

## The Comparison of Mediating Models for Stimulating Imagination with Psychological and Environmental Factors

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**Abstract.** The present study aimed to compare different mediating models of stimulating imagination for university students (novice creators) who were under demanded to demonstrate highly imaginative and creative capabilities. We invited 876 university students to participate in this study. Using the reliability and validity of research tools to explore the competing models obtained according to literature review, we then suggested the two factors mediating model that was appropriate for novice creators (through *inspiration through action* and *intrinsic motivation* as mediators between internal/external factors and two types of imagination). The results displayed: (a) the inherently psychological factors and two types of imagination were closely related. (b) *Intrinsic motivation* and *inspiration through action* can play the mediating roles between external/internal influence factors and two types of imagination. (c) The impact of environmental factors on imagination is relatively limited, but two mediators would raise the predictive power. (d) Using this model to stimulate the creators' imaginations, we should pay attention to how the *social climate* and *negative emotion* may carry out a direct negative influence, and guide learners through two mediators to stimulate imagination that would be the more effective inspirational path.

**Keywords:** environmental factors; imagination capability; model comparison; psychological factors.

### Introduction

Innovators in a variety of fields need high quality internal and external resources to develop their imaginations and create works of influence (Ribot, 1906). During the process of innovation, from coming up with an original idea, implementing the idea, arranging the content, making the characteristics stand out, and simulating audience's viewpoints, a huge amount of imagination and creativity was required. How individuals release imagination is often influenced by internal and external factors. Internal factors refer to how an individual operates his or her cognition, motivation, emotion, and self-efficacy (e.g., Finke, 1996; Hsu, Liang, & Chang, 2014; Vygotsky, 1967/2004); external factors refer to

how individuals cooperate with environmental resources, such as physical components, social climate, organizational measure, and aggregate culture (e.g., Chang & Lin, 2013; Liang, Hsu, & Chang, 2013; Zhao, Seibert, & Hills, 2005). However, there have been few empirical studies systematically exploring how internal and external situations can coordinate to stimulate the creator's imagination. Therefore, this study concentrated on both psychological and environmental factors by examining how these two sets of factors coordinate to inspire imagination. The results of this study expect to establish a foundation for constructing innovators' imagination capabilities.

Previous studies (Eckhoff & Urbach, 2008; Lindqvist, 2003) summarized Vygotsky's key points regarding imagination and pointed out that for individuals, imagination is the bridge of thinking between reality and the unknown. Broad theoretical expositions have clearly shown that imagination is profound for innovators. For example, to achieve outstanding performances in the field of creativity, high-quality imaginative energy is essential (Chiu, 2013; Perdue, 2003; Stokes, 2006). Given these internal operations of imagination, creators focus their imagination on certain targets of creation by mentally planning all details in their minds; then, through a series of processes, it is possible that the tacit imagination can be turned into real existence. In other words, imagination, which plays the role of the bridge between reality and the unknown, is an inherent important mental ability of humans (Beaney, 2005; Perdue, 2003); it is characterized as flexibility of mind, and allows us to call up mental images, think about things that are not present, or consider things that do not exist (Egan, 1992, p. 36; Egan, 2007).

Specifically, factors that drive creators' flexible applications of this strong mental ability also include internal psychological influences, external environments, and guidance, as well as creators' perception and interpretative capability (Bailin, 2007, p. 113). These factors all play important roles and need to be further clarified. For example, Speller (2006) pointed out that environment can facilitate, change, or constrain individuals' behaviors and emotions, further influencing their thoughts. Browne (2008) and Henderson (1999) both mentioned the interactions between individuals and his or her environments can be used to analyze human behaviors and can be used as a way to influence the development of imagination. However, while philosophical or narrative studies abound on the relationships between imagination capabilities and internal/external influence factors, use of empirical methods to validate these variables and to conduct model comparisons was relatively rare. Due to the background described above, this study focused on the subjects in whose studies cultivation of innovation capabilities was emphasized. These participants were the college students majoring in design, film/video, or information communication as the target subjects. The concepts of imagination in this study refer to the individuals' capabilities of transforming their inner imagery while facing their productive themes.

### **Creative Works and Imagination**

Susanne K. Langer (1895–1985) pointed out in her representative book “Feeling and Form” (1953), regarding modern esthetics, that imagination plays an important role in both the process of creation and that of appreciation. Especially in the phase of creative work forming, the creator must continuously respond to many unsolved internal issues. In this phase, the creator needs to fill himself with rich thoughts, emotions, and imagination in order to start a series of exercises of his mind. Creators need a huge amount of imagination to master and control emerging creative ideas. Through continuous refinements of imagination and ideas, eventually creators would find core spirits and main subjects in their minds. Then, they can further use creation media (possibly images, music, or colors), along with rhythms, strengths, and forms, to concretize their rich creative ideas and show their creativeness.

Next, through a detailed insight into the process of a production, it can be seen that its literary composition requires the writer’s and the director’s knowledge of existing events. Through imagination, the events can be described. Well applications of the combination of illusion and reality can help audiences get into the plot. Therefore, Das (2007) indicated that the ability of imagination is an important ability for a writer to use his or her talents and present his or her creativity. In other words, the answers to how many plot details should be included in a film and which details create what kinds of feelings for the audience are all related to the tasks and skills of the writer and the director. That is, creative professionals need not only have rich imagination but also must include the audience’s feelings and responses into their own imagination, combing them so that the completed works can be connected to the audience’s thoughts and feelings.

We investigated the concepts on imagination literatures thought out databases of EBOSCO, ERIC, PsycINFO, and SSCI between the period of 1900 and 2012. The research team observed that most of studies define imagination as a trait, however, the present study would argue that “imagination” is “abilities” (different from fantasy and containing multiple capability dimensions), which can be further developed (Weick, 2006). The research angle taken was different from seeing “imagination” as the degree of vividness of a human impression (Marks, 1995) or spatial mental representations (Thurstone & Thurstone, 1989). One’s imagination is based on his rich life experiences, and it can further connect, expand, or transform various elements to create a new manifestation (e.g., Bailin, 2007; Chiu, 2015; Egan, 1992, pp. 45–65). Imagination can help people using others’ experiences as a foundation to develop competency and empathize with others. Moreover, because almost all emotions are linked to certain images, with languages or related cognition as the media, imagination can be linked to these images more thoroughly.

Imagination in this study was defined as the ability shown during the evolution of internal awareness or a mind map in the process of thinking while a creator handles the production task or faces a problem (Gaunt, 2003; Stokes, 2006). This was consistent with the later viewpoints from the studies, which considered

imagination as “a power of the mind” or “a creative faculty of the mind” (Passmore, 1985; Perdue, 2003). Furthermore, this study organized the viewpoints from a lot of studies, categorizing imagination into creative imagination and reproductive imagination (Betts, 1916; Liang, Hsu, Chang, & Lin, 2013). Creative imagination is often perceived as a facilitator for great discoveries and achievements of humankind, it emphasizes the thinking attributes of initiation and originality. In Liang and his colleagues’ (2013) work, *Creative Imagination* (CI) has six indicators: *exploration* refers to the ability of the individual to continuously explore unknown or novel things (Finke, 1996; Finke, Ward, & Smith, 1992); *novelty* refers to the ability of the individual to come up with an unconventional idea or an idea that differs from traditional ones (Pelaprat & Cole, 2011); *productivity* refers to the ability of individuals to continuously produce rich content of imagination (Karwowski & Soszynski, 2008); *sensibility* refers to the sensitive emotions that the individual has for content of imagination (Bailin, 2007); *intuition* refers to the individual’s ability to associate different information in an instant and come up with content of imagination (Reichling, 1990); and *concentration* refers to the ability of the individual to continuously concentrate so that imagination can be formed (Liang et al., 2013).

Next, *Reproductive Imagination* (RI) is characterized by the capability to reproduce mental images described by others or images from less accurate recollection of reality. RI contains four indicators: *effectiveness* refers to the ability of the individual to come up with content of imagination for the target subject matter; *dialectics* refers to the ability of the individual to repeatedly investigate and make improvements (Thomas, 1999); *crystallization* refers to the ability of the individual to present an abstract concept using a concrete image (Reiner & Gilbert, 2000); and *transformation* refers to the individual’s ability to adapt to different situations and transform his/her thoughts for applications (Liang et al., 2013).

### **The Psychological and Environmental Factors to Stimulate Imagination**

From practical teaching experiences, creators’ internal psychological influences and learning environments may affect development of their imagination to a certain degree. If the structural relationships among these factors can be clarified, it would be a great help to building a more efficient prediction model for effectively guiding creators to release their imagination capability. During the years, numerous scholars put in a lot of effort to drive imagination, directly or indirectly. For example, regarding the cognition aspect, there were studies by Finke (1990, 1996), Pylyshyn (2002), and Pelaprat and Cole (2011). Regarding the motivation aspect, there was a study by Eisenberger and Shanock (2003). Regarding the behavior aspect, there was the “seeing-moving-seeing” theoretical structure proposed by Schön and Wiggins (1992). As for the self-efficacy aspect, which is closely related to creators’ ability to make self-adjustments, there have been some studies in the field of creativity research (Choi, 2004; Prabhu, Sutton, & Sauser, 2008) and the initial exploration of imagination was covered.

This study adopted the results from related studies (e.g., Hsu et al., 2014) and summarized psychological influential factors into the following factors: *generative cognition* refers to the ability of the individual to explore diversified methods to generate ideas (such as one's own life experiences, extension of sensual perception, associations, assumptions, simulations, and other methods); *intrinsic motivation* refers to the individual's interest in the task or assignment, hold curiosity, or belief that engaging in the task was beneficial for oneself; *positive emotion* refers to individuals' emotions, such as merriment and excitement; *negative emotion* refers to the individual's feelings of frustration, anxiety, and worry; *inspiration through action* refers to the individual thinking while doing and intuition, inspiration, and review and evaluation of meta-thinking (Hsu et al., 2014); and *self-efficacy* refers to individuals' professionalism, familiarity with software/hardware tools, operating standards, goal assessments, and will to achieve a goal (Bandura, 2012; Choi, 2004).

Similarly, several environmental factors may influence learners' imagination. For example, some scholars found the influences of external physical models on facilitating students' imagination from various aspects, including designing tasks, life field and school constructions (e.g., Büscher, Eriksen, Kristensen, & Mogensen, 2004; Claxton, Edwards, & Scale-Constantinou, 2006; Upitis, 2007). This study referenced the literature related to influences of learning environments on imagination and referenced the research results from Hsu et al. (2014), then defined that the aspects of learning environments included: *physical component* as the physical conditions of an environment, including lighting, sound volume, ventilation, materials, decoration, tools, equipment, or public space for performances, that may influence imagination; *learning resource* refers to static (e.g., posters and models) and dynamic stimulations (e.g., short films and dynamic simulations) in an environment, including books, data, and learning activities, that may influence imagination; *organizational measure* refers to teaching, guidance, and measures of learning from organizations or teachers that may influence creators' imagination; *social climate* refers to peer atmosphere formed by creators' perception of peer groups' discussions, communications, and competitions that may influence creators' imagination (Strange & Banning, 2001); and *human aggregate* refers to organizational cultures or campus traditions formed in departments or schools that may influence creators' imagination (Kember, Ho, & Hong, 2010). This study explored the influences of environments on imagination based on these five variables.

### **The Present Study: Comparison of Models for Stimulating Imagination**

The current study on imaginative capabilities adopted the research tool developed by Liang et al. (2013) of stable factor structure with good validity and reliability estimates. Then, we further analyzed the influences of internal and external situational factors on the students' imagination. This study expected to make comparisons among two models, which were based on prior related researches (i.e., Choi, 2004, 2012; Hsu et al., 2014; Zhao et al., 2005), and further built a structural model of consistency to efficiently trigger imagination. Specifically, the purposes of this study included: (a) Verify the validity and reliability of the imagination capability scale, with the sample of college students

of innovation majors, including design, film/video productions, and information communication, (b) Examine the theoretical model of the internal psychological and external environment influence on creators' presentation imagination, (c) Compare two models to reveal an integrated model with psychological state and environmental condition as predictive factors simulating the reproductive and creative imagination.

Psychological influences and environmental influences play the internal and external roles that influence individuals' imagination. This study assumed that the prediction power of the influences of these environmental and psychological factors on imagination might differ due to the cognitive characteristics of the learners. Furthermore, in the prediction model of learners' imagination, "intrinsic motivation" often played the key mediating roles between the psychological/environmental factors and imagination (e.g., Choi, 2004; 2012). Numerous contemporary studies have revealed that the framework of intrinsic motivation as a mediating role can stimulate creative process engagement (e.g., Zhang & Bartol, 2010). Therefore, this study, based on the existing literature, proposed a hypothetical model:

**Model 1. Single-factor mediating model.** Through the mediating effect of *intrinsic motivation*, psychological and environmental influences can be used to predict imagination.

There were, however, few studies to investigate the novice innovators' stimulating model, and the creators are usually in situations requiring a huge amount of teamwork, requiring them to get feedback through phased works in order to complete the final work; this study included "inspiration through action" to play the mediating role. Hsu referenced this factor in the study, Liang et al. (2013), which applied exploratory factor analysis and confirmatory factor analysis and found that this factor was convergent with personnel from various fields, such as curriculum design, interactive design, and visual design. To be more specific, this factor covered actions and operations, review and modification, thinking while doing, intuition, and inspiration. Egan (2007) and Shin (1994) also suggested that actions and operations could driver creators' imagination, and operations could trigger tacit knowledge and meta-cognition, and further drive imagination. Based on this, the study inferred that this factor might play a key mediating role regarding the creation field, where learning and thinking are performed through operation of tools and objects.

Then the present study proposed the second hypothetical model:

**Model 2: Two-factor mediating model.** Through the mediating effects of intrinsic motivation and inspiration through action, psychological and environmental influences can be used to predict imagination.

## Method

**Participants.** Two independent samples of college students were from Taiwan. Sample 1 served as the sample for confirming the structure of the imagination scale. This sample consisted of 212 college students (156 female, 56 male) ranging from freshman to senior students. Sample 2 served as the validation

model sample and consisted of 664 college students. Of them, 467 were female and 197 were male. Table 1 is the demographic information of the participants.

**Table 1**

The demographic information of participants in the current study

	Confirmatory factor analyses		Model verification	
	Number	Percentage (%)	Number	Percentage (%)
Gender				
Male	56	26.4	197	29.7
Female	156	73.6	467	70.3
Grade				
Freshman	70	33.0	194	29.2
Sophomore	90	42.5	279	42.0
Junior	42	19.8	151	22.7
Senior	10	4.7	40	6.0
Total	212	100.0	664	100.0

## Instruments

**Imagination scale.** This study adopted the research tool developed by Liang et al. (2013) to assess the construct of imagination. This scale consists of both creative and reproductive imagination, the 10-item scale that was composed of both creative (6-item) and reproductive (4-item) imagination. The Cronbach's  $\alpha$  of each subscale was .763, .844, and the composite reliabilities of creative and reproductive imagination was .876 and .8215, respectively, both higher than .60. The average variances extracted were .546 and .539, respectively, both higher than .50, meaning good convergent validities (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). The confidence interval of the relationship between reproductive and creative imagination was (0.682, 0.878), not including 1, meaning good discriminant validity between the two latent variables.

**Psychological influence scale.** This scale, developed by Hsu et al. (2014), was used to evaluate psychological influences in this study. This dimension contained six psychological subscales (variables); the 28-item scale included *generative cognition* (6-item), *intrinsic motivation* (7-item), *positive emotion* (3-item), *negative emotion* (3-item), *inspiration through action* (4-item), and *self-efficacy* (5-item). The Cronbach's  $\alpha$  of each subscale was .874, .757, .839, .782, and .844, respectively. The average variances extracted (AVEs) of the original psychological variables were .626, .597, .742, .899, .571, and .617, respectively. The composite reliabilities were .908, .880, .894, .963, .839, and .888, respectively. Based on the values above, the convergent validity of this scale with this sample in this study was very good. The discriminate validities between the psychological variables were satisfactory.

**Learning environment scale.** The scale developed by Hsu et al. (2014) was used to measure environmental influences. This dimension contained six environmental subscales (variables), the 23-item scale including *physical components* (4-item), *learning resource* (4-item), *organizational measure* (6-item), *social climate* (5-item), and *human aggregate* (4-item). The Cronbach's  $\alpha$  of each subscale was .660, .722, .899, .849, and .862, respectively. The AVEs of the five

variables were .413, .469, .705, .708, and .697, respectively. The composite reliabilities were .674, .778, .922, .922, and .900, respectively. The discriminate validities between the environment variables were satisfactory.

**Data analyses.** The LISREL 8.80 computer program, using the covariance matrix of all items, was applied for conducting confirmatory factor analysis for the imagination model. The following indexes were indicators for evaluating model in the current study: (a) comparative fit index (CFI; Bentler, 1990), (b) standardized root-mean-square residual (SRMR; Jöreskog & Sörbom, 2002), and (c) root-mean-square error of approximation (RMSEA; Steiger, 1990) to test model fitness.

## Results

**Descriptive statistics.** The mean and standard deviation of all constructs were presented in Table 2. It can be seen that creativity and reproductive imagination were positively correlated. The correlations of the five learning environment variables and six psychological influence variables with imagination showed moderate-to-low correlation. In addition, the correlations of several psychological influence variables (e.g., generative cognition, intrinsic motivation, and self-efficacy, with imagination) were slightly significant than those of the learning environment variables.

**Table 2**

The descriptive statistics, reliabilities, and correlation coefficients of the scales ( $N = 664$ )

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Reproductive imagination	4.47	.629	(.767)												
2. Creative imagination	4.35	.645	.676	(.844)											
3. Physical component	4.54	.825	.102	.138	(.631)										
4. Learning resource	4.68	.782	.241	.276	.373	(.722)									
5. Organizational measure	5.13	.790	.194	.250	.396	.582	(.901)								
6. Social climate	5.47	.658	.197	.179	.302	.411	.621	(.887)							
7. Human aggregate	4.73	1.003	.195	.232	.229	.464	.551	.438	(.865)						
8. Generative cognition	5.05	.719	.320	.348	.287	.426	.489	.405	.411	(.874)					
9. Intrinsic motivation	5.20	.698	.322	.308	.215	.401	.553	.455	.510	.560	(.830)				
10. Positive emotion	4.98	.907	.225	.256	.250	.417	.449	.366	.292	.379	.527	(.840)			
11. Negative emotion	4.95	1.175	.072	.018	.117	.239	.384	.331	.231	.197	.318	.342	(.943)		
12. Inspiration through action	5.00	.701	.194	.232	.399	.400	.509	.431	.340	.528	.505	.385	.351	(.781)	
13. Self-efficacy	5.00	.790	.266	.256	.214	.453	.536	.432	.342	.361	.533	.386	.341	.488	(.847)

Note: (): reliability coefficient.



### Model Examination

Based on the suggestion of the testing mediation model procedure by Baron and Kenny (1986), and Frazier, Tix, and Barron (2004), the first step was to confirm whether the individual variables (including organizational measure, social climate, generative cognition, positive emotion, and negative emotion) can predict the outcome variable (including creative imagination and productive imagination), and if it indicates the model fit the data well:  $\chi^2(1120) = 4521.65$ ,  $p < 0.05$ ,  $df = 1120$ ,  $CFI = 0.99$ ,  $RMSEA = 0.035$ ,  $SRMR = 0.058$ ,  $NFI = 0.97$ ,  $NNFI = 0.99$ . The second step was to explore whether the predictor variables can predict the mediators (including intrinsic motivation and inspiration through action), the results support the hypotheses, which is that the factors of organizational measure, social climate, generative cognition, positive emotion, and negative emotion can predict the productive and creative imagination by different degrees and be significant,  $\chi^2(707) = 3310.35$ ,  $p < 0.05$ ,  $df = 707$ ,  $CFI = 0.99$ ,  $RMSEA = 0.038$ ,  $SRMR = 0.062$ ,  $NFI = 0.98$ ,  $NNFI = 0.99$ .

Then we examined the different mediating models comparison. These models included the following: Model 1: Single-mediating factors model (e.g., intrinsic motivation); Model 2: Two mediating factors model (e.g., intrinsic motivation and inspiration through action). Model 1 was established based on related prior studies (e.g., Choi, 2004; 2012; Liang, et al., 2013; Zhao, Seibert, & Hills, 2005). Model 2 was the baseline model, which was derived from the present study and in which the supposed factor of "inspiration through action" may also play as the mediator, due to creators as team members performing work through actual operation as part of a back-and-forth interplay to modify the production, having bursts of inspirations influenced by other members' ideas; teamwork can drive the creative and reproductive imagination. The test results showed that both models were appropriate to explain the data. However, under the same sample size condition, the largest degree of freedom indicated the least number of parameters; the number of parameters of Model 1 was more than Model 2, but Model 1 did not have significant adaption. Referring to the simple principle, we adopted Model 2.

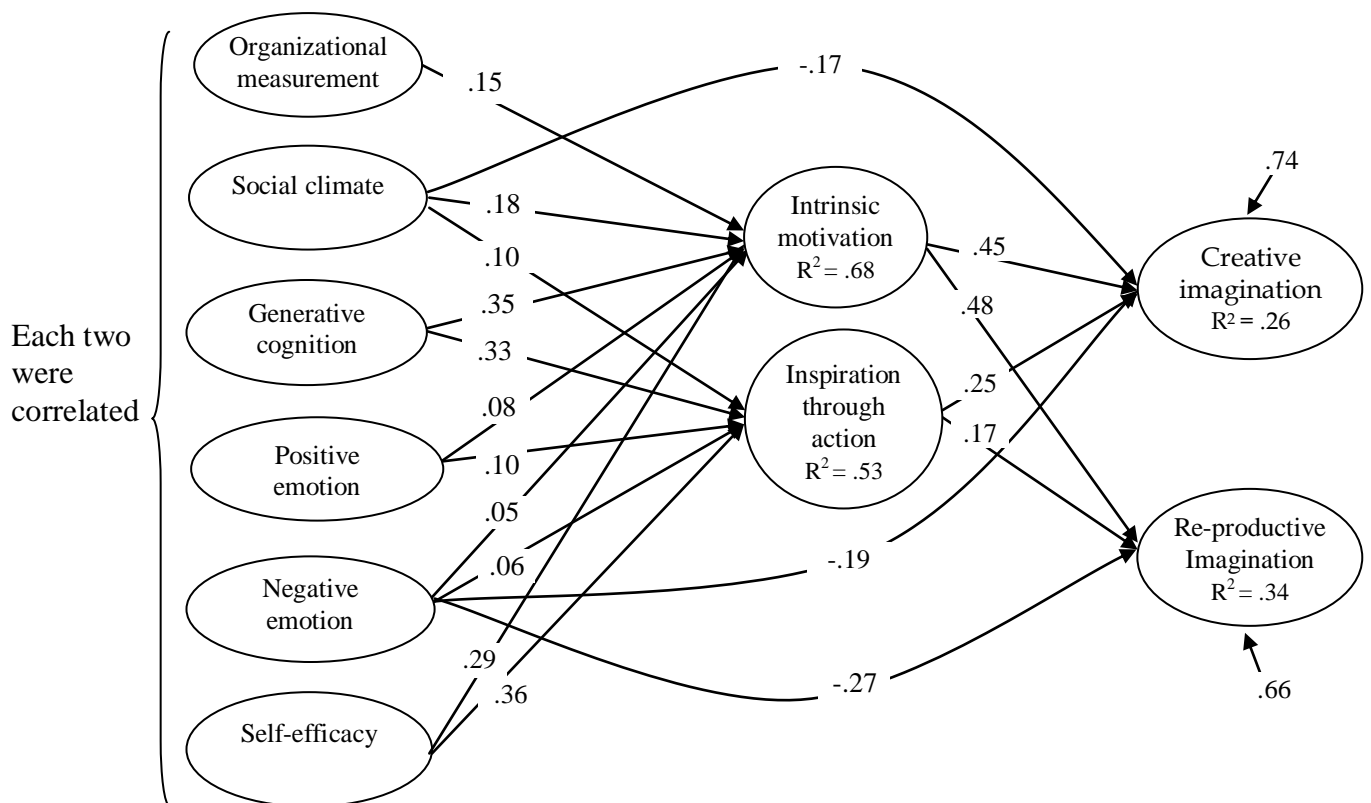
**Table 3**

Testing results of the fitness of the two models ( $N=664$ )

Model	Chi-square	S-B Chi-square	df	$\Delta$ S-B Chi-square	p-value	RMSEA	SRMR	CFI	NFI	NNFI
Model 1: Single factor mediating model	4855.49	2158.02	1132	3.55	0.17	0.04	0.08	0.99	0.98	0.98
Model 2: Two factors mediating model	4860.51	2161.67	1134	-	-	0.04	0.07	0.99	0.97	0.98

Note: The  $\Delta$  S-B Chi-square might be negative, because the estimations went through the adjustment of the Satorra–Bentler scaled chi-square (Satorra & Bentler, 2010).

The results of the structural equation modeling analysis are summarized in Figure 1 and Table 4. The model test results showed that the two mediating factors model (i.e., Model 2) was the appropriate model, which explained 25% of the variance in the creative imagination and 33% of the variance in the reproductive imagination. It displayed that when the mediating factors of intrinsic motivation and inspiration through action were added to the model, the predictive effects to imagination from psychological and environmental factors would be significantly reduced (Frazier et al., 2004). Within these mediating factors, the intrinsic motivation displayed the highest effect, followed in turn as inspiration through action. The environmental factor of social climate and the psychological factors of generative cognition, positive emotion, and negative emotion, can predict two types of imagination through two mediators. In addition, organizational measures influenced intrinsic motivation, and social climate can predict imagination both directly and indirectly.



**Figure 1. The structural model of the psychological and environmental influences on creators' imagination**

**Table 4**

The correlation of latent independent variables and their direct and indirect effects for imagination

Independent variables	1	2	3	4	5	Direct effect		Indirect effect	
						RI	CI	RI	CI
1. Organizational measurement	—	—	—	—	—	—	—	.07	.07
2. Social climate	.65	—	—	—	—	—	-.17	.10	.10
3. Generative cognition	.42	.40	—	—	—	—	—	.22	.23
4. Positive emotion	.39	.39	.37	—	—	—	—	.06	.06
5. Negative emotion	.22	.26	.20	.30	—	-.19	-.27	.04	.04
6. Self-efficacy	.43	.52	.48	.44	.33	.11	.07	.20	.22

Note: RI, reproductive imagination; CI, creative imagination.

## Discussion

Overall, the present study was displayed to drive creators escaping the imagination, who need the psychological factors, including cognition, motivation, and emotion, to cooperate with different paths and strengths. Consideration of the existing mediating model, such as Liang and his colleagues' (2013) intrinsic motivation as the single mediator model, our research team further explored the two mediators model, and the model fit well, based on the general characteristic of student innovators. The model was expanded to explain the major areas of novice creators while emphasizing innovation and imagination.

The present findings suggested that the features of imagination capabilities were distinguished appropriately as creative imagination and reproductive imagination. In other words, the present empirical studies supported the framework of reproductive and creative imagination as appropriately describing the innovators' different types of imagination. The sequence exertions made more concrete the ambiguous features of imagination (Egan, 2007; Fettes, 2010; Liang et al., 2013). Subsequently, we suggest these imaginative thinking characteristics can further conjunct with the curriculum design, which leads innovators to release their reproductive and creative imaginations.

It is noteworthy that even though the present predictive model integrated the external environmental and internal psychological factors to predict imagination, the explained power of two types of imagination was still low (less than 50%); this perhaps indicated that there are remaining factors (such as personal traits, learning materials, or other individualized factors) which were needed to be examined further. In addition, environmental factors such as *social climate* influence on imagination are less obvious than psychological factors; however, the two mediators of the model can influence imagination more effectively. These results could suggest that integration of the external environmental and internal psychological factors to influence imagination are important for the development of effective teaching strategies.

The study also pointed out that *intrinsic motivation* and *inspiration through action* can mediate the relation between the predictive variables of *generative cognition* as well as *positive* and *negative emotion* and the outcome variables of two types of imagination. The results demonstrated that the mediating roles of *intrinsic motivation* for imagination are consistent with the studies of Prabhu, Sutton, and Sauser (2008). Furthermore, we found

that *inspiration through action* also could be the mediating role to emphasize innovation majors. It is possible that for novice innovators, in addition to *intrinsic motivation* can be displayed the mediators, the factors relating the operation or action (i.e., inspiration through action) displaying the critical mediating roles.

Additionally, *organizational measure*, through intrinsic motivation as a mediator, displayed an indirect predictive effect on imagination. In the *social climate*, positive and negative emotion displayed not only a positive, direct effect on two mediators; it also had a direct effect on two types of imagination. Specifically, *social climate* had a negative, direct effect on creative imagination; demonstrating that it emphasizes directly the role of *social climate* and would not be a valuable strategy for stimulating imagination; however, through two mediating factors, social climate would have a positive influence on imagination. The results indicated that the climate of peer groups would positively influence creators' motivation and action. Both negative and positive emotions had negative direct effects on reproductive imagination; only negative emotion had negative direct effects on creative imagination. That indicated the positive, effective way to stimulate both types of imagination and that the emotional factors would be better stimulants through the two mediators.

### Conclusion and further study

According to the research results, this study proposed several suggestions for follow-up studies and practical applications. First, there are indeed relationships among imagination, the psychology of learning, and the learning environment. In the future, this model can be referenced in teaching activity design or self-learning for planning teaching measures or creators' self-guidance. Second, the research subjects of this study were creative talents majoring in innovation fields. In these fields, dealing with problematic situations or tasks, teamwork and the tools and objects they work with are highly valued. In other fields emphasizing independent creation or having different professional levels of development, there may be differing preferences and values. Therefore, the model built by this study can be compared and modified for more appropriate applications to other creation-related fields. Third, although the results of fitness from the tests of the measuring model and the structural model were good, the residuals of the overall model corresponding to the predictions of creative and reproductive imagination were .75 and .67, respectively, showing that there were still influential factors not included in the overall model (such as individual difference or material difference). Follow-up studies may consider them to improve predictions of imagination. Lastly, to explore efficient models for cross-professionals will be important for talent cultivation. Therefore, follow-up studies can continue using these research tools with stable variable structures to compare models in different fields and combine academic cooperation between/among various fields.

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