

The predictive model of imagination stimulation

梁朝雲

國立臺灣大學生物產業傳播暨發展學系

Chao-yun Liang

Department of Bio-Industry Communication and Development, National Taiwan University

cliang@ntu.edu.tw; iccylian@saturn.yzu.edu.tw

Abstract

The focus of this study was on developing a theoretical framework of imagination stimulation to: (1) examine the effects of personality, psychological and environmental variables on the imagination of university students, (2) analyze the predictive relationships between these identified variables; and (3) test the mediator effect resulting from the variables of both intrinsic motivation and inspiration through action. 943 film majors from eight universities across Taiwan served as research subjects. The findings of this study provided empirical evidence to support the indicators of imaginative capabilities, psychological influence, and environmental influence. The hypothesis of the study—that the variables of both intrinsic motivation and inspiration through action mediate the effects of personality, psychological and environmental predictors, and both types of imagination—was partially supported. The structural model also showed that most personality traits had direct effects on imagination, while most psychological and environmental predictors had indirect effects.

Keywords: environmental predictors; imagination; mediator effect; personality traits; psychological predictors.

摘要

本研究旨在研發想像力激發的理論架構，在其中分析人格特質、學習心理和學習環境等變項對大學生想像力的預測關係，並驗證內在動機與做中悟的中介效果。來自臺灣各地八所大專院校之 943 位影視科系學生參與本研究。本研究結果為想像力、心理影響和環境影響提供構念分析的驗證支持。本研究假設—內在動機與做中悟在人格、心理、環境和想像力之間扮演中介變項的角色—獲得部分支持。結構方程分析結果顯示，多數的人格特質對想像力具有直接預測效果，而多數的心理和環境變項對想像力則具有間接的預測效果。

關鍵字：環境預測變項、想像力、中介效果、人格特質、心理預測變項

INTRODUCTION

The field of film production is a playground of imagination. Many film stories are derived from human experience. They may be drawn from scattered recollections of the director, or the personal story of the producer. Indeed, film production largely demands reproductive imagination. For example, the script writer must be good at generating sentiments and forming emotional

triggers within stories. The editor must make a series of proposals through subtle shifts in tense from what the sequence currently 'is' to what it 'will be'. Even an Oscar-winning actor or actress still needs to empathize with someone's emotion in order to bring the character to life.

Some films, especially science fiction movies, require tons of creative imagination. *Star-Trek* is one such example. This entertainment franchise has initiated many trends in pop-culture. Taking the nature of film production into account, the cameraman must be able to capture the angles, transitions and acting with the ideal lighting that will evoke certain feelings within the audience. The director must know how to facilitate techno-aesthetic collaboration between film engineers and theatre artists. In a production team, the producer must keep everyone motivated and well-supplied, and he must also creatively complete the project on time and under budget.

Laurier and Brown (2012) indicated that imagination, in the context of film production, can be perceived as the inter-subjective task of seeing the film-that-is-to-come through what is currently completed, what is missing, and what needs to be added. Century (2007) stated that in the techno-aesthetic frame of modern animation production, each exact imagination from a single domain has its unique contribution. When these original contributions are distributed amongst collaborators in the production team, a particularly valuable result of "exact imagination and distributed creativity" comes out. Century added that collaborative research would benefit from formulation of such an exact imagination, distributed across networks of differentiated creative individuals.

Imagination is different from creativity, but it can be perceived as the vehicle of active creativity (Gaut, 2003). Kaplan (1972) also indicated that the autonomy of imagination is the precondition of its creativity. Many studies concluded that human creativity may be influenced by the interaction between personal and environmental variables (Hennessey, & Amabile, 2010; Shalley, Zhou, & Oldham, 2004). The research team expanded the above conclusion and believed that human imagination may also be influenced by these variables. The team further divided the variables into three categories, namely environmental predictors, psychological predictors, and personality traits.

In this vein, the present study developed a theoretical framework of imagination stimulation to: (1) examine the effects of personality-, psychology-, and environment-related variables on imagination in university students, (2) analyze the predictive relationships between these identified variables; and (3) test the mediator effect resulting from the variables of both *intrinsic motivation* and *inspiration through action*. In this study, imagination refers generally to the process of transforming the inner imagery of film students, when they face a production task.

Imagination

Many exceptional artists and scientists believe that imagination has a profound impact on their creations. For example, William Shakespeare once stated that "The lunatic, the lover, and the poet, are of imagination all compact." Blaise Pascal contended that "Imagination disposes of everything; it creates beauty, justice and happiness, which are everything in this world." Albert Einstein also held that "(Imagination) is the preview of life's coming attractions." Moreover, George Lucas

claimed that “You can't do it unless you imagine it.”

Dewey (1910) explained that imagination is an aspect of reflective thinking that enables us to create ideas that not only go beyond what is given but are effective, in the sense that they are likely to transform experience as intended (p. 7). Trotman (2006) further explained that imagination is an essential human capacity in various activities such as the pursuit of creativity and innovation, the symbolic expression of ideas, and critical thinking. With a wider interpretation in regards to imagination, Craft, Chappell, and Twining (2008) proposed a concept of agency-focused ‘possibility thinking’ (or imagining) which may open a further seam of widening participation in both access to and engagement in higher education.

Liu and Noppe-Brandon (2009) held that imagination is the ability to conjure new realities and possibilities (p. 19). Imagination can unfold in the conscious and deliberate, and in the unconscious and intuitive (p. 12). They further indicated that imagination is fundamentally about making associations and analogies between things that hadn't previously seemed connected (p. 182). Many contemporary psychologists would describe imagination as one of the “higher mental functions” that “involve the synthetic combining of aspects of memories or experiences into a mental construction that differs from past or present perceived reality and many anticipate future reality” (Morosini, 2010, p. 42).

Many scholars have indicated that the activities of human imagination can be classified into two different categories: reproductive imagination and creative imagination (e.g., Betts, 1916; Colello, 2007). Reproductive imagination is characterized by the capability to reproduce mental images described by others or images from less accurate recollections of reality. This type of imagination is comprised of four characteristics, namely crystallization, dialectics, effectiveness and transformation (Liang, Hsu, Chang, & Lin, 2012). In contrast, creative imagination focuses on the attributes of initiation and originality. This type of imagination is composed of six characteristics, namely exploration, concentration, intuition, novelty, productivity and sensibility (Liang et al, 2012).

Crystallization refers to an individual's ability to express abstract ideas by using concrete examples (Perdue, 2003; Vygotsky, 2004). *Dialectics* refers to an individual's ability to seek improvement by logically analyzing ideas (Cartwright & Noone, 2006; Ribot, 1906). *Effectiveness* refers to an individual's ability to generate effective ideas about the goal (Ribot, 1906; Shin, 1994). *Transformation* refers to an individual's ability to perform tasks by transforming what they have known across multiple fields of knowledge (Ribot, 1906; Vygotsky, 1978).

Exploration refers to an individual's ability to explore the unknown (Folkmann, 2010; Valett, 1983). *Concentration* refers to an individual's ability to formalize ideas through focus (Cartwright et al., 2006; Folkmann, 2010). *Intuition* refers to an individual's ability to generate immediate associations to the target (Reichling, 1990; Townsend, 2003). *Novelty* refers to an individual's ability to create uncommon ideas (Beaney, 2005; Vygotsky, 2004). *Productivity* refers to an individual's ability to productively generate ideas (Folkmann, 2010; Ribot, 1906). *Sensibility* refers to an individual's ability to evoke feelings during the creative process (Reichling, 1990; Ricoeur, 1978).

In the current study, films are the filmmaker's creations and can be perceived as the transformation of the filmmaker's memory. Perdue (2003) indicated that film uses mixed-media to create a represented version of perceptible reality which evokes a mental concept to go beyond what is observable by the senses. Film is considered "a phantasm of images" which creates an imagined reality. The reality represents "higher truth" experienced in the viewer's imagination. Perdue further elaborated that film not only represents a version of imagination to the public in mass media form, but film also suggests an associative capability of the imagination in cognitive reasoning.

Psychological Predictors

The study of imagination has a long history associated with the field of psychology (Heath, 2008). Some psychological states, such as emotion, self-efficacy, cognition, and motivation have been proven to have an effect on imagination (Hennessey, 2004). For example, Fredrickson (2001) suggested that *emotions* such as joy and love broaden a person's available cognitive repertoire, thus enhancing creativity and imagination. Although emotions have been studied as facilitating factors in changing people's attitude, motivation, and problem-solving skills (Erez & Isen, 2002), there are other studies that argue conversely. Some studies show that emotions experienced during cognitive processing can be viewed as unnecessary loads, and they can have a negative effect on human reasoning (Paas, Renkl, & Sweller, 2003).

Many studies indicated that individuals with high *self-efficacy* perceive themselves as capable of resolving problems, and imagine the likelihood that acts can be performed (Anderson, 1983; Bandura, 2000). Bandura (2012) further indicated that self-efficacy is a focal determinant because it affects behavior both directly and by its influence on the other determinants. People with high self-efficacy, believe and imagine that they can affect change, and they have control over their thoughts, feelings, and actions. They are confident in their capacities; they are motivated to see difficult tasks as challenges rather than threats, setting meaningful goals for themselves and striving to achieve them.

The recent studies in the field of creative imagery reveal the cognitive structures and processes that are involved in creative thinking and imagination (Finke, 1996). For example, O'Connor and Aardema (2005) situated imagination within consciousness complete with its own pre-cognitive, cognitive and meta-cognitive domains. In the *geneplore* model of creative cognition, Finke (1996) claimed that two aspects accounted for creative thinking and imagination, a generative phase where an individual formulates mental representations, and an exploratory phase where those structures are adopted to establish creative ideas. Creative thinking at the generative phase is closely associated with generative cognition, while the exploratory phase is associated with metacognition.

In regards to motivation, Rosenbaum (2002) explained that a person's performance at a given time is affected by what they imagine and plan to do next. Oettingen and Mayer (2002) also believed that both positive expectations and fantasies would predict high-effort and successful performance. In order to examine the relationship between creativity and some personality traits, Prabhu, Sutton, and Sauser (2008) tested the meditational role of intrinsic motivation finding that creativity was positively related to self-efficacy, openness to experience and intrinsic motivation. In

addition, intrinsic motivation mediated the relationship between creativity and both personality traits of openness to experience and self-efficacy.

Environmental Predictors

Many studies have elucidated the role of environment in creativity. For example, Amabile et al. (1996) recognized crucial environmental conditions that nurture creativity: freedom, sufficient resources, challenging work, group support, supervisory encouragement, and absence of organizational impediments. Research has also suggested that the majority of individuals in a society exhibit personality traits favored by the cultural environment (Benedict, Mead, & Catherine, 1989). Moreover, Oldham and Cummings (1996) detected a four-way interaction among individual and environmental variables, in which creative performance was highest when employees with highly creative personalities worked on complex, challenging tasks under supportive supervision.

Accordingly, the college campus can be divided into four dimensions: its physical components and design, its dominant human characteristics, the organizational structures that serve its purposes, and the participants' constructions of its social climates (American College Personnel Association, 1994). First, the *physical component* dimension of a campus consists of its natural environment and man-made environment. Both components define space for activities and events, thereby encouraging some phenomena while limiting others (Strange, 2000). Second, the *organizational measure* dimension arises from the myriad decisions made about organizational purposes and functions (Strange, 2000). As a result, rules and regulations are formed, rewards systems are developed, and reports become necessary for resource allocation.

Third, the *social climate* dimension focuses on the subjective experiences of participants (Allodi, 2010; Strange & Banning, 2001). The social climate has both intrinsic influence and external impact. McMillan (1995) thus held that all schools should create a climate that is full of encouragement and support in order to cultivate student imagination. Fourth, the *human aggregate* dimension represents the collective characteristics of people who inhabit the campus environment. This dimension is about the dynamics of person-environment interactions, and reduces environmental differences to the collective effects of inhabitants' characteristics, personalities, and types (Komives & Woodard, 2003).

Furthermore, according to the recent studies in learning environments (e.g., Gislason, 2010), student learning should be separated as an independent variable to be studied. Kember, Ho, and Hong (2010) also indicated that student motivation can be enhanced through several supportive conditions, namely establishing relevance, establishing interest, allowing choice of courses, learning activities, teaching for understanding, assessment of learning activities, close teacher–student relationships, and sense of belonging between classmates. This study thus took *learning resources* into account to explore the impact of a campus environment on student imagination.

Personality Traits

Although imagination is different from creativity, it is usually viewed as the basis for cultivating creative thinking, and thus the driving force of innovation (Finke, 1996; Robinson &

Aronica, 2009). The present study expanded the argument that both imaginative and creative people share common personality traits, and these traits, in turn, may influence their imagination and creativity. This argument has been indirectly supported by several earlier studies, for example, the association between divergent thinking and imagination (Suddendorf & Fletcher-Flinn, 1999), and the personality traits of divergent thinkers (Batey, Chamorro-Premuzic, & Furnham, 2009).

Over the years, numerous researchers have found five traits that creative individuals have, namely high Openness to experience, low Agreeableness, low Conscientiousness, high Extraversion and high Neuroticism (King, McKee Walker, & Broyles, 1996; Prabhu et al., 2008). The previous study (Oldham & Cummings, 1996) also showed that employees who score high on openness to experience value environmental conditions that support creativity (e.g., supervisory encouragement) and respond to these conditions by exhibiting high creativity. Conversely, those who score lower on openness tend to devalue these conditions and respond less positively to them.

Other creative personality traits have been discussed such as: shyness, curiosity and neuroses (Nagera, 1969); being capable, clever, egotistical, insightful and resourceful (Gough, 1979); high energy, self-confidence, persistence in the face of barriers, and broad interests to recognize divergent information (Barron & Harrington, 1981); fantasy-orientation, impulsivity, emotional sensitivity, independence, unfriendliness, and the need for achievement and autonomy (Feist, 1999); divergent thinking, introversion, tolerance for ambiguity, willingness to take risks, behavioral flexibility, emotional variability, and the ability to absorb imagery (James & Asmus, 2001); a tendency towards novelty, eager to cooperate, and high self-esteem (Lee, 2005; McCrae, 1987); as well as playfulness and a sense of humor (Proyer & Ruch, 2011).

Personality traits indicate how people relate to each other and foster mutuality in the group (Clarkson, 2005). Anderson, Spataro, and Flynn (2008) found that extroverts attained more influence in a team-oriented organization, whereas conscientious individuals attained more influence in an organization in which individuals worked alone on technical tasks. Shalley et al. (2004) indicated that little research has been conducted to determine whether cognitive style or ability and personality make independent contributions to creativity or whether they interact with one another to affect an individuals' creative response. The current study is intended to provide some answers to this void in the research.

Proposed Hypotheses

Numerous studies have found that the creative personality is positively related to high intrinsic motivation and meta-cognitive ability, such as willingness to take risks and persistence in the face of barriers (Barron et al., 1981; McCrae, 1987). Previous research also claimed that people could be motivated by emotions (Bickhard, 2000) and self-efficacy (Brookhart, Walsh, & Zientarski, 2006). Much of the contemporary research concerned with creativity has been guided by an intrinsic motivation framework (Hennessey, 2004; Prabhu et al., 2008; Shalley et al., 2004). In addition, earlier studies (Deci, Connell, & Ryan, 1989) showed that external conditions, whether controlling or informational, might affect intrinsic motivation and subsequent creative performance.

In regards to the role of metacognition, many scholars claimed that people's motivation could

be augmented by their cognition (Bickhard, 2003) and metacognition (Efklides, 2011; Paris & Winograd, 1990). Fredrick (2007) also indicated that the most effective and creative problem-solvers engage in a process of metacognition in which they are aware of how they are thinking as they are doing the thinking. Vasquez and Buehler (2007) also found that people feel more motivated to succeed on a future task when they visualize its successful completion via a third-person. That is, recognition from third-persons (e.g., teachers, classmates) toward individuals' meta-cognition with hands-on practice can greatly motivate their imaginative tasks and creative performance. In his MASRL model, Efklides (2011) indicated that metacognition has positive relationships with both emotions and self-efficacy. According to the Cognitive Evaluation Theory, Deci et al. (1989) claimed that external conditions affect human cognition.

The present study took into account the crucial roles of both intrinsic motivation and metacognition on imagination-stimulation, and the practice-oriented nature of the film production field. We hypothesized that the personality, psychological, environmental predictors predict imagination through both intrinsic motivation and metacognition. To fit in with the context of film production, we renamed metacognition as *inspiration through action*. This enabled the participants to better express how they felt in regards to their imagination being influenced by metacognition with hands-on practice. Subsequently, the following relationships were hypothesized in this study:

H1: Intrinsic motivation is positively associated with both reproductive and creative imagination.

H2: Intrinsic motivation mediates the effects of personality traits and both types of imagination.

H3: Intrinsic motivation mediates the effects of psychological predictors and both types of imagination.

H4: Intrinsic motivation mediates the effects of environmental predictors and both types of imagination.

H5: Inspiration through action is positively associated with both reproductive and creative imagination.

H6: Inspiration through action mediates the effects of personality traits and both types of imagination.

H7: Inspiration through action mediates the effects of psychological predictors and both types of imagination.

H8: Inspiration through action mediates the effects of environmental predictors and both types of imagination.

METHOD

Variables and Measures

Imaginative Capability Scale. Based on Liang et al. (2012), the measure for imaginative capability was a 10-item scale which was composed of two dimensions: reproductive imagination and creative imagination. Respondents answered on a six-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). In regards to reproductive imagination, some representative items are: "I often complete my tasks by focusing on effective ideas" and "I am good at seeking improvement by logically analyzing ideas." With respect to creative imagination, some

representative items are: “I often help myself imagine by arousing personal feelings” and “I often have uncommon ideas compared to others”. The Cronbach’s α of this scale in the present study is reported in Table 1.

Psychological Influence Scale. Based on Hsu, Liang, and Chang (2013), psychological influences were measured with a 26-item scale which was composed of six subscales namely: intrinsic motivation, generative cognition, positive emotion, negative emotion, inspiration through action, and self-efficacy. The *generative cognition* is a six-item subscale that measured the degree to which participants considered what cognitive approaches were important in stimulating their imagination. The *positive emotion* subscale includes three items reflecting the extent to which participants reported being positively influenced by a feeling. The *negative emotion* subscale is a three-item subscale that indicated the degree to which participants felt their imaginations were influenced by their negative psychological states and surroundings. *Self-efficacy*, a five-item scale, evaluated the extent to which participants reported being influenced by the belief in their own competence. The *intrinsic motivation* subscale consists of five items that assess participants’ imagination being influenced by personal satisfaction rather than for some external rewards. Finally, four items constitute the *inspiration through action* subscale and examine how participants felt regarding their imagination being influenced by metacognition with hands-on practice. Respondents answered on a six-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). Some representative items are: “Use immersive sensory exploration to spark imagination” (generative cognition), “Joyfulness from the surroundings” (positive emotion), “Anxiety felt by individuals” (negative emotion), “Be determined to achieve set standards” (self-efficacy), “Courage to present different ideas” (intrinsic motivation), and “Hands-on design with constantly-changing concepts envisaged in mind” (inspiration through action). The Cronbach’s α of each subscale is listed in Table 1.

Environmental Influence Scale. Based on Chen, Huang, and Liang (2012), the environmental influence scale is composed of items that cluster into five subscales. The *social climate* subscale consists of four items that assess the extent to which participants reported being influenced by the climate of the class. The *physical component* subscale includes three items reflecting the degree to which participants felt the spaces and facilities in an environment stimulated their imagination. The *learning resources* subscale is a four-item subscale that assesses the degree to which participants felt the messages and activities in an environment stimulated their imagination. The *organizational measure* subscale is a six-item subscale that measures participant perception of the influence of organizational structure and instructional measures. Finally, four items constitute the *human aggregate* subscale. It reflects the extent that the imagination is influenced by the organizational culture and its dominant human characteristics by the participants. Respondents answered on a six-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). Some representative items are: “Communication and discussion with classmates” (social climate), “Public spaces for creation, discussion and exhibitions” (physical component), “Dynamic audiovisual stimuli such as rhythm, sound, and movies” (learning resources), “Teacher’s encouragement and praise for taking risks” (organizational measure), and “There is a culture on campus of putting imagination into practice”

(human aggregate). The Cronbach's α of each subscale in the current study is also reported in Table 1.

Big-Five Mini-Markers (BFMM). Based on the International English Big-Five Mini-Markers (Thompson, 2008), personality traits were measured with a 40-item scale. The scale items consist of short phrases that are used to assess the traits typically associated with each of the Big-Five dimensions: extraversion (e.g., talkative, energetic, outgoing), open to experience (e.g., creative, intellectual, deep), emotional stability (e.g., unworried, unanxious, unenvious), conscientiousness (e.g., efficient, systematic, organized), and agreeableness (e.g., sympathetic, cooperative, warm). Before creating the survey, this scale was translated from English to Chinese and then translated back into English by three independent bilingual individuals to ensure equivalency of meaning (Brislin, 1980). Respondents answered on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α of International English BFMM in this study also refers to Table 1.

Participants and Procedure

The hypothesized model was tested with data from eight universities across different regions in Taiwan. The participants in this study were students in film programs from these universities. In order to ensure the quality of this study, the research team discussed the above scales with instructors in the target programs before carrying out the survey. The survey was delivered in each program using the same procedure and was processed in tutorial groups accompanied by the class instructors. In this manner, the problems participants faced when answering the questions could be resolved directly.

In the questionnaire, the students were asked to determine their level of agreement with regard to each imaginative capability, each item of Thompson's (2008) Big-Five Mini-Markers, and the strength of psychological/environmental influence that each item had on their imagination. Of the 1,025 participants, 943 completed all the parts of this study. The majority (70.6%) was female; 42.5% were juniors, 30.4% were sophomores, 21.5% were seniors, and 5.5% were graduate students. Participation was voluntary and guaranteed anonymity.

RESULTS

Descriptive Analysis

The data was analyzed using SPSS 17.0 software. The results of descriptive analysis, with regard to the means, the standard deviations, and the correlation among variables, are illustrated in Table 1.

TABLE 1
The *M*, *SD*, Cronbach's α , and Correlation among Variables

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Reproductive imagination	4.42	.65	(.76)																	
2. Creative imagination	4.31	.66	.67*	(.85)																
3. Extraversion	3.35	.76	.15*	.21*	(.88)															
4. Openness	3.36	.58	.50*	.56*	.11*	(.77)														
5. Emotional Stability	2.86	.63	.07*	.07*	.00	.14*	(.80)													
6. Conscientiousness	3.36	.63	.33*	.25*	.13*	.33*	.15*	(.85)												
7. Agreeableness	3.90	.51	.20*	.15*	.20*	.13*	.17*	.19*	(.76)											
8. Physical component	4.55	.72	.12*	.14*	.04	.08*	-.05	.05	.13*	(.74)										
9. Learning resources	4.54	.79	.15*	.12*	.08*	.07*	-.03	.04	.11*	.49*	(.83)									
10. Organizational measure	4.98	.77	.18*	.14*	.08*	.10*	.01	.11*	.18*	.44*	.50*	(.91)								
11. Social climate	5.40	.67	.17*	.13*	.15*	.05	-.06	.03	.17*	.35*	.36*	.56*	(.90)							
12. Human aggregate	4.56	.99	.15*	.16*	.12*	.09*	-.05	.06	.16*	.28*	.43*	.51*	.41*	(.87)						
13. Generative cognition	4.89	.68	.26*	.26*	.09*	.20*	-.06	.08*	.13*	.34*	.39*	.39*	.37*	.32*	(.89)					
14. Intrinsic motivation	5.14	.67	.33*	.31*	.09*	.23*	-.02	.10*	.19*	.32*	.37*	.48*	.50*	.39*	.53*	(.83)				
15. Positive emotion	4.91	.82	.12*	.14*	.04	.16*	-.01	.06	.16*	.27*	.27*	.35*	.36*	.32*	.40*	.47*	(.82)			
16. Negative emotion	4.84	.99	-.03	-.01	.04	-.05	-.15*	.01	.04	.16*	.13*	.24*	.28*	.27*	.20*	.27*	.30*	(.94)		
17. Inspiration through action	4.94	.70	.30*	.30*	.10*	.22*	-.06	.13*	.12*	.31*	.36*	.43*	.46*	.39*	.55*	.60*	.44*	.29*	(.86)	
18. Self-efficacy	5.05	.73	.29*	.25*	.04	.15*	-.06	.18*	.17*	.32*	.36*	.45*	.48*	.36*	.42*	.59*	.40*	.31*	.59*	(.89)

Note: * $p < .05$, (n) = Cronbach's α .

Mediator Effect

The hypotheses of the present study suggested that five sets of variables (intrinsic motivation, inspiration through action, personality traits, psychological predictors, and environmental predictors) stimulate imagination, and that both intrinsic motivation and inspiration through action mediate the effects of the other three clusters of variables on imagination. The research team tested the mediator effect of the present study based on the four steps provided by MacKinnon et al. (2002).

First, we tested the effects of predictive variables (personality traits, psychological predictors, and environmental predictors) on outcome variables (both reproductive imagination and creative imagination). The results of this analysis showed a good fit to our data ($X^2 = 4483.67$, $df = 1770$, $p < .005$, $CFI = .97$, $RMSEA = .040$, $SRMR = .040$, $TLI = .97$, 90% CI .039 to .042). The research team removed the non-significant paths, and revised the model ($X^2 = 2023.45$, $df = 561$, $p < .005$, $CFI = .96$, $RMSEA = .053$, $SRMR = .045$, $TLI = .96$, 90% CI .050 to .055).

Second, we continually examined the effects of predictive variables on the mediator (intrinsic motivation and inspiration through action). The results of the initial and revised analyses showed a good fit to our data. The revised model demonstrated a reasonably good fit ($X^2 = 2953.68$, $df = 818$, $p < .005$, $CFI = .98$, $RMSEA = .053$, $SRMR = .045$, $TLI = .97$, 90% CI 0.51 to .055). Third, we further tested the effects of the mediator on both types of imagination. Our results still showed a

good fit to the present data ($X^2 = 4521.16$, $df = 1581$, $p < .005$, CFI = .98, RMSEA = .044, SRMR = .044, TLI = .97, 90% CI .043 to .046).

The final step described by MacKinnon et al. is to show that the strength of the relation between the predictor and the outcome is significantly reduced when the mediator is added to the model. According to our analyses, the relationships between all predictive variables and both types of imagination were significantly reduced when both mediators were included in the model. Thus, the mediation model was initially supported.

Structural Models

Although the hypothesized model ($X^2 = 5855.05$, $df = 2331$, $p < .005$, CFI = .98, RMSEA = .040, SRMR = .042, TLI = .97, 90% CI .039 to .041) showed a good fit to the present data, not all factors were significantly associated with two types of imagination. We removed the non-significant paths and then revised the structural model. The trimmed model showed a model fit comparable to that of the initial model, $X^2 = 4521.16$, $df = 1581$, $p < .005$, CFI = .98, RMSEA = .044, SRMR = .044, TLI = .97, 90% CI .043 to .046. It accounted for substantial variance in intrinsic motivation (the first mediator, $R^2 = .62$), inspiration through action (the second mediator, $R^2 = .58$), reproductive imagination ($R^2 = .50$) and creative imagination ($R^2 = .49$).

The standardized path coefficient of intrinsic motivation to reproductive imagination was .27*, and the path of intrinsic motivation to creative imagination was .11*. The relevant coefficients of inspiration through action were .15* and .12*. With regard to predictor variables, our results showed that openness owned the strongest direct effects on reproductive imagination (.45*) and creative imagination (.60*), followed by the direct effect of conscientiousness on reproductive imagination (.20*). The direct and indirect effects resulting from all the latent predictor variables on imagination are illustrated in Figure 1. Table 2 also reported the correlation of these predictor variables.

The case of model trimming suggested that the final model is more presentable, and hence, should be supported. Overall, the SEM results summarized in Figure 1 partially support the present hypotheses. With respect to the effects resulting from intrinsic motivation, our data showed that this variable directly influenced both creative and reproductive imagination (H1 was supported). Partially supporting the mediating hypotheses of intrinsic motivation (H2, H3 and H4), one personality trait (openness), three psychological predictors (self-efficacy, generative cognition, and positive emotion), and two environmental predictors (social climate and organizational measure) influenced imagination through their impact on intrinsic motivation.

In regards to the effects resulting from inspiration through action, the results revealed its direct effect on both types of imagination (H4 was supported). Our study also partially supported the mediating hypotheses of inspiration through action (H5, H6 and H7), two personality traits (openness and agreeableness), three psychological predictors (self-efficacy, generative cognition, and positive emotion), and two environmental predictors (social climate and human aggregate) influenced imagination through their impact on inspiration through action.

TABLE 2
The Correlation of Latent Predictor Variables and Their Effects

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Direct effect		Indirect effect	
											RI	CI	RI	CI
1. Extraversion	--										--	.10*	--	--
2. Openness	.16*	--									.45*	.60*	.03*	.04*
3. Conscientiousness	.17*	.41*	--								.20*	--	--	--
4. Agreeableness	.25*	.16*	.20*	--							--	.08*	-.01*	-.01*
5. Organizational measure	.09*	.11*	.11*	.20*	--						--	--	.03*	.01*
6. Social climate	.16*	.03	.04	.21*	.61*	--					--	--	.05*	.03*
7. Human aggregate	.13*	.11*	.08*	.17*	.57*	.44*	--				--	--	.01*	.01*
8. Generative cognition	.10*	.21*	.09*	.13*	.43*	.39*	.36*	--			--	--	.10*	.06*
9. Positive emotion	.08*	.16*	.06	.21*	.39*	.40*	.35*	.43*	--		-.15*	-.11*	.05*	.03*
10. Self-efficacy	.04	.16*	.19*	.19*	.50*	.51*	.40*	.46*	.44*	--	--	--	.15*	.07*

Note: * $p < .05.$, RI = Reproductive Imagination, CI = Creative Imagination

DISCUSSION

As stated earlier, while philosophical studies abound on the influence of various factors on imagination, little empirical research articulated about imaginative capabilities and influential factors, nor the way that these factors may affect these capabilities. The present study contributes to a map for traveling around in the complex world of human imagination. The results of this study increase the understanding of the influences of the long-standing individual personality, the situation-dependent psychological influences, and the context-dependent environmental impacts on human imagination.

Imaginative Capabilities

Our results supported the earlier study (Liang et al, 2012) that imaginative capabilities can be categorized into two groups. First, reproductive imagination consists of crystallization, dialectics, effectiveness and transformation. Second, creative imagination is comprised of exploration, concentration, intuition, novelty, productivity and sensibility. While in no way definitive or exhaustive, nonetheless, the study has yielded a path for further inquiries. For example, it would be interesting to elaborate each of the ten imaginative capabilities identified in this study and clarify their uses. It would also be valuable to explore which imaginative capability may be best facilitated in which age-range. It would be even more exciting to elucidate which imaginative capabilities may be required in various domains, e.g., arts, science, design, engineering, or management.

Based upon the belief in imagination as a vehicle of creativity, the results of this study open a window to empirically explore the relationship between imagination and creativity. To be more specific, it would be interesting to know if imaginative and creative individuals share common personality traits. It would also be valuable to learn which imaginative capability can trigger which creative ability. Like many time-honored measures existing in the field of creativity studies (e.g.,

Guilford, 1975; Torrance, 1998), it is important to make each imaginative capability assessable and to develop feasible capability tests. The integration of game-based learning and performance assessment may be one of the best means to develop imaginative capability tests.

Mediator effects

The present study hypothesized that intrinsic motivation and inspiration through action may play facilitating roles in augmenting the effects of identified influential variables on student imagination. Our findings partially supported this hypothesized mediating relationship. The mediator effects were majorly affected by self-efficacy and generative cognition, moderately influenced by positive emotion and social climate, and slightly affected by other variables.

Particularly, our results shed light on the crucial role that cognitive ability may play in human imagination. The cognitive ability includes self-efficacy, generative cognition and inspiration through action (i.e., metacognition with hands-on practice). The mediator effects may conclude that the cognitive ability is the most critical resource to connect human imagination and creativity. Until now, little empirical research has been articulated about the interaction between these two important human capabilities. This finding will potentially bridge the literature gap between creativity and imagination. In addition, this study also found that the mediator effect of intrinsic motivation uniquely predicted reproductive imagination. This has been an issue little discussed in the film field and highlights the need for future inquiries.

According to our data, self-efficacy, generative cognition, positive emotion and social climate contributed to the mediator effect of intrinsic motivation the most. On the other hand, the three most critical contributors to the mediator effect of inspiration through action were: self-efficacy, generative cognition and social climate. In response to these findings, film instructors may need to pay attention to: arranging interesting assignments, giving freedom during the production process, encouraging different ideas, arousing curiosity for the unknown, and inspiring different ways of thinking and/or doing during the production process. According to our study, these strategies can be best used by consolidating the influences of self-efficacy, generative cognition, and social climate.

Although we demonstrated the mediating roles of intrinsic motivation and inspiration through action in this study, we wonder if any moderators or non-linear relationships, as studied by Prabhu et al. (2008), exist in this vein? Much more work needs to be done in order to shed light on the issues of mediation and moderation, especially the effects that collaborative practice has on the interdisciplinary film production context as described by Laurier et al. (2012).

Effects on Imagination

With respect to reproductive imagination, it is not surprising to find openness to experience is positively related to reproductive imagination. In fact, many scholars have identified openness as most related to imagination (e.g., Barrick & Mount, 1991). What surprised us about the evidence shown in this study is that conscientiousness was directly associated with reproductive imagination. Few studies have implied, let alone articulated, this relationship. This may be due to the fact that previous imaginative studies largely focused on creative imagination but overlooked the mental

reproductive capability. In addition, our data also showed that reproductive imagination is positively influenced by intrinsic motivation but negatively affected by positive emotion.

These findings provide intriguing insights into student selection processes and educational strategies, not to mention employee recruitment and retention programs in the corporate world. Accordingly, to improve the reproductive imagination of film students, it may be important to use the following strategies: encourage students to be more conscientious and open to various life experiences, stimulate their intrinsic motivation, and build up their cognitive structure through hands-on practices. This study also suggests that the instructor should be adept at recognizing positive emotions while encouraging and intervening to change students' affective states whenever possible.

In regards to creative imagination, the results showed that both openness and extroversion greatly influenced creative imagination. Our data also indicated that agreeableness had a slight but significant effect on creative imagination. This finding is incompatible with earlier studies (e.g., King et al., 1996; Prabhu et al., 2008), which might stem from the oriental-western cultural difference or the research focus of this study on creative imagination rather than imagination as a whole. In addition, we also found that positive emotion had a negative impact on creative imagination. These findings further underscore the demand for more effort to be devoted to this line of research in the future.

According to these results, the following instructional strategies may be suggested: strategically use intrinsic motivation and inspiration through action as mechanisms through which self-efficacy, generative cognition, and social climate, may trigger creative imagination among students. It also suggests that each film program may need some kind of student recruitment policy. For example, assessment tools of personality traits, especially the imagination- and/or creativity-related ones, may need to be added into student-selection procedures. Instructors may also need to encourage their students to be more open to diverse life experiences in order to absorb more positive energy for creative performance.

Limitations

The social desirability and variation in context may have contributed to errors in self-reporting instruments. The choice of research tools however, was justified by the preliminary nature of most imagination studies. The questions asked in our survey did not contain any sensitive items that would cause the respondents to present themselves in a more socially acceptable manner. Furthermore, using a self-reporting survey enables us to study large samples of students. Following Chan's (2009) discussion of self-reporting measures, the samples of our study (nearly a thousand participants) were large enough across universities to allow us to generalize our findings to a larger population.

Although the final model we presented fits the data well, the predictive validity could be stronger. Similar to multiple influential variables on human creativity (Shalley et al., 2004), personality traits, psychological factors, and environmental factors are but three variables stimulating student imagination. Additional variables, such as student ethnicity, gender, age, and

school location, should be taken into account in future research. Such an inquiry might enable one to trace the complicated effects resulting from the interplay of involving variables.

CONCLUSION

Although the limitations of this study must be kept in mind, the results of this study provided several intriguing insights of how film student imagination was stimulated by the combined impact of personality traits, psychological states, and the surrounding environment. To begin, the present study lent additional support to previous study that imaginative capabilities can be categorized into two groups, namely reproductive imagination and creative imagination. Furthermore, this study extended our understanding about how strongly variables influenced on both types of imagination, and how they might function.

The results of this study partially supported the mediation model of intrinsic motivation and inspiration through action in which personality traits, individual psychology, and learning environment, both directly and indirectly influenced the two types of imagination. The mediator effects were majorly affected by self-efficacy and generative cognition, and moderately influenced by positive emotion and social climate. Also, the results indicated that the personality trait of openness was the most predictive variable to both types of imagination. With respect to reproductive imagination, it may be positively influenced by conscientiousness and intrinsic motivation, but negatively affected by positive emotion. In regards to creative imagination, it may be positively affected by extroversion and agreeableness, but also negatively influenced by positive emotion.

The fact that human imagination depends largely on individual personality traits to influence other variables (e.g., Karwowski, 2008; Karwowski & Soszynski, 2008) makes it critical for scholars in the creativity field to understand the origins of influence. The current study additionally provided empirical support that a particular mediating relationship can serve as an important source of influence. Theoretically, our results also shed light on the critical role that cognitive ability can play to connect human imagination and creativity. These findings could potentially bridge the literature gap in regards to imaginative capabilities, and the gap between creativity and imagination, which underscores the need for future inquiry.

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