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### **Effects Of Individual Absorptive Capacity on Design Innovative Behavior: A Case Study of Environmental Design Major of Xx University in Guangdong Province, China**

#### **Li Pengnan**

Ph.D, Candidate, Arts Performance and Communication, School of Liberal Art, Shinawatra University

Email: [62402004-6@st.siu.ac.th](mailto:62402004-6@st.siu.ac.th)

#### **Palphol Rodloytuk**

Asst.Prof.Dr., School of Liberal Art, Shinawatra University

Email: [palphol@siu.ac.th](mailto:palphol@siu.ac.th)

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#### **Abstract**

This Article aimed to study: (1) Define the individual absorptive capacity of design students; (2) The relationship between individual absorptive capacity and design innovation behavior. This article was selected by Environmental design major of a university in Guangdong Province, China. The instrument for collecting data was questionnaire method. Analysis data by Content analysis and Regression analysis. The research results were found as follows: (1) The absorptive capacity in the design process refers to the degree to which designers Acquisition, Assimilation, Transformation and Exploitation external knowledge (design concepts, technical tools and other resources) in order to achieve the design creative goals; (2) Potential absorptive capacity and actual absorptive capacity can promote design innovation behavior.

#### **Keywords**

Individual Absorptive Capacity, Design Innovative Behavior, Environment Design Major

#### **Introduction**

According to the statistics of the Ministry of education of China (2018), the enrollment scale of art and design has expanded year by year, with about 1.4 million students in the last four years. The number of students is second to none in the

world. Every year, a large number of design students enter the society to engage in design work. Under the background of fierce competition in the design industry, how to carry out design teaching and what kind of ability to cultivate have become the problems that many design colleges need to consider. Since the beginning of the 20th century, design has gradually changed from a part of business and trade activities to a new humanity under the background of technology and culture (Buchanan, 1992). The design is oriented by the user's needs, and integrates the needs of people, technical feasibility and business success by using the methods and tools accumulated by itself (brown, 2008). The design process can be divided into five stages: problem generation; Seek solutions to problems; Seek the best solution; Evaluation and verification; Publication, communication and application. Creativity comes from the collision of individual thinking. It is very important to seek solutions to problems, which means that designers will search for various resources, seek support from various technologies, integrate various resources to solve problems, expand their knowledge structure, improve their ability to understand social needs, and create value for society and business.

In recent years, there is a common phenomenon among designers, which is the "Inspiration from existing project as a method" . the problem is that some of designers are experiencing difficulty getting inspired from existing project. Thus, sometimes the result of this process looks more like "Copy-paste" rather than conscious inspiration (Sabry et al., 2016). The design process has become more and more standardized, more and more rigorous and rational, and relying on "sudden mental insight" (SMI) is increasingly insufficient to support scientific and logical design. There is still a big gap between the overall innovation consciousness of Chinese designers, the overall innovation level of Chinese design and people's expectations. Designers do not understand the essence and internal laws of design innovation, and most of them rely on "instant inspiration" or experience accumulation. Therefore, designers cannot grasp the essence, creative potential and innovative vitality of innovation, nor can they realize sustainable innovation. Students majoring in environmental design in colleges and universities lack the ability of innovation. Their design works pursue the formal beauty of appearance, rarely consider the region, history and culture, and lack the understanding and grasp of space. The lack of sensitivity to new technologies and new business trends is due to the lack of innovation awareness and innovation behavior of individuals. In addition, the cultivation of talents in Colleges and universities, personal learning ability of designers, imperfect industrial structure, nonstandard market competition, lack of legal supervision and other factors have a great impact on the cultivation of personal innovation consciousness (Agrawal & Singh, 2020; Aguirre & Gómez, 2020).

What is the individual absorptive capacity of design majors? Will individual absorptive capacity promote design innovation? The purpose of this study is to analyze the influence of individual absorptive capacity on design innovation behavior by taking the environmental design major of XX University in Guangdong,

China as an example. Define the individual absorptive ability and design innovation behavior of design students; The purpose of this paper is to explore the relationship between individual absorptive capacity and design innovation behavior. The purpose of this study is to study the relationship between variables through the combination of theory and empirical methods, and provide valuable countermeasures and suggestions for the generation of design innovation behavior (Ajah, Ajah, & Obasi, 2020).

### **Research Objectives**

The purpose of this research is to analyze the influence of individual absorptive capacity on design innovation behavior, taking the environmental design major of Guangdong University of Finance and economics as an example.

- 1.To determine the absorptive capacity of design majors.
- 2.To explore the relationship between individual absorptive capacity and design innovative behavior.

### **Literature Review**

1.Design innovation behavior is a manifestation of individual innovation behavior. Innovative behavior refers to the behavior that individuals consciously generate, promote and realize new ideas in the organization (Janssen & Van Yperen, 2004). Hurt et al. (1977) defined personal innovation as a willingness to change in a broad sense. Individual innovation can be regarded as the generation of novel and appropriate ideas, processes and solutions in work (Amabile, 1988). West and Farr (1989) defined individual innovation behavior as the activities of all individuals to produce, introduce and apply useful novelty. Farr and Ford (1990) defined individual innovation behaviors as behaviors that can lead to the generation and application of new and beneficial ideas, processes, products or processes. Kanter (1988), Scott and Bruce (1994) all believe that individual innovation is a multi-stage process, which should start from problem confirmation, then the innovative individual finds supporters for his own ideas, generates innovative models, and finally turns the ideas into practical habits or systems. The performance degree of individual innovation behavior not only refers to the innovation idea itself, but also includes the generation, content, promotion and development of the innovation idea, so as to ensure that the innovation can be effectively implemented (Zahra & George, 2002). Das and Teng (1998) also hold the same view: individual innovation behavior includes the generation, introduction and application of innovative ideas to all individual actions in the organization, including the exploration of opportunities, the formation of innovative ideas, and the implementation and application of new ideas (Das & Teng, 1998). Kleysen et al (2001) defined individual innovation behavior as all individual actions that generate, introduce and apply beneficial innovation to any level of the organization (Kleysen & Street, 2001). Xue Yupin (2007), a domestic scholar, believes that individual innovation refers to the creativity of individuals in an organization in

terms of products, services, work processes and methods, or the performance of their creativity. Based on the research of West and Farr (1989) and Kleysen (2001), this study defines individual innovation behavior as the individual action of generating and applying novelty at any level of the organization, including new ideas or technologies, work processes and methods. Design is a creative behavior. Akin (1979) found in his research that one of the uniqueness of design behavior is that it constantly generates new task goals and redefines task difficulties. Psychologist Howard Gardner (1983) said that design ability is a form of human natural intelligence, and a special and creative ability. Creativity is a fascinating and exciting aspect of human thinking. It is defined as the ability to change old ideas to produce unique inventions. In an article on the empowerment of creativity published by Gordon (1961), he used four kinds of ratios, namely, symbolic analogy, direct analogy, personal analogy and fantasy analogy, to characterize creativity. Boden (1990) pointed out that creativity is a non-traditional ability that can capture ideas from different sources and use them to solve problems, explore and evaluate solutions. Unlike invention, creativity does not mean creating absolutely new things, because it depends mainly on previous achievements. Cross has surveyed 68 designers from the "Royal Institute of industrial designers" in graphic design, product design and furniture design. Most designers repeatedly mentioned that "intuition" affects their creativity (cross, 1982). This study describes creativity as a kind of talent, which is naturally possessed or produces so-called "inspiration", "creative leap" (DORST & Cross, 2001) or "Epiphany" (akin, 1979) without any preparation or deliberate effort. Amabile (1983) believes that the skills / processes related to creativity can be defined as a person's general ability, that is, to think about a problem, generate new and original ideas, and analyze the quality of the generated solutions. Amabile & Pillemer (2012) further elaborated on this part, including "flexible cognitive style, personality characteristics, such as openness to experience, skills to use creative thinking, and continuous work style". Akin (1996) proposed that creativity is produced in a special way, which is expressed through products or processes. From science to art to daily life, creativity covers a lot of activities and products. The products of creative behavior are novel and unusual in a sense. Creativity can also be reflected in the social value and durability of products. He called this phenomenon "sudden mental insight" (SMI). According to the previous literature review on the design process, subjective design behavior has three parts: define the problem, generate ideas and make the prototype. Therefore, the innovation in the design process is mainly divided into the following aspects: (1) definition. The innovation of defining problems does not start from a certain problem, but from the goal or the achievement to be achieved and the solution-oriented thinking (Lu Bainian, 2015, innovative design thinking). From the perspective of a bright future and ideal vision, excavate the needs or potential needs of design objects to find problems. Pay attention to the change of users' needs under the influence of social culture, integrate design thinking and business thinking, and emphasize the experience of

unknown and desired design objects. Integrating cultural elements into modern products will become the design trend of the global market. Verganti (2008) and Moaosi et al. (2010) have studied the process of integrating culture into design innovation and put forward their respective theoretical models (Verganti, R. 2008; Moaosi et al. 2010); (2) Generate ideas. New conceptual methods will also bring innovation to the design results. Designers often unconsciously put forward some new design concepts, which come from the designer's knowledge reserves and previous experience. (Sabry et al., 2016) ; Designers often introduce technologies or concepts from other disciplines. For example, fuzzy decision-making method (Zhijian, 2015), digital technology (Yu CongGang, 2017), artistic language or concept (Zhao Jing, 2010), etc. Non logical thinking (Wang Tao, 2007), user centered design and service design (Xin Xiangyang, 2018; Kimbell L, 2011) have brought different design concepts and promoted changes in design process and objectives. (3) Make the prototype. The innovation of form generation can be divided into the following aspects: the design has the property of realizing ability, which means that there is a need to have a clear and specific form of things, and the response to relevant information and needs in the design research stage and the sorting out of various relationships in the design project should be expressed through specific forms (Fang Xiaofeng, 2018). The design form comes from the understanding and analysis of previous experience or relevant cases. The designers have different forms. They can break the form of fixed style and style, and also follow the original universal space form. The new form generation can be a part of the design innovation behavior. The innovation of form generation mostly focuses on the updating and translation of the original element symbols and the adoption of new drawing technology or software. This study believes that the design innovation behavior refers to the behavior that the designer can update his own design concept in time during the design process, keenly define the changing needs of users under the influence of social culture, have innovative ideas or innovative solutions, and finally solve problems and achieve the set design goals by borrowing new methods and tools. In essence, it is a manifestation of creativity.

2. In 1989, Cohen & Levinthal first proposed the concept of absorptive capacity from the perspective of enterprise management, pointing out that absorptive capacity refers to the ability of enterprises to identify, digest and develop knowledge from the environment (Cohen & Levinthal, 1990). Absorptive capacity includes three steps: 1. Knowledge identification ability. Refers to the ability to correctly identify the value of external new knowledge; 2. Ability to digest knowledge. It refers to the ability to understand external new knowledge and internalize new knowledge in the process of dealing with new knowledge; 3. Knowledge utilization ability. It is the ability to effectively use the knowledge after digestion and internalization, so as to achieve the goal and form the accumulation of knowledge and experience. The absorptive capacity includes acquisition, digestion, transformation and utilization. Most of the existing studies rely on specific research background and purpose for the composition analysis and

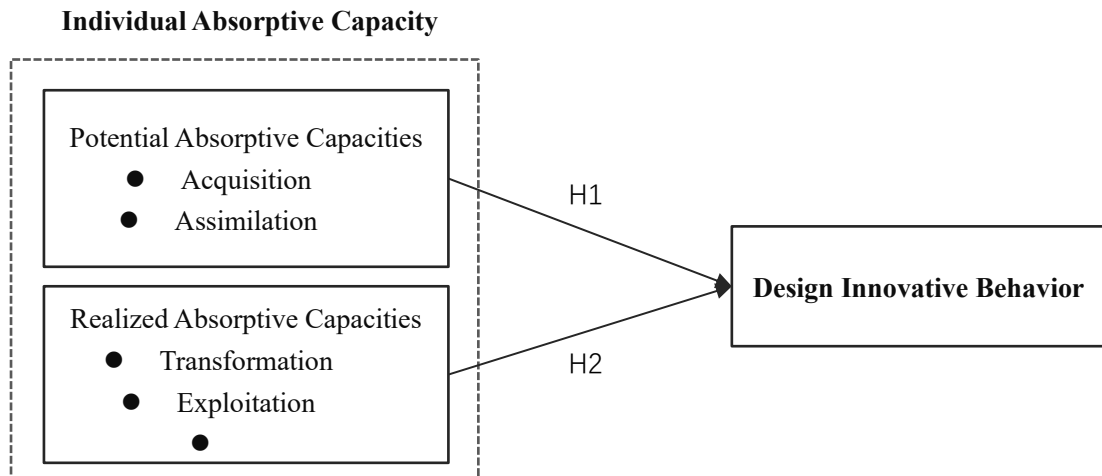
structure division of absorptive capacity, focusing on the theoretical level. The research samples are concentrated in the R & D Department of enterprises to explore how absorptive capacity can promote enterprise innovation and employee innovation performance (Zhang Zhengang, 2018); There are also studies on the influencing factors of absorptive capacity, taking R & D investment, organizational structure, atmosphere, organizational culture and other factors as independent variables (Jin Li, 2016). However, there are few studies that take absorptive capacity as independent variable and innovation behavior as dependent variable. There is no relevant literature to take the design innovation process as the research object to explore the impact of absorptive capacity on design innovation behavior.

### **Conceptual Framework**

This paper carries out the research according to the following logic: first, based on previous studies, the concept of individual absorptive capacity in the design process is defined, and an absorptive capacity model containing multiple components is proposed, and the internal relationship between the components at different levels is systematically analyzed. Secondly, taking the environmental design major of XX University in Guangdong Province, China as the investigation object, this paper uses exploratory factor analysis to empirically test the individual absorptive capacity and design innovation behavior, and provides theoretical support and empirical basis for the teaching practice and design innovation behavior activities of the design major. Based on the previous review, this paper believes that the design process is a dynamic process, including multiple stages: understanding and learning the design object and background; Understanding and learning of relevant tools and materials / resources; Transformation and utilization of design research results in the process of concept generation and form generation. Design individuals need to acquire, absorb, transform and apply a large amount of external information to achieve design goals. This study explores the impact of individual absorptive capacity on design innovation, and refers to Zahra & George's definition of absorptive capacity. Absorptive capacity in the design process refers to the degree to which designers acquire, absorb, transform and apply external knowledge (design concepts, technical tools and other resources) in order to achieve design creative goals. At the same time, these four scales are divided into two parts: potential absorptive capacity (PACAP) and applied absorptive capacity (racap). The personal absorptive capacity of the design specialty includes a series of processes of knowledge acquisition, absorption, transformation and application. The knowledge absorptive capacity is further divided into potential absorptive capacity and actual absorptive capacity. The potential absorptive capacity emphasizes the prior learning and accumulation of knowledge, including acquisition capacity and absorptive capacity. The actual absorptive capacity emphasizes the expansion and utilization of knowledge, including transformation capacity and application capacity. The absorptive capacity in the design process refers to the degree to which the designer acquires, absorbs,

transforms and applies external knowledge (reference cases, technical tools and other design resources) in order to achieve the design creative goals.

Figure.1 Conceptual Framework



H1: The potential absorptive capacity has a significant positive impact on design innovation behavior. The stronger the individual potential absorptive capacity is, the more design innovation behavior it shows.

H2: The realization of the absorptive capacity has a significant positive impact on the design innovation behavior. The stronger the individual's absorptive capacity is, the more innovation behavior it shows.

### Research Methodology

According to the research purpose and the definition of the research object, the environmental design students of Guangdong XX University in China are selected as the research samples. The environmental design major of the University was founded in 2008, and there are 308 students in the school. In 2018, it won the enrollment qualification of academic Master of Design and master of art. The employment is distributed in professional design institutions, enterprises, government units and self-employed enterprises in the Pearl River Delta region and major provincial capitals in China. According to statistics, there are 304 students majoring in environmental design. Therefore, the snowball method was used in this study. A total of 79 people were surveyed.

In this study, qualitative and quantitative methods were used. Qualitative research: collect a large number of documents for content analysis to clarify the meaning of individual absorptive capacity in design; Quantitative research: the author needs to select the scale with high reliability and validity for modification through relevant literature review, measure the variables, form a formal research questionnaire, and lay a foundation for scientific and reasonable follow-up empirical research. The absorptive capacity scale of Senge (1990), Szulanski (1996), Zahra George (2002), Fu Siyang (2018) and others was modified according to the characteristics of design specialty. The design innovation behavior was modified

according to the scale proposed by Tiemey, Farmer & Graen (1999), Bi Yanqi (2016) and Fu Siyang (2018). These items were measured with the five-point Likert scale, ranging from "strongly disagree" to "strongly agree". Before using the questionnaire, all questions should be tested for reliability and validity. The validity of the questionnaire was tested and modified by Items-Objective Congression (IOC). According to the pre-test, Cronbach's  $\alpha$  Is 0.909,  $\alpha$  the value of is greater than 0.7. It shows that the scale has high reliability, so the questionnaire is acceptable. Based on the data collected by the questionnaire, correlation analysis and regression analysis are used to analyze the data to reach a conclusion.

**Research Results**

**Objective 1**

The results showed that the design process is a dynamic process, including multiple stages: understanding and learning the design object and background; Understanding and learning of relevant tools and materials / resources; Transformation and utilization of design research results in the process of concept generation and form generation. Design individuals need to acquire, absorb, transform and apply a large amount of external information to achieve design goals. This study explores the impact of individual absorptive capacity on design innovation, and refers to Zahra & George's definition of absorptive capacity. In the design process, absorptive capacity refers to the degree to which designers Acquisition, Assimilation (AB), Transformation and Exploitation external knowledge (design concepts, technical tools and other resources) to achieve the design creative goals. At the same time, these four scales are divided into two parts: Potential Absorptive Capacity and Realized Absorptive Capacities.

Table.1 Correlation Analysis coefficients of Design Innovative Behavior with Acquisition, Assimilation, Transformation, Exploitation

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
1.Acquisition	1				
2.Assimilation	.725**	1			
3.Transformation	.575**	.644**	1		
4.Exploitation	.546**	.525**	.624**	1	
5.Design Innovative Behavior	.695**	.630**	.570**	.614**	1

**Objective 2. The results showed that**

The Pearson correlation coefficients of Design Innovative Behavior with Acquisition, Assimilation, Transformation, Exploitation were 0.695, 0.630, 0.570, 0.614 respectively. The coefficients have passed the significance test with a significant level of 1%. It could be seen that the Acquisition, Assimilation, Transformation, Exploitation capacity have significant positive correlation with



design innovative behavior (Table 1).

Table.2 Regression analysis of potential absorptive capacity and design innovation behavior

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.653	.231		2.825	.006	
	Potential Absorptive Capacity	.822	.069	.805	11.905	.000	1.000
$R^2=0.648$ , Adjusted $R^2=0.643$ , $F=141.732$ ( $P<0.05$ )							

According to SPSS statistical analysis, the maximum Vif value of variance expansion factor is 1, which meets the standard of 0 ~ 10. It can be seen from the above table that through the significance test, there is a significant difference between the regression coefficient of design innovation behavior and 0 (SIG < 0.05), and the regression coefficient of potential absorption capacity is 0.822. The results show that the potential absorption capacity has a significant positive impact on design innovation behavior, and the impact coefficient is 0.822. Assuming H1 holds, the relationship between potential absorptive capacity has a positive impact on design innovation. The results show that the stronger the individual's potential absorption capacity, the more obvious the design innovation behavior (table. 2).

Table.3 Regression analysis of Realized Absorptive Capacities and design innovation behavior

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.429	.255		1.685	.096	
	Realized Absorptive Capacities	.851	.073	.799	11.660	.000	1.000
$R^2=0.638$ , Adjusted $R^2=0.634$ , $F=135.945$ ( $P<0.05$ )							

Through SPSS analysis, we know that the maximum Vif (variance expansion) of the variance expansion factor is 1, which meets the standard of 0 ~ 10. It can be seen from the above table that through the significance test, the regression coefficient of the design innovation behavior is significantly different from zero (SIG < 0.05), and the regression coefficient of the realized absorptive capacity is 0.851, indicating that the realized absorptive capacity has a significant

positive impact on the design innovation behavior, and the impact coefficient is 0.851. Assuming H2 holds, the relationship between the actual absorptive capacity has a positive impact on design innovation. The results show that the stronger the individual's ability to absorb the reality, the more innovative design behaviors they show (Table 3).

### **Discussions**

Through the empirical research of literature research and sample survey, this paper makes a new theoretical explanation of the internal process and mechanism of design innovation behavior based on absorptive capacity. According to the theoretical model, this paper finds that the mechanism of individual absorptive capacity on design innovation behavior is individual absorptive capacity can directly and positively promote the generation of design innovation behavior, that is, individual absorptive capacity can provide designers with creative materials and inspiration and help to stimulate designers' innovative behavior.

### **Knowledge from Research**

### **Conclusion**

The individual absorptive capacity of design major includes a series of processes of knowledge acquisition, absorption, transformation and application. The knowledge absorptive capacity is further divided into potential absorptive capacity and actual absorptive capacity. Potential absorptive capacity emphasizes the prior learning and accumulation of knowledge, including acquisition capacity and absorptive capacity. Actual absorptive capacity emphasizes the expansion and utilization of knowledge, including transformation capacity and application ability. The absorptive capacity in the design process refers to the extent to which designers acquire, absorb, transform and apply external knowledge (reference cases, technical tools and other design resources) in order to achieve the design creative goals.

(1) In addition to cultivating students' creativity, teaching also needs to cultivate students' ability to acquire, absorb, transform and utilize knowledge. The empirical research results of design innovation behavior can effectively promote the design teaching. In the teaching process, we should pay attention to the four abilities of acquiring, digesting, absorbing and using new knowledge, which are embodied in the cultivation of students' ability of data collection, classification, analysis and application. In addition, students should be trained to investigate the needs of the design object in the early stage of the design and tap the potential needs to bring special value to the design.

(2) The innovative behavior of design is different from that of other majors. Design innovation behavior includes definition problem, concept generation and prototype design. Definition problem refers to paying attention to the change of users' needs under the influence of social culture, integrating design thinking and

business thinking, emphasizing the unknown and desired experience of design objects; concept generation comes from not only the designer's knowledge reserve and previous experience, but also the introduction of technology or concepts from other disciplines, such as user centered design and service design, to promote the design process and innovation. The change of goal; the design has the property of realization ability, which means that it does not stay on paper or text, but needs to have a clear and specific form of things. The designer's breaking the form of fixed style and style is also a part of design innovation behavior.

### Suggestions

The sample selection of this study is only limited to students majoring in environmental design, and only for environmental design majors. There are some limitations. In the follow-up study, the sample can be expanded to different majors and different universities. Further verify the reliability of the model and scale.

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