The Gap in Design Creativity Education between China and Developed Countries

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Abstract

Extant research indicates that Chinese higher education has overlooked creativity. However, based on indirect clues, we infer that the degree of emphasis on creativity and related courses in Chinese higher education has changed. Therefore, we conducted a survey using a questionnaire to compare the creativity-related courses and adopted creativity methods in higher education between China and developed countries. The results indicate that participation rates and assessments of creativity-related courses, adopted creativity methods, and evaluations differ between China and developed countries.

Keywords: design education, design creativity, design methods, higher education, idea generation

1. Introduction

With accelerated globalization, economic development faces more complicated situations, needs to respond quickly to competition, and requires a consideration of sustainable development. Creativity has been considered the capacity to stimulate sustainability in economic and social development (Bobirca and Draghici, 2011). This means that companies and organizations need to ensure more efficient use of human resources, including enhancing their leaders' and employees' creativity to create and develop new products and services continuously. This will help capture a more significant share of the commercial market (Moreno *et al.*, 2014; Sutapa, Mulyana and Wasitowati, 2017; Chen *et al.*, 2018; Tang, Byrge and Zhou, 2018). Creative individuals require training in solid educational infrastructure and a new creative education mechanism (Wuwei, 2011; Cascini *et al.*, 2022), and higher education is the cornerstone that helps train creative students and facilitates the creation of novel products in the future (Jackson, 2014). This has resulted in higher education institutions offering courses to enhance students' creativity and researchers focusing on applying creativity methods to encourage students to generate novel and useful ideas, increase learning outcomes, and enhance creativity (Jahnke, Haertel and Wildt, 2017; Al-Samarraie and Hurmuzan, 2018; Jahnke and Liebscher, 2020; Matraeva *et al.*, 2020). For example, brainstorming is one of the most popular creativity methods, and many researchers investigated brainstorming in higher education (Albers *et al.*, 2014; Al-Samarraie and Hurmuzan, 2018; Sosa, 2020b, 2020a). Al-Samarraie and Hurmuzan reviewed 1677 papers based on the adoption of brainstorming in higher education and proposed the challenges and solutions of various disciplines (Al-Samarraie and Hurmuzan, 2018). Moreover, many researchers explored new technologies (e.g., additive manufacturing and virtual reality) that support students in the design process (Rias *et al.*, 2016; Lindwall and Törlind, 2018; Richter *et al.*, 2018; Barhoush *et al.*, 2019; Ford and Minshall, 2019; Georgiev, 2019; Barhoush, Georgiev and Loudon, 2020; Hu and Georgiev, 2020, 2020; Hu, Nanjappan and Georgiev, 2021). For example, 3D printing has been applied

in education, which could spark the educators' interests and engagement and enhance students' creativity (Ford and Minshall, 2019).

Although a continued foray into creativity methods applied in higher education (Nutzmann *et al.*, 2019; Marlina, Rahmi and Antoni, 2020; Puspita, 2020), a few studies have indicated that Chinese higher education focused on essential knowledge and skills instead of fostering students' creativity (e.g., Dineen and Niu, 2008). The Chinese education system (an exam-driven knowledge-based education) may result in educators only caring about the students' score in the exam, leading to the development of students who lack independent intellectual exploration and creative thinking skills (Niu and Sternberg, 2001, 2003; Niu, 2007), which inhibits creativity. However, those studies were conducted around 20 years ago, and during the last few decades, China has improved in every regard (Kakwani et al., 2022). Chinese higher education has also changed and cultivated creativity (Wuwei, 2011). For example, although reshaping the educational mechanism is probably the most challenging breakthrough in China's education system today, several universities are experimenting with cultivating creative individuals and industries by establishing new courses and related majors (Wuwei, 2011). That implies that present Chinese higher education fosters creativity in related courses; also, the Chinese students and educators value creativity, unlike 20 years ago.

To our best knowledge, there is still absent a survey to investigate the cultivation of creativity in higher education in China and further explore the difference of creativity cultivating between China and developed countries. The reasons to compare China to developed countries are because higher education is one of the most critical factors contributing to competitiveness, sustainable development, and economic growth (Krstić, Filipe and Chavaglia, 2020). China has been one of the fastest-developing global economies (Kuyucu, 2020), and China's Human Development Index (HDI) ranking was 0.761 in 2019 (United Nations Development Programme, Human Development Reports, http://hdr.undp.org/), near that of developed countries. Based on the previous investigation, there is a positive relationship between higher education and economic growth (Maneejuk and Yamaka, 2021), which implied with the Chinese gross domestic product (GDP) near the developed countries, higher education in China also improved and near the developed countries. The differences in the level of development of countries are evident by GDP or Human Development Index; however, the difference in creativity cultivating in higher education between countries is unexplored. Therefore, we conducted a study based on a questionnaire to answer the research questions (RQs) exploring creativity cultivating in China and comparing it to developed countries to explore the difference in creativity cultivating between them, including:

> *RQ 1. Is there any difference between creativity-related courses in higher education between China and other developed countries?*
> *RQ 2. Is there any difference in motivation for participating in creativity-related courses in higher education between China and other developed countries?*
> *RQ 3. What are the adopted creativity methods and the most effective creativity methods in creativity-related courses of higher education in China and other developed countries?*
> *RQ 4. What is the evaluation of creativity methods in higher education of China and other developed countries?*

By exploring the above RQs, we might identify the degree of emphasis on cultivating creativity in China's higher education system and its present situation and shortcomings. Moreover, it will help China and other developing countries implement educational reforms and progress and encourage students to be creative and create novel products in the future.

2. Study Design

Our questionnaire investigated creativity in higher education by targeting creativity-related courses. The creativity-related course in our study refers to a class within a degree program, which explicitly involves creativity methods or providing creativity training and exercises, or promoting creativity-related activities, such as some examples of application within the design thinking, data visualization, and user-centered product concept design course.

2.1. Data Collection Method

A web-based survey was employed using Microsoft Forms (Microsoft, Redmond, WA, USA), written in English and translated to Chinese by a professional translation company. A seven-page questionnaire was developed and divided into three sections to ask questions related to the participants' experiences and feelings of participating in a creativity-related course, which aims to investigate the situation of creativity cultivating in higher education. We also consulted other researchers who are familiar with creativity-related content or teaching in a university or college, and according to their feedback, we revised the questionnaire and described it as follows, shown in Figure 1.
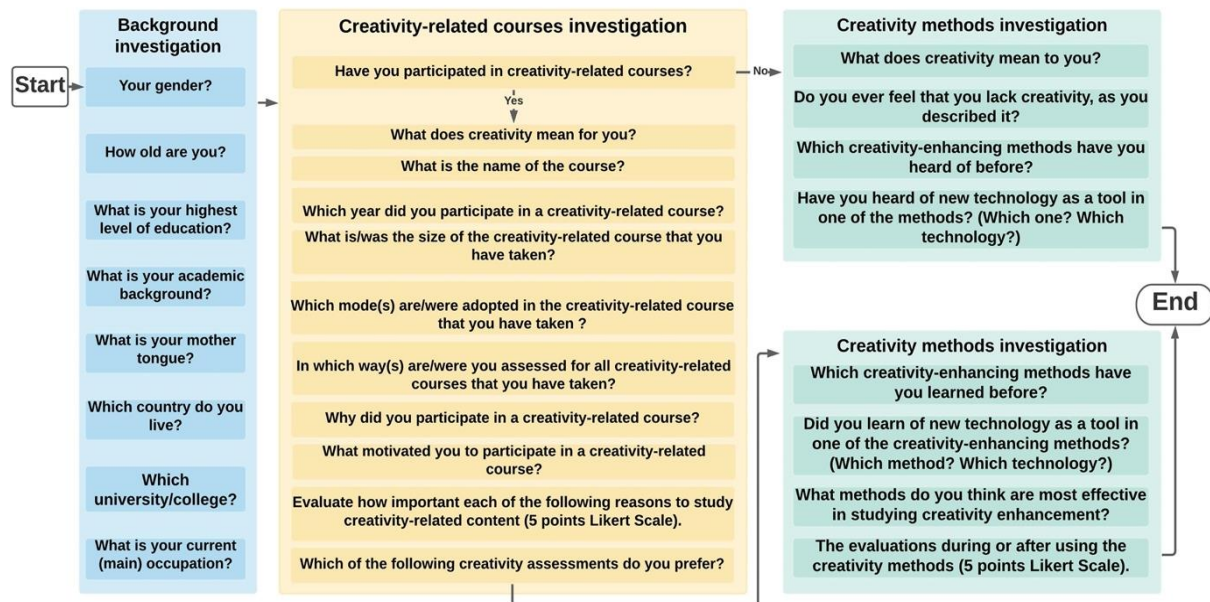

Figure 1. The contents and the sequence of the questionnaire

Background investigation enquired of participants' demographic information, such as gender, age, the highest level of education, academic background, and mother tongue.

Creativity-related course investigation enquired about participants' experiences, which were divided into two branches (participated and never participated in a creativity-related course). If the students participated in the related course, they were required to answer the following questions: the year they participated, the students' number of the course, the adopted model, and the assessments. Participants were also asked to evaluate how important it was to study creativity-related content to evaluate the motivation of joining creativity-related courses, using a 5-point Likert scale.

The last section of the questionnaire investigated the creativity methods used in the related course. The creativity methods were collected from the previous studies (e.g., Saha *et al.*, (2012)). The questions included, "Which methods related to enhancing creativity have you learned before?" "Did you hear about any new technology as a tool in one of the methods (If so, which one?)," and "Which methods do you think are most effective in the class?" Moreover, the participants were asked to answer questions about their feelings and behaviors while using or after using the creativity methods using a 5-point Likert scale. In contrast, if the students had not participated in the related course, they were asked questions such as "What does creativity mean to you?" "Do you feel a lack of creativity?" "Have you heard about creativity methods to enhance creativity?"

2.2. Respondents' Recruitment and Background

Participants were recruited via email and different social media platforms. Over 100 respondents participated in the research. According to our research aim, we set up a few exclusions: 1) The main occupation should be a student or educator in a higher university; 2) The current working or studying country should be in China or developed countries (the Human Development Index over 0.800, based

on United Nations Development Programme, Human Development Reports, http://hdr.undp.org/); and 3) The response time should be longer than 80 seconds (without having participated in a creativity-related course) or longer than 350 seconds (participated in a creativity-related course). Therefore, we excluded 15 company employees, six self-employed or freelance workers, five other occupations, five in undeveloped countries, and three with short response times.

After the first exclusion, we collected 85 valid responses to investigate the participation rate. The ages of respondents ranged from 18 to 60 years. The mean age of respondents is 30.7 years, with a median of 24 years. Twenty-eight respondents were male (32.9%), 51 female (60%), and eight did not specify their gender (7.1%). Around 68% of participants were from China, and 31.8% were from developed countries.

In the second exclusion, we collected 32 valid responses to explore the differences of creativity-related courses in higher education between China and developed countries by excluding 53 responses who had not participated in a creativity-related course. The ages of respondents ranged from 19 to 60 years. The mean age of respondents is 37.56 years, with a median of 14.52 years. Fifteen respondents were male (46.9%), sixteen were female (50%), and one participant did not specify their gender (3.1%). Total 43.8% of participants were from China, and 56.2% were from developed countries, including the United States of America, France, Sweden, the United Kingdom, Finland, Portugal, Canada, Turkey, Japan, Denmark, and South Korea.

3. Results

All statistical analyses were conducted using SPSS 26.0 software (SPSS Inc., Chicago, IL, USA). We used the Mann-Whitney U test (a rank-based nonparametric test) to determine differences between two groups regarding a continuous or ordinal dependent variable. The Mann-Whitney U test is presented as the nonparametric alternative to the independent-samples t-test when the data is not normally distributed (Dinneen and Blakesley, 1973).

3.1. Creativity-related Courses

Creativity-related courses aim to inspire students' creativity and apply creativity methods for creative activities or exercises. The participants reported that they adopted various creativity methods in related courses, such as design cognition, design of everyday things, and architecture and environmental design.

3.1.1. Creativity-related Course Investigation

In response to our questioning, 53 participants responded that they had not participated in the creativity-related course, accounting for 62.4% of 85 participants. When comparing the different regions, the participation rate of creativity-related courses was different. Only 24.1% of 58 participants living in China had participated in creativity-related courses, compared to 66.7% of 27 participants living in developed countries. Therefore, RQ 1 was partly answered - the participation rate of creativity-related courses in China is much lower than that in developed countries.

The assessments between China and developed countries are different based on 32 responses, who had participated in a creativity-related course. Specifically, 21.4% of the responses were no assessment, the same as the multiple-choice test from Chinese students' reports. Written exam, written report, project, and analysis of case studies constituted the remaining share equally (14.3%) from Chinese responses. Conversely, the project was the most popular assessment (31%); in order of popularity, other assessment types were presentations, 26.2%; written reports, 14.3%; analysis of case studies, 9.5%. Written exams, other assessments, and not assessed accounted for 4.8%, while oral exams and lab reports accounted for about 2.5% in developed countries, which partly answered RQ 1 that the assessment methods were different between China and developed countries.

3.1.2. Motivation for Participating in the Creativity-related Course

A 5-point Likert scale (1 = not important at all, to 5 = extremely important) was adopted to evaluate the importance of participating in creativity related content. We ran the Mann-Whitney U test to determine

differences in motivation of participating in a creativity-related course between China and developed countries. The most important motivation was "Creativity enhances one's thinking capability." The differences shown in Table 1 can be summarized. There was a statistically significant difference in the seven sub-categories: 1) Creativity enables me to gain an interest in learning (mean rank score for China = 21.18 was statistically significantly higher than developed countries = 12.86, U = 60.5, z = -2.7, p = .007); 2) Creativity supports necessary skills (mean rank score for China = 21.25 was statistically significantly higher than for developed countries = 12.81, U = 59.5, z = -2.729, p = .006); 3) Creativity enables my freedom of expression (mean rank score for China = 22.25 was statistically significantly higher than for developed countries = 12.03, U = 45.5, z = -3.27, p = .001); 4) Creativity is suitable to my understanding of a related course (mean rank score for China = 20.07 was statistically significantly higher than for developed countries = 13.72, U = 67, z = -2.111, p = .035); 5) Creativity is appropriate learning content (mean rank score for China = 20.64 was statistically significantly higher than for developed countries = 12.28, U = 68, z = -2.306, p = .021); 6) Students are required to enhance creativity (mean rank score for China = 20.39 was statistically significantly higher than for developed countries = 13.47, U = 71.5, z = -2.274, p = .023); 7) Creativity is important for sustainability of development for learning (mean rank score for China = 22.29 was statistically significantly higher than for developed countries = 12 U = 45, z = -3.281, p = .001). Therefore, RQ 2 was answered in that Chinese participants had a more positive attitude for participating in a creativity-related course than that of developed countries with statistical differences.

Table 1. Test statistics of participating motivations of China and developed countries

	Gaining interest in learning	Enhancing thinking capability	Supporting necessary skills	Expressing freely	Solving problems	Understanding related course	Appropriate learning content	Important within course	Requiring to enhance creativity	Sustainability of development for learning
Mann-Whitney U	**60.500**	102.000	**59.500**	**45.500**	120.500	**76.000**	**68.000**	121.000	**71.500**	**45.000**
Asymp. Sig. (2-tailed)	**.007**	.298	**.006**	**.001**	.816	**.035**	**.021**	.839	**.023**	**.001**

3.2. Creativity methods

3.2.1. Adopted Creativity Methods

The results based on the responses, shown in Figure 2, which partly answer RQ 3, are summarized as follows: the most popular creativity methods adopted in creativity-related courses were mind mapping, 13%; brainstorming, 9.4%; thinking outside the box, 8.9%; role-play scenarios, 8.3%; and storyboards, 7.69. However, PRIZ (abbreviation the theory of innovative solution of the problem (Jafarzadeh Ghadimi, Abdoltajedini and Hosseini Nasab, 2020)), 6-3-5, and brain shifter only accounted for around 1.5% of creativity methods; and TRIZ (theory of inventive problem solving (Salamatov and Souchkov, 1999)), insights game, and SCAMPER (abbreviation of substitute, combine, adjust, modify, magnify, minify, put, eliminate, and reverse (Serrat, 2017)) accounted for 2.1% of creativity methods, as shown in Figure 2. Although mind mapping to be chosen by participants was the most frequently used method to enhance creativity in two groups, the typically followed popular creativity methods differed between China and developed countries. The frequently adopted creativity methods for China were brain-writing, brain-drawing, thinking outside the box, and brainstorming. By contrast, the following frequently adopted creativity methods in developed countries were storyboarding, brainstorming, mood boards, and role-play scenarios.
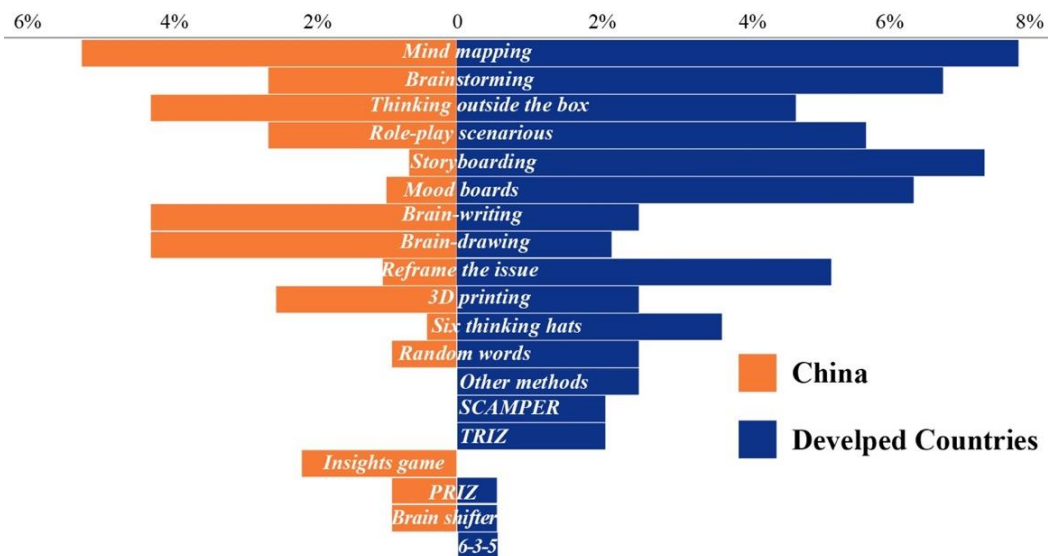
Figure 2. The chart of learned creativity methods between China and developed countries

3.2.2. Most Effective Creativity Methods

The most effective creativity methods in our study refer to the creativity methods perceived as effective methods by participants. There were differences in the most effective creativity methods between China and developed countries. From the participants' perspective, the most effective creativity method in China was brain-drawing and mind mapping (approximately 15%), which was also the second most effective method in developed countries (20.8%), following other methods (e.g., sketching and art-based methods). However, the percentages of brain-writing, brain-drawing, and thinking outside the box were effective as brainstorming in China, but these percentages were much lower than other options like brainstorming, storytelling, role-play scenarios, and reframe the issue in developed countries (Figure 3). In addition, other methods (e.g., sketching and art-based methods) were proposed in developed countries, and 6-3-5 was chosen as an effective creativity method in developed countries, while no one mentioned it in China. Conversely, 3D printing, insights game, random words, brain shifter, and six thinking hats were believed to be the effective methods in China rather than in developed countries (partly answered the RQ 3 regarding the most effective creativity methods).
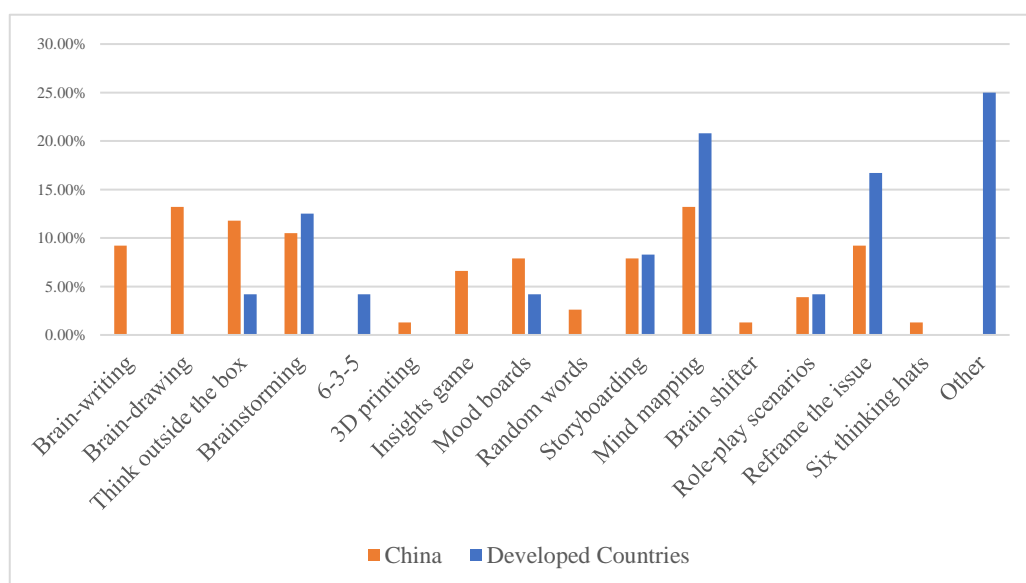

Figure 3. The most effective creativity methods between China and developed countries

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3.2.3. Evaluation of the Most Effective Creativity Methods

The mean of sub-categories was different when evaluating the most effective creativity methods by participants. The highest mean was 4.16, "creativity-related courses improved my creative ability," and "after adopting creativity methods, I felt more enthusiastic." Conversely, the lowest mean was 3.13, "employing creativity-enhancing methods increased my workload burden" - 31.3% of the participants disagreed or strongly disagreed with this statement, and 28.1% were neutral.
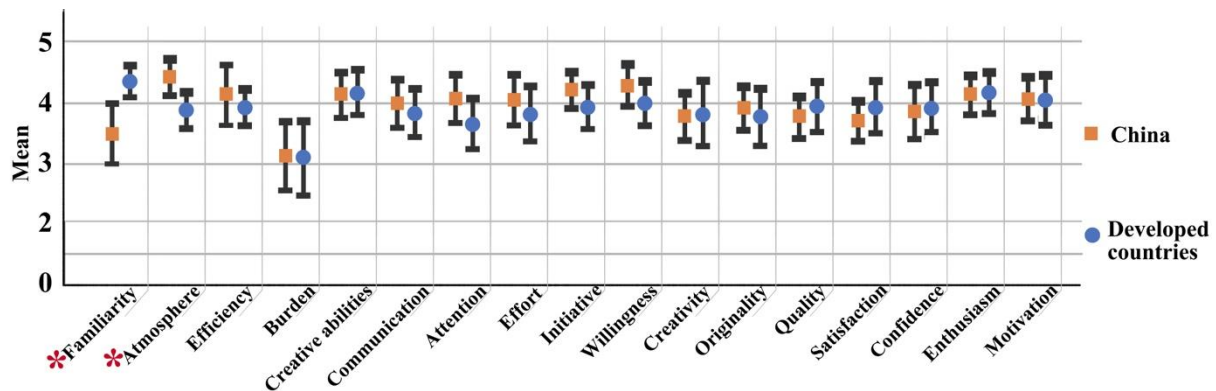

Figure 4. The means of evaluation of adopted methods between China and developed countries

There are two statistically significant differences between China and developed countries are showed in Figure 4 with * signal, which answered RQ 4, including: 1) the levels of familiarity for developed countries (mean = 4.39) were statistically significantly higher than for China (mean = 3.5), U = 51, z = -3.063, p = .002; and 2) the levels of relax and pleasant class atmosphere for developed countries (mean = 3.89) were statistically significantly lower than for China (mean = 4.43), U = 70, z = -2.475, p = .013.

4. Discussion

The participants reported that they adopted various creativity methods in related courses in mainly two types of courses - traditional design courses (e.g., visual communication design, and illustration design and graphic design), and interaction design related courses (e.g., user experience design, interactive systems design, and interaction design). The respondents had a positive attitude towards attending creativity-related courses and practicing creativity methods for their study, work, and research. However, almost all participants from China participated in a creativity-related course from Art and Design. Conversely, participants from developed countries participated in creativity-related courses from various subjects, such as Art, Architecture, Science, and Engineering. Chinese higher education realized the importance of creativity and offered creativity-related courses; however, only in Art and Design subjects. Other subjects were slightly overlooked to foster students' creativity.

However, the Chinese participants had a more positive attitude towards participating in creativity-related courses than those in developed countries in seven sub-items with statistical differences. That means, although the participation rate was lower in Chinese higher education, students and educators value creativity, which differs from previous studies (Niu and Sternberg, 2003; Niu, 2007; Dineen and Niu, 2008). Moreover, the types of assessments in Chinese higher education were not as flexible as in developed countries. The most popular assessment in China was multiple-choice, included in the objective test, mainly for assessing the recognition, strategy, comprehension, and coverage hierarchies of understanding. Conversely, the most popular assessment in developed countries was the project, included in the performance test, and mainly for assessing the needed skills in real life (Biggs and Tang, 2011). Regarding the adopted creativity methods, mind-mapping, brainstorming, and thinking outside the box were the most frequently used creativity methods in higher education. However, there were a few creativity methods that students had not learned, such as C-sketch for all participants, 6-3-5, TRIZ, and SCAMPER in Chinese higher education, and the insights game in developed countries.

Mind mapping was selected in a more significant proportion by participants in both groups who considered mind mapping is effective for creativity enhancement, and the methods followed were

different between China and developed countries. Moreover, few methods were not selected as effective methods. This is understandable because students failed to use all methods; they could only select the effective creativity methods from previous experiences. It does not mean those methods excluded by students are ineffective. It means that higher education might apply more creativity methods to foster students' creativity in teaching. We further asked participants whether they had heard of new technology through the questionnaire, excluding those we had listed. The answers included: virtual reality sculpting, various manual rapid prototyping techniques, coding and AI, 3D visualization software, intelligence community, augmented reality or virtual reality, note-taking tools, and text or drawing combination tools (e.g., for iPad). However, all the responses were from participants in developed countries.

Furthermore, participants favored the effective creativity methods and creativity-related courses, which had a higher evaluation. The results showed that the Chinese participants felt more relaxed and pleased and enjoyed the classroom atmosphere when applying those creativity methods. Other participants from developed countries were more familiar with using creativity methods than those from China, which indirectly verified previous analysis in our study that Chinese higher education offered less creativity-related courses and creativity methods than developed countries.

5. Conclusion and Limitations

This study investigated the differences in creativity-related courses and creativity methods in higher education between China and developed countries. The main findings are summarized as follows: 1) the participation rate of creativity-related courses was different. Only 15 participants from China (24.1% of 58) vs. 18 from some developed countries (66.7% of 27) participated in creativity-related courses, as discussed in section 3.1.1; 2) most of the participants had a positive attitude towards attending a creativity-related course, and the motivation scores were higher in China than in developed countries. Additionally, the seven sub-categories of motivations differed significantly between China and developed countries, as shown in section 3.1.2; 3) the most popular creativity method was mind mapping; however, the lowest applied creativity methods were C-sketch, PRIZ, TRIZ, 6-3-5, and brain shifter, as discussed in section 3.2.1; 4) there were different views about the most effective creativity methods, such as brain-drawing and brain-writing between China and developed countries, as explained in section 3.2.2; 5) the evaluation of sub-categories of the most effective creativity methods were different between China and developed countries, as analyzed in section 3.2.3.

On the one hand, the results indicated that although creativity is essential for all individuals, creativity training in higher education is insufficient. Only 24.1% of students participated in a creativity-related course in China, and all of them were studying Arts or Design. Those who had not participated in a creativity-related course were studying Science, Engineering, Literature, History, Business, Arts, or Education. On the other hand, this study indicated that Chinese higher education students and educators valued creativity, offered creativity-related courses, and applied creativity methods in related courses. Therefore, we suggest that universities might further provide more creativity-related courses for each discipline, for example, by applying various creativity methods during classes to aid students' work and cultivate students' divergent thinking skills.

Concerning limitations, the number of responses and samples is relatively small. First, our research may be prone to selection bias because it may attract people who are particularly interested in creativity and creative methods, such as design educators and students. Second, the response is limited, and participants are from a narrow sample of universities, which might lead our investigation to be limited in coverage; it is better to collect more responses. Thirdly, we did not identify the students and educators, which may have different motivations for participating in creativity-related courses and deserve further exploration.

In the future, we will conduct the experiment by adopting the rarely used creativity methods and exploring their effectiveness. Moreover, we will experiment in different countries and identify whether the students from different countries or with various cultural backgrounds have specific needs or preferences regarding creativity methods, which will contribute to the design creativity, design education, and cultivation of creativity in higher education. Specifically, it will help developing countries reform the education system from cultivating collective knowledge to individual creativity.

Acknowledgement

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