FACTORS INFLUENCING CREATIVE ACHIEVEMENT

by

HYERI PARK

(Under the Direction of Tarek C. Grantham)

ABSTRACT

Although a great deal of research has been conducted examining the relationship of domain knowledge or creative potential and creative achievement, there is still a lack of research on more comprehensive understanding on how much each of potential factors is related to individual's creative achievement. The current studies aimed to investigate potential factors influencing creative achievement based on Amabile's (1983) componential theory of creativity framework.

The first study examined potential influence of domain-relevant skills (domain knowledge) and creativity-relevant processes (creative potential) on everyday creativity and creative achievement (quantity and quality) among STEAM major undergraduate Korean students. The results indicated that creative-relevant skills (creative potential) would enhance everyday creativity and creative achievement regardless of any field of domain knowledge. The second study extended to examine the mediating role of everyday creativity in the relationship between personality factor (openness to experience), task motivation (intrinsic motivation) and creative achievement by comparing two different cultures. The study found the mediating role of everyday creativity and different direct and indirect path between two cultures. The result implied

that the role of everyday creativity is vital to be able to reach individual's actual creative achievement.

INDEX WORDS: Domain knowledge, STEAM, Divergent thinking, Ideational behavior, Openness to experience, Intrinsic motivation, Everyday creativity, Creative achievement, Culture

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by

HYERI PARK

B.A., Kyungnam University, Korea, 2003

M.A., Kyungnam University, Korea, 2010

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by

HYERI PARK

Major Professor:	Tarek C. Grantham
Committee:	Bonnie Cramond
	Margaret E. Hines
	Amanda E. Ferster

Electronic Version Approved:

Ron Walcott
Vice Provost for Graduate Education and Dean of the Graduate School
The University of Georgia
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CHAPTER 1

INTRODUCTION

Creative achievement has been the focus of creativity research over the decades. Although some people are engaged in professional creative pursuits, many people produce their creative products through their daily or leisure activities. Creative products can also be in different forms. A new poem or musical composition which is both novel and useful can be a creative product (Barron, 1969). However, not all creative products are in the arts. As Maslow said, "A first-rate soup is actually more creative than a second-rate painting" (Maslow, 1973, p. 136). Not only poems or sculptures, but even soups are considered as creative products (Besemer, 1984).

What do the traits of an individual with high creative achievements explain? Not only one single factor, but many factors have been investigated in explaining creative achievement. Amabile (1983) elaborated it with the components of creativity theory: three within-individual components and one outside the individual component: domain-relevant skills (expertise in the relevant domain or domains), creativity-relevant processes (cognitive and personality processes conducive to novel thinking), and task motivation (specifically, the intrinsic motivation to engage in the activity out of interest, enjoyment, or a personal sense of challenge) and one outside individual component (social environment) (Amabile, 2012).

According to Amabile's components of creativity, domain-relevant skills are vital for creativity. Domain-relevant skills include knowledge or intelligence in the particular

domain. Successful creators are not only creative but also intelligent (Sternberg & Lubart, 1996; Sternberg & O'Hara, 1999). Guilford (1981) emphasized intellectual ability to explain creativity and treated creativity as a subset of overall intelligence. From traditional a point of view, intelligence is considered as necessary yet not sufficient for creative achievements (Milgram & Milgram, 1976; Simonton, 2013). Research on the relationship between intelligence and creativity showed curvilinear relationship (Cho et al., 2010; Fuchs-Beauchamp et al., 1993; Karwowski & Gralewski, 2013) while other studies showed linear relationships (Preckel et al., 2006; Sligh et al., 2005). Traditional intelligence is more relevant in certain fields of creativity. From a three-level meta-analysis of 117 correlation coefficients from 30 studies, the estimated effects were stronger for overall creative achievement and achievement in scientific domains than for correlations between intelligence and creative achievement in the arts and everyday creativity (Karwowski et al., 2021).

However, ability to accumulate knowledge is not sufficient for creative achievement. For instance, traditional intelligence tests only account for minor variations in creative performance. They cannot measure directly the ability to generate new ideas or things (Taylor & Holland, 1962). Creative potential explains much about creative achievement. Level of creative achievement is actualized as time spent and received recognition in work, which is the result of successful and productive application of one's creative potential (Helson & Pals, 2000). A number of studies discussed how creative potential can be measured. Divergent thinking can be operationalized as the ability to generate diverse ideas. Divergent thinking (DT) tests can be useful estimates of the creative potential and good indicators estimating future creative performance (Runco,

2010; Runco & Acar, 2012). Through the meta-analyses of the relationship of creative achievement to both IQ and divergent thinking, Kim (2008) presented that DT test scores and creative achievement have higher correlation coefficients than IQ and creative achievement. However, few researchers argue that having a high score on DT tests alone is a sufficient condition to be creative (Piffer, 2012). Creative achievement requires not only divergent thinking ability but also other creative potential traits, such as ideational behavior or personality traits such as openness to experience.

Ideational behavior refers to actual overt behavior that involves ideation. It can be added to explain creative achievement in that actual overt behavior distinctively reflects the individual's use of ideas (Runco et al., 2001). Results from the study examining the relationship of ideational behavior and creative achievement with a sample of elementary school children across six domains indicated that ideational behavior played a significant role in explaining children's creative performance (Paek et al, 2016). Another trait, a personality factor, openness to experience, is also closely associated with creative achievement. With a large sample of 1,035 participants, Kaufman et al. (2016) found that openness to experience predicted creative achievement in the art domain, while intellect predicted creative achievement in the science domain. Personality traits such as openness to experience were consistently predictive of creative achievement when creativity was assessed with a self-rating creative achievement measure (Batey et al., 2010).

Amabile's (1983) third component of within-individual components is task motivation (specifically, the intrinsic motivation to engage in the activity out of interest, enjoyment, or a personal sense of challenge). According to Amabile (2012), a central tenet of the componential theory is the intrinsic motivation principle of creativity because

individuals are most creative when they feel intrinsically motivated by the interest or enjoyment rather than competition or evaluation in a certain way. In a discussion of the mediating role of intrinsic motivation on creativity and openness to experience, Prabhu et al. (2008) found that openness to experience is closely associated with both intrinsic motivation and creativity, and intrinsic motivation was strongly related to creativity. In a recent study which examined the role of motivation in the prediction of creative achievement inside and outside of the school environment, results showed that the interaction between openness and intrinsic motivation was the strongest predictor of creative achievement (Agnoli et al., 2018).

Amabile's (1983) outside the individual component is the surrounding environment – in particular, the social environment. Amabile (2012) explained this component using an example of work environment. Work environment can enhance creativity by encouraging new ideas or recognition for creative work. On the other hand, work environment could also block creativity by criticizing new ideas, conservative attitude, and emphasis on the status quo. An individual's creative potential is influenced by different elements of social environment. For instance, social norms and cultural values emphasizing social harmony and fitting in could limit degree of expression and consequently negatively influence individuals' originality (Ivcevic, 2009).

The concept of individualism vs. collectivism has been used as a dimension to differentiate among cultures (Eisenberg, 1999). The features of individualism include self-reliance, competitiveness, aggressive creativity, and individual pleasure seeking, while collectivism includes group protection, and cooperation with the group (Hsu, 1983; Triandis, 1990). Views of creativity in individuals in the East are often described as

reflecting a collectivist perspective, while western views are described as reflecting individualism.

Level of creative achievement is the result of successful productivity from individual's creative potential toward new and valuable constructions by time spending and receiving recognition (Helson & Pals, 2000). More recently, more wide spread forms of creativity such as everyday creativity have seen much attention (Silvia, 2018). Everyday creative accomplishment should not be overlooked (Richards, 2009). Everyday creativity is defined as self-expression that focuses on human originality in daily activities taking place in leisure time (Hegarty, 2009), and problem solving in everyday life among non-eminent populations (Richards, 2010; Richards et al., 1988).

Objectives of the Current Studies

From research on creative achievement, it is apparent that creative potentials such as divergent thinking, ideational behavior, openness, and intrinsic motivation are closely related to creative achievement. However, these studies raise questions about how much each of these creative potential factors accounts for creative achievement beyond domain-relevant skills (domain knowledge). Domain knowledge on creativity was substantively addressed for decades, but mainly comparing science and art in a dichotomous perspective. Because of increasing attention to STEM/STEAM education and creativity, it is intriguing to investigate differences of creative potentials and creative achievements in STEAM (Science, Technology, Engineering, the Arts, and Mathematics) areas, not limited only to the broad categories of science and art.

Therefore, first study investigated differences of creative potential and creative achievements in STEAM domains and further examined the role of creative potentials on

creative achievement beyond controlling domain-relevant skills (STEAM domains) based on Amabile's (1983) componential theory of creativity. The second study extended to examine components of the creative-relevant process (openness to experience as a personality factor) and task motivation (intrinsic motivation) in the relation to creative achievement was examined along with the role of everyday creativity by comparing an outside individual component (culture as social environment).

A study of domain knowledge and creative potential in relation to everyday creativity and creative achievement among STEAM undergraduate Korean students

The first study examined the influence of domain knowledge (domain-relevant skills) and creative potential (creativity-relevant processes) on everyday creativity and creative achievement. From the responses of 270 STEAM major undergraduate students in Korea, a one-way MANOVA (STEAM major) was used to explore the difference on creative potential, everyday creativity and creative achievement. In addition, a hierarchical multiple regression model tested possible predictors of creative potential on everyday creativity and creative achievement.

The following research questions guided this study.

R1: Is there a statistically significant difference among students in the STEAM domains in everyday creativity and creative achievement (quantity and quality)?

R2: To what extent does domain knowledge (STEAM major) predict students' everyday creativity and creative achievement (quantity and quality)?

R3: To what extent does creative potential (divergent thinking and ideational behavior) predict everyday creativity and creative achievement (quantity and quality)?

R4: To what extent does the personality factor (openness to experience) predict everyday creativity and creative achievement (quantity and quality)?

270 STEAM major undergraduate Korean students participated for this study. To examine group comparison among STEAM major undergraduate students regarding the first research question, the one-way multivariate analysis of variance (MANOVA) was conducted. The MANOVA was followed up with discriminant analysis, and a canonical discriminant function analysis. Regarding the following research questions from two to four, hierarchical multiple regression was conducted in order to examine if domain knowledge (STEAM major), creative potential (divergent thinking and ideational behavior), and personality factor (openness to experience) would predict and explain variance in everyday creativity and creative achievement (quantity and quality).

A study of everyday creativity mediating openness to experience, motivation and creative achievement among Korean and American college students

The second study used multiple-group structural equation modeling (MGSEM) to examine the mediating role of everyday creativity in the relationship between individual components (openness to experience and intrinsic motivation) and creative achievement by comparing an outside individual component (culture-Eastern and Western cultures).

To achieve this study goal, the specific research questions are as follows:

R1: What are the relationships among cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement?

R2: How do cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement differ between two cultural orientations?

R3: Will everyday creativity mediate in the relationship between components (openness to experience and intrinsic motivation) and creative achievement?

R4: Will mediation mechanism differ in two different cultures?

Data from 98 Korean and 134 American college students were used to achieve the study purpose. The Pearson correlations were calculated to address the first research question examining in the relationships among cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement. Regarding the second research question, an independent sample t-test was computed to examine differences of study variables between two cultural orientations (Korea and America). Regarding the rest two research questions (R3 & R4), a multiple-group SEM (MGSEM) was conducted to examine mediating effect of everyday creativity in the relationship between individual components (openness to experience and intrinsic motivation) and creative achievement by comparing two cultures.

These two studies were undertaken to contribute to a more in depth understanding of the mechanism of influencing factors of within-individual components and outside the individual component on everyday creativity and actual creative achievement. The role of domain knowledge (STEAM major), creative-relevant skills (creative potentials such as ideational behavior, openness to experience) and task motivation (intrinsic motivation)

were investigated on individuals' everyday creativity and creative achievement. Specific discussion and implications of these two studies are described in the following chapters.

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CHAPTER 2

REVIEW OF THE LITERATURE

In the sense that everyone has creative potential, each individual has infinite possibilities to actualize a certain level of creative achievement in one's life. Considerable amounts of previous research interrogated the relationship of creative potential and creative achievement, however, in-depth understanding of factors influencing actual creative achievement is still needed.

Amabile (1983) explained the level of an individual's creativity is a function of creativity components operating within and around the individual. The components of creativity include three within-individual components and one outside the individual component: domain-relevant skills (expertise in the relevant domain or domains), creativity-relevant processes (cognitive and personality processes conducive to novel thinking), and task motivation (specially, the intrinsic motivation to engage in the activity out of interest, enjoyment, or a personal sense of challenge), and outside the individual component (social environment). In this chapter, based on the components of creativity, each component influencing creativity is discussed in relation to the two studies of this dissertation.

First component: domain-relevant skills (domain knowledge)

Understanding the terminology regarding domain is an initial crucial step to comprehend for further investigation of domain relevant research. Baer (1998) clearly

defined the terminology of domain. According to Baer (1998), the evidence of domain specificity includes, more broadly, cognitive domains such as scientific, mathematical, and artistic domains and, more narrowly, task based or content domains such as story writing or collage making.

Scientific creativity is different from artistic creativity since it is concerned with creative science experiments, creative scientific problem finding and solving, and creative science activity. For instance, scientists who breakthrough in a science field may not be accomplished at performing art creatively (Huang et al., 2017).

From the domain specific point of view on creativity, Hu and Adey (2002) discussed in detail the distinct features of scientific creativity from general creativity and developed a Scientific Creativity Structure Model (SCSM). Below is the elaborated definition with a set of hypotheses about the structure of scientific creativity (Hu & Adey, 2002, p.392).

(1) Scientific creativity is a kind of ability. The structure of scientific creativity itself does not include non-intellectual factors, although non-intellectual factors may influence scientific creativity.

(2) Scientific creativity must depend on scientific knowledge and skills.

(3) Scientific creativity should be a combination of static structure and developmental structure. The adolescent and the mature scientist have the same basic mental structure of scientific creativity but that of the latter is more developed.

(4) Creativity and analytical intelligence are two different factors of a singular function originating from mental ability.

Based on their theoretical justification, with the data of 160 secondary school students, Hu and Adey (2002) indicated that science ability is a necessary but not sufficient condition for scientific creativity. Although the scientific process and the general creative process have similarities in considering creative products as novel and useful, these two constructs are distinctive in theoretical foundations in terms of the knowledge component and domain-relevant skills (Ayas & Sak, 2014). Based on these assumptions, Ayas and Sak (2014) developed a domain-specific test of scientific creativity, which is C-SAT for measuring scientific creativity.

Much evidence has shown that artistic creativity is distinct from scientific creativity. By conducting a meta-analysis of personality in scientific and artistic creativity, Feist (1998) found that creative people in art have different personality profiles from creative people in science. Artists are more emotionally instable, cold, and reject group norms more than scientists. Akinola and Mendes (2008) investigated not only the personal level, but also situational factors related to creativity. From this study, interesting results showed that social rejection was associated with greater artistic creativity. As additional evidence for the person by situation model, they found that individuals performed better on artistic creativity tasks when they were more vulnerable and in a strongly rejecting situation.

Second component: creativity-relevant processes

Not only eminent people, but every individual has creative potential in many aspects of their personal and professional lives (Davis, 1989; Runco, 2004). Torrance (1979) put it this way, individuals can be creative in various ways without any limit. However, the level of creative achievement may differ in their lives. Even though one has

a high level of creative potential, without any intentional efforts, it is unfeasible to reach a certain degree of creative achievement. Level of creative achievement is the result of the successful and productive application of creative potential through investment of time in work and acknowledgement that is received for work (Helson & Pals, 2000).

Amabile (1983) described that creativity-relevant processes include skills in generating ideas as well as a cognitive and personality processes conducive to novel thinking. The creativity-relevant processes component can be explained in creative potential framework. Creative potential refers to the presence of an individual's various traits such as aptitudes (e.g., divergent thinking) and personality traits (e.g., openness) (Fürst, & Grin, 2018).

Divergent thinking

Creative potential remains latent until it is measured by a task (Lubart et al., 2013). The most frequently used task for measuring creative potential is through Divergent Thinking (DT) tests. Divergent thinking can be operationalized as the ability to generate diverse ideas. Study of divergent thinking has been conducted for a long period of time and the largest areas have been in creativity research (Guilford, 1950; Weisberg, 2006; Silvia et al., 2008). Although it is possible that someone who has high scores on divergent thinking tests never actually performs in a creative manner (Runco & Acar, 2012), a substantial amount of research indicated that divergent thinking ability is one of the primary attributes in predicting actual creative achievement and often leads to originality. The results from a meta-analysis (Kim, 2008), the relationships between both IQ and divergent thinking test scores and creative achievement indicated that there is a significantly higher relationship between divergent thinking test scores and creative

achievement (*r*= .216, 95% CI= .207-.225) than between IQ test scores and creative achievement (*r* = .167, 95% CI=.141-.193).

Using an open-ended question type of divergent thinking (DT) tests, ideational fluency, originality, and flexibility can be measured. Divergent thinking (DT) tests are the most often used instruments for measuring an individual's creative potential based on the psychometric tradition of creativity research (Acar et al., 2020; Baer, 1994; Zeng et al., 2011). Widely used divergent thinking tests include the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1966) and different kinds of divergent thinking (DT) tests (e.g., Wallach and Kogan's DT tasks, 1965). Divergent thinking is domain general, but can also be domain specific, in that, collage making is different from that in storytelling (Baer, 1998).

Ideational behavior

Not only DT tests, but also ideational behavior can be used to measure creative potential. Ideation, in fact, may need to be addressed in any effort to interpret potential into actual performance (Runco, 2010). Ideational behavior is a universal component of creativity in that creativity at all levels involves ideation (Runco et al., 2001). Empirical studies indicated that ideational behavior is related to creativity and influences individuals' creativity. In order to assess ideational behavior, the Runco Ideational Behavior Scale (RIBS) (Runco et al., 2001) has been used for two decades in creativity research. The Runco Ideational Behavior Scale (RIBS) focuses on the internal world of ideas rather than on measuring a performance of creativity (Batey et al., 2010).

In examining the influence of ideational behavior on creative extracurricular activities, the study found that ideational behavior made a significant contribution to

creative activity in all six domains (e.g., science, art, writing, technology) of creative achievement even after ruling out the motivational contribution from creative self-efficacy from the sample of 255 elementary students (Paek et al., 2016). In a recent study exploring social media use and creativity, Acar et al., (2021) found that those who use social media primarily for expressing their ideas or opinions have a high degree of ideational behavior and creative activity.

Openness to experience

Amabile's (1983) creativity-relevant processes also include personality characteristics. Among personality factors, a substantial amount of evidence from previous research showed a positive association between openness to experience and creativity (Feist, 1998; Ivcevic & Brackett, 2015), and the prediction of openness to experience on actual creative achievement. Openness to experience is a consistent and significant correlate of various aspects of creativity, which was the strongest predictor of creative achievement (Batey & Furnham, 2006; Feist, 1998, 2010). Openness to experience is among the big five dimensions of Personality Theory (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) and is both conceptually and empirically the most closely associated with individual creativity and creative achievement (Kaufman et al., 2016; Schilpzand et al., 2011).

The empirical evidence demonstrated that openness to experience enables people to engage in novel and unique ways of thinking that contradict traditional conventions. According to McCrae (1987), openness to experience as well as divergent thinking abilities are commonly inevitable conditions for creativity, providing the tendency and aptitude for original thinking. The result of the study indicated that those with higher

levels of openness to experience had higher levels of divergent thinking accordingly, which was associated with creativity. From a large sample of 1,035 participants, Kaufman et al. (2016) investigated the predictive validity of openness and intellect across arts and sciences. This study confirmed that openness predicts creative achievement in the arts while intellect predicts creative achievement in the sciences.

Jauk et al. (2014) investigated a latent variable model of the road to creative achievement and found that openness to experiences along with creative potential, ideational originality and fluency predicted everyday creative activities which predicted actual creative achievement. Silvia et al. (2014) explored which traits predicted daily time spent on creative pursuits. As a result, openness to experience, a trait associated with behavioral flexibility, strongly predicted time spend on creative activities. In an organization study, McCrae and Costa (1997) suggested that employees with a high openness to experience personality dimension have a variety of different approaches and perspectives, and openness was the most relevant trait for creativity.

Several studies from investigations on brain structures also showed the relationship between openness to experience and creativity. For instance, Li et al. (2015) investigated brain structures underlying individual differences in trait creativity using structural magnetic resonance imaging (sMRI). The results in this study found that openness to experience mediated the relationship between brain structure and the results on the Williams Creativity Aptitude Test (WCAT), which was used as the measure of individual trait creativity. They suggested that the personality trait of openness to experience plays a crucial role in shaping individual's creativity.

Third component: task motivation (intrinsic motivation)

The third within-individual component of Amabile's (1983) components theory of creativity is task motivation (especially intrinsic motivation) involves in undertaking a task because of personal interests or satisfaction rather than extrinsic motivation from rewards or competition (Amabile, 2012). Many studies indicate that intrinsic motivation is viewed as fundamental for creative achievement (Amabile, 1983; Csikszentmihalyi, 1996; Runco, 2007; Sternberg, 2006).

Jesus and his colleagues (2013) investigated intrinsic motivation and creativity related to product through a meta-analysis of the studies published between 1990 and 2010. As a result, this meta-analysis identified a positive relationship between intrinsic motivation and creativity related to product (r=.30, p=.001) by analyzing fifteen studies. In a recent study which examined the role of motivation in the prediction of creative achievement inside and outside of the school environment, results showed that the interaction between openness and intrinsic motivation was the strongest predictor of creative achievement (Agnoli et al., 2018).

Studies examining the mediation role of intrinsic motivation also showed the positive influence of intrinsic motivation on creativity. For example, Prabhu et al. (2008) empirically tested the mediating and moderating role of intrinsic and extrinsic motivation in the relationship between three personality traits (openness to experience, self-efficacy, and perseverance) and creativity with a sample of 124 undergraduate students. This study found that intrinsic motivation partially mediated the relationship between creativity and openness to experience. This result supported the potential mediating role of intrinsic motivation. Partial mediation happens when the mediating variable (intrinsic motivation)

is only responsible for a part of the relationship between creativity and openness to experience. In another study examining the mediating role of intrinsic motivation in the mechanism of openness and creativity, from 198 undergraduates in Malaysia, Tan et al. (2019) found that students who scored high on openness had higher intrinsic motivation. The high motivation increased engagement in creativity related activities, and ameliorated students' creativity.

Fourth component: outside the individual component

Amabile's (1983) outside the individual component can be explained by social environment. For instance, individuals' creativity are largely influenced by work environment because work culture could serve as obstacles or as stimulants to individuals' intrinsic motivation and creativity. The social environment is defined that, "The social environment refers to the immediate physical and social setting in which people live or in which something happens or develops. It includes the culture that the individual was educated or lives in, and the people and institutions with whom they interact." (Wikipedia, 2021).

From the cultural perspective, how individuals in the east and west view creativity, and the degree of their creative expressions or type of support system might differ among cultures. Views of creativity in individuals in the East are often described as reflecting a collectivist perspective, while western views are described as reflecting individualism. A substantial study showed how two different cultures in the east and west have different conceptions of creativity and demonstrate different degrees of creative achievement (e.g., Lan & Kaufman, 2012; Niu & Sternberg, 2002; Paletz & Peng, 2008).

Pang and Plucker (2012) presented two different approaches (Top-down vs. Bottom-up) when comparing two cultures in promoting creativity in China and America. Chinese school systems can be explained as a top-down approach. Schools in China are to follow national and local educational policies in determining when and how to nurture creativity from the local level to school level. Perfectionism is applied to achieve high-level creativity, in this sense, as a means of achieving artistic creativity, Chinese parents push their children to practice different forms of the arts including painting, Chinese calligraphy, and musical instruments (Niu & Kaufman, 2013). In Niu and Sternberg (2001)'s study, cultural influences on artistic creativity were investigated by comparing American and Chinese participants. The authors found that American participants produced more creative and aesthetically pleasing artwork than did their Chinese counterparts. These results supported the hypothesis that an independent culture is more supportive of the development of artistic creativity than an interdependent culture. However, Rudowicz (2004) emphasized that justifying treating Chinese culture (traditional culture and contemporary culture) as a uniform group should be a caution because China has long history of inventions, unique art and poetry along with a high reverence towards tradition.

French and Song (1998) described that, in general, in a typical Korean preschool classroom, teachers talk while students sit still and listen to the teacher more as compared to children in the American classrooms. Elementary and secondary classrooms are not much different. Korean teachers' conception of creativity is also tied to the Asian cultural influence focusing on group goals and contribution to the society, while American

teachers' emphasis is more on individual student's personal goals and emotional support when teaching creativity (Nisbett & Masuda, 2003).

However, even within the same cultural orientation, different generations may have distinct concepts of creativity and values towards creativity. Rudowicz (2003) described that Korean lay peoples' implicit concepts of creativity are similar to Westerners although Korean teachers emphasize negative characteristics of creative students more than North Americans. There are also contradictory statements that unlike Korean adults, young Korean students value the creator as a successful leader, which is not different from Westerners' view (Niu & Sternberg, 2002).

Everyday creativity

Everyday creativity is defined as self-expression focusing on human originality in daily activities and problem solving in everyday life among non-eminent populations (Richards, 2010; Richards et al., 1988). To understand everyday creativity, what happens in an individual's natural environments should be investigated (Silvia et al. 2014). Everyday creativity is more associated with little-c creativity (Kaufman & Beghetto, 2009), and daily creative leisure activities or hobbies for enjoyment fall in this category.

Craft (2003) defined little-c creativity as capacity to encompass personal effectiveness in successfully enabling the individual a course of action in everyday life. Little-c is motivated by intrinsic motivation involving real life innovation (Karwowski, 2009). For instance, everyday little-c activities include planning a fundraising event (Richards, 2007), creatively arranging family photos in a scrapbook (Kaufman & Begheto, 2009), creating humor (e.g., coming up with a funny nickname for someone)

(Ivcevic, 2007), and making greeting cards or rocking out in a basement (Silvia et al. 2014).

In a recent article, Amabile (2017) posed a question: “When ordinary people undertake creative endeavors in their work or non-work lives, what is the nature of their everyday psychological experiences, and how do those experiences affect creative outcomes?” From analyzing nearly 12,000 daily electronic diary entries from 238 professionals working on creativity projects in seven different companies, Amabile and colleagues discovered three important points. First, daily psychological experience such as motivations or emotions significantly influence daily creative performance. Second, making progress in meaningful work is the most important because all the events at work can lead to positive psychological experience. Finally, individuals trying to be creative in their work experience a rich and wide variety of motivations, emotions, and perceptions that associate with their work and color the quality of their lives.

Across two studies, Benedek et al. (2020) explored the association of nine different motivations including enjoyment, expression, and challenge on creativity. The results strongly indicated that intrinsic motivations such as enjoyment, expression, and development of one’s potential primarily influenced everyday creative activities. The distinct finding from other studies is that this study highlighted that individuals pursue everyday creative activities as a means to revive or to have an enjoyable time. These findings confirmed that everyday creativity can be not only be a consequence, but also a cause, of positive affect (Richards, 2010).

Fürst and Grin (2018) reviewed a comprehensive method for the measurement of everyday creativity and categorized it into two main methods, several questionnaires

(assessing aspects of personality, cognitive styles, creative interests, activities, and achievements) and creativity tasks (divergent thinking, insight, and "real-life" creativity tasks). Self-report measures of creative activities and achievements are clearly distinct in nature from measures of personality traits. Actual activities and creative achievement measures are more direct by asking respondents to explicitly indicate their everyday creative activities and achievement in various domains while measures of traits or styles are somewhat indirect indicators of creativity (Fürst, & Grin, 2018).

Creative achievement

Creative achievement refers to observable creativity at a given point in time from the form of a single product or overall creative performance (Fürst, & Grin, 2018). In a similar vein, creative achievement can be defined as, "Creative achievement requires the attribution of sufficient originality and effectiveness to a represented outcome of a creative process by at least one estimator at a specific time" (Corazza, 2016).

To measure individuals' creative achievement, various measures are employed in different studies and a creative product can be achieved through different domains, such as science, mathematics, crafts, or technology, for example. Some of them include the Creative Achievement Scale (CAS) (Ludwig,1992) and Lifetime Creative Sales measuring everyday creativity (Richards et al., 1988); the Creative Behavior Inventory (Hocevar, 1979); the Creative Achievement Questionnaire (CAQ) (Carson et al., 2005); and the Creative Activity and Accomplishment Checklist (CAAC), which is part of the Runco Creativity Assessment Battery (rCAB).

An empirical study by Jauk et al. (2014) investigated the effects of creative potential, intelligence, and openness to experiences on everyday creative activities and

actual creative achievement. Latent multiple regression analyses by structural equation modeling (SEM) from a sample of 297 participants showed that openness to experiences and ideational fluency and originality predicted everyday creative activities and actual creative achievement. Through meta-analysis, Kim (2008) examined the relationship of creative achievement to both IQ and Divergent Thinking test scores. The analysis found a significantly higher relationship between DT test scores and creative achievement (r = .216, 95% CI= .207-.225).

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CHAPTER 3

A STUDY OF DOMAIN KNOWLEDGE AND CREATIVE POTENTIAL IN RELATION TO EVERYDAY CREATIVITY AND CREATIVE ACHIEVEMENT AMONG STEAM UNDERGRADUATE KOREAN STUDENTS[1]

[1] Park, H. To be submitted to *Thinking Skills and Creativity*

Abstract

The purpose of this study was to examine the influence of domain knowledge (domain-relevant skills) and creative potential (creativity-relevant processes) on everyday creativity and creative achievement based on Amabile's (1983) componential theory of creativity framework. Results from the one-way MANOVA, with 270 STEAM (Science, Technology, Engineering, the Arts, and Mathematics) major undergraduate students, indicated that no STEAM major effects appeared for creative achievement (quality), but significant differences occurred in the everyday creativity and creative achievement (quantity). In examining predictors for everyday creativity and creative achievement, hierarchical multiple regression model testing results indicated that ideational behavior (creative potential component) explained significant variance in everyday creativity and creative achievement, and further, as hypothesized, this study confirmed that openness to experience (personality factor) explained significant variance beyond that provided by creative potential (divergent thinking and ideational behavior) and domain knowledge (STEAM major). The study found additional critical roles of creative potential and personality factor such as openness to experience in STEAM undergraduate education. Results and implications for STEAM education are discussed.

INDEX WORDS: Domain knowledge, STEAM, Divergent thinking, Ideational behavior, Openness to experience, Everyday creativity, Creative achievement (quantity and quality), MANOVA, Hierarchical multiple regression

Introduction

An individual's creative work can be explained by Amabile's (1983) componential theory of creativity framework. According to the componential theory, the influences on creative work include three within-individual components and a component outside the individual, social environment. The three within-individual components are domain-relevant skills (expertise in the relevant domain), creativity-relevant processes (cognitive and personality processes conducive to novel thinking), and task motivation (the intrinsic motivation to engage in the activity out of interest, enjoyment, or a personal sense of challenge). Domain-relevant skills include knowledge or skills in the particular domain such as electrical engineering. Creative-relevant processes include cognitive style and personality such as skills in idea generation (Amabile, 2012). In a similar vein, Simonton (2012) argued that both domain-specific knowledge and creative potential (creativity-relevant processes such as personality) are the drive for creative achievement.

Domain knowledge as a domain specific factor

Although no clear definition exists for the term *domain*, a variety of domain areas in creativity studies have been discussed over the decades. Gardner (1983), Guilford (1967), Holland (1997), and many others proposed multi-dimensional or domain specific aspects of intelligence rather than a unitary construct. Gardner (1983) asserted seven discrete "intelligences" which challenged traditional views of human intelligence (Hopper & Hurry, 2000). His initial theory of Multiple Intelligences introduced seven intelligences: logical-mathematical, linguistic, musical, spatial, bodily-kinesthetic, interpersonal and intrapersonal (Gardner, 1983). Guilford (1967) proposed the multi-dimensional structure of intelligence. His structure of the intellect model (SOI) led to

discussion of the nature of creative thinking over the multidimensional perspective of diverse domains along with domain generality. Holland's (1997) vocational interest model (realistic, investigative, artistic, social, enterprising, and conventional) was also addressed in the concept of specificity of creative domains. More recently, Kaufman and Baer (2004) broadly defined creativity in cognitive domains, such as mathematical or musical domains and more narrowly, task level domains, such as story or poetry writing.

How creativity is alike or different in different domains was discussed in several studies. Science is considered to represent rationality and logical reasoning, while art is commonly regarded as primarily aesthetic. For this reason, creativity is more associated with art than science (Kind & Kind, 2007). By conducting a meta-analysis of personality in scientific and artistic creativity, Feist (1998) found that creative people in art and science have different personality profiles. Artists tend to be more emotionally unstable and more likely to reject group norms than scientists. Furnham and colleagues (2011) examined divergent thinking fluency, self-rated creativity, and creative achievement in matched groups of art and science students. Their results indicated that self-rated creativity displayed significant group differences; arts students scored higher on self-rated creativity than science students. On the other hand, Schmidhuber (2009) viewed artists and scientists as alike in creating a new product of curiosity, but not when encountering random data or previously unknown regularities.

Over the several decades since, more studies in creativity investigated domain specificity, and the concept of subdomain was further discussed in a great number of studies. Mathematicians and musicians have different definitions of creativity, and musicians are distinct from plastic artists, and poets from novelists in their cognitive

domains (Villarreal et al., 2013). The characteristics and thinking processes differ from domain to domain (Li, 1997).

In Amabile's (1983) componential theory, another within-individual component is creativity-relevant processes (cognitive and personality processes conducive to novel thinking). According to this theory, an individual's creative achievement can be further explained by creativity-relevant processes beyond domain-relevant skills (expertise in the relevant domain). The component of creativity-relevant processes is also explained by creative potential (domain general) framework.

Creative potential as a domain general factor

Creative potential refers to an individual's creative ideation or ideational behavior that reflects skill with ideas (Runco, Plucker & Lim, 2001). Hinton (1968 & 1970) defined creative potential as the creative capacity, skills, and abilities that the individual possesses. Walberg (1988) specified creative potential as a latent ability to produce creative work. An individual's unique combination of these latent abilities (e.g., cognition, personality) explains differences in an individual's creative potential across domains and creative tasks (Lubart, 1999; Lubart, Zenasni, & Barbot 2013; Sternberg & Lubart, 1995). Creative skills and abilities, and other aspects of creative potential are necessary prerequisites for creative action (Ford, 1996; Tierney & Farmer, 2002; Woodman & Schoenfeldt, 1989).

One of the major factors largely tied to creative potential is divergent thinking because it reflects the individual's ability to generate original, flexible, and fluent ideas (Runco, Plucker & Lim, 2001). Divergent thinking can be operationalized as the ability to generate diverse ideas. Creative potential has been most often measured by divergent

thinking tests (Torrance, 1974), which is based on the psychometric tradition of creativity research (Zeng et al., 2011). Divergent Thinking (DT) tests are useful estimates of creative potential (Runco & Acar, 2012). With open-ended questions, DT tests are assessed for ideational fluency, originality, and flexibility (Runco, 1986) among other abilities (Torrance, 1974).

Although DT tests are still popular instruments for measuring creative potential, DT inventories have underlying limitations and, therefore, have received considerable criticism (Zeng et al., 2011). For instance, ideational fluency has a confounding factor with ideational originality (Dumas & Runco, 2018; Forthmann et al., 2020; Hocevar, 1979), and divergent thinking tests alone do not fully account for individual's creative potential in generating creative breakthroughs (Kilgour, 2006).

Another component of creative potential can be discussed from the ideation or ideational behavior perspective. Ideation, in fact, may need to be addressed in any effort to interpret potential into actual performance (Runco, 2010). Ideational behavior is a universal component of creativity in that creativity at all levels involves ideation (Runco et al., 2001). In order to assess ideational behavior, the Runco Ideational Behavior Scale (RIBS) has been used for two decades in creativity research. The Runco Ideational Behavior Scale (RIBS) focuses on the internal world of ideas rather than on measuring a performance of creativity (Batey et al., 2010).

Empirical studies have implemented RIBS for measuring creative potential and for predicting creative achievement. For instance, the influence of ideational behavior on creative extracurricular activities was examined in 255 elementary student samples. The results showed that even after ruling out the motivational contribution from creative self-

efficacy, ideational behavior made a significant contribution to creative activity in all six domains (e.g., science, art, writing, technology) of the creative achievement (Paek et al., 2016). When examining why certain entrepreneurs are successful, Ames and Runco (2005) discovered that the more successful entrepreneurs had higher Runco Ideational Behavior Scale (RIBS) scores, which means that they tended to produce many ideas and use their ideational skills more frequently in the natural environment.

Openness as a component of personality

In Amabile's (1983) componential theory, creativity relevant processes also include personality such as openness to experience. In creativity research, personality has been repeatedly shown to account for variance in creative achievement (e.g., Feist, 1998; Furnham et al., 2008). Among personality factors, Openness to Experience is a consistent and significant correlate of various aspects of creative potential, which was the strongest predictor of creative achievement (Batey & Furnham, 2006; Feist, 1998, 2010). In investigating a latent variable model of the road to creative achievement, Jauk et al. (2014) found that openness to experiences along with creative potential, ideational originality, and fluency predicted everyday creative activities which, in turn, predicted actual creative achievement. King, et al. (1996) instructed participants to freely list their creative accomplishments and subjected these lists to peer ratings. As a result, they found that quality ratings were best predicted by an interaction between creative potential and openness to experiences.

The Big Five Inventory has been used to measure the personality dimensions in the context of creativity (Feist, 1998; Kwang & Rodrigues, 2002; Sung & Choi, 2009). Five personality dimensions—neuroticism, extraversion, openness to experience,

agreeableness, and conscientiousness were included in the Big Five Inventory (John et al., 1991; John & Srivastava, 1999). Openness to Experience is the personality dimension that is most frequently examined, with findings that have consistently shown it to be a positive predictor of creativity (George & Zhou, 2001; McCrae & Costa, 1997; Puryear et al., 2017). The Big Five personality domain Openness to Experience includes a mix of traits that relate to intellectual curiosity, intellectual interests, perceived intelligence, imagination, creativity, artistic and aesthetic interests, emotional and fantasy richness, and unconventionality (Kaufman, 2013).

In an empirical study of the relationship between the Big Five factors and creative performance, Sung and Choi (2009) found that extraversion and openness to experience had significant effects on individual creativity. In addition, consistent with previous studies (George & Zhou, 2001; McCrae & Costa, 1997), the empirical evidence added the finding that openness to experience enabled people to engage in novel and unique ways of thinking which contradicted traditional conventions.

Everyday creativity

Creativity research has focused on creative achievements in different domains. Since Richards and colleagues (1988) introduced the Lifetime Creativity Scales (LCS) for assessment of everyday creativity, more recent studies have focused on everyday creativity. Everyday creativity is defined as self-expression that focuses on human originality in daily activities and problem solving in everyday life among non-eminent populations (Richards, 2010; Richards et al., 1988). Most previous studies on everyday creativity used college students or children as participants. Deriving from the line of everyday creativity theories and previous studies, everyday creativity focuses on little-c

creativity (Kaufman & Beghetto, 2009). Contrary to Big-C creativity as genius-level creativity, little-c creativity refers to the everyday creativity that may be found in most people in their daily lives (Merrotsy, 2013). Daily creative leisure activities for enjoyment fall in this category, for instance, planning a fundraising event (Richards, 2007), creatively arranging family photos in a scrapbook (Kaufmann & Begheto, 2009), and creating humor (e.g., inventing a funny nickname for someone) (Ivcevic, 2007).

Previous measures that assessed actual creative accomplishment have limitations in that these measures focused on specific areas (e.g., arts or science) and also required social recognition (e.g., awards or citations) (Richards et al., 1988). Ivcevic (2009) identified 5 factors (Crafts, Cultural refinement, Self-expressive creativity, Interpersonal creativity, and Sophisticated media consumption) in order to measure everyday creativity among 121 items in a sample of college students. Sample items included: made a scrapbook, made photo collages for crafts domain; nonfiction books read, visited museum (other than art) for Cultural refinement; painted clothes, invented recipe for Self-expressive creativity; told jokes, made self the center of attention for Interpersonal creativity; researched on topic of interest on the Internet, read music reviews for Sophisticated media consumption.

A handful of recent studies investigated motives for everyday creativity. Results from 750 participants indicated that intrinsic motives, such as enjoyment of creative activities were considerably related to high openness to experience in the prediction of creative achievement (Benedek et al., 2020). In another study that analyzed participants' (N=433) diary investigations of their everyday creative behaviors and activity regarding arts, science, and everyday functioning, such as cooking and blogging, researchers found

that active positive emotions predicted daily creative behaviors in general although individual differences played a role in complex domain specific skills (Karwowski et al., 2017).

Assessment of creative achievement

Creative potential is closely related to creative achievement. Creative achievement can be characterized as the sum of creative products that an individual produces over the course of his or her lifetime (Carson et al., 2005). Creative potential in a youthful genius in certain conditions, such as cultural and social conditions, becomes fully actualized in the form of fertile and meaningful creative productivity in adulthood (Simonton, 1978). When compared with creative achievement in adulthood, children's creativity is often not considered outstanding when applied to eminent standards (Runco, 2003).

A creative product can be achieved through different domains, such as writing, composition, science experiments, crafts, or technology. Barron (1955) emphasized that the criteria for a creative product should be originality and functionality in relation to reality in a pragmatic way. Level of creative achievement is the result of the successful and productive application of creative potential through investment of time in work and acknowledgement that is received for work (Helson & Pals, 2000).

Various measures have been used in different studies to assess creative achievement. Some of them include the Creative Achievement Scale (CAS) (Ludwig,1992) and Lifetime Creative Scales measuring everyday creativity (Richards et al., 1988); the Creative Behavior Inventory (Hocevar, 1979); the Creative Achievement Questionnaire (CAQ) (Carson et al., 2005); and the Creative Activity and

Accomplishment Checklist (CAAC), which is part of the Runco Creativity Assessment Battery (rCAB).

Runco (1986) examined the relationship between Divergent Thinking test scores and creative performance by comparing gifted and nongifted children. The results indicated that with the gifted sample, the divergent thinking and creative performance scores were moderately related. Kim (2008) examined the relationship of creative achievement to both IQ and Divergent Thinking test scores by using meta-analysis. The analysis found a significantly higher relationship between DT test scores and creative achievement (r = .216).

The Present Study

Based on Amabile's (1983) componential theory of creativity, two within-individual components (domain-relevant skills and creative-relevant processes) are discussed. Simonton (2012)'s emphases on both domain-specific knowledge and creative potential as drivers for creative achievements are coherent with Amabile's componential theory. This focus motivated this investigation on whether domain-relevant skills (domain knowledge) predict creative achievements (everyday creativity and quantity and quality of creative achievements) and creative-relevant processes (creative potential such as divergent thinking, ideational behavior, and openness to experience) predict creative achievements beyond domain-relevant skills.

The following research questions guided this study.

R1: Is there a statistically significant difference among students in the STEAM domains in everyday creativity and creative achievement (quantity and quality)?

R2: To what extent does domain knowledge (STEAM major) predict students' everyday creativity and creative achievement (quantity and quality)?

R3: To what extent does creative potential (divergent thinking and ideational behavior) predict everyday creativity and creative achievement (quantity and quality)?

R4: To what extent does personality factor (Openness to experience) predict everyday creativity and creative achievement (quantity and quality)?

Method

Participants

College students who major in STEAM (Science, Technology, Engineering, Arts, and Mathematics) fields were recruited from three different universities in South Korea. A total of 318 students responded to the survey. Among them, 28 were excluded from data analysis due to incomplete surveys; additionally, outliers were removed (n=20). To detect outliers, a boxplot was carried out, and outliers falling outside the Interquartile Range (IQR) were removed.

Of the final sample of 270 students, 62 (23%) students are science majors, 43 (15.9%) are technology majors, 51 (18.9%) are engineering majors, 41 (15.2%) are arts majors, and 73 (27%) are math majors. Gender is equally distributed for total sample; 54.8% (n=148) are male students, and 45.2% (n=122) are female students. Within the domains, gender is equally distributed except for arts: male students for science (56.5%), technology (55.8%), engineering (43.1%), mathematics (46.6%), and arts (80.5%).

More than 50% of the responses are from sophomores (n=144, 53.5%), followed by juniors (n=80, 29.7%); seniors represent 8.9% (n=24), and freshmen represent 7.8% (n=21). One student did not indicate his/her year of study.

Measures

Divergent Thinking Test. Wallach and Kogan's (1965) Divergent Thinking tasks (DT tasks) were used to measure college students' divergent thinking. The DT task items are open ended. DT tasks have different types of questions, including instances tasks and alternative uses tasks. Instances tasks refer to the generation of possible instances of a concept. Example items include "Name all the round things you can think of," and "Name all the things you can think of that move on wheels." Alternative uses refer to thinking of possible uses for an object. A sample item includes "Tell all the different ways you could use a newspaper."

For this study, three Alternative Uses (AU) task items from Wallach and Kogan's (1965) DT tasks were used to measure college students' divergent thinking for their creative potential. The three alternative uses tasks include 1) Tell all the different ways you could use a newspaper. 2) Tell all the different ways you could use a hanger. 3) Tell all the different ways you could use a brick. The fluency and originality scores were measured for each participant. The fluency score was calculated based on the number of appropriate ideas for each task. The originality score was calculated by counting the number of ideas which were statistically infrequent (less than 5%) in the sample. The composite fluency and originality scores were calculated by averaging the three DT items. Two independent evaluators scored ideational originality, and the inter-rater reliability between the two raters was .83.

Ideational behavior. Ideational behavior is a universal component of creativity in that creativity at all levels involves ideation (Runco et al., 2001). The Runco Ideational Behavior Scale (RIBS) focuses also on the internal world of ideas rather than measuring

performance of creativity (Batey et al., 2010). The Runco Ideational Behavior Scale (RIBS) was used to examine college students' ideational behavior. RIBS asks subjects to rate the degree, "describe actual overt behavior – behavior that clearly reflects the individual's use of, appreciation of, and skill with ideas" (Runco et al., 2001, p.394). It asks about ideational behaviors that may occur in day-to-day situations or in common tasks (Ames & Runco, 2005; Runco et al., 2001). RIBS is a single factor self-report scale that includes 23 items ranging from 1 (never) to 5 (very often), and sample items include, "I come up with an idea or solution other people have never thought of," "I have trouble sleeping at night, because so many ideas keep popping into my head." Runco and colleagues (2016) reported the Cronbach's alpha of RIBS scale was .90. With the Chinese version of RIBS, the internal consistency reliability was reported to be .95 (Tsai, 2015).

Openness to experience. Openness to experience was measured with the subscale of the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). A total of 10 items including two reverse items were used. The 5-point scale ranges from 1 (strongly disagree) to 5 (strongly agree).

Creative achievement. The Creative Activity and Accomplishment Checklist (CAAC) is a widely used scale for measuring creative achievement. CAAC includes sub domains in science, math, music, art, technology, and writing. Okuda et al. (1991) reported good inter-item reliabilities for the various domains ($.71 < rs < .91$). A recent study also reported high reliability for CAAC, for both quantity ($\alpha=.86$) and quality ($\alpha=.87$) (Paek & Runco, 2018).

A total of 49 items of the CAAC were used to measure quantity and quality of creative achievement. The quality items are recent, and these items ask about a socially recognized award of achievement (Runco et al. 2017). Items are included to measure creative achievement in art (quantity) "Drawn a picture just to express an idea or feeling?" and in writing (quality), "Published something you wrote in a school-wide magazine or newsletter?" in music (quantity), "Recorded your own ringtone or music for your cellphone?" and in technology (quality), "Been asked to create or maintain a website (e.g., Facebook) or blog as a web host for a class or club?" The scale asks respondents how many times they had been involved in each activity or received awards for their creative achievement. The response types included four options: Never (0), 1-2 times (1), 3-5 times (2), Over 5 times (3). In order to address the research questions, the quantity scale from CAAC (CAAC-Quantity) and the quality scale from CAAC (CAAC-quality) were calculated in addition to the composite score of CAAC (CAAC-Total).

Everyday Creativity. Measuring everyday creativity involves 17 items from the Runco Creativity Assessment Battery (rCAB, 2011). Sample items included to measure everyday creative accomplishment are "Designed or made tools or objects for daily life (e.g., household tools or something to help with schoolwork)?" "Been recognized by your classmates for suggesting fun games to play or changing game rules to make it funnier?" and "Photographed and then framed the image or used in some public fashion?"

Procedure

All instruments were translated from English into Korean. Two researchers reviewed all items and discussed ambiguous translation to minimize possible misinterpretation. After reaching an agreement, two other researchers in South Korea

administered either the online survey or the paper and pencil survey at three different universities to collect data. Students who consented to this survey completed demographic questions, the RIBS scale, divergent thinking (DT) tasks, openness to experience, CAAC, and everyday creativity questionnaire. Students completed the entire battery in 30-40 minutes.

Results

Before addressing research questions, several statistical analyses were conducted. First, reliability of all indices was checked using coefficient alpha. Second, bivariate correlations were examined using Pearson correlations among variables. To examine group comparison among STEAM major undergraduate students in terms of multiple measures of creativity, the one-way multivariate analysis of variance (MANOVA) was conducted to control for possible inflated Type I error rate. The MANOVA was followed up with discriminant analysis, and a canonical discriminant function analysis was conducted. Then, hierarchical multiple regression was conducted in order to examine if domain knowledge (STEAM major), creative potential (divergent thinking and ideational behavior), and personality factor (openness to experience) would predict and explain variance in everyday creativity and creative achievement (quantity and quality).

Descriptive Statistics and Correlations

The internal consistency reliability (Cronbach's alpha) of divergent thinking tasks for fluency was .74 and .70 for originality scores. The reliability of RIBS was .91 with 23 items and .79 with openness to experience with 10 items. The coefficient alpha for CAAC (composite score) was .89 and .79 for the quantity scale and .83 for the quality

scale of CAAC. The reliability of everyday creativity scale was .76. The results indicated that the alpha coefficients for each variable were adequately reliable.

The Pearson correlations were calculated in order to evaluate the relationships of each variable. Descriptive statistics and correlations are shown in Table 3.1. Correlation between the composite scores of fluency was significantly correlated with the composite score of originality (r = .826, p <.01) and also with RIBS (r = .241, p <.01), with openness (r = .218, p <.01), with everyday creativity (r = .158, p <.05), and CAAC with quantity scale (r = .168, p <.05). Fluency was not significantly correlated with quality scale. Originality was also significantly correlated with RIBS (r = .306, p <.01), with openness (r = .280, p <.01), with everyday creativity (r = .158, p <.01), and CAAC with quantity scale *(*r = .184, p <.05). RIBS was significantly correlated with openness (r = .736, p <.01), with everyday creativity (r = .349, p <.01), and with the quantity scale of CAAC (r = .328, p <.01) and also quality scale (r = .217, p <.01). Openness to experience was significantly correlated with everyday creativity (r = .381, p <.01), with the quantity scale of CAAC (r = .419, p <.01) and also quality scale (r = .295, p <.01). Everyday creativity was significantly correlated with both quantity scale (r = .573, p <.01) and quality scale (r = .513, p <.01). The correlation between the CAAC quantity scale and the quality scale was highly correlated (r = .719, p <.01).

Table 3.1

Bivariate Correlations of Study Variables

	Variable	*Mean*	*SD*	1	2	3	4	5	6	7
1.	Fluency	3.46	1.47	-						
2.	Originality	1.64	1.06	.826**	-					
3.	RIBS	3.15	0.55	.241**	.306**	-				
4.	Openness	3.30	0.55	.218**	.280**	.736**	-			
5.	Everyday creativity	0.62	0.38	.158**	.158**	.349**	.381**	-		
6.	CAAC (Quan)	0.92	0.42	.168**	.184**	.328**	.419**	.573**	-	
7.	CAAC (Qual)	0.73	0.40	.069	.056	.217**	.295**	.513**	.719**	-

Note: RIBS = Runco Ideational Behavior Scale; CAAC = Creative Activity and Accomplishment Checklist
*$p < .05$, **$p < .01$.

Among STEAM major undergraduate students, the means and standard deviations of the various measures of creativity scores are shown in Table 3.2. Ideational behavior was measured using RIBS on a 5-point Likert-type response scale, which yielded a mean score of 3.28 (*SD*=0.53) for Arts, followed by Technology (*M*=3.27, *SD*=0.48). The students majoring in Technology (*M*=3.51, *SD*=0.35) had the highest mean in openness to experience and students in Math (*M*=3.18, *SD*=0.55) had the lowest mean among domains. The mean score for everyday creativity for Arts was 0.80 (*SD*=0.43), followed by Technology (*M*=0.77, *SD*=0.35). For the quantity scale of the CAAC, Arts also had the highest mean (*M*=1.11, *SD*=0.40) among other majors, and also for the quality scale, the mean score of Arts was 0.91 (*SD*=0.39), which was higher than that of the other majors.

Table 3.2

Descriptive Statistics of Main Variables by STEAM Major (n=270)

Variable		Science (n=62)		Technology (n=43)		Engineering (n=51)		Arts (n=41)		Mathematics (n=73)	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Divergent thinking	Fluency	3.45	1.46	3.58	1.59	3.26	1.46	3.46	1.60	3.52	1.36
	Originality	1.58	1.09	1.83	1.41	1.56	0.98	1.70	1.05	1.62	0.83
Ideational behavior	RIBS	3.14	0.57	3.27	0.48	3.13	0.59	3.28	0.53	3.02	0.54
	Openness	3.23	0.55	3.51	0.48	3.25	0.58	3.47	0.49	3.18	0.55
	Everyday creativity	0.59	0.38	0.77	0.35	0.63	0.35	0.80	0.43	0.46	0.33
Creative achievement	Quantity	0.98	0.47	0.98	0.38	0.84	0.40	1.11	0.40	0.79	0.36
	Quality	0.78	0.40	0.71	0.36	0.63	0.39	0.91	0.39	0.66	0.39

Domain differences in STEAM

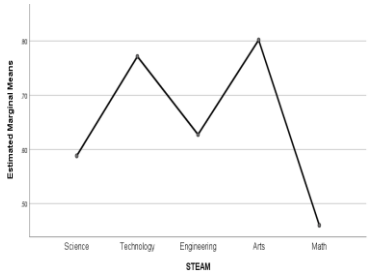
According to Carey (1998), in the following two major situations, MANOVA can be used. First, the researcher desires a single, overall test on the set of variables instead of performing multiple individual tests when there are several correlated dependent variables. Second, the researcher wishes to explore how independent variables influence some patterning of response on the dependent variables. For this reason, the one-way MANOVA was conducted to detect differences among domain knowledge (STEAM major) in terms of three creative achievement aspects (everyday creativity, creative achievement (quantity), and creative achievement (quality)).

The result indicated that there was a statistically significant difference in domain knowledge (STEAM major), F (12, 696) = 4.05, p = 0.00; Wilk's Λ = .84, partial η^2 = .06. STEAM major effects on the everyday creativity, and quantity and quality scale of creative achievement were investigated in the Tukey's HSD post-hoc univariate analyses.

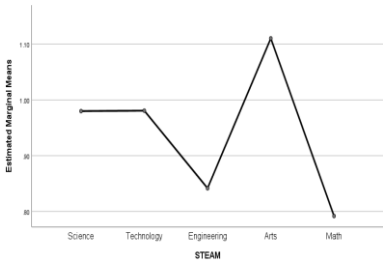
The results showed that mean scores for everyday creativity were statistically different between Science (*M*=.59) and Arts (*M*=.80) at *p* <.05, Technology (*M*=.77) and Math (*M*=.46) at *p* <.01, and Arts (*M*=.80) and Math (*M*=.46) at *p* <.01.

The mean scores for creative achievement (quantity) were statistically significantly different between Engineering (*M*=.84) and Arts (*M*=1.11) at *p* <.05, and Arts (*M*=1.11) and Math (*M*=.98) at *p* <.01. For creative achievement (quality), the mean scores were statistically significantly different between Engineering (*M*=.63) and Arts (*M*=.91) at *p* <.01, Arts (*M*=.91) and Math (*M*=.66) at *p* <.01.

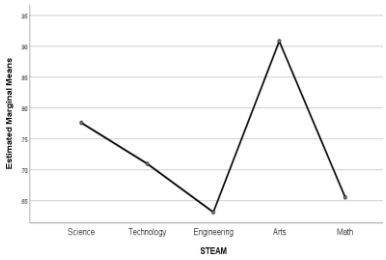
Results of subsequent univariate analyses indicated that significant STEAM major differences were found in all three aspects of creative achievement. Arts major students excelled other majors in everyday creativity and the quantity and quality scale of the creative achievement. Figure 3.1 shows the profile plots for everyday creativity, quantity and quality of Creative achievement by STEAM major.



Everyday Creativity



Creative Achievement (Quantity)



Creative Achievement (Quality)

Figure 3.1. Profile plots

Discriminant analysis is a powerful analysis in terms of examining differences between two or more groups with respect to several variables simultaneously (Klecka et al., 1980). Discriminant analysis is capable of showing the underlying dimensionality of the data, while ANOVA is limited to specifying the contribution of each variable to

group separation (Borgen & Seling, 1978). Therefore, the MANOVA was followed up with discriminant analysis, and a canonical discriminant function analysis was conducted.

The first explained 69.4% of the variance, and the second explained 28%, whereas the third function explained only 2.6% of the variance. In combination, these discriminant functions significantly differentiated the STEAM major groups, $\Lambda = .837$, $x^2(12) = 47.27$, $p = .000$; removing the first function indicated that the second function did significantly differentiate the STEAM major groups, $\Lambda = .946$, $x^2(6) = 14.85$, $p = .021$, but removing the first and second functions did not significantly differentiate the STEAM major groups, $\Lambda = .995$, $x^2(2) = 1.28$, $p = .528$. The discriminant function plots showed that the first function discriminated Arts and Technology majors from Mathematics majors, and the second function differentiated Science and Arts from Engineering and Technology majors.

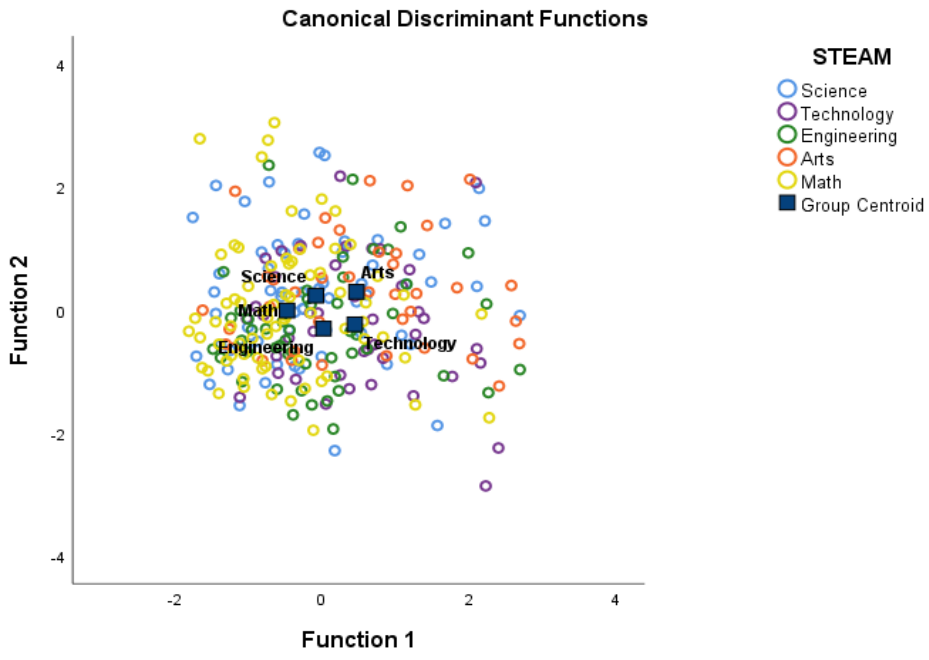


Figure 3.2 Combined-groups plot

The confounding effect of divergent thinking

As the most significant issue on divergent thinking, there has been considerable debate over how to score the tests (Plucker et al., 2011). Traditionally, a fluency score counts the number of ideas generated, originality counts by the number of infrequent (e.g., less than 5%) ideas among the total sample, and flexibility counts the number of ideas over different categories. A great amount of research in creativity follows this traditional scoring method. Although DT tests are still popular instruments for measuring creative potential, DT inventories have underlying limitations and, therefore, have received considerable criticism (Zeng et al., 2011). For instance, there has been much evidence on the confounding effect between fluency and originality. Hocevar (1979) found high correlations between ideational fluency and originality; for instance, 82% of the studies reported exceeded .50, with an average correlation of .69 through reviewing 18 studies.

From the results of hierarchical multiple regression, the confounding effect of divergent thinking between ideational fluency and originality was found. The results indicated that divergent thinking (originality) did not explain any additional variances beyond divergent thinking (fluency) in predicting everyday creativity, and creative achievement (quantity). With creative achievement (quality) as a dependent variable, the result indicated that both divergent thinking fluency and originality did not predict creative achievement (quality). Based on these findings, divergent thinking (fluency) was used to predict everyday creativity and creative achievement (quantity) instead of using both fluency and originality for this study.

Hierarchical multiple regression model testing

To examine possible predictors based on previous research, including domain knowledge (STEAM major) (R2), Divergent thinking (fluency) and ideational behavior (R3), and openness to experience (R4) on everyday creativity and creative achievement (quantity and quality), the probabilistic model for all competing models was established below.

Reduced Model 1:

$$E(y) = \beta_0 + \beta_1 \text{ STEAM major}$$

Reduced Model 2:

$$E(y) = \beta_0 + \beta_1 \text{ STEAM major} + \beta_2 \text{ DT(fluency)}$$

Reduced Model 3:

$$E(y) = \beta_0 + \beta_1 \text{STEAM major} + \beta_2 \text{DT(fluency)} + \beta_3 \text{Ideational behavior}$$

Complete Full Model:

$$E(y) = \beta_0 + \beta_1 \text{STEAM major} + \beta_2 \text{DT(fluency)} + \beta_3 \text{Ideational behavior} + \beta_4 \text{Openness}$$

A series of hierarchical multiple regressions were conducted to examine whether creative potential (ideational fluency, ideational behavior) and personality (openness to experiences) could predict everyday creativity and creative achievement over and above that accounted for by domain knowledge (STEAM major).

Thus, data was entered in four blocks: Domain knowledge (STEAM majors) in block 1 for control variables, ideational fluency in block 2, ideational behavior scores in block 3, and openness to experience in block 4. The results of the hierarchical multiple regression models are shown in Table 3.3 (Everyday creativity), Table 3.4. (Creative

achievement/quantity), and Table 3.5. (Creative achievement/quality). The STEAM majors were dummy-coded variables using science major as a reference group.

First, in Table 3.3., everyday creativity was regressed on STEAM major, ideational fluency, ideational behavior, and openness to experiences. Control variables and domain knowledge (STEAM majors) were entered in the first step. In total, the control variables explained 10.8% of the variance in everyday creativity. When ideational fluency was added to the regression model as a next step, 2.5% of significant incremental variance was explained for everyday creativity significantly. For the next model, the ideational behavior score was entered, and the model explained a significant increase in 7% variance for everyday creativity over and above STEAM major, and divergent thinking (fluency) scores. For the final model, openness to experience was entered, and the final full model explained a significant increase in 2.1% variance for everyday creativity over and above domain knowledge (STEAM major), and creative potential (ideational fluency and ideational behavior).

Table 3.3
Hierarchical Multiple Regression Analyses Predicting Everyday Creativity

	Everyday Creativity				
				Full Model	
Variables	Model 1 β	Model 2 β	Model 3 β	β	95% CI
Constant	.588	.445	-.101	-.244	
Technology	.183*	.178*	.156*	.126	(-.009, .262)
Engineering	.039	.047	.047	.042	(-.086, .169)
Arts	.214**	.213**	.188**	.165*	(.028, .302)
Math	-.128*	-.131*	-.105	-.112	(-.229, .005)
DT - Fluency		.041**	.024	.022	(-.007, .051)
Ideational behavior			.193***	.086	(-.025, .198)
Openness to experience				.151**	(.038, .263)
F	8.047***	8.129***	11.182***	10.793***	
ΔF		7.650**	23.048***	6.944**	
R^2	.108	.133	.203	.224	
ΔR^2		.025	.070	.021	

*$p < .05$, **$p < .01$, ***$p < .001$. *Note. Reference group for STEAM major: science major*

Second, in Table 3.4., creative achievement (quantity) was regressed on domain knowledge (STEAM major), divergent thinking (fluency), ideational behavior, and openness to experiences. The results indicate that STEAM majors significantly predicted creative achievement (quantity) accounting for 7.2% of the variance. In model 2, after controlling STEAM majors, ideational fluency was added to the regression model as a next step. An additional 2.7% of significant incremental variance was explained for creative achievement (quantity). In model 3, the ideational behavior was entered, and the model explained a significant increase in 6.6% variance. For the final model, openness to experience was entered, and the final full model explained a significant increase in 6% variance for creative achievement (quantity) over and above domain knowledge (STEAM major) and creative potential (ideational fluency and ideational behavior).

Table 3.4
Hierarchical Multiple Regression Analyses Predicting Creative Achievement (Quantity)

	Creative Achievement (Quantity)				
				Full Model	
Variables	Model 1 β	Model 2 β	Model 3 β	β	95% CI
Constant	.980	.818	.239	-.026	
Technology	.001	-.005	-.029	-.083	(-.231, .064)
Engineering	-.138	-.129	-.129	-.140*	(-.278, -.001)
Arts	.130	.130	.103	.061	(-.088, .210)
Math	-.188**	-.191**	-.164	-.177**	(-.304, -.050)
DT - Fluency		.047**	.029	.024	(-.007, .056)
Ideational behavior			.204***	.006	(-.115, .127)
Openness to experience				.280***	(.158, .402)
F	5.162**	5.840***	8.703***	10.908***	
ΔF		8.005**	20.827***	20.306***	
R^2	.072	.100	.166	.226	
ΔR^2		.027	.066	.060	

*p < .05, **p < .01, ***p < .001. *Note. Reference group for STEAM major: science major*

Since divergent thinking (fluency) did not further explain creative achievement (quality) beyond STEAM majors, only ideational behavior, and openness to experiences

were examined to determine whether these variables are possible predictors of creative achievement (quality). Table 3.5 shows the result of this testing model. In model 2, when the ideational behavior was entered, the model explained a significant increase in 3.7% variance in creative achievement (quality) after controlling STEAM major. The full model indicates that openness to experience explained a significant increase in 3.8% variance for creative achievement (quality) over and above domain knowledge (STEAM major) and creative potential (ideational behavior).

Table 3.5
Hierarchical Multiple Regression Analyses Predicting Creative Achievement (Quality)

	Creative achievement (Quality)			
			Model 3	
Variables	Model 1 β	Model 2 β	β	95% CI
Constant	.776	.334	.129	
Technology	-.066	-.084	-.126	(-.274, .023)
Engineering	-.145*	-.142*	-.150*	(-.289, -.010)
Arts	.132	.113	.082	(-.068, .232)
Math	-.121	-.103	-.113	(-.241, .015)
Ideational behavior		.141**	-.012	(-.133, .109)
Openness to experience			.212**	(.089, .335)
F	3.890**	5.358***	6.567***	
ΔF		10.662**	11.546**	
R^2	.055	.092	.130	
ΔR^2		.037	.038	

*p < .05, **p < .01, ***p < .001. *Note. Reference group for STEAM major: science major*

Discussion

The aim of this study was to investigate whether there exist group differences among college students according to their STEAM major in their everyday creativity and creative achievement and whether two within-individual components (domain-relevant skills and creative-relevant processes) predict creative achievement based on Amabile's (1983) componential theory of creativity.

The first research question concerned differences among STEAM major undergraduate students in everyday creativity and creative achievement. The result indicated that no STEAM major effects appeared for the quality of creative achievement, but there were significant effects in everyday creativity and quantity of creative achievement. Students majoring in technology and arts had statistically higher levels in everyday creativity, and Arts majors had statistically higher levels than other majors in quantity of creative achievement.

In a link to the first research question, the second research question examined to what extent domain knowledge (STEAM major) predicts students' everyday creativity and creative achievement. The hierarchical regression model indicated that STEAM major predicted students' creativity. Earlier studies found that artists have a higher level of creativity than scientists or engineers. For instance, on two open-ended divergent thinking tests, art students differed significantly from science students at a university (Hartley & Beasley, 1969). Hartley and Greggs (1997) found that divergent thinking test scores declined along the arts-science continuum among four groups of students: pure arts, arts and social science, social science and science, and pure sciences. This study also supported Hartley's earlier study (Hartley & Beasley, 1969) in that the arts students scored significantly higher than the science students on three of the four divergent thinking tests (Hartley & Greggs, 1997).

The present study's finding is consistent with previous empirical evidence in that Art majors excelled other majors in all creativity scores–everyday creativity, as well as quantity and quality scores of creative achievement. Compared to Art domain, Sciences require more in-depth domain knowledge before creating something new in creative

achievement, whereas art students are expected to produce creative product earlier and more regularly. In addition, the time it takes to do an art product may be considerably less than the time it takes to complete scientific research. Another possible reason for this result could be art students may be more aware of creativity than science students.

The third research question addressed the role of creative potential (divergent thinking and ideational behavior) in predicting everyday creativity and creative achievement. Considering divergent thinking as a potential predictor, the results indicated that the significant incremental variance was explained for everyday creativity and quantity of creative achievement but was not significant in quality of creative achievement. Creative individuals possess divergent thinking abilities such as idea fluency, flexibility, elaboration, and originality (Guilford 1950, 1968). Divergent thinking is considered as creative potential and an indicator for actual creative performance (Kogan & Pankove, 1972; Runco & Acar, 2012; Torrance, 2002).

Although there have been few studies indicating the discriminant validity of two measures, ideational fluency and originality (Benedek, et al., 2006), there has been much evidence on the confounding effect between fluency and originality. Hocevar (1979) found high correlations between ideational fluency and originality; for instance, 82% of the studies reported exceeded .50, with an average correlation of .69 by reviewing 18 studies. Aligned with most studies reporting confounding effects between ideational fluency and originality, the result of this study also indicated that ideational fluency was also highly correlated with originality at .83, and did not explain additional variance in predicting creative achievement. Thus, the present study used ideational fluency as a predictor in everyday creativity and creative achievement after controlling STEAM

major. This finding is well in accordance with the previous studies' findings on divergent thinking fluency in the prediction of creative activities and creative achievement along with intelligence and openness to experiences (Jauk et al., 2014).

The following analysis addressed the role of ideational behavior in everyday creativity and creative achievement beyond that provided by divergent thinking (fluency). The results indicated that significant variance was explained in all creative scores: everyday creativity, and quantity and quality of creative achievement. Ideation plays a role in creativity at all levels as a universal component of creativity (Runco et al., 2000-2001). The finding is aligned with the study finding involving 255 elementary school children that ideational behavior explained a unique portion of variance in creative performance above and beyond the potential confounding factors (Paek et al., 2016).

Finally, the role of personality factor (openness to experience) in everyday creativity and creative achievement was explored by testing variance beyond that provided by ideational fluency and ideational behavior. Openness to experience is the dominant personality factor in creativity (Silvia et al., 2009). Evidence was reported that ideational behavior was significantly associated with openness to experience (Batey et al., 2010). The results indicated a significant increase in explained variance in all three creative scores: everyday creativity, as well as quantity and quality of creative achievement. The result confirmed the role of openness to experience in creative achievement in accordance with many other studies. For instance, Kaufman and colleagues (2016) reported from their study of 1035 participants that openness predicts creative achievement in the arts, while intellect predicts creative achievement in the sciences. The results of this investigation confirmed previous research findings and

further extended the role of openness to experience in everyday creativity and creative achievement.

The present study attempted to examine everyday creativity and creative achievement in different domains among STEAM undergraduate students. Further, creative potential predictors such as divergent thinking, ideational behaviors, and openness to experience were investigated in everyday creativity and creative achievement. In many previous creativity studies, the measure and the role of divergent thinking were emphasized. Studies investigating the role of ideational behavior are relatively rare. In this sense, the significant variance of explaining ideational behavior in everyday creativity and creative achievement in this study is noteworthy. This study also confirmed openness to experience as a dominant personality factor explaining everyday creativity and creative achievement even beyond controlling ideational behavior. The unique feature of this study was its examination of the research questions regarding STEAM undergraduate students and their everyday creativity and creative achievement. The findings in this study suggest the important roles of creative-relevant processes (creative potential: divergent thinking, ideational behavior) and personality factor (openness to experiences) beyond domain-relevant skills (domain knowledge) among STEAM majors.

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CHAPTER 4

A STUDY OF EVERYDAY CREATIVITY MEDIATING OPENNESS TO EXPERIENCE, MOTIVATION AND CREATIVE ACHIEVEMENT AMONG KOREAN AND AMERICAN COLLEGE STUDENTS[2]

[2] Park, H. To be submitted to *Personality and Individual Differences*

Abstract

An individual's creative achievement is largely influenced by cultural characteristics (Individualism or collectivism). Based on Amabile's (1983) componential theory of creativity, creative-relevant skills (personality factor such as openness to experience), task motivation (intrinsic motivation), and one outside the individual component (social environment such as culture) influence on creativity. This study explored this mechanism in the relationship of individual components and creative achievement by comparing between two cultures (outside the individual component). In addition, the mediation role of everyday creativity was examined within this mechanism. As a result, Korean (n=98) college students showed greater vertical individualism (individuals see each other as different, and inequality is expected) than American (n=134) college students while Americans showed higher horizontal individualism (an individual is more or less equal in status with others). Contrary to previous studies, American students displayed a higher degree of collectivism (vertical and horizontal) than Korean students. As expected, Americans demonstrated a higher degree of openness to experience, intrinsic motivation, and everyday creativity. From the result of multiple-group SEM (MGSEM), the mediation role of everyday creativity was found in both groups, however, the two cultures displayed different indirect paths to creative achievement.

INDEX WORDS: Cultural orientation, Individualism, Collectivism, Openness to experience, Intrinsic motivation, Everyday creativity, Creative achievement, MGSEM

Introduction

Culture is closely related to creativity. The influence of culture on creativity or the relationship with creativity has been discussed in previous studies. Rudowicz (2003, p.285) stated that "culture clearly has a profound influence on the conceptualization of creativity and on creative expression." Csikszentmihalyi (1999) explained that creativity is not only a mental process but also a culturally bound phenomenon. Culture can influence how much creativity occurs along with how it is defined and assessed (Zha, Walczyk, Griffith-Ross, Tobacyk, & Walszyk, 2006). Glaveanu (2010) discussed creativity as cultural participation and from a socio-cultural perspective. He suggested the following as support for creativity as socio-cultural:

> a) the set of skills and types of knowledge that individual actors possess are developed through social interaction; b) creativity in itself is often the result of explicit moments of collaboration between individuals; c) creativity is largely defined by social judgement or validation; and d) creativity exists only in relation to an established ensemble of cultural norms and products that both aliment the creative process and integrate its "outcomes" (p.50).

Culture and Creativity

How individuals in the east and west view creativity, and the degree of their creative expressions or support system may differ among cultures. Views of creativity in individuals in the East are often described as reflecting a collectivist perspective, while western views are described as reflecting individualism. In an American context, implicit concepts of a creative person can be grouped into motivational qualities such as energetic, active personality, willing to take a stand, curious, and adventurous (Sternberg,

1985; Runco & Bahleda, 1987; Runco, 1989; Westby & Dawson, 1995). Rudowicz and Ng (2003) found that Asian society is tightly organized, collectivistic and hierarchical; as a result, it is more difficult for Asians to think and feel in a creative manner compared to Westerners. Cross-cultural studies of creativity demonstrated that people in the east differ from the west in terms of their divergent thinking performance and creative expressions (Niu & Sternberg, 2002).

For example, Chinese culture places a greater value on the group or morality in understanding the concept of individual creativity (Rudowicz & Yue, 2000). In a conformist culture, such as Confucian Heritage Culture (CHC), schools emphasize collectivism and conformity rather than encouraging individual interest or students' initiatives (Craft, 2005). People in Chinese culture consider nonconforming or disobedient manners as rebellious or expressing their opinions as arrogant or attention seeking behaviors. For these reasons, Chinese teachers may not appreciate students' nonconforming, expressive behaviors (Chan & Chan, 2010).

Hong Kong is also greatly influenced by Confucianism despite long-term British rule (Hofstede, 2001). Hong Kong's unfavorable colonial political and social system influenced each individual in many ways. For instance, the Hong Kong Chinese have a feeling of security in money, wealth, material reward through hard working (Redding & Wong, 1986). Education is perceived as a means of a family's financial prosperity rather than individual's intellectual growth. Therefore, there is little room for creativity in children, rather focusing on memorization and hard work (Rudowicz, & Hui, 1998).

Zha et al. (2006) investigated the relationship between culture and creative potential in highly educated American and Chinese adults. By testing the hypothesis that

through culture (individualistic or collectivistic) the society of origin influenced creative potential and achievement, the authors found that Americans showed greater individualism and displayed significantly higher creative potential than Chinese, while Chinese had significantly higher skill mastery in the domain of mathematics. Ivcevic (2009) argued that these different collectivist cultural orientations do not imply that certain cultures do not have high potential for creativity; rather, individual potential may be expressed differently depending on the cultural context.

Japan is greatly influenced by both Buddhism and Confucianism brought from China around the 6th century. The emphasis on hierarchy and the group orientation of the society leads to the importance of harmony and teamwork. The social value of group orientation makes it difficult for the Japanese to give direct criticism (Schwarz-Geschka, 1994). Japanese and Americans are divergent in thinking of the self, others, and the interdependence of the two. Japanese tend to fit in groups or with others, and harmonious interdependence with each other is an important value of the society, while Americans appreciate differences in others and value asserting the self (Markus & Kitayama, 1991). In a comparative study of creative thinking using the Torrance Tests of Creative Thinking (TTCT) figural test, American college students showed statistically significantly higher scores and demonstrated more elaboration in their creative thinking than Japanese counterparts (Saeki, Fan, & Van Dusen, 2001).

Cultural differences between East and West may be seen in early education, too. In general, in a typical Korean preschool classroom, teachers talk more of the time while students sit still and listen to the teacher when compared to children in American classrooms (French & Song, 1998). Elementary and secondary classrooms are not much

different. Korean teachers' conception of creativity is also tied to the Asian cultural influence focusing on group goals and contribution to the society, while American teachers' emphasis is more on an individual student's personal goals and emotional support when teaching creativity (Nisbett, 2004). In a study of Korean lay people's conceptions of creativity and a comparison to an American sample, Lim and Plucker (2001) found that Korean adults evaluated specific cognitive, personal or motivational aspects of creativity higher than noncognitive aspects such as independence. Additionally, Koreans see the creator as a lonely individual, while Americans view the creator as a leader. Choe (2006) also stated that Korean adults view the creator as having negative traits deviant from Korean culture. However, there are some indications that this may be changing. Unlike Korean adults, young Korean students value the creator as a successful leader, which is not different from Westerners' view (Niu & Sternberg, 2002).

Individualism and Collectivism

The concept of individualism vs. collectivism has been used as a dimension to differentiate among cultures (Eisenberg, 1999). Triandis (2001) emphasized not assuming that everyone in one dimension, for example, in individualist cultures, has all features of these cultures and vice versa. Rather, people have varying degrees of characteristics of individualism or collectivism depending on the situation. The dimensions appear in all societies, and there is some of each feature everywhere rather than one discrete dimension. However, individualism appears to be, to a large extent, characteristic of Western society (Kagitcibasi, 1997).

Over the decades, many studies have reported on the features of individualism and collectivism. Hsu (1983) reported the features of individualism include: self-reliance,

competitiveness, aggressive creativity, and insecurity. The features of collectivism include: low emotionality; seeking group protection; and low in creativity. Triandis (1990) reported this feature of individualism: an individual is an end in himself, and as such ought to realize his "self" and cultivate his own judgment, notwithstanding social pressures toward conformity. For collectivism, Triandis placed emphasis on the views, needs, and goals of the group and social norms and duty defined by the group rather than pleasure seeking; beliefs shared with the group rather than beliefs that separate self from the group; and readiness to cooperate with the group. Cha (1994) reported on Korean collectivism, describing features such as dependence, hierarchy, courtesy, and family line. Yamaguchi (1994) described Japanese collectivism: expectation of rewards and punishments from the ingroup lead to "collectivistic tendencies"; low need for uniqueness, high self-monitoring, and external locus of control. Bellah et al. (1985) described American individualism as self-reliance, independence and separation from family, religion, and community; the self as the only source of reality.

Triandis conducted numerous studies on Individualism and Collectivism (IND-COL). Triandis and Gelfand (1998) emphasized that there are different kinds of IND-COL, and they differentiated between vertical and horizontal IND-COL. Their measure, INDOL (Triandis & Gelfland, 1998) has 16 items based on four dimensions of IND-COL: Horizontal collectivism (HC), Vertical collectivism (VC), Horizontal individualism (HI), and Vertical individualism (VI) as described in one of their studies. Specific characteristics of each dimension are described in the study (Singelis, Triandis, Bhawuk, & Gelfand, 1995).

> Horizontal collectivism (H-C) is a cultural pattern in which the individual sees the self as an aspect of an in-group. That is, the self is merged with the members of the in-group, all of whom are extremely similar to each other. In this pattern, the self is interdependent and the same as the self of others. Equality is the essence of this pattern. Vertical collectivism (V-C) is a cultural pattern in which the individual sees the self as an aspect of an in-group, but the members of the in-group are different from each other, some having more status than others. The self is interdependent and different from the self of others. Inequality is accepted in this pattern, and people do not see each other as the same. Serving and sacrificing for the in-group is an important aspect of this pattern. Horizontal individualism (H-I) is a cultural pattern where an autonomous self is postulated, but the individual is more or less equal in status with others. The self is independent and the same as the self of others. Vertical individualism (V-I) is a cultural pattern in which an autonomous self is postulated, but individuals see each other as different, and inequality is expected. The self is independent and different from the self of others. Competition is an important aspect of this pattern. For example, in a factor analysis of items relevant to the individualism-collectivism constructs, with American-generated items and American students, the most important factor (accounting for most of the variance) was called self-reliance with competition (Triandis et al., 1988). (Singelis et al., 1995, p.244-245).

Openness and Creativity

Openness to experience has been an important personality trait in creativity research and numerous theoretical and empirical studies have supported its role in

contributing to creative achievement (e.g., Silvia, et al., 2011; Tan, et al., 2019; Urban, 2005). Previous research explained the personality trait of openness to experience as appreciation and pursuit of new experiences, and trying new ideas without being afraid of the unfamiliar (Theurer et al., 2020). A great deal of creativity research employed the Big Five Inventory (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) in investigating the relationships between openness to experience and creativity (Feist, 1998; Kwang & Rodrigues, 2002; Sung & Choi, 2009). Openness to Experience is the personality dimension that is most frequently examined, which findings have consistently showed to be a positive predictor of creativity (George & Zhou, 2001; McCrae & Costa, 1997; Puryear et al., 2017). Additionally, Openness to Experience is a consistent and significant correlate of various aspects of creative potential, which was the strongest predictor of creative achievement (Batey & Furnham, 2006; Feist, 1998, 2010).

Openness to experience plays a critical role as a stimulant for creative expression, ideas, and creative activities (Shi, et al., 2016). Traits like openness are more valued in Western cultures, whereas cooperation is more valued in non-Western cultures. Westerners express their ideas more openly and score higher on openness to experience as compared to East Asians (Allik & McCrae, 2004).

Although substantial evidence showed that the degree of openness to experience differs in cultural orientation (e.g., the East and the West), the degree of individuals' openness to experience may differ even in the same culture. Individuals who had more multicultural experiences showed increased creative performance. Openness to experience is related to both multicultural experiences and increased creativity (Leung & Chiu, 2010).

Intrinsic Motivation and Creativity

Literature indicates that intrinsic motivation is viewed as fundamental for creativity (Amabile, 1983; Csikszentmihalyi, 1996; Runco, 2007; Sternberg, 2006). According to Rogers (1954), one of the important sources of creativity is an individuals' intrinsic task interest, which leads to new alternatives and ideas. Individuals' intrinsic motivation can result in achieving creative results (Amabile, 1983). According to Amabile (1996), intrinsic motivation, along with expertise and creative thinking skills, is one of the three components needed for creativity. In order to be creative, an individual has to be inherently interested in the issue or problem. This trait motivates the individual to find a solution to the problem (Steiner, 1965), and he or she derives satisfaction from performing the tasks themselves (Gagne & Deci, 2005).

Jesus and his colleagues (2013) investigated the intrinsic motivation and creativity related to product through a Meta-analysis of the studies published between 1990 and 2010. As a result, this meta-analysis identified a positive relationship between intrinsic motivation and creativity related to product (r=.30, p=.001) by analyzing fifteen studies. Eisenberger and Aselage (2009) found that intrinsic interest, produced by performance pressure, was positively related to supervisors' ratings of creative performance.

In the study investigating individual and contextual predictors of creative performance, based on longitudinal and multisource data, Choi (2004) identified that underlying psychological processes such as creative self-efficacy, completely mediated the effect of individual motivation on creative performance. Complete mediation means the individual motivation has no direct effect on creative performance, only through psychological processes (creative self-efficacy and creativity intention). In a recent study

which examined the role of motivation in the prediction of creative achievement inside and outside of the school environment, results showed that the interaction between openness and intrinsic motivation was the strongest predictor of creative achievement (Agnoli et al., 2018). In reviewing findings about how workplace social contexts affect employee creativity, Zhou and Su (2010) found cultural differences in that Westerners' intrinsic motivation comes primarily from having individual choice while Easterners' motivation is influenced by the group.

Mediating role of Everyday creativity

From a systematic review of the concept and main characteristics of everyday creativity, Villanova and Cunha (2020) conceptually defined everyday creativity as "a phenomenon in which a person habitually responds to daily tasks in an original and meaningful way." The concept of everyday creativity is distinct from creative achievement. Everyday creativity is also called "little-c" while eminent creativity called "Bic-C" (Kaufman & Beghetto, 2009).

Everyday creativity involves creative activities of personal interest rather than publicly recognized creative achievement (Richards, Kinney, Benet, & Merzel, 1988) and occur in one's leisure time (Benedek, et al., 2020). For instance, arranging furniture in a creative way or making a creative video for a group event or cooking with one's own recipe can be examples for everyday creative activities. In a recent study, Benedek et al. (2020) investigated the association of nine different motivations including enjoyment, expression, and challenge on creativity. The results strongly supported that intrinsic motivations such as enjoyment, expression, and development of one's potential primarily influenced everyday creative activities.

Everyday creativity is essential behavior that is the basis for actual creative achievement (Richards, 2010). A vast majority of creativity is associated with everyday creativity through experiences and social interactions (Pachucki, et al., 2010). Engaging in everyday creative activities allows individuals to explore new relationships and reflect critically on their surrounding world. Successively, the new knowledge and insights from everyday creative activities perform as derivation of strength and resilience (Silvia et al., 2014).

A few studies empirically investigated the relationship between everyday creativity and creative achievement. Zhu et al. (2016) examined the neural correlates of everyday creativity to creative achievement. The results indicated that more creative activities were significantly positively related to larger gray matter volume (GMV), which is a motor planning area involving in the creation and selection of novel actions and inhibition. The gray matter volume, in turn, had a significant positive relationship with creative achievement and art scores. The distinct finding from other studies is that this study highlighted that individuals pursue everyday creative activities as a means to revive or to have an enjoyable time. These findings confirmed that everyday creativity can be not only a consequence, but also a cause, of positive affect (Richards, 2010).

The Present Study

A great number of cross-cultural studies of creativity indicate that cultures between the east and the west are distinct and people's conceptions of creativity, the creative thinking process, and their performance in creativity differ (Niu & Sternberg, 2002; Shao et al., 2019; Xie & Paik, 2019). Much of the literature has indicated that cultural orientation is related to creative achievement (Shah, 2013; Zhang et al., 2020). In

addition, previous studies indicated that there is a positive relationship between openness to experience and creative achievement (George & Zhou, 2001; Harris et al., 2019), and also between intrinsic motivation and creative achievement (Moneta, 2012; Prabhu et al., 2008).

In this sense, based on Amabile's (1983) components of creativity theory framework, this study investigated the influence of creativity-relevant process (openness to experience as a personality factor) and task motivation (intrinsic motivation) on creative achievement by comparing outside the individual component (cultural difference as a social environment).

In spite of the importance of everyday creativity on actual creative achievement, relatively few studies have examined the role of everyday creative activities in creative achievement. Additionally, no known studies have been conducted on the mediating role of everyday creativity in the mechanism of Amabile's (1983) componential theory of creativity between different cultures. Therefore, as an additional variable, everyday creativity as a mediator was examined in the relationship of a personality factor (openness to experience) and task motivation (intrinsic motivation) on creative achievement between two different cultures.

To achieve this study goal, the specific research questions are as follows:

R1: What are the relationships among cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement?

R2: How do cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement differ between two cultural orientations?

R3: Will everyday creativity mediate in the relationship between components (openness to experience and intrinsic motivation) and creative achievement?

R4: Will mediation mechanism differ in two different cultures?

Method

Participants

To achieve these study goals, data was gathered from college students from both Western and Eastern cultures (U.S. and Korea). To minimize experience bias, two exclusion criteria were used for sampling in this study. First, only college students in their early 20s were recruited. Korean college students, especially juniors and seniors, are often in their late 20s because Korean men are required to serve in the military. When they return to school, they are normally in their mid or late 20s. Their experience might be different compared to their counterparts in the U.S. Another exclusion criterion was students who lived outside of their culture for an extended period (e.g., an American student who lived in an Asian country longer than in the U.S. or vice versa) were excluded. This criterion was applied because there is a greater possibility that students who lived outside of their country for an extended period could be influenced by the cultural contexts where they lived. This study aimed to compare two distinct cultures in terms of the relationship of personality traits and creative achievement.

Based upon these criteria, college students in the U.S. and Korea were recruited for this study to investigate cultural orientation and its relationship to creative

achievement. Students in the U.S. were recruited from a large university in the southern United States of America. A total of 140 students responded to the survey. Among them, six were excluded from data analysis due to incomplete surveys. Therefore, 134 responses were used for the final analysis. For the Korean sample, students from two different colleges in South Korea participated in the study. A total of 117 students responded to the survey, and 19 were excluded from the final analysis due to incomplete surveys. A total of 98 responses were used for the final analysis.

Measures

Cultural orientation. The Individualism and Collectivism scale (INDOL; Triandis & Gelfand, 1998), also known as the Culture Orientation Scale, was used to examine cultural orientation. INDOL is a 16-item scale designed to measure four dimensions of collectivism and individualism:

Horizontal Individualism (HI) – seeing the self as fully autonomous, and believing that equality between individuals is the ideal.

Horizontal Collectivism (HC) – seeing the self as part of a collective but perceiving all the members of that collective as equal.

Vertical Individualism (VI) – seeing the self as fully autonomous, but recognizing that inequality will exist among individuals and accepting this inequality.

Vertical Collectivism (VC) – seeing the self as a part of a collective and being willing to accept hierarchy and inequality within that collective.

Sample items include “I’d rather depend on myself than others” (HI: Horizontal individualism), “When another person does better than I do, I get tense and aroused” (VI: Vertical individualism), “It is my duty to take care of my family, even when I have to

sacrifice what I want" (VC: Vertical collectivism), "If a coworker gets a prize, I would feel proud" (HC: Horizontal collectivism). The 9-point response scale is also used with a 6-point scale (1=extreme disagreement to 6=extreme agreement) (Triandis et al., 1993). In a study investigating the psychometric properties of this scale, internal reliability in Switzerland for individualism and collectivism was .75 and .73, respectively; in South Africa, these values were .78 and .84, respectively (Györkös, Becker, Massoudi, Antonietti, Pocnet, de Bruin, & Rossier, 2013).

Openness to experience. Openness to experience was measured with the subscale of the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). A total of 10 items including two reverse items were used. The 5-point scale ranges from 1 (strongly disagree) to 5 (strongly agree).

Intrinsic motivation. The Work Preference Inventory (WPI; Amabile, Hill, Hennessey, & Tighe, 1994) was used to measure intrinsic motivation. The intrinsic motivation scale includes 15 items that assess the degree to which respondents enjoy the challenge of the work. Sample items include "I enjoy tackling problems that are completely new to me" and "I enjoy trying to solve complex problems" with a 4 point scale where 1 = Never or almost never true of you, 2 = Sometimes true of you, 3 = Often true of you, and 4= Always or almost always true of you (Prabhu et al., 2008). In Prabhu et al. (2008)'s study, Cronbach's alpha for the intrinsic motivation scale (WPI) reported 0.71.

Everyday creativity. A total of six items from the Runco Creativity Assessment Battery were used to measure everyday creativity in this study. Sample items included "How often have you seen that your friends shared your post(s) in social media?" and

"How often have you cooked an original dish for a group" "How often have you made a video that was used by some group?" The Cronbach's alpha for everyday creativity items were .73.

Creative achievement. The Creative Activity and Accomplishment Checklist (CAAC) is a widely used scale for measuring creative achievement. Okuda, Runco, and Berger (1991) reported good inter-item reliabilities for the various domains (.71 < rs < .91). A recent study also reported high reliability for CAAC, in terms of quantity (α=.86) and quality (α=.87) (Paek & Runco, 2018). The scale asked respondents how many times they had been involved in each activity or been awarded for the creative achievement. The response types were four options: Never (0), 1-2 times (1), 3-5 times (2), Over 5 times (3).

CAAC includes various domains, and for this study, a total of 33 items of sub domains in Music, Art, Technology, and Writing were used to measure creative achievement in this study. Both quantity and quality items were used and the mean scores across quantity and quality for each domain were utilized for this study.

Sample items were included to measure creative achievement in Music "How often have you been performed music in public (e.g., music performance or a talent show)? "How often have you been recognized by your classmates or in your school for your musical talent?" in Writing, "How often have you won an award for something you wrote in a competition?" and "How often have you published something you wrote in a school-wide magazine or newsletter?" in Technology, "How often have you been asked to create or maintain a website (e.g., Facebook) or blog as a web host for our class or club?" and in Art, "How often have you drawn a picture just to express an idea or

feeling?" and "How often have you represented class or school for an art competition or fair?"

Procedure

An online survey was used to collect samples in both the U.S. and South Korea. All instruments used for this study were originally developed in English. These instruments were then translated into Korean for Korean students. Two researchers reviewed and cross checked all items to determine any ambiguous translation in an effort to minimize possible misinterpretation. After the researchers reached an agreement, the online survey was distributed. Several researchers in South Korea guided students to participate in the online survey from two different universities. Students who consented for this survey completed demographic questions, the Individualism and collectivism scale (INDOL), Openness (NEO-FFI), and Work Preference Inventory (WPI), Everyday creativity items, the Creative Activity and Accomplishment Checklist (CAAC).

Results

Construct Validity and Reliability

Before examining the research questions, confirmatory factor analysis (CFA) was employed to assess the construct validity of each scale. The factor loadings and the fit indices of the measurement model including CFI (the Comparative Fit Index), TLI (Tucker and Lewis Index), and RMSEA (the Root Mean Square Error of Approximation, and SRMR (the Standardized Root Mean Square) were checked to detect problematic items.

With the 10-item Openness to experience scale (NEO-FFI), CFA results indicated unacceptable goodness-of-fit. Items number 7 and 9, which are both reverse items,

indicated low factor loadings under 0.5 with item number 10. The factor loadings of the problematic three items (item 7, item, 9, and item 10) were each -.233, .106, and .377. By removing these three items, the modified model, the goodness-of-fit was acceptable (χ 2 =33.241, df=14, GFI=0.962, TLI=0.96, CFI=0.973, RMSEA=0.077) with all factor loadings over 0.5. Thus, the final seven items were used for the final analysis. The internal consistency reliability (Cronbach's alpha) of the Openness to experience with these 7 items was .87, which indicated it was adequately reliable.

The confirmatory factor analysis (CFA) was also employed to evaluate dimensionality of the Individualism and Collectivism scale (INDOL) and its construct validity. Among 16 items total, the 15 items were loaded under each sub dimension (Horizontal individualism, Horizontal collectivism, Vertical individualism, and Vertical collectivism) as intended under theory. However, one item, "It is important to me that I respect the decisions made by my groups (VC)," was loaded under Horizontal collectivism (HC) not Vertical collectivism (VC) which was originally the dimension under theory. Thus, this one item was removed from the final analysis. The internal consistency reliability of the total of 15 items was .74. The reliability of each dimension is indicated as follows: .73 for Horizontal individualism (HI), .76 for Horizontal collectivism (HC), .77 for Vertical individualism (VI), and .64 for Vertical collectivism (VC). The results indicated that the alpha coefficients for each sub dimension of the Individualism and collectivism scale (INDOL) were adequately reliable.

The Work Preference Inventory (WPI; Amabile, Hill, Hennessey, & Tighe, 1994) was used to measure intrinsic motivation. After CFA, four items were removed to improve the model. The 11 final items indicated .75 of reliability. With four domains

(Music, Art, Writing, Technology) of creative achievement, as CFA results, 4 items each for Music, Arts, Writing, Technology, 24 items in total were used in this study. The internal consistency reliability for each domain is .79 for Music, .81 for Art, .81 for Writing, and .73 for Technology.

Descriptive Statistics and Correlations

The Pearson correlations were calculated to address the first research question examining in the relationships among cultural characteristics (individualism & collectivism), openness to experience, intrinsic motivation, everyday creativity and creative achievement, Descriptive statistics and correlations are shown in Table 4.1. Horizontal Individualism (HI) was significantly positively correlated with all variables, except creative achievement. Intrinsic motivation was most strongly correlated with Horizontal Individualism (HI) (r = .456, p <.01). Vertical Individualism (VI) was not significantly correlated with any variable. VI was negatively correlated with Openness to experience (r = -.105), but not significantly. Horizontal Collectivism (HC) was significantly positively correlated with Vertical Collectivism (VC) (r = .392, p <.01), Openness to experience (r = .305, p <.01), Intrinsic motivation (r = .325, p <.01), Everyday creativity (r = .249, p <.01), but HC had no correlation with Creative achievement. Openness to experience was significantly positively correlated with Intrinsic motivation (r = .394, p <.01), Everyday creativity (r = .481, p <.01), Creative achievement (r = .143, p <.05). Intrinsic motivation was significantly positively correlated with Everyday creativity (r = .310, p <.01) and Creative achievement (r = .167, p <.05). Everyday creativity was significantly positively correlated with Creative achievement (r = .293, p <.01).

Table 4.1

Bivariate correlations of study variables

	Variable	*Mean*	*SD*	1	2	3	4	5	6	7
1.	Horizontal Individualism	6.44	1.32	-						
2.	Vertical Individualism	5.17	1.59	.191**	-					
3.	Horizontal Collectivism	6.87	1.19	.262**	-.057	-				
4.	Vertical Collectivism	6.12	1.46	.203**	.095	.392**				
5.	Openness to experience	3.88	.79	.370**	-.105	.305**	.295**			
6.	Intrinsic motivation	3.12	.36	.456**	-.008	.325**	.154*	.394**		
7.	Everyday creativity	1.00	.72	.306**	.038	.249**	.119	.481**	.310**	
8.	Creative achievement	.82	.76	.028	-.016	.038	-.150*	.143*	.167*	.293**

*$p < .05$, **$p < .01$, ***$p < .001$.

An independent sample t-test was computed to address the second research question in examining differences among cultural characteristics (individualism & collectivism), individual components (openness to experience, intrinsic motivation), everyday creativity and creative achievement between two cultural orientations. As the results in Table 4.2. shown, there were significant differences in Horizontal Collectivism, Openness to experience, Intrinsic motivation, and Everyday creativity between the two groups. Americans were significantly higher in Horizontal Individualism (HI) (*M*=6.91, *SD*=1.20) than Koreans. Americans were significantly higher in Horizontal Collectivism (HC) (*M*=7.25, *SD*=1.11) and also Vertical Collectivism (VC) (*M*=6.41, *SD*=1.38) than Koreans. Regarding personality traits (Openness to experience and Intrinsic motivation), Americans were higher in Openness to experience (*M*=4.33, *SD*= .62) and Intrinsic motivation (*M*=2.73, *SD*= .65) than Koreans.

Table 4.2

Independent sample t-test comparing main variables between Korea and the U.S.

	Korean (*n*=98)		American (*n*=134)		*t*
	M	SD	M	SD	
Horizontal Individualism	5.80	1.21	6.91	1.20	*-6.89****
Vertical Individualism	5.35	1.40	5.04	1.72	1.49
Horizontal Collectivism	6.36	1.14	7.25	1.11	-5.92***
Vertical Collectivism	5.73	1.47	6.41	1.38	-3.59***
Openness to experience	3.27	.55	4.33	.62	-13.49***
Intrinsic motivation	2.55	.55	2.73	.65	-2.13*
Everyday creativity	.61	.49	1.29	.72	-8.59***
Creative achievement	.85	.49	.79	.91	.509

*$p < .05$, **$p < .01$, ***$p < .001$.

The Function of Mediator Variables

In an explanation of a parallel multiple mediator model, Hayes (2009) explained that variable X is modeled to exert its effect on Y through $k + 1$ pathways. One pathway is direct, from X to Y without passing through any of the proposed mediators, and the other k pathways are indirect, each through a single mediator. The total effect is equal to the direct effect of X (independent variable) on Y (outcome variable) plus the sum of the indirect effect through mediators (Hayes, 2009). In other words, the multiple mediation model involves two parts. Analyzing the total indirect effect, whether the set of mediators transmits the effect of generation status to creative achievement. The second part is the testing of hypotheses regarding individual mediators such as intrinsic motivation, creative self-efficacy, and creative attitude and values investigating specific indirect effects.

Testing the hypothesized model

Structural equation modeling (SEM) has been recommended for consideration to assess mediation because it offers a reasonable way to control measurement error along with providing some alternative ways to explore the mediation effect (Baron & Kenny,

1986; Holmbeck, 1997; Judd & Kenny, 1981; Kline, 1998). MacKinnon et al. (2002 & 2004) recommended the use of the distribution of the product approach or bootstrapping over the Sobel test (1982) or causal steps approach in the sense of yielding greater statistical power and more accurate Type I error rates than traditional regression procedures (Baron & Kenny, 1986). Bootstrapping is a nonparametric resampling procedure and an additional method for testing mediation that does not impose the assumption of normality of the sampling distribution (Preacher & Hayes, 2008). A bootstrapping approach to assessing indirect effects can be implemented using AMOS (Arbuckle & Wothke, 1999). AMOS is statistical software, which is added to the SPSS module. It is specially used for SEM (Structural Equation Modeling), Path analysis, and CFA (Confirmatory factor analysis).

Regarding research questions 3 & 4, the mediating effect of everyday creativity in the relationship between components (openness to experience and intrinsic motivation) and creative achievement was examined using a bootstrapping approach. The mediation mechanism was compared between two cultures. The bootstrap procedure was used to examine the magnitude and significance of the mediated and direct effects (Shrout & Bolger, 2002; Mallinckrodt, Abraham, Wei, & Russell, 2006). AMOS implements the percentile bootstrap method for total indirect effects in simple and multiple mediator models (Preacher & Hayes, 2008). Therefore, this study model was analyzed using the AMOS program. Figure 4.1 indicates a research model for this study based on the literature review.

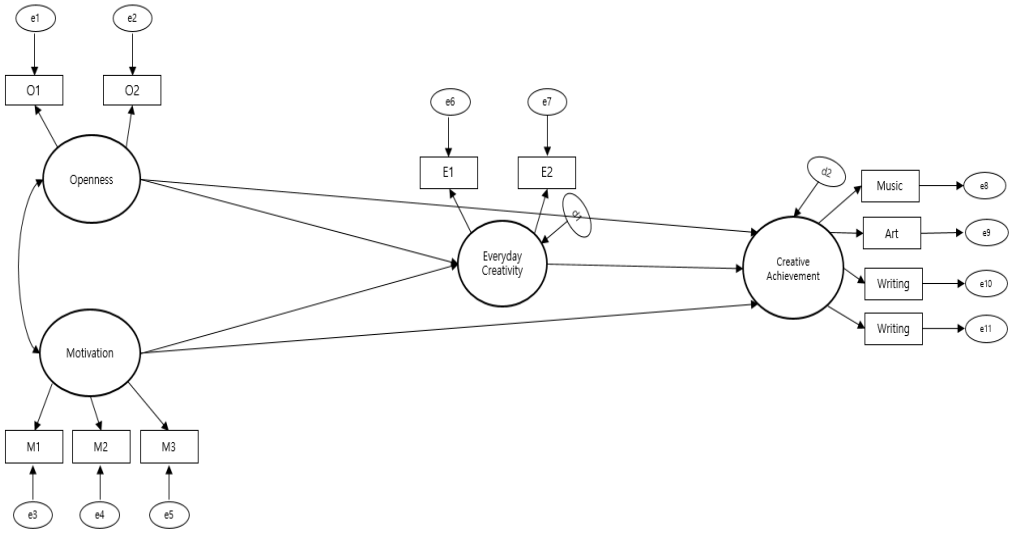

Figure 4.1. Research model

Before conducting a structural equation modeling, cross validity was tested between two cultural orientations (Korean and American groups). The measurement equivalence test result indicated that the overall fit of the model was very good. The $\chi^2(58)$= 76.362, p= .053, χ^2/df ratio =1.317, CFI = .95, TLI = .93, RMSEA = .04. The model with path coefficients are seen in Table 4.3. Among five direct paths, two direct paths each for Korean and American were found. For the Korean group, the path from openness to experience to everyday creativity was significant and the path from everyday creativity to creative achievement was significant and a large influence (1.26). For the American group, the path from intrinsic motivation to everyday creativity was significant and everyday creativity to creative achievement was significant and a large influence (4.18).

Table 4.3.

Direct effects of structural model

Path			Korean			American		
			β	C.R.	*p*	*β*	C.R.	*p*
Openness to experience	→	Everyday creativity	.49	2.48	.01	.04	.25	.80
Intrinsic motivation	→	Everyday creativity	-.19	-.43	.67	.72	2.39	.02
Everyday creativity	→	Creative Achievement	1.26	3.64	.00	.46	4.18	.00
Intrinsic motivation	→	Creative Achievement	.69	1.22	.22	.03	.17	.87
Openness to experience	→	Creative Achievement	-.17	-.61	.54	.10	1.04	.30

The results of mediation effect are shown in Table 4.4. For the Korean group, openness to experience had a significant indirect influence on creative achievement via everyday creativity. For the American group, intrinsic motivation had a significant indirect influence on creative achievement via everyday creativity. Unexpectedly, the two groups had a different significant path on creative achievement. Both groups showed complete mediation of everyday creativity, meaning the total effect of independent variables (openness to experience and intrinsic motivation) on a dependent variable (creative achievement) is transmitted through everyday creativity.

Table 4.4

Mediation effect

Korean (path)					Indirect Effect	*p*
Openness to experience	→	Everyday creativity	→	Creative achievement	.743	.026
Intrinsic motivation	→	Everyday creativity	→	Creative achievement	-.224	.754
American (path)						
Openness to experience	→	Everyday creativity	→	Creative achievement	-.001	.891
Intrinsic motivation	→	Everyday creativity	→	Creative achievement	.254	.028

Figure 4.2 and 4.3 show the results of the direct and indirect path and its significance.

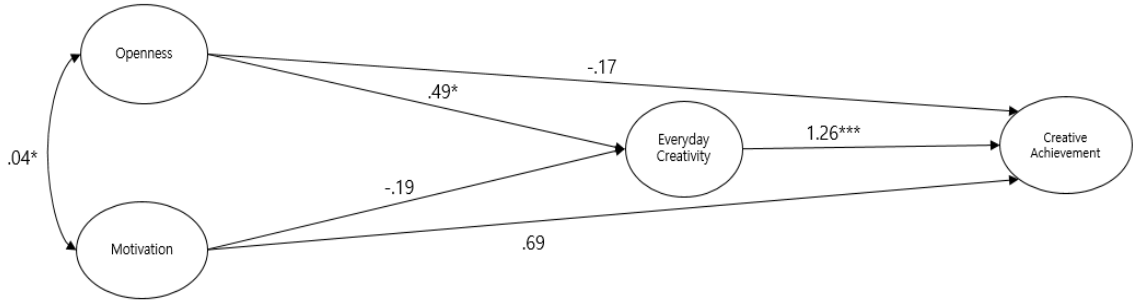

Figure 4.2. Model for Korean group

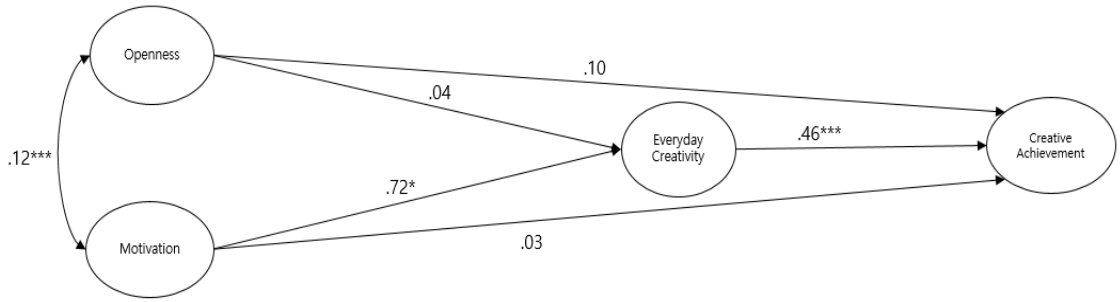

Figure 4.3. Model for American group

Discussion

Based on Amabile's (1983) components theory of creativity, this study investigated influencing within-individual component factors (openness to experience and intrinsic motivation) and outside the individual component (culture) on creative achievement with testing the mediating role of everyday creativity.

Two cultures, 98 Korean and 134 American college students were compared on measure of INDOL with four dimensions: Horizontal Individualism (HI), Vertical Individualism (VI), Horizontal Collectivism (HC), and Vertical Collectivism (VC). The result indicated that Americans had significantly higher horizontal individualism than Koreans. Unexpectedly, Americans showed significantly higher horizontal collectivism and vertical collectivism than Koreans.

Regarding the degree of individualism, the result was consistent with Chiou's (2001) study in that the American sample showed more horizontal individualism than Argentine and Taiwanese samples. However, regarding the collectivistic characteristic, the study results showed a contrary finding to most previous research, which has indicated that eastern cultures show a greater degree of collectivism than western cultures. This result seems to be a contrary finding to the previous research in the dichotomy mechanism of individualism and collectivism.

Supporting evidence for this result can be found in Niu and Sternberg (2002), that young Korean students view of creativity is not different from that of westerners. Most studies on cultural difference were conducted prior to 1990 or during 1990s and early 2000s. In more recent years, young Koreans are living in a high-tech leading country with a highly competitive society, under much pressure for social success. These features of young generations in Korea are very different from older generations, who valued family and group protection. Another reason could be that even in America, different cultures may exist, for instance, between the northern region and southern region of America. Most samples in this study are from the southern part of America, therefore, sampling from different regions of America may lead to different results.

Based on the literature review, as hypothesized, the results of openness to experience indicated that American students have significantly higher scores than Korean students. This result is consistent with most previous studies that East Asians are comparatively low on openness to experience compared to Europeans or Americans (Hildenbrand, et al., 2018; Schmitt, et al., 2007). Along with openness to experience, Americans showed higher intrinsic motivation. Previous research reported East Asian's

motivation are at a lower level even though they have consistently outperformed academically in academic achievement tests such as in the Programme for International Student Assessment (PISA), and Trends in International Mathematics and Science Studies (TIMSS) (Zhu & Leung, 2011).

The mediating role of everyday creativity was examined in the relationship of individual components (openness to experience and intrinsic motivation) and creative achievement by comparing social environment (culture). As a result, different mediation paths for Koreans and Americans were found. Openness to experience for the Korean group and intrinsic motivation for the American group had a significant, indirect influence on creative achievement via everyday creativity.

The result of the mediation path for the Korean group is consistent with findings of Jauk et al. (2014) in that openness to experiences predicted everyday creative activities which, in turn, predicted actual creative achievement. The result added to most previous findings that openness to experience is one of the strongest predictors of actual creative achievement (Batey & Furnham, 2006; Feist, 1998, 2010).

The result of the mediation path for the American group is consistent with what Amabile (2017) emphasized, that daily psychological experiences, such as motivations, significantly influence daily creative performance. It also aligned with the result of Benedek et al. (2020)'s study in that intrinsic motivations including enjoyment and expression influenced everyday creative activities. The interesting complete mediation result from this study indicated the greater role of everyday creativity in actual creative achievement.

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CHAPTER 5

A DISCUSSION OF THE FINDINGS

Not just one single factor, but many factors have been investigated in explaining creative achievement. According to Amabile's (1983) componential theory of creativity, three individual components: domain-relevant skills, creativity-relevant processes, and task motivation, as well as one outside the individual component (social environment) influence creativity. Although much literature has been investigated in the relationship of domain-relevant skills (intelligence or domain knowledge) and creative achievement, creative-relevant processes (creative potential) and creative achievement independently, factors influencing creative achievements can be better understood in the mechanism of the combined components.

Based on this motivation, the first study described in this dissertation explored the role of domain knowledge and the potential role of creative potential on creative achievement beyond controlling domain knowledge. The second study extended in the mechanism of the relationship between creative potential and creative achievement. Especially, Amabile's (1983) third component of within-individual component which is intrinsic motivation along with openness to experience is investigated as a predictor for creative achievement in two different cultures (social environment). In addition, everyday creativity (domain general factor) was examined whether it has a mediating role between

the relationships of two individual component predictors (openness to experience and intrinsic motivation) on creative achievements.

A study of domain knowledge and creative potential in relation to everyday creativity and creative achievement among STEAM undergraduate Korean students

The purpose of this study was to explore the role of domain knowledge (STEAM domains), creative potential (divergent fluency and ideational behavior) and personality factor (openness to experience) on everyday creativity and creative achievement. The one-way MANOVA (STEAM major) was used to explore the difference on everyday creativity and creative achievement from the sample of 270 STEAM major undergraduate students in Korea. To examine the main research questions, a hierarchical multiple regression model was tested to see whether traits of creative potential predicted everyday creativity and creative achievement.

Findings and Implications

From the first part of the analysis, the results from the one-way MANOVA (STEAM major) indicated that no STEAM major effects appeared for the quality of creative achievement, but there were significant effects in everyday creativity and quantity of creative achievement. Students majoring in technology and arts had statistically higher levels in everyday creativity, and Arts majors had statistically higher levels than other majors in quantity of creative achievement.

A great deal of research has indicated that artists or art students have a higher level of creativity than scientists or engineers (Hartley & Beasley, 1969; Hartley & Greggs, 1997). Living in an advanced technology world, young generations more frequently incorporate technology in their everyday creativity. The field of technology

requires more creative ability to produce new ways of products consistently, which are distinct from old technology. Artists and technologists have something in common in that they are exploring virtual and physical interactivity by combining sound and image (Candy & Edmonds, 2002).

In examining predictors for everyday creativity and creative achievement, a hierarchical multiple regression model testing results indicated that creative potential (divergent thinking and ideational behavior) explained significant variance in everyday creativity and creative achievement beyond domain knowledge. Additionally, this study confirmed that the personality factor (openness to experience) explained additional significant variance beyond that provided by domain knowledge and creative potential.

Driven by the componential theoretical bases of creativity, this study explored components through an individual's cognitive expertise, creative potential, and personality elements on creativity by analyzing them simultaneously. This study provided additional understanding of within-individual components (domain-relevant skills and creative potential) on everyday creativity and creative achievement (quantity and quality).

Everyone has creative potential, not just the eminent (Runco, 2003 & 2004), and creativity can be found not only in the gifted or highly intelligent child but also in every child (Runco, 2003) and creativity can be nurtured (Niu & Sternberg, 2003; Passow, 1981; Zimmerman, 2009). Practical implications indicated that regardless of any field of domain knowledge, creative-relevant skills (creative potential) and openness to experience would enhance individual's everyday creativity (domain general) and creative achievement (domain-specific). Anyone might become creatively productive in

meaningful ways, such as by learning more about their own creative potential and applying strategies through creative efforts (Treffinger, 1995). It is worth highlighting that enhancing individual levels of ideational behavior and openness to experience in daily activities is crucial.

Limitations and Future study

This study used STEAM majors as an indicator for domain knowledge. In this case, it is assumed that students majoring in a certain domain have more knowledge level in that domain (e.g., math or arts). However, for measuring domain-relevant skills more accurately, intelligence tests or knowledge tests in different domains can be used. Many studies through the decades have shown positive environmental effects of creativity (e.g., Amabile, 1983, 1996; Sternberg & Lubart, 1992; Torrance, 1962, 1972, 1987; Westberg, 1996). The level of creative achievement may differ in terms of individuals' stages within the surrounding environment. Based on Amabile's (1983) componential theory of creativity, an external component such as social environment could be added as a potential predictor to better understand an individual's creative achievement.

A study of everyday creativity mediating openness to experience, motivation and creative achievement among Korean and American college students

Many individuals are engaged in numerous daily creative activities either for enjoyment or as a mode of self- expression. These everyday daily activities often link to actual creative achievement. This study examined the mediating role of everyday creativity between creative-relevant process (openness to experience) and task motivation (intrinsic motivation) and creative achievement by comparing social environment (two

different cultures, Korea and America) based on the components of creativity theory (Amabile, 1983).

Findings and Implication

First of all, the Pearson correlations indicated that Horizontal Individualism (HI) was significantly positively correlated with all variables, except creative achievement. Intrinsic motivation was most strongly correlated with Horizontal Individualism (HI). Openness to experience was significantly positively correlated with intrinsic motivation, everyday creativity, and creative achievement. Intrinsic motivation was significantly positively correlated with everyday creativity and creative achievement. As in task motivation (intrinsic motivation) included as the essential component of creativity (Amabile, 1983), a number of studies emphasized the fundamental role of intrinsic motivation in creativity (Agnoli et al., 2018; de Jesus et al., 2013; Hennessey, 2003) and intrinsic motivation is considered as a driving force for initiating creative behavior (Prabhu et al., 2008).

Secondly, two different cultural orientations were compared with the four dimensions of Individualism and Collectivism (IND-COL), creative potential (openness to experience and intrinsic motivation), everyday creativity and creative achievement. Unexpectedly, vertical collectivism was lower than that of Americans. Recent Korean trends and rapidly changing culture could explain this result. Korea is a rapidly changing society, as also seen in family characteristics that went from having big families (several generations) living together in older generations to a nuclear family, where only parents and children (only a child or two) live together in younger generations. Korean millennials have distinct characteristics from older generations. A recent news article

from BBC (Moon, 2020) described young Korean millennials pushing back against conventional ideas about professional success and social responsibilities. Young Koreans are searching for something beyond material success and activities for “sohwakhaeng” is getting attention. The neologism, “sohwakhaeng” refers “something that is small but wholly yours.” This shows distinct characteristics of younger generations from old generations. According to Yoon, who co-authored 2019 Korean Trends, Korean tradition is revolved around a “gathering culture” such as class reunions. However, “These gatherings reinforce an authoritarian culture that an increasing number of younger South Koreans are choosing not to partake in anymore.”

Thirdly, from the result of multiple-group SEM (MGSEM), the two groups had unexpectedly different significant paths on creative achievement. The study result indicated that everyday creativity was completely mediated on creative achievement. A complete mediation refers that the total effect of an independent variable (openness to experience and intrinsic motivation) on a dependent variable (creative achievement) is transmitted through the mediator variable (everyday creativity). The structural equation modeling (SEM) provides much value for causal inquiry in behavioral research fields (Lowry, & Gaskin, 2014). This result implied that the role of everyday creativity is vital to be able to reach actual creative achievement. In education settings, for instance, incorporating creative activities in curriculum are more encouraged, in turn, students may have more frequent everyday creative activities in their personal lives.

Limitations and future research

Despite some new findings of this study, at least two limitations should be pointed out and addressed in future studies. First, the sampling in this study includes only college

students and sample size is relatively small. For a more rigorous cultural comparison study, large samples including a broader population are needed. Additionally, sampling from broader regions are necessary to report a more general tendency of the result. People from the north and south, even within the same country like in the U.S., may have different values on individualism and collectivism. Second, most cultural comparison studies were conducted in the 1990's or early 2000's. Most previous research reported relatively dichotomous results in that eastern cultures tend to be collectivistic while western cultures are more individualistic. However, for instance, Korea is a rapidly changing society in terms of family format and individual values. The cultural orientation between the old and young generation might be very different. In this sense, more recent cultural comparison studies are necessary to better understand the influencing factors on creativity under the mechanism of cultural influence.

A considerable amount of evidence indicated that multicultural experiences have more benefits on creativity. Leung and Chiu (2010) found that exposure to multicultural experiences is positively associated with the possibility of engaging in some creativity supporting processes such as generation of unconventional ideas. This study found that European American undergraduates' creative performance immediately improved after their exposing to a foreign culture about five to seven days. In this sense, another possible study could compare three groups: for instance, culture in the west and the east and a group with multicultural experience in investigating their degree of everyday creativity and creative achievement.

After Amabile created the componential theory of creativity in 1983, she also presented a model of factors influencing creativity and innovation in organizations in

1988. In a recent study (Amabile & Pratt, 2016), a significant revision of the model of creativity and innovation in organizations was presented by modifying certain components and causal connections and introduce four new constructs into the model. From the perspective of organizational innovation, potential factors influencing individual's creativity based on Amabile's updated dynamic componential model of creativity and innovation in organizations could be investigated for future.

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