

A Study on the Application of Epistemic Beliefs Framework in Graphic Design

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Abstract.

Designers often apply abilities of design thinking, observation, design management, communication and coordination, as well as creative thinking. Comparing with other disciplines, design is rather special in the way that designers obtain knowledge through experiences of participating and reflecting. Design is usually working in multiple way with different perspectives, and in general consideration, there is no standard answer for a single design work. When designers are more aware of inherent advantages and appropriateness within their own context, the more possibilities and uniqueness can be inspired and presented. Epistemic beliefs are the basic assumptions of learners on knowledge, which will make them view knowledge from different perspectives and affect their learning performance. There have been many researches on epistemic beliefs in science, education and other fields. However, it is rarely explored in design discipline.

The purpose of this study is to apply the knowledge belief framework to graphic design, and to explore graphic designers' view on epistemic beliefs of graphic design. The research take surveys on people who are learning graphic design, based on the literature and studies on epistemic beliefs in other fields, in order to understand graphic designers' epistemic beliefs. The result shows that the commitment in graphic design is significantly correlated with the "certainty of knowledge" in Epistemic Beliefs, and the commitment in graphic design is moderately correlated with the "organization of knowledge" and "judgment of knowing". It can be seen from the results that the higher commitment in investing graphic design, the more uncertain the knowledge will be, and the knowledge are interrelated, and the better solutions will be found after self-judge, feeling, evaluation and comparison. Finally, this study proposes a list of suggestions for designers to utilize and researchers for further study.

Keywords: Epistemic beliefs, graphic design, design learning

1. Introduction

In Taiwan 2019 Curriculum Guidelines, literacy is the skill that students will use in the field of school. Teachers create a situation and generate comprehensive knowledge skills. In class, the knowledge generated by the interaction between teachers and students is the most valuable and active-minded (zhangfenfen, 2019). Which is also suitable in design situation, the ability of design thinking is often used in the design process. The basic characteristics of design thinking are people-oriented methods, which express designers' design demands in the way of designer collaboration and participatory co creation. Such a method is not only the thinking ability of designers, but also to solve problems in a creative way (tschimmel, 2012).

Most of the literatures in design field focus on few directions, such as: principles of applying design to various fields (seckler, opwis, & tuch, 2015), effective design principles (cross, 2007), interdisciplinary applications (Yang Yingxian, Lin Youzheng, & Cai Jinfa, 2019), application of design thinking to other fields, or design curriculum research (Lin Chonghong, 1997), etc.

As mentioned above, we found that there are few literature focus on what kind of beliefs designers hold about their knowledge, which will lead educators into some inherent misunderstanding in design education or curriculum design: the current design curriculum primary with practice, secondary with necessary theoretical knowledge, in order to meet the needs in getting a job or advanced studies (Ministry of education, 2008), And the effectiveness of the curriculum and teaching method can be judged by the students' learning effect.

Since design is a unique and attractive subject, with its own unique knowledge and culture. The knowledge of design lies in the design process and the product itself, which is obviously different from other subjects, which have constructed solutions, but the knowledge of design can be considered from multiple perspectives, and there is no specific answer. Therefore, it can be determined that the learning effectiveness of students in the classroom is judged by the subjective views of experts or teachers, which will involve the subjective aesthetics or beliefs held by the experts or teachers in the classroom, and the objectivity is lower than that of other disciplines.

This kind of curriculum design and teaching method is mainly based on teachers, but beliefs held by students will affect their learning process, and also impact in curriculum participation. Therefore, this study aims to explore the relevant literature of learning research. There are many research viewpoints used to describe students' learning process, such as self-regulated learning (Cheng Binglin, 2001), situated learning (Chen Huijuan, 1998), and the design thinking mentioned above, although design thinking can bring the expected design and marketing results (S. Chen, Benedictus, Kim, & Shih, 2018), it can also explain the designer's creative thinking, so it is also widely used in non-design fields. However, none of these studies can accurately explain the differences or changes in learning knowledge and self-belief in the process of design learning.

In recent years, more and more studies show that epistemic beliefs can effectively explain these views. Epistemic beliefs are learners' basic assumptions about knowledge, which will make learners use different views and perspectives to view knowledge, and then affect their

learning performance (Chen kuiqing & Zhang Jingyuan, 2007), That is to say, Epistemic Beliefs in different fields are not the same (Buehl & Alexander, 2006). This research breaks through the rare research category in the field of design, so that research can explore graphic design from the perspective of knowledge belief and explore the knowledge belief of graphic design according to the professional knowledge of graphic design.

1.1 Research goals and problems

The purpose of this study is to explore the framework of Epistemic belief in graphic design learning. The purpose of this study is to explore the theoretical framework of Epistemic belief in graphic design learning, and to understand the relationship between Epistemic belief and graphic designers. Based on the above research purposes, the main questions of this study are: what are the views of graphic designers on Epistemic Beliefs?

According to the main research questions, the secondary research questions are as follows

- (1) How to summarize knowledge belief from graphic design professional knowledge?
- (2) What is the relationship between the learning experience of graphic design and the Epistemic Beliefs of graphic designers?
- (3) What is the relationship between the degree of involvement in graphic design and the Epistemic Beliefs of graphic designers?

2. Epistemic Beliefs

Belief in knowledge: in earlier studies, the two nouns "Epistemic Beliefs" and "Epistemological Beliefs" have been used interchangeably. However, the former has been more widely used recently, because it specifically refers to the belief in knowledge and understanding knowledge, while the latter refers to the research on Knowledge Theory (Hofer, 2016). Therefore, the translation of this study is mainly based on Epistemic Beliefs, All references will be studied.

The so-called universal research is not for specific areas of research. Research on Epistemic Beliefs shows that age and education level have a unique impact on Epistemic Beliefs. With the increase of age, learners believe that they can improve their learning ability; The more education they get, the more likely they are to believe that knowledge is highly complex and evolving (schommer, 1998).

In different cultural backgrounds, there are also different influencing factors. Therefore, even if the same measurement tool or the same subject is used, the experiment will produce different results and the interaction between the interviewees will also have other changes due to the different cultural context. This is because different cultural context will produce different connotations of Epistemic Beliefs (Chan * & Elliott, 2004).

Learners' Epistemic Beliefs greatly affect their ability beliefs, achievement values and some forms of strategy use (Buehl, 2003). It can be judged that in the process of learning, there are variables that directly affect students' Epistemic Beliefs, which are likely to exist in the school environment, teachers' teaching, education system, and even learners' departments.

Schommer (1990) is a pioneer in the field of knowledge belief research, which has been followed up by many scholars. In 1990, according to his research on knowledge belief for many years, knowledge belief was divided into five dimensions, namely: (1) source of knowledge: the subject thought that knowledge was imparted by authority or textbooks rather than other channels, or that knowledge was internalized through subjective, objective and argumentation (2) Certainty of knowledge: the view that knowledge is absolute and unchangeable, or that knowledge is constantly developing and changing (3) Organization of knowledge: it thinks that knowledge is fragmented and irrelevant, or that knowledge is interrelated and can be integrated with each other (4) Control of learning: the ability to learn is innate and cannot grow up with acquired effort or practice, or learning ability can be acquired from acquired experience (5) Speed of learning: think that learning is fast, all have nothing, or think that learning is a progressive process.

Barbara K. Hofer and pintrich (1997) put forward a new knowledge belief framework, which is different from schommer's five dimensions, considering that schommer has some shortcomings in the process of collecting data and adopts a less open problem elaboration In order to help clarify the research and thinking in this field, four dimensions are composed of source of knowledge and justification for knowing. The certainty, simplicity and source of knowledge are similar to schommer's. The judgment of knowledge refers to how learners evaluate their knowledge claims, including the use of evidence, their use of authority and professional knowledge, and their evaluation of experts. The lower level learners will defend their beliefs through observation or authoritative guidance, or according to the viewpoint of feeling right; At a higher stage, learners will use query view and confirm their judgment through personal evaluation and integration of experts' views (Barbara K Hofer, 2000). This is different from schommer's research on the dimension of knowledge belief, which provides another way of thinking in the field of knowledge belief and lays the foundation of another research school.

3. Epistemic Beliefs and learning

The existence of a school is the best place for students to express, defend, reexamine and advocate the practices needed for their ideas (Barbara K. Hofer, 2001). In the process of learning, knowledge belief and achievement motivation are important components of the learning process (Buehl, 2003), and knowledge belief is also an important predictor of teachers' teaching and learning concepts (Turan, 2018). Young people's beliefs have a significant impact on their academic achievement and motivation. The collaborative debate of team work among students to understand and solve problems is especially effective for improving students' understanding of knowledge and the nature of knowledge (J. A. Chen & Pajares, 2010). If

students focus on the performance of goal-directed motivation, they may enhance their sense of certainty of knowledge, that is, they think that complex problems have correct answers, and they will pay more attention to the knowledge imparted by textbooks or knowledge authorities (J. A. Chen & Pajares, 2010).

4. Teacher's Epistemic Beliefs

Teaching profession is also the closest profession to students in the social field. Therefore, teachers' behavior, teaching mode and beliefs are the major research topics in the field of Epistemic Beliefs. Teachers need to consider how social interaction promotes the acquisition of Epistemic Beliefs, and how classroom practice promotes or hinders the development of Epistemic Beliefs (Buehl & Alexander, 2006). Teachers need to use a lot of teaching methods and techniques in the teaching field, which can help learners and professors gain more experience in the process (K ö Semen, 2012), the teacher's guidance is not only to enhance students' learning ability by teaching facts and simple knowledge, but also to enable students to participate in the use or increase their creative ability and skills (Hong, Hartzell, & Greene, 2009). The course design can be carried out in a richer way, which helps students to absorb more knowledge. Let students use a variety of ways of thinking to increase their differences in Epistemic Beliefs. This can encourage them to understand the relationship between these beliefs, which will be helpful to students' thinking towards more complex Epistemic Beliefs (Brownlee, 2004).

5. Graphic Design Education

The earliest contact in the field of design in Taiwan is usually in the later stage of secondary education. Students will study related disciplines through entering the studio or technical high school. As far as Taiwan's current education system is concerned, the design group of technical senior secondary schools is an initial exploration into the field of design education. In design education, there is a universal teaching method of "describing design learning as instinct", which strengthens the common belief in the automatic absorption of knowledge (Logan Cheri, 2006). Therefore, the current design curriculum takes practice as the core to meet the needs of future employment and further education (Ministry of education, 2008). It is generally believed by higher educators or employers that it is of great significance to cultivate students' career development in technical high school. Design group education should cultivate students to have common core competence in design, and lay a foundation for learning in relevant professional fields or advanced professional knowledge and ability (Zhong Guangyang, Chen chunse, 2018).

In the field of design learning, there is a close relationship between the cognitive and behavioral dimensions of learning psychology (Xu Yuling, Liang Chaoyun, 2011). This has a lot to do with the works produced by designers. Compared with other fields, the works produced by designers are more free and difficult to copy unconditionally.

The major subjects of design group in technical senior middle school are introduction to design, color principle, shape principle, basic design, painting basis and basic graphics. Among them, introduction to design, color principle and shape principle are the examination scope of major subject 1 in the unified entrance examination of four technical secondary schools. The examination adopts the form of multiple-choice questions to measure the examinees' professional knowledge. The teaching goal of these professional subjects is to cultivate students' basic ability in design theory, design performance and design practice, so students need to spend a lot of time pondering and absorbing curriculum knowledge (Liao Xin, Ke Tingyu, ye zhenbi, 2019).

5.1 Color principle

Among the courses of the Department of art and design, chromatics is a very important core foundation, and it is also one of the compulsory courses of the design group course in technical senior secondary schools. From the point of view of the design group course, if students can't apply their color knowledge to the major of creation and design through their understanding of color, Such color learning will not meet the original curriculum design and expectations (CAI Meizhu, Xiao Huijun, 2016). In teaching design, the use of color will affect students' knowledge retention level. In curriculum design, the use of color to present teaching information in different ways can effectively use the basic color to stimulate memory ability (Alyahya & Nasser, 2019).

5.2 Shaping principle

The principle of forming is based on the exploration of "concept" and "thinking", and only by some conditions of formation can the formation itself have internal or external forming conditions (Lin Chonghong, 2009); In Taiwan's design education, courses applying the principle of shaping usually introduce different shaping principles and formation background, and then apply different appreciation of famous paintings to make learners understand their characteristics and forms to express people's aesthetic thinking at that time, and then students will be allowed to use the shaping elements to create shapes (duanshizhen, 2018).

"Shape creation" is a kind of visible, touchable and perceptible form, which mainly consists of the media of materials to form design styles. The shape making is not only on its appearance, but also has its specific connotation. This connotation includes materials, internal texture, color, attributes, etc., which is the knowledge principle of enriching design (Lin Chonghong, 2011).

5.3 Introduction to design

The main purpose of the introduction to design is to enable learners to understand the changes in the design field and the background of the design style, so as to cultivate the ability of applying theory to practical development (Liao Xin et al., 2019). Compared with the principles of color and the outline of shape, the scope of study of the outline of design centers on the knowledge of "design", including design field, design principles, environment, design history and design related industries. Graphic design is a process in which creators complete their professional creation and express their design ideas with professional skills such as font design, typesetting and visual art (Chu, 2018).

Generally speaking, the concept and application of design are widely distributed in all walks of life. Designers should pay close attention to current trends, artistic, philosophical, political, sociological issues and developing technologies (kanat, 2019). Therefore, in order to achieve success in the field of design, designers must keep the information up-to-date and keep creativity, which means that designers or design learners must keep lifelong learning.

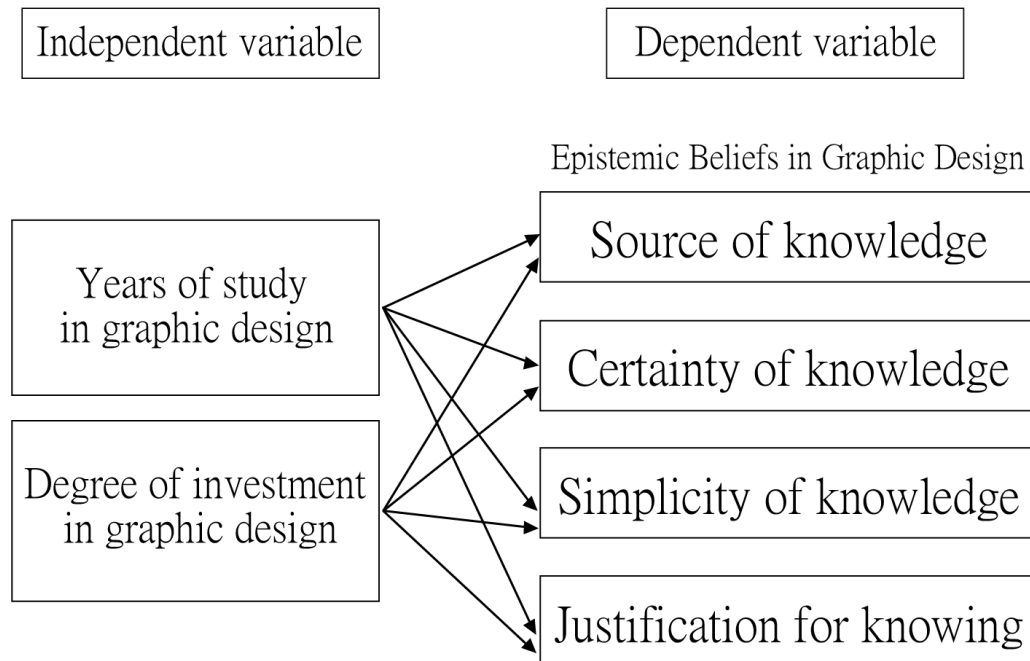
6. Methodology

This research takes the learning experience of graphic design and the degree of involvement in graphic design as the independent variable, and with Pearson correlation analysis, we can test the relationship between these two independent variable, and the four dimensions of graphic design Epistemic Beliefs.

7. Finding

The purpose of this study is to explore the characteristics of Epistemic Beliefs in graphic design, and the relationship between the degree of involvement of graphic design learners, design experience and Epistemic Beliefs. The research method adopted is "questionnaire survey", through which we can understand the characteristics of Epistemic Beliefs in the field of graphic design.

Figure 1: Figure description (TNR 10pt., centered, italics)



The Conceptual Framework of this study is based on Hofer and Pintrich (1997) framework to understand the designer's views on Epistemic Beliefs. There are two parts in the questionnaire. The first part is about personal information, how many years' experience and level of commitment; The second part is the Epistemic Beliefs of graphic design, which consists of four aspects. The contents of the questionnaire are in the appendix, and the connotations of each dimension are described as follows:

7.1 Source of knowledge

This aspect mainly understands that the designer thinks that knowledge is acquired by his own internalization through subjective, objective and argumentation, or that knowledge is imparted by authority or textbooks rather than other pathway.

Figure 1: "Source of Knowledge" item

coding	topic	Professional knowledge
SK01	The basic formative elements taught in design textbooks or design books must be correct.	Shaping principle
SK02	I think the most important thing to learn about design is to remember the visual function of color and related perceptual principles.	Color principle
SK03	I believe that only experts can discover new visual identity systems or graphic design processes.	Introduction to design

SK04	I think the experts' suggestions shouldn't be questioned.	Introduction to design
SK05	I think we can learn any design skills by viewing works.	Introduction to design
SK06	When the result of the group discussion is different from the teacher's suggestion, I will believe that the teacher is right.	Introduction to design

7.2 Certainty of knowledge

This aspect measures the designer's view on the revision of design knowledge, holding the view that the design knowledge is absolutely correct or not necessarily completely correct; Designers think that knowledge is absolute and unchangeable, or that knowledge is constantly developing and changing.

Figure 2: " Certainty of knowledge " item

coding	topic	Professional knowledge
CK07	Color perception (such as feeling blue when seeing blue, etc.) will never change.	Color principle
CK08	There are fixed standards for the formation of basic shapes.	Shaping principle
CK09	There are fixed standards for the designed programs, which will not be changed.	Introduction to design
CK10	The characteristics of the design industry I know will not change even after a while.	Introduction to design
CK11	I think we can learn any design skills by viewing works.	Color principle
CK12	When the result of the group discussion is different from the teacher's suggestion, I will believe that the teacher is right.	Shaping principle
CK13	There are not much answers to a design question.	Introduction to design
CK14	I think design knowledge may be revised after a period of time.	Introduction to design

7.3 Simplicity of knowledge

This aspect understands the designer's view of graphic design knowledge, that knowledge is irrelevant, or that knowledge is interrelated and can be integrated with each other.

Figure 3: " Simplicity of knowledge " item

coding	topic	Professional knowledge
OK015	I think there is a relationship between design principles and design principles(Reverse question).	Introduction to design
OK016	I think that to learn design well, we need to connect the elements of shape(Reverse question).	Shaping principle

OK017	My understanding of color perception will not affect the color matching in my design.	Color principle
OK018	I think the explanation of design phenomenon can not only rely on a single factor, but also consider the influence degree of other factors(Reverse question).	Introduction to design
OK019	When I was designing, what I could imagine were works of the same type as the title.	Introduction to design
OK020	Different views will only hinder the solution of design problems.	Introduction to design
OK021	When I study design, I tend to look only for what I need and ignore other relevant information.	Introduction to design

7.4 Justification for knowing

This aspect understands the designer's view of graphic design knowledge, that knowledge is irrelevant, or that knowledge is interrelated and can be integrated with each other.

Figure 4: " Justification for knowing " item

coding	topic	Professional knowledge
JK22	I will compare which is more suitable for this work before using color(Reverse question).	Color principle
JK23	I can judge whether the color used in the work conforms to the feeling that the whole work wants to present(Reverse question).	Color principle
JK24	I will use the principle of beauty to judge the quality of the work(Reverse question).	Shaping principle
JK25	I understand the relationship between shape and culture, and can judge which culture it belongs to through the works(Reverse question).	Shaping principle
JK26	I will judge the cause of design style by understanding the history of design(Reverse question).	Introduction to design
JK27	I will judge which artistic style the work is inclined to(Reverse question).	Introduction to design
JK28	In the field of graphic design, the correct answer is more opinions than facts(Reverse question).	Introduction to design
JK29	When faced with a variety of different versions of the design material, I will try to compare(Reverse question).	Introduction to design
JK30	I will use some criteria to judge the quality of different design methods(Reverse question).	Introduction to design
JK31	I have the ability to judge whether the design knowledge I have learned is correct(Reverse question).	Introduction to design

8. Reliability and validity

In this study, the reliability test was conducted by SPSS statistics software, and Cronbach's of the questionnaire α value is 0.836, which is the reliability standard of "very credible".

The compilation of the questionnaire is based on the literature related to Epistemic Beliefs, so the reliability and validity of the questionnaire are measured by the confirmatory study (CFA). After CFA measurement, 14 questions with the number of factors load less than 0.5 was deleted, leaving 32 questions. On Sk03 and sk04, although the factor load is less than 0.5, will cause the cronbachs alpha value to decrease after deletion, so it is decided to keep two items Although the average variation extraction (AVE) of the structure such as the source of knowledge, the certainty of knowledge, the speed of learning and the judgment of knowledge are slightly smaller than 0.5, the factor load is greater than 0.5, the composition reliability (CR) is greater than 0.6, and the cronbachs alpha value is larger than 0.7 except the "source of knowledge" structure, so it is within the acceptable range. The detailed data are shown in the table below.

Figure 5: Confirmatory factor analysis

Aspect	Item	Factor loading	Cronbachs Alpha	Rho_A	CR	AVE
Source of knowledge	SK01	0.954	0.629	1.317	0.732	0.430
	SK02	0.619				
	SK03	0.479				
	SK04	0.444				
Certainty of knowledge	CK07	0.656	0.774	0.916	0.825	0.447
	CK09	0.557				
	CK10	0.588				
	CK11	0.567				
	CK12	0.745				
	CK13	0.847				
Simplicity of knowledge	OK17	0.713	0.726	0.789	0.840	0.638
	OK20	0.870				
	OK21	0.805				
Justification for knowing	JK22	0.507	0.852	0.860	0.875	0.443
	JK23	0.738				
	JK24	0.525				
	JK25	0.606				
	JK26	0.623				
	JK27	0.731				

	JK29	0.597				
	JK30	0.765				
	JK31	0.826				

9. Analysis method

9.1 Descriptive statistics

This paper analyzes the basic personal data of the research subjects, including the gender of graphic design learners, the years of learning design, the time of viewing design works every week, and the time of designing every week, and presents their distribution through the percentage value.

9.2 Pearson correlation coefficient

Correlation coefficient is a measure method used to measure the relationship between two paired random variables. The value of Pearson correlation coefficient represents the closeness between the two variables. The higher the correlation coefficient is, the closer the two variables are. The lower the correlation coefficient is, the more uncorrelated the two variables are.

10.Result

10.1 Epistemic Beliefs in graphic design

This study summarizes the professional knowledge of graphic design from the literature discussion, integrates with the items in the Epistemic belief scale, forms Epistemic Beliefs questionnaire of graphic design, and obtains the research conclusion from the analysis. Most of the aspect of Epistemic Beliefs of graphic design learners are in line with the previous literature. Most students' Epistemic beliefs are more complex and high-level than their unfamiliar scientific Epistemic beliefs when facing Humanities and Social Sciences (Marra & Palmer, 2008). Therefore, it is opposite with Paulsen and Wells (1998) research results that student majoring in humanities, fine arts, social sciences and other applied fields hold relatively naive Epistemic Beliefs. Except for the average of the "source of knowledge" aspect, which tends to be naive, other aspects hold complex Epistemic Beliefs.

In table 6 shows that Epistemic Beliefs of graphic design learners have the following characteristics: (1) Learners tend to think that knowledge is mainly obtained by textbooks, books and experts (2) Learners think that knowledge will change and has no fixed standard (3) Learners tend to think that knowledge and knowledge are interrelated (4) Learners have doubts about their ability to come up with good solutions to problems after their own judgment and comparison.

Figure 6: The mean and standard deviation of the facet of Epistemic Beliefs in graphic design

	Source of knowledge	Certainty of knowledge	Simplicity of knowledge	Justification for knowing
Mean	2.7	1.98	2.03	2.48
Standard deviation	.618	.602	.747	.613

10.2 The more experience you have in learning design, the more likely you are to believe in what authority teaches you.

There is a low correlation between “source of knowledge” and “experience of learning design”. In the process of learning design, we need to be led by many experts, works and reference materials to establish our own aesthetic system. Therefore, "reference" and "imitation" are very important for design learners from start. As time goes on, they usually establish their own aesthetic quality and preferences, and the designed works will be more in line with their own preferences and styles. But the results of this study found that the opposite result, with the more experience of design, the more trust in authoritative knowledge. The possible reason is that the more design experience you have, the more design works you have seen, and the more design talents you will contact, then you will think your ability is not comparable to them, and the more willing you are to accept the arguments and design styles of the strong ones you recognize.

Figure 7: Pearson Correlation Test of years of experience in learning design

Pearson Correlation						
		Level of commitment	Source of knowledge	Certainty of knowledge	Simplicity of knowledge	Justification for knowing
Years of experience in learning design	Pearson correlation	.408**	.189*	-0.053	-0.141	-.187*
	Significance (double-tailed)	0.000	0.038	0.565	0.122	0.043
	N	120	121	120	121	118

10.3 The more experience in design learning, the better the design scheme can be put forward to the problem.

There is a low degree of negative correlation between “justification for knowing” and “learning design experience”. The more experience you have in learning design, the more able you are to put forward good solutions to design problems after judgment, feeling, evaluation and comparison. The result of this study is consistent with Paulsen and Feldman (2005):

students can improve their internal goal orientation and understanding of the value of learning tasks through efforts and experience, so as to enhance their beliefs. After the experience of time, design learners are more and more able to judge the true meaning of the design task, choose the best design scheme, and complete the design scheme through practicing their own design techniques.

10.4 The more level of commitment in design, the better see the design knowledge as nonstop-developing and changing.

From the Pearson correlation test of the degree of input to design in Table 8, we can see that the level of commitment in design and the "certainty of knowledge" P value is .004. The Pearson correlation coefficient of investment in design is -.265. There is a negative correlation between knowledge and certainty of knowledge.

In daily life, design learners are more likely to have a special understanding of graphic design knowledge with higher and more frequent involvement in graphic design learning and design. Design learners will think that design knowledge is constantly developing and changing. After being exposed to more design works, media and design methods, the psychological state of design learners may be changed, resulting in more creativity and innovation, and the original cognition of design knowledge may also be relatively changed.

Figure 8: Pearson Correlation Test of Level of commitment

		Pearson Correlation				
		Years of experience in learning design	Source of knowledge	Certainty of knowledge	Simplicity of knowledge	Justification for knowing
Level of commitment	Pearson correlation	.408**	-0.028	-.265**	-.233*	-.249**
	Significance (double-tailed)	0.000	0.758	0.004	0.010	0.007
	N	120	120	119	120	117

10.5 The higher the degree of input, the more likely to hold the view that design knowledge can be integrated with each other.

In table 8, the Pearson correlation coefficient shows that the coefficient between the degree of input in design and the "simplicity of knowledge" aspect is -.233, reaching a moderate negative correlation. In the process of learning design, the more frequent the behaviors related

to design or learning design are, the more likely they are to hold the view that design knowledge can be integrated and related with each other. The perception of color will affect the design thinking. Different design thinking methods can also help solve different design schemes and can be common to each other. When learning design or designing, design learners will not only look for relevant content, but will collect a wide range of information, integrate them, and then identify the design elements and solutions they need.

10.6 The higher the degree of investment, the more likely to put forward better solutions to the problem through judgment.

According to Pearson correlation coefficient in Table 8, it can be observed that the coefficient between the degree of investment in design and the "justification for knowing" aspect is -.249, reaching a moderate negative correlation. In the process of learning design, the more frequent the design or learning design related behaviors are, the more likely the learners will be able to put forward better solutions to design related problems through self-judgment, feeling, evaluation and comparison. The aesthetic feeling of color, the modeling principle of beauty and the shaping culture used in the production of design works need to be internalized by design learners before they can be more appropriately integrated into the design works. And when design learners can learn to judge the suitability of design materials, design methods and artistic styles in their own works, they will help them put forward better design solutions.

10.7 Pearson's Correlation Test Between the Aspects of Epistemic Beliefs in Graphic Design.

The Pearson correlation coefficient analysis among the six aspects of graphic design Epistemic Beliefs is examined in table 25.

There was a significant correlation between the "source of knowledge" and the "certainty of knowledge" aspect ($P < 0.000$) There was a significant correlation between the "source of knowledge" dimension and the "simplicity of knowledge" aspect ($P = .001$). The correlation coefficient was .295, which was a moderate correlation "Certainty of knowledge" and "simplicity of knowledge" $P < 0.000$ The correlation coefficient between "certainty of knowledge" and "simplicity of knowledge" was .516, reaching a moderate correlation.

There is a significant correlation between the "justification for knowing" dimension and other aspects. The judgment of this study may be related to the above mentioned that the mean of the "justification for knowing" aspect is 2.48, which is a relatively neutral data. And the standard deviation was .613. It seems that most of the subjects prefer to choose the median in this aspect, probably because they can't judge whether they can put forward better solutions to the problems after judging, feeling, evaluating and comparing by themselves. Or think that they do not have enough ability to put forward the best solution, but they do not have the ability to judge, feel, evaluate and compare. Because the mean is in the median and the standard deviation is not large, it cannot be significantly correlated with other aspects.

Figure 9: Pearson's Correlation Test Between the Aspects of Epistemic Beliefs in Graphic Design

Pearson Correlation				
		Certainty of knowledge	Simplicity of knowledge	Justification for knowing
Source of knowledge	Pearson correlation	.588**	.295**	-0.101
	Significance (double-tailed)	0.000	0.001	0.277
	N	120	121	118
Certainty of knowledge	Pearson correlation	-	.516**	0.022
	Significance (double-tailed)	-	0.000	0.812
	N	-	120	117
Simplicity of knowledge	Pearson correlation	-	-	0.141
	Significance (double-tailed)	-	-	0.128
	N	-	-	118

11. Summary and concluding discussion

11.1 Summary

This study takes graphic design learners as the research object and designs a graphic design Epistemic Beliefs questionnaire with reference to the previous literature to explore the relationship between learners' graphic design Epistemic Beliefs, their design experience, and the degree of investment in design and Epistemic Beliefs. Based on Hofer and pintrich's (1997) framework, the study is divided into four dimensions: "source of knowledge", "certainty of knowledge", "simplicity of knowledge" and "justification for knowing". Most of the dimensions of Epistemic Beliefs of graphic design learners are in line with the previous literature. Most students' Epistemic Beliefs are more complex and high-level than their unfamiliar scientific Epistemic Beliefs under facing Humanities and Social Sciences (Marra & Palmer, 2008). Therefore, it is contrary to Paulsen and wells (1998) research results that student majoring in humanities, fine arts, social sciences and other applied fields hold relatively naive

Epistemic Beliefs. Except for the mean of the " source of knowledge " dimension, which tends to be naive, all other dimensions hold complex Epistemic Beliefs.

According to Pearson correlation coefficient analysis in four aspects of Epistemic Beliefs of graphic design and the design experience and commitment level of learners, it shows that the more experience learning design is, the more likely it is to believe the knowledge imparted by authority, the better the design scheme can be put forward for the problems. The higher the level of commitment in design, the more likely the design knowledge is to be constantly developing and changing, the more likely to hold the view that design knowledge can be integrated with each other, and the more likely to put forward better solutions to the problems through judgment.

11.2 Research suggestion

Based on the theory of Epistemic Beliefs, professional knowledge of graphic design and the result of this study, this paper has the following suggestions for the reference of researchers in the field of design, education, knowledge belief and graphic designers, and puts forward relevant suggestions for the future research direction.

11.2.1 Recommendations for research subjects

In this study, design learners in the field of graphic design are the main subjects, and most of the subjects are college students.

(1) Take other design fields as the research object.

This study takes graphic design learners as the research object. Future research can focus on other design fields, such as architectural design, interior design, animation media design, etc. the professional knowledge in different design fields is not the same. Therefore, the research results of this study cannot represent other design fields, after analyzing the professional knowledge of each design field, we can carry out the related research of Epistemic Beliefs.

(2) Design learners of different ages are taken as the research objects.

Most of the subjects in this study are college students with less than three years of design learning experience, which is relatively limited in terms of age distribution. It is suggested that future research should be conducted on graphic design learners of different age groups. Different age groups are faced with different design problems. The design solutions to design problems will have different interpretations because of their rich design experience, and their cognition of design may also be different.

11.2.2 Suggestions on research methods

In this study, questionnaire survey method was used to study the correlation of Epistemic Beliefs in graphic design. Before that, the literature of Epistemic Beliefs in the field of design was quite rare. The results show that the design learning experience and engagement of graphic

design are related to each aspect of Epistemic Beliefs. Future research suggests that qualitative in-depth interviews should be used to understand learners' cognition and psychological state of knowledge in the field of graphic design. Through in-depth interviews, more deficiencies in the questionnaire system can be found to make up for the lack of Epistemic Beliefs in the field of graphic design. In depth interview can also supplement the research results of this study, explain the reasons for the results under the data, so as to make Epistemic Beliefs in the field of graphic design more complete.

11.2.3 Suggestions on Epistemic Beliefs in design field

This study in a sense of the field of Epistemic Beliefs from the perspective of professional knowledge of graphic design, and compiles the questionnaire combined with the professional knowledge of technical high school professional subject one. Graphic design knowledge is extensive and profound, and not only the history of design, colorology, shaping principle, design introduction and other categories, but also many related knowledges about design technology and skills is worth exploring. In the future, research on knowledge belief can be carried out from the perspective of design technology knowledge, so as to conform to the domain characteristics of implementation nature in design.

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