted a closer look at each theoretical relationship in the model.

The results from the structural model partially supported the hypotheses regarding the relationship between imagination, creative self-efficacy, and personality factors. Hypotheses one and two were tested in the initial model; however, the final model had better fit when creative self-efficacy positively predicted conceiving imagination, as indicated by the standardized coefficient in the path model (.854; see Figure 3) and initiating imagination (.896).
Figure 3. Results from the structural model 1 of the relationship between the 'Big Five' personality factors, creative self-efficacy, and three-factor structure of imagination. All * paths are significant at the $p < .001$ level.
This indicated that as individuals increased in creative self-efficacy, their initiating and conceiving imaginative thinking also increased. That is, individuals with higher creative self-efficacy have an increased ability to develop original ideas and use their intuition and sensibility to develop active, goal-oriented plans. Hypothesis three was also supported; creative self-efficacy was predicted by transforming imagination (.867). Transforming imagination, or the ability to connect seemingly unrelated concepts by forming mental images, predicted higher levels of creative self-efficacy. Hypotheses four and five were not supported in this study since the model failed to converge with plasticity and stability. These hypotheses were alternatively tested by examining the relationships between the Big Five personality factors, creative self-efficacy, and the three-factor model of imagination.

When looking at the Big Five personality factors in this study, the data showed that extraversion was significantly related to creative self-efficacy (.651) and negatively related to conceiving imagination (-.256). This could be related to an extraverted individual's need to interact with others. Individuals who scored higher on extraversion may place themselves in positions where they receive feedback (positive or negative), which may affect their creative self-efficacy. As a result, extraverted individuals may rely more on feedback and interactions with others than they than they do with their own personal intuition and senses – characteristics associated with conceiving imagination. Conscientiousness had one of the strongest direct effects in the model with conceiving imagination (.649), while openness to experience was negatively related to conceiving imagination (-.238). Conscientious individuals are careful thinkers and have characteristics associated with conceiving imagination. Therefore, it is reasonable that a negative relationship between conscientiousness and unique idea
generation, or initiating imagination, would exist (-.411). Neuroticism had a significant positive
effect on initiating imagination (.503) and a significant negative effect on creative self-efficacy (-
.815). Neuroticism is generally thought of as the opposite of emotional stability, so, as
individuals are characterized by higher levels of neuroticism, their creative self-efficacy
decreases. Factor loadings for these relationships can be found in Figure 3.

The final hypothesis posited that plasticity would moderate the relationship between
conceiving and initiating imagination and creative self-efficacy. Because the model failed to
converge using plasticity, we were unable to determine whether the hypothesis was supported.
An alternative hypothesis was tested using the two personality traits that form plasticity,
openness to experience and extraversion. This alternative hypothesis evaluated the effects of
moderation using openness to experience and extraversion. No moderation effects were found.

Discussion

Creative Self-Efficacy as a Predictive Factor of Imagination

Evidence supports the relationship between creativity and imagination (Liang & Lin,
2015; Liang, et al., 2013; Puente-Díaz & Cavazos-Arroyo, 2017), as well as the relationship
between self-efficacy and imagination (Hsu et al., 2015; Yeuh, Chang, & Liang, 2013). Puente-
Díaz & Cavazos-Arroyo (2017) found that creative self-efficacy was a positive predictor of the
two-factor model of imagination, reproductive imagination and creative imagination. In this
study, creative self-efficacy was a strong predictor of the three-factor model of imagination,
initiating, conceiving, and transforming imaginative capabilities. However, it is possible that
while individuals may exhibit elevated levels of creative self-efficacy, they may not actually
exhibit matching levels of creative ability. In other words, individuals may have an inflated perception of how creative they are as compared to their actual creative ability or quality of creative output. Although that relationship is supported in this study, it evaluates these relationships in the absence of a creative ability measure. Therefore, this estimation is limited in its suppositions in this regard. However, the supporting link between creativity and imagination in this study as well as other studies (imagination as a conduit process of creativity) provides a crucial context for this process and associated outcomes – creative self-beliefs, particularly those involving creative self-efficacy, are important predictors for imaginative thinking.

Multiple studies support creative self-efficacy and imagination as a malleable construct, or skills that can be developed (Beghetto, 2008; Dziedziewicz, Oledzka, & Karwowski, 2014; Karwowski & Soszynski, 2008; Tierney & Farmer, 2002; Zivkovic et al., 2015). More specifically, creative self-efficacy is influenced by supervisor feedback (Tierney & Farmer, 2002) and teacher feedback (Beghetto, 2006) and can be increased through trainings (Byrge & Tang, 2015). Moreover, students with higher levels of creative self-efficacy also displayed positive beliefs regarding their academic abilities. They were also more likely to indicate plans to attend college and exhibited higher rates of participation in after-school programs (Beghetto, 2006). Byrge and Tang (2015) also found that creative production increased as creative self-efficacy increased. In short, creative self-efficacy and imagination in multiple populations and environments can be developed, and the development of these beliefs and skills can lead to increased creative and academic outcomes (Chang & Lin, 2013; Hsu et al., 2014). Future investigations should examine creative self-efficacy, imagination, and measured creative outcomes together.
The Effects of Personality

Personality traits are tricky to unravel. While the findings from this study mostly coincided with the findings from other studies, there was some deviation from trends in the literature. This could be a side effect of an ongoing creativity debate: Is creativity domain-specific, or is creativity a general construct? It stands to reason that as this debate surrounds creativity, it would also surround creative self-efficacy and imaginative thinking as these constructs are highly related. Personality traits, as they vary by domain or discipline in their relation to creativity and imaginative thinking, have been supported (Chang et al., 2014; Feist, 1998; Liang et al., 2013; Liao et al., 2014; Lin, Chang, & Liang, 2015; Yeuh et al., 2013). For instance, agreeableness was related to conceiving and transformation imagination in design students (Chang et al., 2014) but did not predict any of the three factors for science students (Lin et al., 2015). Future studies should examine creativity and imagination in the context of domain variability further.

Substantial relationships between the big five personality traits and imaginative thinking have been supported (Chang et al., 2014; Liang & Lin, 2015; Liao, Chang, Lin, & Liang, 2014). Some studies have shown openness to experience to be the highest predictor for each of the three factors of imagination: conceiving, initiating, and transforming imagination (Chang et al., 2014; Liu & Liang, 2014). Following Feist’s (1998) review, openness to experience typically exhibits a strong relationship with imaginative thinking and artistic creativity. Openness to experience, while not the highest predictor in this study, was positively related to initiating imagination, which involves novel thinking and the development of original ideas. In this study conscientiousness was the highest predictor of conceiving imagination. This finding coincides
with the findings from the Liang and Lin (2015) study, in which they posit that the positive relationship between conscientiousness and conceiving imagination could lie in characteristics unique to conceiving imagination and characteristics exhibited by individuals scoring high in conscientiousness. Conceiving imagination involves intuition and sensibility, especially when conceiving imagination requires careful thought and planning actions to acquire a goal.

Conscientiousness and conceiving imagination are related to task performance (Liang & Lin, 2015). Additionally, conscientiousness has been linked to scientific creativity which involves reflection, intuition, and the ability to think through situations carefully (Feist, 1998). These characteristics are similar to conceiving imagination. When conducting studies regarding creative individuals and creative self-efficacy and/or imagination personality factors should be considered.

The presence of a general factor of personality, the Huge Two, or plasticity and stability, as higher-order factors of the Big Five personality factors has been supported by some (DeYoung, 2006; Digman, 1997; Karwowski & Lebuda, 2016; Rushton & Irwing, 2008; Silvia et al., 2009), but contested by others (Ashton, Lee, Goldberg, & de Vries, 2009; Costa & McCrae, 1995). This study found no evidence of the Huge Two higher-order factors of personality. When conducting both the measurement and structural models in this study, both models failed to converge when estimated with plasticity and stability. In response to this finding, the model was then conducted using the Big Five factors of personality and a general factor of personality. The model did converge when estimated with a general personality factor while also allowing the big five personality factors to correlate. This may coincide with an assertion made by Musek (2007), “Interestingly, only within the ability and self-concept domains, the existence of only
one single general factor on the top of the structural hierarchy has been convincingly confirmed. In all other domains, the highest-order solutions vary from two or three to five or more basic factors” (p. 1214). It is possible that in asking participants to report on their creative self-efficacy and imaginative capabilities (similar to ability and self-concept) the model successfully ran using a general factor of personality. However, Musek (2007) cautions against the hasty acceptance of the Big One and advocates for more research in this area, which the author of this study wholeheartedly agrees with.

Limitations and Projected Implications for Future Research

While research has supported the relationship between personality and creative self-efficacy and imagination with personality and creativity, it is limited when investigating the relationship of the three constructs together. By adding the construct of imagination, this study adds another layer of creativity worth considering in the field of creativity research. Creativity is often preceded by imagination (Beghetto, 2008; Chang et al., 2014; Gündoğan, Meziyet, & Gönen, 2013; Zivkovic et al., 2015); therefore, the two constructs should be investigated together. One of the main purposes of this investigation is to nudge the conversation surrounding the empirical investigation of imagination within the creative process. However, as is the case with most areas of research, the issues in this study are complex. This study serves as a starting point into this inquiry.

This study’s design has foreseen limitations. Homogeneity of the sample is both a strength and a limitation in this study. This study focuses on university students, allowing us to extend upon previous studies that focused on the three constructs of imagination in university
students in Taiwan. Although convenience sampling provides some advantages, it does limit the generalizability of this study. Subsequent research can address this limitation by replicating the present study, using randomized sampling, and targeting specific populations. Because most studies investigating imagination have been conducted in design and architecture fields, one recommendation for future research would be the replication of this study in different discipline-specific populations, such as educators, healthcare professionals, law professionals, and general education students. This would also help to address issues about the nature of creativity and related constructs as domain specific or general. Replication studies with representative, varied populations would increase generalizability of the results.

This investigation also evaluates creative self-efficacy as a malleable construct and hopes to add another element of creativity worth exploring to existing literature regarding constructs that we can influence and develop to promote creative achievements and performances. Researchers have recommended the modification and extension of previously used creative self-efficacy scales to develop comprehensive measures of creative self-efficacy (Beghetto, 2006; Beghetto & Karwowski, 2017; Karwowsk & Lebuda, 2016). Measuring creative self-efficacy using three items is a limitation of this study. Therefore, subsequent research should extend the findings of this study to inform the development and validation of a more comprehensive creative self-efficacy scale. Additionally, the creation and validation of a creative self-efficacy should be conducted and replicated across settings and samples to increase validity and generalizability.

The high correlation between the three factors of imagination in the Imaginative Capability Scale in this study is also cause for concern. Measurement invariance has been
addressed by Liang and Chia (2014) regarding the utility of the instrument across different domains. However, studies using the Imaginative Capability Scale have been conducted in various regions of Taiwan, but none have taken place beyond that (Lamb, manuscript in progress). It’s possible the Imaginative Capability Scale is not measuring the same three-factor construct when used with U.S. populations. Future research should consider replicating studies using the Imaginative Capability Scale across cultures and populations. These areas of study need to be addressed if we wish to answer a key question: Are we really measuring what we think we are measuring?

Educational research is fruitless without evaluating and informing educational practice. The results of this study can be useful in informing program creation and development in educational practice as well as professional development for educators. This study also serves as a conversation starter regarding classroom practices and approaches to imagination, creativity, creative self-efficacy while also acknowledging the role personality factors play within the overall process. Addressing the constructs of imagination and creative self-efficacy as malleable constructs within the classroom, places great responsibility and power in the hands of classroom teachers. This study aims to support educators as conduits of instruction and facilitators of creative thinking. Thus, the overarching aim of this study is to advocate creativity, imagination, and creative self-beliefs as a creative pedagogy easily implemented by educators while also advocating creativity, imagination, and environments that bolster creative self-efficacy as a new norm for classroom learning for all students.
References


Liu, Y., & Liang, C. C. (2014). The mediating roles of generative cognition and organizational culture between personality traits and student imagination. *International Journal of Educational Psychology, 3*(1), 49-68. doi:10.4471/ijep.2014.03


In the field of educational research and practice, buzzwords such as innovation and innovative thinking, 21st century skills, creative thinking, and creativity (though these terms may be on their way out as the term innovation accelerates in trend and popularity) are claimed, declared, and sought after as desired developmental skills by educational practitioners, researchers, and business entrepreneurs alike (Craft, 2003; Olszewski-Kubilius, Subotnik, & Worrell, 2016; Renzulli, 2012; Skiba, Tan, Sternberg, & Grigorenko, 2010). However, creativity in educational settings is said to be lacking within the United States (Hong & Ditzler, 2013). Further, Research in organizational psychology and education tends to focus on the enhancement of creativity as opposed to why creativity is important to begin with (Forgeard & Kaufman, 2016). Saturated by information and technology, today’s problems can only be solved with creative thinking (Hennessey & Amabile, 2010; Olszewski-Kubilius et al., 2016).

Additionally, creativity is a skill necessary in developing the ability to break away from one-track mindsets (Dai & Cheng, 2017) and dogmatic thinking (Olszewski-Kubilius et al., 2016). Further, creativity is associated with lifelong success (Hong & Ditzler, 2013; Plucker, Beghetto, & Dow, 2004) connected to individuals’ social and emotional wellness as well as academic (Plucker et al., 2004) and entrepreneurial/organizational success (Amabile, 1988; Hennessy & Amabile, 2010). While most of these studies focus on the role of creativity, rarely do these studies address the role imagination plays in the creative process (Forgeard & Kaufman, 2016; Liang, Hsu, Chang, & Lin, 2012). Further, in educational settings, imagination is often an unwelcomed guest at the institutional table (Fettes, 2013). Neglecting the examination of imagination in research and applied settings leaves an incomplete understanding of the role of creativity in the
advancement of society. So, where does imagination fit in our discussions of the creative process? Where does imagination fall in the context of practical education settings other than educators discouraging the likes of daydreaming in exchange for focused, streamlined attention to test-taking skills, and why should it matter for today’s students?

Imagination is often conceptualized as the “magic and mystery” of the creative process and product (Khatena, 1975, pp. 149). Vygotsky (2004) conceptualized imagination as the foundation for all creative processes. Others posit imagination as a promoter of creativity (Liang & Chia, 2014), a “gift to humans” (Liang et al., 2012, p. 1037), a gift from the Muses (Piirto, 2000), and the “driving force of innovation” (Liang et al., 2012, p. 1038). While defining imagination may vary, as most definitions of constructs do in the literature, the one consistent idea throughout the literature is the existing connection between imagination and creativity (Khatena, 1975; Liang & Chia, 2014; Liang & Lin, 2015; Lin & Tsau, 2012). The two are related in process and often viewed as sequential yet dependent processes. Otherwise put: imagination is the fuel and creativity the wheels, both necessary in the creation of ideas and setting ideas into motion. Although creativity research may be robust, dating decades back to Guilford’s call in his 1950 APA presidential address, research focused on understanding imagination as a related construct and indicators for recognition remain hazy (Liang, Chang, & Hsu, 2013; Liang et al., 2012).

Background

Lack of coherence and agreement in defining creativity has elicited a host of issues in creativity research and pedagogy (Hennessey & Amabile, 2010; Plucker et al., 2004). While the
connection between imagination and the creative process is supported throughout the research, this connection is often illustrated through conceptual and philosophical works. Further, empirical studies examining imagination and measuring the construct of imagination are lacking (Liang et al., 2012). To address this issue in the literature, Liang et al. conducted a research synthesis in which they evaluated research from 1900 – 2012 with two aims: to clarify the term imagination and to identify associated markers of imagination. This synthesis identified two dimensions and ten associated markers of imagination. The two dimensions included creative imagination (indicated by novelty, productivity, exploration, focus, intuition, and sensibility) and reproductive imagination (indicated by dialectics, crystallization, transformation, and effectiveness). The two dimensions of imagination are distinct in that creative imagination is typically associated with originality and characterized by groundbreaking discoveries and revolutions, while reproductive imagination is typically associated with reproducing mental images and characterized by exploration, focus, intuition, novelty, sensibility, and productivity (Liang et al., 2012). Through confirmatory factor analysis, their results supported the two dimensions of imagination.

In 2016, Forgeard and Kaufman reviewed 50 randomly selected peer-reviewed articles to examine who studies imagination, creativity, and innovation (or ICI), as well as whether researchers are addressing the importance of the topic, and what those reasons are. Their results suggest that the construct of creativity was most represented in creativity, education, and psychology journals. Innovation was most represented in business and industrial/organization journals. Very few studies (4%) investigated the construct of imagination. Further, most studies in the sample focused on creativity as a predictive outcome
or ways in which creativity could be enhanced. Forgeard and Kaufman also found that few studies examined ways in which creativity may lead to other desired outcomes such as overall well-being and success. Perhaps more startling, 71% of reviewed articles provided minimal or no explanation addressing why individuals should care about imagination, creativity, and/or innovation though they did account for potential limiting factors such as space limitations and readership associated with certain journals. Regardless, Forgeard and Kaufman place an urgent call to researchers to do better by developing explicit research questions that extend beyond the general and widely accepted idea that creativity is beneficial, but beneficial when, how, for whom, and why.

**Review Objectives and Research Questions**

This review was designed in response to calls placed by Forgeard and Kaufman (2016) as well as Liang et al. (2012) by contributing through explicitly investigating the human imagination as a psychological construct in relation to the creative process. Broadly, this review answers the questions of: imagination for whom, under which circumstance, and why imagination is an important component of the creative process, or essentially, why imagination matters. The means with which this is accomplished is through the examination of explicit and implicit descriptors of imagination across varied fields or disciplines of research, such as design, engineering, and education, as well as the examination of instruments used to empirically measure the construct of imagination.

This study responds to Forgeard and Kaufman’s (2016) call to “do better” and serves the primary goal of improving our understanding of the relationship between imagination and the
creative process (p. 256). A secondary objective of this investigation is to highlight areas ripe for elucidation and provide recommendations for future studies regarding imagination and the creative process to better inform educational practices. Each of the objectives was achieved respectively through the synthesis of qualitative data on definitions used as well as descriptive key words and/or phrases used to describe imagination in relation to creativity, and finally, by examining methodological and analytical approaches, this study helps answer the question “where do we go from here?” and informs directions for future research and practice based upon systematically defining where we have been, and what we currently know.

The following research questions guided this review: (a) In what ways has imagination been defined as a construct in empirical studies related to creativity? (b) In what ways has imagination been measured, and how does the measurement of imagination differ by field of study?

Method

Search Parameters

The search for literature on the role of imagination in the creative process included the discipline areas of creativity, business, design, engineering, and educational contexts. Major creativity journals in the field of creativity research were searched: Creativity Research Journal; Journal of Creative Behavior; Psychology of Aesthetics, Creativity, and the Arts; and Thinking Skills and Creativity. Since the construct of imagination is the primary construct under investigation, the journal Imagination, Cognition, and Personality was included in the search. The electronic databases included in this search included Academic Search Complete, Education
Source, and PsychARTICLES. Initially, each search was limited to peer-reviewed, empirical studies in scholarly journals published in the English language from 2000 to 2017. However, during data collection, one of the articles (Liang et al., 2012) summarized factors of imagination through a systematic review of the literature published between 1900 and 2012; for that reason, the dates in this study were further limited to extend upon their findings and capture the most recent decade (2007 – 2017). For the purposes of this investigation and to better address the specificity of the research questions and objectives, an empirical study was defined by two criteria: (a) the presence of a methods section; and (b) a description of participants. Article searches were conducted in three phases: (a) phase one - searches were performed against the article abstracts, with the exception of Academic Search Complete and Education Source databases, which was performed against the primary search term (imaginat*) being included in the article title; (b) phase two - article removal based on duplication or reprints; and (c) phase three - article review for relevancy to the purpose of this investigation and characteristics indicative of an empirical study as defined in this study (quantitative/ qualitative, methods section and description of participants). The database search concluded in October 2017.

Search Terms

After informally reviewing relevant literature, the list of search terms was created. The term "imaginat*" was used as the primary search term, limited to the title or abstract, in order to identify articles in which imagination was a central focus of the journal article. The second search term “creativ*” was searched throughout the text and used to further collect articles in
which creativity was also a focus of the journal article, but not necessarily the primarily focus. The asterisk was used for both primary and secondary terms to permit the endings of each term to vary. For example, “imaginat*” allowed the researcher to capture multiple search terms such as imaginative and imagination. As part of the initial criteria, articles were required to have a methods section, therefore, the search term “methods” was used to specifically select empirical studies. See Table 4 for a comprehensive list of the number of articles initially found as a result of search terms used for each database and journal. The initial search returned 640 studies. However, this initial result included the studies duplicated across database searches as well as studies from 2000-2017.

Inclusion Criteria

A number of criteria were further specified during phase three to assist in the selection of studies appropriate for inclusion in this review. Phase three criteria comprised of the following questions/statements: (a) Was the study conducted in 2007 or after? (b) Does the study provide participant/sample information? (c) Does the study provide methods? (d) Does the study provide results? (e) The study must be empirical and peer-reviewed; and (f) The study must include imagination AND creativity as the main variables in investigation. Including imagination and creativity as the main variables in the investigation helped narrow the focus of studies included in this review. For example, one article was excluded because the central purpose of the article was to investigate dreaming and its impact on imagination while another article was excluded as its central focus was on imagination in psychotherapy (Arnd-Caddigan, 2013). A total of 39 articles were included in the final sample for the data analysis phase.
## Table 4

**Search Parameters and Initial Results**

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Source</th>
<th>Search Limiters</th>
<th>Hits</th>
</tr>
</thead>
</table>
| TITLE imaginat* AND creativ* AND methods | Academic Search Complete | Document type: Article  
Language: English  
Publication Type: Periodical  
Scholarly Peer-Reviewed Journals 2000-2017 | 291 |
| TITLE imaginat* AND creativ* AND methods | Education Source | Document type: Article  
Language: English  
Publication Type: Academic Journal  
Scholarly Peer-Reviewed Journals 2000-2017 | 178 |
| TITLE imaginat* AND creativ* AND methods | PsycARTICLES | Document type: Journal Article  
Population: Human  
Scholarly Peer-Reviewed Journals 2000-2017 | 10 |
| TITLE imaginat* AND creativ* AND methods | Imagination, Cognition, and Personality (SAGE journals) | All content  
2000-2017* | 14 |
| ABSTRACT imaginat* AND creativ* AND methods | Journal of Creative Behavior (Education Source) | Language: English  
Publication Type: Academic Journal  
| ABSTRACT imaginat* AND creativ* AND methods | | | 7 |

*(table continues)*
<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Source</th>
<th>Search Limiters</th>
<th>Hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT imaginat* AND creativ* AND methods</td>
<td><em>Thinking Skills and Creativity (ScienceDirect)</em></td>
<td>Document Type: Article 2000-2017 (2006 – present; included Articles in Press)</td>
<td>34</td>
</tr>
<tr>
<td>ABSTRACT, TITLE, KEYWORDS imaginat* AND creativ* (only permits two search terms)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initial Total 640

Note. Totals under Hits include article numbers prior to the removal of duplicates; *permits the search term to vary in ending

Table 5

*Descriptive Sample Characteristics*

<table>
<thead>
<tr>
<th>Article</th>
<th>Sample Size</th>
<th>Gender</th>
<th>Mean Age</th>
<th>Context of Study</th>
<th>Geographic Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beghetto, R. A. (2008)</td>
<td>176</td>
<td>83% Female 17% Male</td>
<td>Not provided</td>
<td>Prospective teachers</td>
<td>United States</td>
</tr>
<tr>
<td>Chang, H., &amp; Lin, T. (2013)</td>
<td>63</td>
<td>77.8% Female 22.2% Male</td>
<td>Not provided</td>
<td>University student in the Department of Creative Design</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Chang, C., Wang, J., Liang, C., &amp; Liang, C. (2014)</td>
<td>195</td>
<td>53.9% Female 46.1% Male</td>
<td>21.5</td>
<td>University students in Multimedia design programs</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Chang, C., Yao, S., Chen, S., King, J., Liang, C. (2016)</td>
<td>217</td>
<td>66.8% Female 33.2% Male</td>
<td>20.24</td>
<td>College of Engineering/Computer Engineering students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Cheung, R. H., &amp; Leung, C. H. (2014)</td>
<td>564</td>
<td>99% Female 1% Male</td>
<td>Not provided</td>
<td>Preschool teachers</td>
<td>Hong Kong</td>
</tr>
</tbody>
</table>

*table continues*
<table>
<thead>
<tr>
<th>Article</th>
<th>Sample Size</th>
<th>Gender</th>
<th>Mean Age</th>
<th>Context of Study</th>
<th>Geographic Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaz-Puente, R., &amp; Cavazos-Arroyo, J. (2017)</td>
<td>477</td>
<td>63% Female</td>
<td>21.94</td>
<td>College of Business students</td>
<td>Mexico</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diener, M. L., Wright, C., Brehl, B., &amp; Black, T. (2016)</td>
<td>94</td>
<td>47.8% Female</td>
<td>4.4</td>
<td>Preschool and kindergarten students</td>
<td>Poland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.2% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dollinger, S. J., &amp; Skaggs, A. (2011-2012)</td>
<td>184</td>
<td>61% Female</td>
<td>22</td>
<td>University students</td>
<td>Not provided</td>
</tr>
<tr>
<td></td>
<td></td>
<td>39% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dziedziewicz, D., Gajda, A., &amp; Karwowski, M. (2014)</td>
<td>122</td>
<td>64% Female</td>
<td>Not provided</td>
<td>Primary school students</td>
<td>Poland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dziedziewicz, D., Oledzka, D., &amp; Karwowski, M. (2014)</td>
<td>128</td>
<td>43% Female</td>
<td>Not provided</td>
<td>Preschool and Elementary school students</td>
<td>Poland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>57% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feng, Z., Logan, S., Cupchik, G., Ritterfield, U., &amp; Gaffin, D. (2017)</td>
<td>940</td>
<td>74.4% Female</td>
<td>Not provided</td>
<td>College students enrolled in intro to psychology and psychology courses</td>
<td>America, Canada, China, and Germany</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.6% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gündoğan, A., Meziyet, A. I., &amp; Gönen, M. (2013)</td>
<td>1000</td>
<td>Not provided</td>
<td>Not provided</td>
<td>Primary school students</td>
<td>Turkey</td>
</tr>
<tr>
<td>He, W., Wong, W., &amp; Chan, M. (2017)</td>
<td>1055</td>
<td>50.4% Female</td>
<td>14.22</td>
<td>Secondary school students</td>
<td>Hong Kong</td>
</tr>
<tr>
<td></td>
<td></td>
<td>44.2% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoff, E. V., Ekman, A., &amp; Pho, A. K. (2017)</td>
<td>95</td>
<td>55.8% Female</td>
<td>9.7</td>
<td>Elementary school students</td>
<td>Sweden</td>
</tr>
<tr>
<td></td>
<td></td>
<td>44.2% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hsu, M. M., Chang, C. C., &amp; Liang, C. C. (2014)</td>
<td>1052</td>
<td>25% Female</td>
<td>Not provided</td>
<td>University students in science and engineering education</td>
<td>Taiwan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hsu, Y., Chang, C., &amp; Liang, C. (2015)</td>
<td>865</td>
<td>70% Female</td>
<td>Not provided</td>
<td>Film production</td>
<td>Taiwan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30% Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hsu, Y., Liang, C., &amp; Chang, C. (2014)</td>
<td>380</td>
<td>75.3% Female</td>
<td>Not provided</td>
<td>Education university students</td>
<td>Taiwan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24.7% Male</td>
<td></td>
<td></td>
<td></td>
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*(table continues)*
<table>
<thead>
<tr>
<th>Article</th>
<th>Sample Size</th>
<th>Gender</th>
<th>Mean Age</th>
<th>Context of Study</th>
<th>Geographic Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huang, Y., &amp; Li, J. (2015)</td>
<td>60</td>
<td>45% Female 55% Male</td>
<td>Not provided</td>
<td>Professional designers and university students in design</td>
<td>Not provided</td>
</tr>
<tr>
<td>Karwowski, M., &amp; Soszynski, M. (2008)</td>
<td>47</td>
<td>83% Female 17% Male</td>
<td>21.9</td>
<td>Undergraduate education students</td>
<td>Not provided</td>
</tr>
<tr>
<td>Leu, Y., &amp; Chiu, M. (2015)</td>
<td>372</td>
<td>33% Female 67% Male</td>
<td>Not provided</td>
<td>Grade 4 students in Mathematics</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liang, C., Chang, C., &amp; Hsu, Y. (2014)</td>
<td>943</td>
<td>70.6% Female 29.4% Male</td>
<td>Not provided</td>
<td>Video/film production university students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liang, C., &amp; Chia, T. (2014)</td>
<td>529</td>
<td>34.6% Female 65.4% Male</td>
<td>20.4</td>
<td>Design and engineering university students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liang, C., Hsu, Y., &amp; Chang, C. (2013)</td>
<td>1025</td>
<td>70% Female 30% Male</td>
<td>Not provided</td>
<td>University students in Video/Film production</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liang, C., Hsu, Y. U., Chang, C. S., &amp; Lin, L. D. (2012)</td>
<td>631</td>
<td>70% Female 30% Male</td>
<td>Not provided</td>
<td>Multimedia design students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liang, C., &amp; Lin, W. (2015)</td>
<td>436</td>
<td>67.9% Female 32.1% Male</td>
<td>Not provided</td>
<td>Design university students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Liao, K., Chang, C., Lin, J., &amp; Liang, C. (2014)</td>
<td>5</td>
<td>Not provided</td>
<td>Not provided</td>
<td>Renowned case writers</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Lin, H., &amp; Tsau, S. (2012-2013)</td>
<td>847</td>
<td>Not provided</td>
<td>Not provided</td>
<td>First year undergraduate students across 12 departments of NTUT</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Lin, J., Chang, W., &amp; Liang, C. (2015)</td>
<td>547</td>
<td>65.4% Female 34.6% Male</td>
<td>21.3</td>
<td>University students enrolled in physical, chemical, mathematical, and biological science programs</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Lin, W. L., Hsu, Y. E., &amp; Liang, C. I. (2014)</td>
<td>271</td>
<td>70.5% Female 29.5% Male</td>
<td>Not provided</td>
<td>Design school students</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Article</td>
<td>Sample Size</td>
<td>Gender</td>
<td>Mean Age</td>
<td>Context of Study</td>
<td>Geographic Location</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-------------------------</td>
<td>----------</td>
<td>-------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Lin, Y. (2010)</td>
<td>67</td>
<td>Not provided</td>
<td>Not provided</td>
<td>Students in drama class</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Ren, F., Li, X. I., Zhang, H., &amp; Wang, L. (2012)</td>
<td>4320</td>
<td>Not provided</td>
<td>Not provided</td>
<td>Middle school and high school students from rural and urban areas</td>
<td>China</td>
</tr>
<tr>
<td>Siew, N. M. (2017)</td>
<td>50</td>
<td>74% Female, 26% Male</td>
<td>16</td>
<td>Secondary students in the Engineering Design Process (EDPI) program</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Wang, C., Ho, H., Wu, J., &amp; Cheng, Y. (2014)</td>
<td>5</td>
<td>40% Female, 60% Male</td>
<td>Not provided</td>
<td>Elementary school teachers</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Wang, C., Niemi, H., Cheng, C., &amp; Cheng, Y. (2017)</td>
<td>74</td>
<td>45.9% Female, 46.1% Male</td>
<td>11.82</td>
<td>Science students</td>
<td>Finland</td>
</tr>
<tr>
<td>Ward, T. B., &amp; Wickes, K. N. S. (2009)</td>
<td>228</td>
<td>56.1% Female, 43.9% Male</td>
<td>Not provided</td>
<td>Intro to Psychology university students</td>
<td>Not provided</td>
</tr>
<tr>
<td>Yeuh, H., Chang, C., &amp; Liang, C. (2013)</td>
<td>876</td>
<td>65% Female, 35% Male</td>
<td>Not provided</td>
<td>Undergraduate students in science and engineering</td>
<td>Not provided</td>
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Data Analyses

Qualitative Analysis

To answer the research questions guiding this study, descriptive analysis was employed to empirically examine emerging trends and patterns as well as garner a more comprehensive view of imagination as a construct in the creative process. Deductive coding was utilized as key terms and phrases were chosen according to prior research and guided by theory (Fereday & Muir-Cochrane, 2006).

Step 1: Categorization of studies. Studies were initially categorized as either quantitative or qualitative. Thirty-three articles were categorized as quantitative studies, four were categorized as qualitative studies, and two were categorized as mixed methods. Next, studies were categorized by field or discipline of interest. Categorization of studies by field or discipline of interest included areas such as business, design, engineering, science, mathematics, and video or media production. This step helped with identifying variations of definitions and characteristics by field or discipline. Studies were further categorized according to the inclusion of an explicit definition of imagination or an implicit definition of imagination (ie. the use of descriptors).

Step 2: Coding of articles. To specifically address research question one and the primary objective to address imagination as an important component of the creative process, studies were coded according to key terms and phrases included in (a) the explicit definition of imagination or (b) the descriptors used to characterize imagination. To answer research question two and address the overarching questions of imagination for whom and how, methods and samples were coded. In order to examine instruments used to empirically
measure the construct of imagination, methods were coded based on the following: (a) quantitative or qualitative methods; (b) method of measurement (ie. survey, interviews, etc.); and (c) analytic approach used. Sample information was coded for the following: sample size, gender, mean age, and geographic location of the study and sample.

Results

Publication dates for articles reviewed in this synthesis ranged from 2007 to 2017, with most of the studies coming from 2014. Most of the articles included in this synthesis were empirical studies conducted in Taiwan, but also included empirical studies that were conducted globally in Austria, Canada, China, Croatia, Finland, France, Germany, Hong Kong, Hungary, Italy, Malaysia, Mexico, Poland, Serbia, Sweden, Turkey, the United Kingdom and the United States. Participant characteristics in the reviewed studies were typically convenient samples comprised of college students. Sample characteristics can be found in Table 5. Six descriptive patterns were identified in the examination of imagination definitions and characteristics across the articles included in this review. Summaries of descriptive patterns can be found in Table 6.

Descriptive Analysis Findings

In answering Research Question 1, six descriptive patterns emerged across articles reviewed. Fourteen articles included an explicit definition of imagination in their study while 25 articles implicitly defined imagination using descriptive terms and phrases. Definitions were classified as explicit if the article clearly constructed and stated a definition or adopted a definition or explanation of imagination found in existing literature to guide their study.
### Table 6

**Definitions and Descriptors of Imagination**

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<tr>
<th>Article</th>
<th>Explicit Definition</th>
<th>Implicit Definition</th>
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<tr>
<td>Beghetto, R. A. (2008)</td>
<td>&quot;The human imagination represents <a href="#">an important cognitive function</a>, which allows us to break from our current understandings, perspectives, and habits and develop new understandings and experiences. Imagination enables <a href="#">possibility thinking</a> and permits us to try things out, consider the perspectives of others, and move beyond what is to what might or could be. It is the imagination that underwrites personal transformation and social change and serves as the <a href="#">basis for all creative activity</a>&quot; (p. 134).</td>
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<tr>
<td>Chang, H., &amp; Lin, T. (2013)</td>
<td>&quot;The term ‘imagination’ refers to the process of creating new images on the basis of existing objects or representation. New products that are generated from the process of imagination are delivered intuitively in the mind in the forms of images rather than words or symbols. Some considered imagination to be a faculty that each individual has that recreates concepts or mental representations on the basis of the basic senses. Imagination is a faculty set that is involved in constructing and delineating in detail the network of images. Vygotsky proposed that imagination is the faculty that generates creative activities when the brain starts to incorporate new elements and also considered imagination to play a <a href="#">significant role</a> in all the activities related to creativity in life. Moreover, most scholars agree that the source materials used by imagination come from everyday life and that these elements, whether real or imaginary, are created into more combinations&quot; (p. 25).</td>
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<tr>
<td>Chang, C., Wang, J., Liang, C., &amp; Liang, C. (2014)</td>
<td>&quot;Imagination is the basis for cultivating creative thinking and, thus, a driving force of innovation. Imagination is an essential human capacity in conducting various activities such as the pursuit of creativity and innovation, the symbolic expression of ideas, and critical thinking. Imagination is the ability to conjure new realities and possibilities... form associations and analogies between objects that previously seemed disconnected&quot; (p. 69).</td>
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<th>Article</th>
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<tr>
<td>Chang, C., Yao, S., Chen, S., King, J., Liang, C. (2016)</td>
<td>&quot;In this study, imaginative capacity refers to a student’s capacity of <strong>initiating</strong>, <strong>conceiving</strong>, and <strong>transforming his or her mental representations</strong> of objects that are <strong>not present to the senses</strong>&quot; (p. 290).</td>
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<tr>
<td>Díaz-Puente, R., &amp; Cavazos-Arroyo, J. (2017)</td>
<td>Not provided</td>
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<td>Dziedziewicz, D., Gajda, A., &amp; Karwowski, M. (2014)</td>
<td>Not provided</td>
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<tr>
<td>Dziedziewicz, D., Oledzka, D., &amp; Karwowski, M. (2014)</td>
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| Feng, Z., Logan, S., Cupchik, G., Ritterfield, U., & Gaffin, D. (2017) | "Imagination involves *the mental representation* of what is **not immediately present to the senses**. It has been defined as "the capacity to **mentally transcend time, place, and/or circumstance**" and is closely related to specific abilities such as *mental time travel* into the past and the future. Imagination **facilitates** the expansion of human experience to the **improbable and impossible**. Imagination is "that most daring side of intelligence which takes risks, formulates hypothesis to **explain the unknown and jumps into unpredictable**" (p. 72)." | (table continues)
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<tr>
<td>Gündoğan, A., Meziyet, A. I., &amp; Gönen, M. (2013)</td>
<td>&quot;Many people use the imagination in the meaning of creativity. The imagination is the driving force behind the creativity and utilizing the imagination enable children to establish unusual connections. Imagination is an important part of the creative intelligence as a powerful tool that helps to understand the alternatives and to make visualizations and includes possibility thinking adding that the imagination may be the pre-condition of creativity. Creative individuals use imagination and fantasy in one hand and sense of reality in the other hand alternately for separating from the present time without losing the connection with the past&quot; (p. 15-16).</td>
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<td>He, W., Wong, W., &amp; Chan, M. (2017)</td>
<td>[Through the lens of Dabrowski and as a contributing factor to creativity]: &quot;Imaginational OE (i.e., vivid imaginations, rich associations of images and impressions). Imaginational OE is also associated with a desire for novelty, variety, and the unusual&quot; (p. 28).</td>
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<td>Hoff, E. V., Ekman, A., &amp; Pho, A. K. (2017)</td>
<td>&quot;Imagination can be defined as a cognitive process in which new constructions are shaped by combining memories, former experiences, and images&quot;.</td>
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<td>Hsu, M. M., Chang, C. C., &amp; Liang, C. C. (2014)</td>
<td>Not provided</td>
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<tr>
<td>Hsu, Y., Chang, C., &amp; Liang, C. (2015)</td>
<td>&quot;In this study, imagination refers to the process of transforming the inner imagery of film students, when they face a film production task&quot; (p. 588).</td>
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<tr>
<td>Hsu, Y., Liang, C., &amp; Chang, C. (2014)</td>
<td>&quot;In this study, ‘imagination’ refers specifically, to ‘the process of transforming the inner imagery of education major students, when solving an educational design task’&quot; (p. 545).</td>
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<tr>
<td>Huang, Y., &amp; Li, J. (2015)</td>
<td>Imagination is ‘a process of an individual with creative infinite visions in mind anytime and anywhere for reaching objectives’. Imagination is working with objectives based on problem solving, understanding, or creative interests devoted to triggering a possible solution, which has not yet been presented” (p. 261-262).</td>
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<th>Article</th>
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<tr>
<td>Liang, C., Chang, C., &amp; Hsu, Y. (2013)</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and is the ability to conceive of what is not—something that does not exist or something that may exist, which we cannot perceive.&quot; (p. 19).</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and is the ability to conceive of what is not—something that does not exist or something that may exist, which we cannot perceive.&quot; (p. 19).</td>
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<tr>
<td>Liang, C., Chang, C., Lian, C., &amp; Liu, Y. (2017)</td>
<td>&quot;In this study, imaginative capacity refers to an entrepreneur’s capacity of initiating, conceiving, and transforming the mental representations of things that are not present to the senses.&quot; (p. 162).</td>
<td>&quot;Imagination is defined as ‘a creative faculty of the mind’ or ‘a power of the mind’ which enables people to go beyond actual experience and construct alternative possibilities. Imagination is the ability to conceive what is not—something that does not exist—or something that may exist which cannot be perceived. Imagination is described as one of the ‘higher mental functions’ that involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality’&quot; (p. 19).</td>
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<tr>
<td>Liang, C., &amp; Chia, T. (2014)</td>
<td>&quot;Imagination is defined as ‘a creative faculty of the mind’ or ‘a power of the mind’ which enables people to go beyond actual experience and construct alternative possibilities. Imagination is the ability to conceive what is not—something that does not exist—or something that may exist which cannot be perceived. Imagination is described as one of the ‘higher mental functions’ that involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality’&quot; (p. 19).</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and is the ability to conceive of what is not—something that does not exist or something that may exist, which we cannot perceive.&quot; (p. 19).</td>
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<tr>
<td>Liang, C., Hsu, Y., &amp; Chang, C. (2013).</td>
<td>&quot;In this study, imagination refers generally to the process of transforming the inner imagery of video/film students, when they face a video/film production task.&quot; (p. 110).</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and construct alternative possibilities. Imagination is the ability to conceive what is not—something that does not exist—or something that may exist which cannot be perceived. Imagination is described as one of the ‘higher mental functions’ that involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality’&quot; (p. 19).</td>
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<tr>
<td>Liang, C. I., Hsu, Y. U., Chang, C. S., &amp; Lin, L. D. (2012)</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and construct alternative possibilities. Imagination is the ability to conceive what is not—something that does not exist—or something that may exist which cannot be perceived. Imagination is described as one of the ‘higher mental functions’ that involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality’&quot; (p. 1038).</td>
<td>&quot;Imagination is one of the most precious cognitive capacities and can enable people to go beyond actual experience and construct alternative possibilities. Imagination is the ability to conceive what is not—something that does not exist—or something that may exist which cannot be perceived. Imagination is described as one of the ‘higher mental functions’ that involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality’&quot; (p. 1038).</td>
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<tr>
<td>Liang, C., &amp; Lin, W. (2015)</td>
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<td>[Imagination is the] &quot;basis for cultivating creative thinking, driving force of innovation. Human imagination could be categorized into the three types, imagination for designers is about seeing things in a new light and being able to achieve different results&quot; (p. 272-273).</td>
</tr>
<tr>
<td>Liao, K., Chang, C., Lin, J., &amp; Liang, C. (2014)</td>
<td>&quot;Imagination is a highly valuable cognitive capacity and enables people to go beyond actual experience and construct alternative possibilities. This 'possibility thinking' can thus be perceived as the basis for cultivating creative thinking and the driving force of innovation. Imagination is particularly suited to be the vehicle of active creativity, and it can enable people to go beyond actual experience. Imagination can be regarded as the conduit through which the unconscious expresses itself in the form of creative mental imagery that can drive deliberate actions. [Further], writer imagination is also rooted in emotion and is derived from a state of trance, which is imaginary and unconscious in the mind. In a state of trance, writers &quot;go with the flow&quot; when working, allowing their thoughts to move freely and rapidly. Their imagination is aroused unconsciously; however, they are wakeful in flow. Writer imagination is also derived from personal empathy&quot; (p.78).</td>
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<tr>
<td>Lin, H., &amp; Tsau, S. (2012-2013)</td>
<td>&quot;The Imaginative Thinking Scale based on the specific definition of imagination, involving initiation, fluency, flexibility, and originality. Imagination denotes the ability to create new ideas, based on mental imagery such as true or fantastic elements, while creativity means the ability to interpret effectively and concretely some idea such as a song, a story, a product, which is like a critical thinking process&quot; (p. 217-218).</td>
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<tr>
<td>Lin, J., Chang, W., &amp; Liang, C. (2015)</td>
<td>&quot;Imagination refers to the ability of science majors to initiate, conceive, and transform their mental images of what is not yet in existence into scientific discoveries&quot; (p. 342).</td>
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<tr>
<td>Lin, W. L., Hsu, Y. E., &amp; Liang, C. I. (2014)</td>
<td>&quot;In the current study, 'imagination' thus refers to the capability of design students to initiate, conceive and transform their ideas into design plans and/or related actions&quot; (p. 75).</td>
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<th>Article</th>
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<tr>
<td>Lin, Y. (2010)</td>
<td>“The features of creative teaching, such as imaginative, dynamic, and innovative approaches often inspire and lead to children's <em>imagination and new ideas</em>, development for <em>imagination and possibility thinking</em>. Creative teaching may facilitate all possibility thinking qualities instead of just <em>imagination</em> and innovation”.</td>
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<tr>
<td>Liu, Y., &amp; Liang, C. C. (2014)</td>
<td>“Imagination is also an aspect of reflective thinking that enables us to go beyond what is given and transform experience. Imagination can be perceived as a <em>creative faculty of the mind</em>. Therefore, imagination can be perceived as the basis for cultivating creative thinking, and thus, it is the driving force of innovation. Different from fantasy, imagination possesses several noticeable characteristics. Some of them are related to psychology aspects, such as: <em>exploration, intuition, sensibility</em> and <em>crystallization</em>. The others are more practice-oriented, such as: <em>effectiveness, novelty, transformation</em> and elaboration” (p. 545-546).</td>
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<tr>
<td>Ren, F., Li, X. I., Zhang, H., &amp; Wang, L. (2012)</td>
<td>“Imagination as a concept generally refers to mental images of something that is neither perceived as real nor present to the senses. Imagination can be: (1) cognitive in nature, (2) related to fantasizing or dreaming, (3) an expression of individuality and (4) an ability. <em>Imagination and creativity are often closely related and enhance each other</em>. Imagination can be either reproductive or creative, with the former being simple perceptual memories, while the latter is formed using memories derived from external objects. <em>Imagination is thus predictive of future creativity</em>” (p. 2044-2045).</td>
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<td>Siew, N. M. (2017)</td>
<td>“The scientific imagination in this study refers to each student's individual mental activity to generate novel ideas through processes as classified by Wang et al. (2015): <em>initiation, dynamic adjustment, and virtual implementation</em>” (p. 379).</td>
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<td>Wang, C., Ho, H., Wu, J., &amp; Cheng, Y. (2014)</td>
<td>“Scientific imagination emphasizes purposeful processes and is the mental activity involved in creating new ideas that are consistent with scientific principles and are linked to daily life experiences” (p.107).</td>
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<td>Article</td>
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<tr>
<td>Wang, C., Niemi, H., Cheng, C., &amp; Cheng, Y. (2017)</td>
<td>Scientific imagination is a type of <strong>purposeful imagination applied to a scientific discipline</strong>. They defined <strong>scientific imagination</strong> as a form of mental activity involving the <strong>creation of new ideas</strong> consistent with scientific principles and that are <strong>linked to daily life experiences</strong>. The daily <strong>life experiences</strong> of students are not only a source for developing <strong>new ideas</strong> but also act as a guide to help students to identify relationships between different ideas*.</td>
<td>Not provided</td>
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<tr>
<td>Ward, T. B., &amp; Wickes, K. N. S. (2009)</td>
<td>Not provided</td>
<td>&quot;Human imagination can bridge ‘images’ and ‘ideas’, makes analogies between things that had not previously seemed connected, and enables a process of <strong>crystallizing mental images</strong>. Imagination can be perceived as the conduit through which the unconscious self finds its way out in the form of <strong>creative mental imagery</strong> which can drive deliberate actions. <strong>Conceiving imagination</strong> can serve as an engine to form the <strong>mental images</strong> generated from both <strong>initiating</strong> and <strong>transforming</strong> imaginations. Imagination is peculiarly suited to be the <strong>vehicle of active creativity</strong>&quot; (p. 81).</td>
</tr>
<tr>
<td>Yeuh, H., Chang, C., &amp; Liang, C. (2013)</td>
<td>&quot;Imagination is the ability to <strong>think of all things as possible</strong>, an aspect of reflective thinking that enables us to <strong>create ideas that not only go beyond</strong> what is given but are effective, in the sense that they are likely to <strong>transform experience</strong> as intended. The things most emphasised in imagination as it <strong>reshapes experience are things which are absent in reality</strong>. Imagination is an <strong>essential</strong> human capacity in various activities such as the pursuit of creativity and innovation, the symbolic expression of ideas, and critical thinking. In other words, imagination is the <strong>internal imagery</strong> of a creator. Imagination <strong>takes us into the future</strong>, allows individuals <strong>generate fresh and useful ideas</strong>. Although imagination is common to everyone, there are individual differences in how individuals <strong>use imagination to generate good ideas</strong> that solve problems&quot; (p. 133).</td>
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Note. Definitions have been altered for brevity. Page numbers have been provided for reference.
For example, Chang, Yao, Chen, King, and Liang explicitly state in their article, "In this study, imaginative capacity refers to a student’s capacity of initiating, conceiving, and transforming his or her mental representations of objects that are not present to the senses" (2016, p. 290).

Overall, explicit and implicit definitions typically included key words and phrases such as transform, imagery, possibilities, "go beyond", "absence of reality", "symbolic expression of ideas", "mental representations", and "new constructions".

When referencing the creative process, descriptions and explanations typically referred to imagination as a precursor to creativity and thus, innovation, the necessity of prior experience to create something new, and serving as the bridge to the unknown. In essence, imagination appears to focus on the unique and novel aspect of creativity. It tends to focus on the generation of novel ideas and solutions that are generally described in the ideation phase of creativity or described as characteristics of creativity. Ten articles did not define imagination at all. Results for research question one, the summary of definitions or descriptive terms and phrases and their associated articles are presented in Table 6.

Differences between explicit and implicit definitions. Explicit definitions tended to be more specific in terms of domain of interest and methodological approach. For example, Hsu, Chang, and Liang (2014) state, “In this study, imagination refers to the process of transforming the inner imagery of film students, when they face a film production task" (p. 588). Eight total studies used the domain of interest to clarify the definition used in the study. Additionally, if authors held the view that imagination was comprised of an underlying factor structure, the explicit definitions used in the study typically reflected these factors. For instance, several studies subscribed to the three-factor model of imagination which includes conceiving,
initiating, and transforming imagination (Chang et al., 2016; Liang & Chia, 2014; Liang & Lin, 2015; Lin et al., 2015). Initiating imagination involves exploring the unknown and generating new ideas. Conceiving imagination is the ability to develop goal-oriented ideas through utilizing intuition and sensibility to mentally grasp a phenomenon, and transforming imagination takes memory and prior experience to reproduce mental images and materialize abstract ideas (Liang & Chia, 2014). Other studies grouped imagination into two factors: creative imagination and reproductive imagination (Liang, Hsu, & Chang, 2013; Puente-Díaz & Cavazos-Arroyo, 2017). Creative imagination is characterized by originality and the creation of new possibilities while reproductive imagination is characterized by the ability to reproduce mental images from outside recall and recollection (Liang et al., 2013). Authors typically named one or all of these factors within the definition and thus, used these factors to further characterize the construct of imagination in the study.

Implicit definitions relied upon existing literature to paint a picture of sorts regarding imagination. Though an explicit definition was not used as a guiding framework for the study, most researchers would thoroughly describe the construct of imagination through the lens of existing literature. It is through the implicit definitions used across articles that revealed most of the common patterns and traits characteristic of imagination. Several overlapping themes were noted and are further discussed in the following sections for both implicit and explicit definitions.

Imagination involves mental representations and imagery. Seventeen of the studies in this review, include mental representations and imagery in their descriptions or explanations of imagination. Imagination is described as a “process of creating new images” (Chang & Lin, 2013,
p. 25), the expression of ideas as symbols (Chang, Wang, Liang, & Liang, 2014), and an individual's ability to generate novel ideas through mental imagery (Lin & Tsau, 2012). Further, mental imagery was often connected to the memories or prior and present experiences of the individual (Hoff, Ekman, & Pho, 2017), but still had to possess a quality of the unknown (Chang et al., 2016; Feng, Logan, Cupchik, Ritterfield, & Gaffin, 2017). In other words, imagination differed from general ideation in that ideas took the form of mental imagery built upon memories and experience and served as a foundation to solve seemingly unsolvable problems or issues. It is these mental images and representations that help individuals to formulate ideas about the future (Chang & Lin, 2013; Lin & Tsau, 2012).

Imagination relies on prior experiences to construct something new. Fifteen of the 39 articles refer to mental imagery when describing imagination. Imagination transforms mental images and former experiences and ideas into something new (Chang et al., 2016; Hoff et al., 2017; Liang & Chia, 2014; Liang et al., 2013; Lin, Chang, & Liang, 2015; Lin & Tsau, 2012; Zivkovic et al., 2015). Some refer to it as “mental time travel” from the past into the future (Feng et al., 2017, p. 72) where new constructions are informed by memories (Hoff et al., 2017) and experiences are reshaped through the imagination. It is the imagination that uses memories or fragments of memories collected from the past as well as daily life experiences (Wang, Ho, Wu, & Cheng, 2014) to fuel ideas, both problem-solving and novel, for the future (Liang et al., 2013). It is the individual’s experiences that serves as the primer for imaginative thinking.

Imagination is the driving force behind new ideas. From the 39 articles examined, 17 articles used new understandings, innovative ideas, and new connections as a defining
characteristic of imagination. It is the creation of novel ideas through imagination that allows individuals to break away from accustomed understandings and habits (Beghetto, 2008). Siew (2017) described imagination as the generation of novel ideas through mental activity. Further, Zivkovic et al. (2015) characterized imagination as the ability to create ideas that transcend our current experience. Others used phrases like incorporating new elements, develop new understandings, new realities, new constructions, and create new ideas to describe imagination (Beghetto, 2008; Chang & Lin, 2013; Chang et al., 2014; Hoff et al., 2017; Lin, 2010; Lin & Tsau, 2012; Siew, 2017; Wang et al., 2014; Wang, Niemi, Cheng, & Cheng, 2017). Imagination was characterized as a “desire for novelty, variety, and the unusual” (He, Wong, & Chan., 2017, p. 28) and the ability to see things in a new light (Liang & Lin, 2015). In relation to the creative process, it is the generation of these new or novel ideas through imagination that lead to creative action.

Imagination facilitates human arrival to the unknown. Imagination facilitates the human capacity to transcend reality and go beyond experience to the impossible, the unknown, and the unpredictable (Feng et al., 2017). Another recurring theme identified in this review was the theme of “possibility thinking” (Gündoğan, Meziyet, & Gönen, 2013, p. 15). Fourteen articles referenced possibility thinking or this ability to transcend or move beyond when characterizing imagination. Further, imagination was often described as a process that enables us to conceptualize that which is not currently present to the senses (Chang et al., 2016), and as the ability to think of all possibilities, and as an essential process to future discovery (Liang & Chia, 2014; Liang et al., 2012; Lin et al., 2015; Zivkovic et al., 2015).
Imagination is an essential piece of human cognition. Imagination is an important, higher order cognitive process (Beghetto, 2008; Hoff et al., 2017; Liang & Chia, 2014; Liang et al., 2013). Others go on to describe imagination as a “precious cognitive capacity” (Liang et al., 2013, p. 12), or a process that is “cognitive in nature” (Ren, Li, Zhang, & Wang, 2012, p. 2044), and as a “faculty of the mind” (Liu & Liang, 2014, p. 545). Typically, imagination was viewed as an inherent cognitive process that varied through individual differences and an essential component leading to creative action or production. From the sample of 39 articles reviewed, eight articles characterized imagination as a cognitive process.

Imagination is a distinct construct and leads to creativity. Thirteen articles assert that imagination is a key component and basis for creativity. Zivkovic et al. (2015) differentiates imagination as the internal imagery possessed by the creator whereas creativity is the outward manifestation of imagination. Lin & Tsau (2012) describe imagination as the ideation stage and creativity as the interpretative stage of the process (focusing on some type of creative product). In other words, imagination serves the primary role of ideation whether that exists as imagery or not, and the primary role of creativity is the physical manifestation of those ideas. Imagination serves as a precursor to creativity, and it is the foundation for creative thinking and innovation (Liang et al., 2013; Liang & Lin, 2015; Lin & Tsau, 2012). However, one discrepancy existed amongst the articles in the sample. Huang and Li (2015) describe it in reverse, positing creative interests, and problem-solving as the basis for imagination. Despite this discrepancy of order, all 13 articles agree that imagination is a distinct construct and process and further emphasize the important role imagination has in creative pursuits and innovation (Liang et al., 2013; Zivkovic et al., 2015).
Measuring Imagination: Instruments and Analytical Approaches across the Literature

To answer research question two, methods were examined for the type and description of instruments used, as well as analytic approaches employed. Overall, most studies utilized surveys or self-report instruments using Likert scales. The analytical approaches most commonly used were factor analyses and correlational analyses. The summary of instruments and analyses used are included in Table 5.

**Instruments**

Most studies (27) used surveys and self-report questionnaires, typically in the form of a Likert scale. For example, Puente-Díaz and Cavazos-Arroyo (2017) used a 10-item survey to measure creative imagination and reproductive imagination, Lin and Tsau (2012) used 13 items to measure initiation, fluency, flexibility, and originality, while others used a 29-item scale to measure conceiving, reproductive, and transformative imagination (Chang et al., 2016; Liang & Chia, 2014; Liang & Lin, 2015; Lin et al., 2015). Fewer studies (nine) utilized task engagement, such as writing or drawing, to measure imagination (Dollinger & Skaggs, 2011; Dziedziewicz, Gajda, & Karwowski, 2014; Dziedziewicz, Oledzka, & Karwowski, 2014; Gündoğan et al., 2013; Ward & Wickes, 2009; Zivkovic et al., 2015).

**Analytic Approach**

Most studies typically used factor analyses as the major analytical approach (Liang & Chia, 2014; Liang et al., 2013; Lin & Tsau, 2012) or at the minimum, as a precursory step to
correlational analyses conducted (Chang et al., 2016; Liang et al., 2013; Liang & Lin, 2015; Lin et al., 2015). Other studies employed structural equation modeling (SEM; Chang et al., 2016; Liang et al., 2013; Liang & Lin, 2015; Lin et al., 2015; Puente-Díaz & Cavazos-Arroyo, 2017) and other correlational analyses, like t-test and regression (Dziedziewicz et al., 2014; He et al., 2017; Zivkovic et al., 2015). A comprehensive listing of instruments and analyses are listed in Table 5.

Overall, studies that employed factor analyses were conducted to validate a newly created instrument or further validate existing instruments such as the Imaginative Capability Scale (ICS). All of the studies in this sample using the ICS supported the three-factor structure and further validated this instrument (Hsu et al., 2014; Liang & Chia, 2014; Liang et al., 2012; Liang et al., 2013; Lin, Hsu, & Liang, 2014; Lin & Tsau, 2012). Other studies, not using the ICS, found support for the two-factor structure (creative and reproductive) of imagination (Liang et al., 2013; Puente-Díaz & Cavazos-Arroyo, 2017).

It is, however, important to note the overlap existing between the two-factor and three-factor structures of imagination. Characteristics such as initiation, originality, novelty, and human discovery are attributed to creative imagination (Liang et al., 2013). These same characteristics coincide with initiating imagination in the three-factor structure. Initiating imagination is comprised of items capturing novelty, productivity, and exploration (Liang & Chia, 2014). Reproductive imagination is composed of items related to mental imagery, transformation, crystallization, effectiveness, and dialectics (Liang et al., 2013; Puente-Díaz & Cavazos-Arroyo, 2017), which are similar characteristics to both conceiving and transforming imagination. While the models share these commonalities, the three factor model particular to the Imaginative Capability Scale (ICS) has been validated across different domains, fields, and
demographic variables (Chang et al., 2014; Chang et al., 2016; Hsu et al., 2014; Hsu et al., 2015; Liang, Chang, Lian, & Liu, 2017; Liang & Chia, 2014; Liang et al., 2013; Liang & Lin, 2015; Lin et al., 2014; Lin et al., 2015; Yeuh, Chang, & Liang, 2013).

Summary of Findings

Correlates of Imagination

Liang et al. (2012) results suggested self-efficacy as a predictor of reproductive imagination in the two-factor model of imagination. However, when looking at self-efficacy through the lens of creativity, or creative self-efficacy, it was found to be a positive predictor of both reproductive and creative imagination (Puente-Díaz & Cavazos-Arroyo, 2017). Self-efficacy as a predictor of all three factors in the imaginative capability model was also supported (Hsu et al., 2015; Yeuh et al., 2013). Results also suggest metacognition as a significant influencer of creative imagination, further defined as inspiration through action, and as a mediator in the relationship of both creative and reproductive imagination (Liang et al., 2012). Hsu et al. (2015) found that cognitive ability, specifically metacognition, was the most critical variable connecting human imagination and creativity. They also supported findings from Liang et al. (2012) by identifying intrinsic motivation, influenced by self-efficacy, as a chain mediator on imagination (Hsu et al., 2015). In another study, metacognition mediated the relationship between psychological factors (intrinsic motivation, self-efficacy, stress, active inspiration, and emotion) and imagination (Hsu et al., 2014). Others found that imagination was linked to elevated levels of prosocial behavior and low levels of shyness (Diener, Wright, Brehl, & Black, 2016).
Personality Traits and Imagination

When studies included personality traits as main variables, studies found significant relationships between personality traits and imagination (Chang et al., 2014; Liang & Lin, 2015; Liao, Chang, Lin, & Liang, 2014). Personality traits were found to have direct and indirect effects on imagination, and the most influential personality trait on imagination was openness. Beyond the overall construct of imagination, openness was shown to be positively related to imagination and the highest predictor for each of the three factors, conceiving, transforming, and initiating imagination (Chang et al., 2014; Liu & Liang, 2014). Extraversion was also found to positively predict initiating imagination (Lin et al., 2015; Liu & Liang, 2014) though the trait negatively predicted conceiving imagination (Liang & Lin, 2015). Conscientiousness was found to be a predictor of conceiving (Liang & Lin, 2015) and transforming imagination (Liu & Liang, 2014). Agreeableness had no to minimal effects on imagination and was more so considered a significant variable in domain specific contexts (Chang et al., 2014; Lin et al., 2015).

Personality effects were found in the domain specific contexts of imagination, such as writers (Liao et al., 2014), scientists (Lin et al., 2015; Yeuh et al., 2013), designers (Chang et al., 2014), engineers (Yeuh et al., 2013), and video/film producers (Liang et al., 2013). Moreover, the relationship between personality traits and imagination varied within specific domains or fields investigated. For instance, while agreeableness did not have any significant effects on initiating imagination, it did significantly predict conceiving and transforming imagination and enhanced transforming imagination as levels of agreeableness increased in design students (Chang et al., 2014). However, in science groups, agreeableness did not affect any of the three factors of imagination (Lin et al., 2015). Another study found that conscientiousness through
transforming and conceiving imagination, mattered in the academic achievements of science groups (Yeuh et al., 2013). Further, personality traits, such as agreeableness and extraversion interacted with imagination differently for engineers, scientists, designers, and writers (Chang et al., 2014; Hsu et al., 2014; Liao et al., 2014; Lin et al., 2015; Yeuh et al., 2013),

The interplay between environment, personality traits, and imagination was also investigated (Lin et al., 2015). For instance, in science students, conscientiousness combined with the social climate affected conceiving imagination, extraversion and social climate affected transforming imagination, and intrinsic motivation moderated the relationship between extraversion and agreeableness regarding initiating imagination (Lin et al.). This also remains an area where multiple researchers call for further investigation.

Imagination is malleable and plays a key role in academic achievement. Results from some of the studies in this review support imagination as a malleable construct (Beghetto, 2008; Chang & Lin, 2013; Dziedziewicz et al., 2014; Karwowski & Soszynski, 2008; Liao et al., 2014; Ren et al., 2012; Siew, 2017) and significantly related to high academic achievement and performance (Hsu et al., 2014; Lin et al., 2014). Moreover, associated factors of imagination varied within academic achievement in specific domains or fields investigated. In 2013, Yeuh et al. conducted a comparative analysis between science groups and engineering groups. They found that initiating imagination had a negative, direct effect on academic performance in both science and engineering groups but was higher in science groups. Additionally, conceiving imagination had a positive, direct impact on academic performance on both groups, but still higher in science groups. When examining the three-factor model of imagination, initiating imagination directly predicted academic performance while conceiving and transforming
imagination indirectly predicted academic performance in both science and engineering students (Hsu et al., 2014). However, even these findings suggest personality traits as a possible variable to consider when findings involved the factors operating differently according to field or domain. These findings coincide with creativity research that focuses on personality and domain specific creativity (Feist, 1998; Puryear, Kettler, & Rinn, 2016; Simonton, 2009).

In addition to the association between imagination and academic achievement, Chang and Lin (2013) found that high school backgrounds and experiences have long lasting impacts on students’ imaginative capabilities. In fact, multiple studies in this sample found that a supportive environment is crucial in fostering imagination in students (Lin et al., 2015; Ren et al., 2012; Wang et al., 2014; Wang et al., 2017). For instance, Ren et al. (2012), found that student centered teaching methods and teachers who were viewed as more supportive related to higher levels of creative imagination exhibited in students. Additionally, Liang et al. (2013) found that while creative imagination was not significantly impacted by environment, reproductive imagination was. Although substantial evidence supports the significant role environment plays in the development of students’ imaginative capabilities, there is still evidence that imagination in the classroom is undervalued. In 2008, Beghetto examined prospective teacher beliefs and found that most teachers believed that the memorization of correct answers should be emphasized over students’ imaginative thinking, even pinpointing this belief that the shift of emphasis to memorization should occur as early as first grade.

Some studies in this review demonstrated the malleability of imagination, dispelling the myth of imagination as an innate or inherent quality delivered by the Muses. These studies provided support for imagination as a skill and a process that can be taught and developed in
students across varying domains (Dziedziewicz et al., 2014; Liao et al., 2014; Lin, 2010; Ren et al., 2012; Siew, 2017). For instance, students in an experiment group scored lower on the pre-test measuring creative imagination than the control group, but through intervention, the experimental group scored higher than the control group on the post-test measuring creative imagination (Dziedziewicz et al., 2014). One study showed that creative imagination could be developed in students through participation in science competitions and science related field trip activities (Ren et al., 2012); while another study presented imagination as a developmental skill through an intervention (Siew, 2017). In this study, Siew, using mixed methods, measured growth in students’ scientific imagination through pre- and post-test, focus groups, and teacher observations after student participation in STEM activities. Results showed significant growth in students’ science imagination after participating in STEM activities. Liao et al. (2014) further demonstrated that imaginative capability in writers could be intentionally developed, while Lin (2010) used drama to foster creativity and develop imagination in an investigation with teachers and sixth grade Taiwanese students. Most of these studies further stressed the importance of a supportive environment in the cultivation of imaginative thinking.

Discussion

The primary goal of this study was to improve our understanding of the relationship that exists between imagination and creativity. Research question one focused on definitions and descriptions of imagination as a construct. The analysis of definitions and descriptors of imagination allows us to formulate a more comprehensive view of imagination as a construct as well as where it fits in the creativity process. The review produced six patterns in the
description or definitions of imagination. Overall, both explicit and implicit definitions describe imagination using similar key words and phrases. However, it is important to note that most explicit definitions framed their operational definitions within the field or domain being examined. By using operational definitions tied to the field of study, researchers were able to note important field or occupational differences in personality and imagination (Hsu et al., 2015; Liao et al., 2014; Lin et al., 2015; Yeuh et al., 2013). Unlike creativity (Hennessey & Amabile, 2010), researchers made no argument for imagination as a domain specific construct, rather their decision to frame imagination within the domain or field of context provided a useful frame of reference for similar relationships as well as different ones while also answering the questions “imagination for whom and under what conditions?”.

Additionally, the analysis of definitions and descriptions used in these articles overwhelmingly support imagination as a distinct construct that plays a crucial role in the creative process (Beghetto, 2008; Chang et al., 2014; Chang & Lin, 2013; Liang et al., 2013). Descriptions, such as novel, new, and unique ideas, of imagination tend to parallel those used in creativity research to describe creative ideation. However, most concede that imagination is the basis for all creative thinking (Beghetto, 2008; Chang & Lin, 2013; Vygotsky, 2004), and that for any conceptual break through to be possible, one must use imaginative thinking (Liu & Noppe-Brandon, 2009). Creativity research must address this gap by including the construct of imagination as an essential and vital component of the creative process. The imagination drives us to creative action and innovation, and without it, creativity would be impossible.

Research question two focused on sampling, methods, and analyses used to research imagination. By analyzing methodological and analytical approaches in the study of
imagination, this addressed the secondary objective of the study, “where do we go from here?” by assessing where we have been and what we currently know from existing research. Analysis of the samples used in the reviewed articles indicate that the majority of imagination research was carried out in Europe and Asia. Thus, sample populations that should be addressed in future studies should include a broad array of age groups, samples from diverse cultures, and other disciplines such as healthcare, law, and politics.

This analysis identified the Imaginative Capability Scale (ICS) as the most commonly used instrument to measure imagination. While the ICS received overwhelming support as a valid and reliable instrument, future studies should conduct comparative analyses with the ICS and other instruments such as the Imagination Thinking Scale (ITS; Lin & Tsau, 2012). Since the ICS was shown to be valid across domains and fields, in varying countries, and across ages and gender, future studies could use other instruments to measure imagination to see if there are any other instruments more appropriate for specific domains. Additionally, the ICS was not used in any intervention studies. Intervention studies typically used task engagement to measure imagination of participants (Dollinger & Skaggs, 2011; Dziedziewicz et al., 2014; Gündoğan et al., 2013; Ward & Wickes, 2009). The ICS might be an appropriate, time and cost-efficient instrument to measure the growth of imagination as an intervention outcome.

Studies using the same analytical approach appeared to support other studies findings, while also placing one more piece to overall puzzle. For instance, studies by Hsu et al. (2015) and Liang et al. (2012) found significant relationships between self-efficacy and imagination using structural equation modeling. Puente-Díaz and Cavazos-Arroyo, 2017 extended upon their findings by using structural equation modeling to support a meaningful relationship
between creative self-efficacy and both creative and reproduction imagination. All three studies supported one another's findings while also introducing new pieces to the puzzle, such as adding creative self-efficacy as a main variable in the study conducted by Puente-Díaz and Cavazos-Arroyo. Based on these findings, we recommend the use of analytical approaches, in conjunction with high-validity instruments to provide a firm foundation for researchers to further study imagination and creativity.

When considering the supporting evidence of the relationship between imagination and academic achievement and performance, studies illustrating imagination as a malleable construct should garner more attention in educational research and practice. Multiple studies in this review found growth in pre- and post-test measures of imagination after participant participation in intervention programs (Dziedziewicz et al., 2014; Lin, 2010; Zivkovic et al., 2015). Imagination, as a cognitive capacity, is accessible to all individuals and more importantly, imaginative thinking can be developed.

Additionally, other factors should be considered in the development of imagination as a skill or a process. Personality factors, which have been shown to vary by discipline in both creativity research and imagination research (Chang et al., 2014; Feist, 1998; Lin et al., 2015; Puryear et al., 2016; Yeuh et al., 2013), should be considered in developmental studies within an educational context. Developing scientific imagination is vastly different from the development of writers' imagination or the imagination of designers (Liao et al., 2014; Yeuh et al., 2013). Studying imagination through the lens of personality and discipline will help with the practical implementation of talent programs and areas of study. Also, environmental factors such as social and school climate and teacher beliefs investigated in relation to the
development of imagination so that researchers may better understand how these factors affect imagination and so practitioners may better understand how to address environmental factors that may positively or negatively impact imagination and thus, creativity.

Future Directions

Despite research extensively supporting imagination as a beneficial and essential capacity of human creativity, why does it remain unnoticed and undervalued in the classroom? It appears in a world where digital devices serve as secretaries and artificial intelligence ushers in the new wave of shopping and taking orders, imagination should be at the top of our educational priorities. The following are suggested areas of research in imagination as well as elaborated discussion and applications where necessary.

Puente-Díaz & Cavazos-Arroyo (2017) suggest future research that examines self-beliefs and their impact on imagery abilities rather than individuals perceived imaginative ability. Additionally, after synthesizing the attributes and findings of studies in this systematic review, only one study investigated the relationship between creative self-efficacy and imagination. Further investigations should be done using creative self-efficacy and imagination as primary variables.

Other studies call for exploratory research into other existing relationships with imaginative capacities. Some of these studies call for further investigations concerning mediating and moderating effects on imagination (Liang et al., 2013) as well as further analyzing the mediating effects of cognition on imagination (Hsu et al., 2014). Other analytical approaches and methodologies, such as qualitative and mixed methods, are suggested for
future research (Dziedziewicz et al., 2014). As mentioned previously, both replication and exploratory investigations should be conducted with more diverse populations to generalize results to broader populations.

Future research should also target imagination and correlates in specific domains or fields of interests. Additionally, which imaginative capabilities, or factors, are necessary for specific domains should be investigated (Liang & Chia, 2014). Research should also consider contextual, personality, psychological variables that may interact with imaginative capabilities and influence domain specific actions (Chang et al., 2016; Liang & Chia, 2014). More specifically, the personality trait of neuroticism and its relationship to imaginative factors should be examined (Lin et al., 2015).

Additional research should also consider environmental factors that cultivate imaginative thinking (Liang & Chia, 2014; Liang & Lin, 2015). Further research should examine creative pedagogy as an environmental factor and more specifically, curriculum that develops and stimulates imaginative capacity. For instance, Chang et al., 2016 suggest research that investigates curriculum that stimulates students’ entrepreneurial thinking and activity. Teacher perceptions and beliefs about imagination and imaginative factors should also be investigated (Beghetto, 2008).

Further research suggestions also focused on elaborating imaginative capability in the creative process, some even calling for studies looking at imagination in the creative genius (He et al., 2017). For example, (Liang & Chia, 2014) stress the importance of learning imagination factors and their connection to certain creative abilities. Another area of research that was not found in this review were studies that focused on collective imaginative capability and
creativity, however it was suggested as an area of further research. Additional suggestions included looking at personality variables and their relationship to collective imagination (Liang & Chia, 2014; Liang & Lin, 2015).

Conclusion

This overarching purpose of this study was to frame the construct of imagination as well as the studies surrounding it to garner a holistic view of where imagination research currently stands, but this goal is incomplete if we do not accurately address where we should move from here. In short, imagination deserves our attention as a key cognitive capacity in the field of creativity and educational research. Imagination is a skill that can be developed through engagement and environmental support. Further research should not only focus on imagination and correlates of imagination but should also aim to understand how imagination is developed. It is time to welcome imagination back to the institutional table, and even then, it’s not enough to simply recognize imagination as an important construct. As researchers and educators, we must continue to dispel the myths surrounding imagination, and we do this by further illustrating imagination as a skill for all individuals and accessible by all individuals.

References


Liu, Y., & Liang, C. C. (2014). The mediating roles of generative cognition and organizational culture between personality traits and student imagination. *International Journal of Educational Psychology, 3*(1), 49-68. doi:10.4471/ijep.2014.03


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