

A Study of Creative Taiwanese University Students in Industrial Design

Chin-Hsiang LIN

Mingchi Institute of Technology, Department of Industrial Design, 84 Gungjuan Rd., Taishan, Taipei, 24306 TAIWAN, clin@mail.mit.edu.tw

Abstract: University professors in industrial design programs have been trained as designers, and have not been trained to teach highly creative students. In addition, instructors of industrial design have not been trained to recognize students' strengths and individual needs. If industrial design programs are to be successful, educators need to better understand the creative characteristics of industrial design students and their perceptions of what contributes to classrooms that enhance creativity. To address this problem, this research study examined the following questions: (1) How do students in an industrial design program identify their creative characteristics? (2) What are the perceptions of students in an industrial design program regarding creativity and successful creative individuals? (3) What are the perceptions of students in an industrial design program regarding learning environments that enhance their creativity?

This qualitative study examined the perceptions of four university students in an industrial design program in Taiwan. Through semi-structured interviews, classroom observations, and document review, the researcher attempted to describe the cultural reality of highly creative industrial design majors.

Additionally, this research revealed specific creative characteristics of the four students. Their perceptions of creativity and successful creative individuals incorporated both Western and Eastern views of creativity. In addition, open, psychologically safe and supportive classroom climates were highly valued as effective environments to enhance creativity. Furthermore, the participants' highlighted a variety of suggestions for college professors to design learning environments and instructional approaches that enhance students' creativity in university classrooms.

Keywords: *Creative Characteristics, Creativity, Industrial Design, Instructional Approaches, Learning Environment, Successful Creative Individuals.*

1. Introduction

Creativity plays an essential role in design education and influences how students perform academically and whether they become successful in their careers. Creativity in industrial designers may look different from expressive creativity. Unlike artists' expressing personal thoughts and feelings, a designer's creation must often address a real world problem rather than be a piece of art; moreover, industrial designers must understand the constraints they face in order to serve the end-users with a better product. For example, theoretical creativity may not emphasize leadership and communication skills; however, designers need to possess both characteristics to promote their new ideas for products so that they, finally, can be successful in their profession.

The purpose of study is to examine what creative characteristics industrial design students perceive they must have in order to be successful. I was interested in learning their perceptions regarding their creative characteristics, and how they viewed successful creative individuals. With this understanding, I may apply my findings to design education programs to enhance students' creativity and assist industrial design educators in creating environments that support creativity.

2. Review of the literature

In order to investigate the creative characteristics of university students majoring in an industrial design department in Taiwan, relevant literature was reviewed, especially the essential personality characteristics influencing creative achievement. In the review of the literature, common creative characteristics were identified, and the essential personality characteristics influencing creative achievement were highlighted. Secondly, since my research examined college students, adult learning styles and adult creativity were also reviewed. Additionally, Taiwanese perspectives of creativity were examined because the findings will be critical to facilitate creative training programs in universities in Taiwan.

2.1 Aspects of Creative Characteristics

Throughout the centuries, philosophers, scientists, educators, and psychologists have made attempts to understand more clearly the creative personality. The questions such as “What is creativity,” “How does creativity occur,” and “How can creativity bring one to one’s highest achievements in life?” have been reoccurring in the minds of researchers. However, there is still no universally agreed upon definition of creativity – any more than there is of intelligence. In examining creative individuals, personality plays a unique role that distinguishes one individual from another. In most dictionaries, the term “personality characteristics” is defined as “the factors distinguishing an individual from the others.” Obviously, creative personality characteristics are the most essential factors that contribute the unique behaviors, attitudes, and thinking styles to a creative individual.

In his classic work, Torrance [1] described many aspects of the creative personality. Some of these include altruism; acceptance of disorder; energeticness; persistence; assertiveness; versatility; withdrawnness, and attraction to the mysterious; unconventionality; independence; oddities of habit; fault finding; discontentedness; stubbornness; sensitivity; and the ability to accept the making of mistakes, and temperamentality. He asserted that creative boys are more feminine and creative girls are more masculine than their less creative peers.

Sternberg and O’Hara [2] asserted that intelligence has been an essential subject of creative personality studies. While reviewing the studies of the correlation between creativity and intelligence, they noted five different assumptions: (1) Creativity is a subset of intelligence; (2) Intelligence is a subset of creativity; (3) Creativity and intelligence are overlapping sets; (4) Creativity and intelligence are essentially the same thing; and (5) Creativity and intelligence bear no relation at all to each other. Despite the differences among these viewpoints, creativity seems to involve synthetic, analytical, and practical aspects of intelligence: synthetic to come up with ideas, analytical to evaluate the quality of those ideas, and practical to formulate a way of effectively communicating those ideas and of persuading people of their value. However, they still emphasized that beyond the basics, it is difficult to find substantial agreement among those working in different fields.

2.2 Essential Personality Characteristics Influencing Creative Achievement

Although there are some common personal qualities found among creative individuals, no research indicates that all creative people are successful. In other words, some creative personality traits play an essential role in a creative individual’s achievement while other personality traits are less important to determining one’s success. For example, scholars believe that most creative people have some degree of humor, but no studies stress that a sense of humor is a necessary characteristic to enhance a creative individual’s achievement. Based on a review of

literature, the following personality characteristics were found as the most likely to influence creative achievement: (1) higher intelligence [3-5], (2) motivation [6,7], (3) open attitude [8,9], (4) attraction to complexity, fantasy and novelty [10,11], (5) leadership [12,13], (6) intuition [14,15] and (7) enthusiasm [13, 16-18].

In addition to the essential creative personality traits, there are other traits accounted for in a number of research studies, such as the ability to use tools and materials effectively, and having a sense of humor [19]. These traits are also considered important personal qualities to creative achievers. They may not directly influence people's achievement, but these characteristics help people develop their interpersonal relationships and/or self-discipline which increase their opportunities to reach higher levels of achievement. A hard-working attitude and enthusiasm, for example, builds a strong mind, and motivates people to solve complex problems. Oversensitivity, for another example, allows people to be more aware of the differences in their daily lives, helps people open their eyes, and develop an open attitude, which is one of the essential factors to becoming creative achievers.

Creative individuals also need different abilities in different domains in order to be successful in a certain area. For example, a product designer needs good communication skills to promote his or her ideas, and a scientist must have solid logical thinking skills to find the optimal solutions among a variety of possible answers. Sometimes, the field-specified disciplines become critical when a creative individual attempts to reach higher achievement. For example, 3-D modeling and rapid sketching skills are essential to a successful creative industrial designer.

3. Methodology

Features of qualitative research designs include flexibility and openness. One important aspect of a qualitative research design is "to remain sufficiently open and flexible to permit exploration of whatever the phenomenon under study offers for inquiry" [20]. In this study, interviews and in-class observations were used to collect data. Additional data was collected through archival document review, including participants' records of design awards, college transcripts and design projects. The data were analyzed using a qualitative data analysis approach as well.

3.1 Participant Selection

The study was conducted from January to June, 2002, in Taiwan. Research data of interviews and in-class observation were collected from one professor's cohort class in the department of industrial design at National Sunshine University of Science and Technology (NSUST) in Taiwan. Undergraduate students who had been studying in the industrial design department for at least three years were the targeted group in this study since they were most familiar with the school's curriculum and the industrial design program.

In order to select the participants for this research, I sought the most creative students in the industrial design degree program cohort through selection using the following three criteria: (1) nomination by former and current instructors, (2) students' (peer group) nomination, and (3) potential participants' archival documents (university transcripts and records of design awards) and products. In reviewing the archival documents, I evaluated design-related awards, academic achievements in studio classes, and instructors' general comments.

3.2 Data Collection

In pursuing my study, I used the following resources of data:

1. document review of the participants' archival documents, including school records, individual portfolios of

their professional study, and the design awarding records.

2. in-depth individual interviews with the participants.
3. individual interviews with the participants' former instructors, current instructors, and their peers; and
4. classroom observations of the participants, documented of extensive field notes.

In this research, the primary source of data collection was in-depth, semi-structured interviews. The semi-structured interviews consisted of open-ended questions design to explore a few general topics to gain information directly from the participants and to develop insight on how the students interpreted aspects of their creativity and their industrial program. A minimum of two interviews were conducted individually with each participant. Each interview took approximately one and a half hours and was recorded. The participants were asked to describe their concepts of creativity, their K-12 educational experiences, and their perceptions of university training in industrial design.

Observations from participants' classes were conducted as well. I observed my participants' in-class performance and their interactions with their classmates to outline their personal traits, external characteristics, and creative behaviors. This time spent in observation in the classroom also allowed me to hold informal conversation with the classmates of the participants, enabling me to obtain more information in order to better understand the creative characteristics and personalities of the students in my study. In addition, I was able to gain insights about the daily performance of the students as well as their interaction with their peers and their instructors.

3.3 Data Analysis and Presentation

In portraiture, the researcher draws out constructs or emerging themes using five types of synthesis, convergence, and contrast. First, the researcher listens for repetitive reframes that are spoken frequently and persistently. Second, he listens for rich metaphors, or symbolic expressions that reveal the way the participants illuminate their experiences. Third, he listens for the themes expressed through cultural rituals that seem to be important to the group. Fourth, the researcher weaves together the threads of data. Finally, the researcher constructs themes and reveals any perspectives that are not consistent with the emerged findings [21].

This five-phase approach to analyzing data in portraiture can be viewed as analytic induction. Analytic induction was a useful and practical qualitative data analysis method in my study since it involved logical and systematic methods of managing data through reduction, organization and discovering relationships. Through the use of analytic induction, I was able to categorize my data and generate findings to address my research questions. The data analysis approach used in this study was best summarized by Lawrence-Lightfoot and Hoffmann Davis [21] as well.

To present the findings of this study, I chose to follow the work of Lawrence-Lightfoot and Hoffmann Davis, and crafted portraits to capture the experiences of my four participants. The portraitist attempts to document and highlight the complexity and detail of a unique experience or place. A researcher who works with portraiture is very interested in the single case because he believes that embedded in the case the reader will discover universal themes; therefore, the more detailed the description, the more likely the reader will be able to identify with the story being told [21].

4. Findings

The portraits of the four participants are illustrated in this section. Following the portraits, the findings are summarized in the end of this section to display the similarity and differences of the four participants' creative characteristics and learning styles. Please refer to the Appendix for a summary of creative characteristics of the research.

4.1 Joy: Fun-Loving, Easy-Going, and Personable

Joy was always an active and outgoing person. Her peers and teachers were all surprised with her energetic lifestyle. Joy was also very imaginative, and this was reflected in not only her design projects, but also her daily life. Additionally, because of her well-maintained interpersonal relationships, Joy's classmates would obey orders under her leadership when she was elected to organize an event for the class or the department. Joy was a friendly and easy-going person to everyone who knew her.

Joy always had a sweet smile on her face, and greeted everyone she met. Her friends commented that Joy's sense of humor could be found anytime anywhere. Observing Joy tell a joke was evidence of her joyful spirit. When she was told a joke in the design studio, her laughter could be heard even outside the classroom. When Joy retold the joke, she presented it comically and in her own dramatic style. Joy had such an outgoing personality and seemed to enjoy everyone she met. When this thoughtful young woman was asked how she had developed her positive attitude and joyful manner, she offered her philosophy of life,

I don't see any reason we can't be happy. Life is short. Even though you see some people as old as 100 years old, it's still nothing compared to the earth, the universe. I think people should be happy every day despite the troubles they face. We can't waste time being sad, and feeling sad won't help us solve problems . . . I love my friends, and I believe they would feel the same way..... We were really like siblings in a whole big family. They were nice to me, talking to me when my products were criticized by the picky instructor. Additionally, they taught me how to improve my designing skills. See, I benefited from the big group of friends a lot. Life is good if you believe life is good.

According to her classmates, Joy was also a "super busy" student. Because of her enthusiasm for group activities, she was usually elected or volunteered to be an organizer of a class or departmental event. Joy frequently emphasized that she loved to be with her classmates, and she believed in the value of close friendships; therefore, she enjoyed organizing social group activities for the class or the entire department. She gathered the whole class together for birthday parties for her classmates each month. At the end of school year, she planned a trip to the beach or a camping trip in the mountains for her class. According to one of Joy's classmates, Joy's reputation as a public-spirited organizer earned her the designation of the "most popular buddy" in her department.

In addition to maintaining good interpersonal relationships, Joy was also a very hard worker. This could be seen in her design work. In order to obtain relevant information for any design project, Joy would spend several days surfing the Internet to find out the rationale for the design. She would look at related products in different stores to stimulate her new ideas. She described how would conduct her own informal research by interviewing customers in local stores regarding why they would purchase particular products. This serious researcher would

question people about whether they were purchasing products because of function, color, style, design or price. After collecting enough information, Joy would spend a great deal of time analyzing the enormous amount of information and then discuss her findings with her instructors.

4.2 Kalki: Innovative, Confident, and Motivated

Kalki was a student who frequently questioned teachers' opinions. While observing his class, I had a chance to witness how he convinced the instructors to accept his design. It was the first stage of the design project, and students had to provide their findings regarding what they wanted to design, what problems were founded with the existing products, and how they would resolve the problem and improve the product. One of Kalki's teammates told me that Kalki was interested in the transportation design, so he and his group were focusing on a "two-wheel moving tool design." They decided to select such an ambiguous theme rather than choose an explicit topic such as "motorcycle design" or "scooter design" because they wanted to avoid being blocked. Kalki said that he was the one who convinced the teammates and the teachers to use this concept to begin their design. He explained,

We spent quite awhile determining the theme to better define what we wanted to do. First of all, we all agreed with creating a product that can help people "move." Then we seven teammates finally narrowed down the various thoughts, and decided to design a "tool" that can help people "move." Meanwhile, most of us suggested that a 2-wheel transportation tool was easier to move and park, so we focused on "2-wheel." However, I suggested that maybe we should avoid using the word "transportation" because there was already a strong image in this vocabulary. We couldn't easily think beyond the limitation due to the definition of the word, while we incubated new ideas. Therefore, we thought "2-wheel moving tools" was the most appropriate one. I mean if things are too clear, then there will be less room for creativity. On the other hand, we can best unleash our creativity if things are chaotic and complex. Ha! Ha! Ha! They all agreed with me.

In addition to the decision making of the theme of the design project, Kalki also provided a solid rationale and plenty of research studies to the instructors when they doubted the efficacy of the power system used in their design. Kalki, patiently, explained why he decided to use Ni-Ca and Ni-MH batteries instead of other types of batteries. Additionally, he showed how new technology could support his design, and make the power system safer to use and faster to recharge. In the face of the overwhelming research based documents, the three instructors did not have too much to say to Kalki, and Kalki seemed to successfully defend his proposal of the design project.

Kalki's hardworking attitude could be found in many different aspects. Kalki did not dedicate himself to schoolwork a lot, instead he spent his time on searching new design concepts and professional trends by participating in various design competitions. Kalki said that he could run 3 to 5 different projects at the same time and prepare his schoolwork as well. Kalki's classmates were amazed by his tight daily schedule and high energy. During two interviews with me, Kalki answered eight phone calls from different people for different purposes. I overheard him explain a design process to a classmate, clarify a few things to another student, and provide his daily schedule to an instructor who needed his help. From listening to his phone calls, I knew that he was running at least two design competitions, organizing an end-of-semester exhibition for the design department, supervising a design project for a design company, arranging a guest speaker for the class, and being a spokesperson for several departmental events. It was apparent that no matter how busy he was, Kalki always looked very energetic

and managed his time efficiently.

4.3 Aurora: Communicative, Thoughtful, and Intuitive

Aurora was the only participant who graduated from a General Program in vocational high school. She did not know much about industrial design before enrolling in the university; however, Aurora earned the highest score on the entrance examination and the applicant evaluation. Although she did not receive any design or art related training in high school, Aurora's talent in art and sketching caught the most attention of the instructors.

Aurora believed that people must be knowledgeable in some field even though they might not perform well in academia. While many students criticized some particular instructors' teaching styles and complained about the curriculum content, Aurora would rather try to accept the instructional approaches and the learning materials in the beginning because she highly valued and respected the instructors' experiences and their academic achievements. Aurora indicated,

I believe an old Chinese proverb, "If three of us are walking together, at least one of the other two is good enough to be my teacher." So, everyone could be my teacher, not to mention the professors in my class. I know some critical teachers don't earn good reputations among students, but I think if I can learn some of their expertise, that's enough. So I always accept whatever teachers say in the class, and follow their instruction to start my research.

To facilitate her learning, Aurora believed that she was a "visual person," and pictures would be helpful to her. Aurora had a strong ability to visualize a new theory she learned. She said that a diagram, a statistical plot, or a flow chart could better facilitate her learning than thousands of words could. While listening to a lecture in the class, Aurora usually sketched some pictures or charts on a piece of paper to help her learn the theory faster. On the other hand, she also had a strong ability to read and interpret a complex diagram. Similar to her "decoding" procedure from constructing a graphic from texts, Aurora's outstanding verbal skills allowed her to convert the pictures to a paragraph of words fluently and accurately.

"Listening to others" had become one of Aurora's ways to learn, and she believed only listening to others' opinion could better know her own products from a customer's viewpoint. To Aurora, if an industrial designer infused too much of their own personality ideas and beliefs without considering the customers' opinions obtained from marketing research, then the product would not be easily accepted by the end-user. Therefore, Aurora believed that having extensive feedback was an essential factor to being a successful industrial designer.

Aurora's humble and calm personality traits were also reflected in her thinking of what constitutes a creative person. She identified a creative person as an individual with a higher E.Q. (Emotional Quotient). She stated, "While I hear that somebody is very creative, I assume that he can control his manner and not to be emotional, or he has both active and quiet personality traits." Aurora also thought that creative people must abound with various ideas, and could easily associate an idea with many other totally irrelevant ideas. Additionally, Aurora defined a creative individual as a "highly inner-directed person." She believed they must have a higher ability of independent study, and a thinking style that allows them to leap from one idea to another. According to Aurora, creative people also have the ability to evaluate everything in their environments. She added, "Most importantly, their ideas and products must be accepted by the mainstream society."

Aurora summarized her thinking on creativity as follows: "Creativity is a natural ability, and everybody has

this ability; however, some people can perceive it, recognize it, unleash it and become very creative while the others do not.” As a future teacher, Aurora insisted that creativity also could be taught and enhanced if the instructor used some appropriate materials and teaching styles. “It is also important that teachers recognize students’ individual differences and apply differentiated curriculum to facilitate students’ developing creativity.”

4.4 Carpenter: Hardworking, Practical, and Enduring

Carpenter was a workaholic according to his close friends. Because he realized his lack of designing skills, Carpenter seized each opportunity to develop his designing ability. For example, while most students would only do a project once in order to accomplish the class requirement, Carpenter spent more time trying to finish the same projects in two or three different ways. He did not think the repeated practices wasted his time; Carpenter believed that his designing ability had been steadily enhanced gradually..

Carpenter highly valued the instructors’ opinion, and each time he finished a new design, he would bring the product to several teachers from different courses to ask for their comments. After spending much time in accumulating the design knowledge and training in designing skills, Carpenter was a good designer and speedy learner in the eyes of his instructors.

Carpenter was also good at logical thinking and had strong analytic skills. Carpenter was always calm. One would hardly ever see any extreme emotion in his demeanor no matter how happy or angry he was. In fact, Carpenter told me that he was hardly ever “very” excited or mad at a person or a situation. Peers and teachers were impressed by his good manners and polite attitude, and they thought of Carpenter as a well self-trained meditator, full of wisdom. Carpenter’s lifestyle seemed peaceful with a steady tempo of performance. His sure-footed way to work and friendly personality had earned him a high reputation for courtesy.

Although Carpenter had planned to be an industrial designer for his future career, he still had some confusion about the design profession; therefore, he often chatted with teachers, and graduates of the program about current professional trends to better prepare himself for his career. Carpenter also participated in many design competitions and earned numerous awards; however, he felt that he still might not be qualified to compete in the mainstream of the profession. I suspected that he did not have strong confidence, and asked him to explain why he felt so insecure about his ability and future. He replied,

I know what I can do, but I think I can't stop improving my abilities if this world doesn't stop changing. Especially in this information era, everything changes so rapidly... That's why I'm always worried about my future. I can't see if I can survive in the changing industrial design profession.

Carpenter’s creativity appeared to be developed and through gradual self-training rather than the result of inherent ability. His introspective personality allowed him able to better understand his strengths and also see his weaknesses; furthermore, Carpenter’s hardworking attitude had effectively enhanced his ability to meet his needs. He said that, “When I entered this department, I found my sketching skill was awful, so I practiced drawing everyday. Now I found my sketches are so much better, and I’m so satisfied with the results.”

Carpenter believed that he could learn a thing or two from people in particular fields although they might not perform well academically. While many students criticized some of the instructors’ teaching styles and complained about the curriculum content, Carpenter preferred to listen to the teachers in the beginning because he

highly respected the instructors' experiences and academic achievements as well. When he read more related references, Carpenter started to conduct some more research to satisfy his curiosity, and judged what was useful to his current study plan and future career goals. He explained his plan,

After determining what to study, I will concentrate on learning the knowledge that most interests me, and then conduct more research and bring up more questions to the class or to the instructors individually. I think that's the way I can learn better.

Carpenter's learning style was more practical than the other 3 participants'. He would rather see an existing substance instead of listening to a lecture with teacher's hands drawing in the air. Carpenter also sensed that he had to develop the mind qualities of abstractness and randomness; therefore, he put much of his efforts into learning design theories and art concepts. Additionally, Carpenter was trying to increase his ability by applying the theories to his design. When he was asked how he planned to achieve this study goal of developing both practical skills and theoretical concepts, he replied,

Because of the difference between the two educational systems, academic and vocational senior high school, I was trained to prepare for a career after graduation, and not taught much about theories. I think somewhere in my brain is still a spread of desert waiting for to be developed, and it's called "theory learning area." Now I pay more attention to learning theories in class. Sometimes, I can't understand the implications of design philosophy or the application of a theory even though I think it is good. However, I don't really mind. I just keep them in mind, and someday, when I have enough experience in design, I'll sense what I have learned, and what the theory means.

5. Summary and Implications

This study revealed creative characteristics of students majoring in industrial design, and their perceptions of creativity and creative achiever; furthermore, the participants' suggestions to learning environments and instructional approaches that can better enhance students' creativity were also generalized in this study. Regarding creative characteristics, while they expressed various individual personalities, the 4 participants demonstrated some similar creative characteristics: 1) leadership, 2) willingness to change and enthusiasm for invention and design, 3) hardworking attitude and high motivation, 4) having broad interests, and 5) the ability to see things differently than others. Additionally, both Western and Eastern views of creative characteristics were recognized in this study.

To these four creative design students, there is no universal definition to describe creativity; they tend to view creativity as a process, ability and type of energy. Although they are flexible in defining creativity, they feel some moral concern should be involved to define a successful creative individual. Additionally, this study also finds that personal design style, communication skill, and interpersonal relationships play an essential role to a creative individual's achievement in an industrial design department. Therefore, I would suggest that instructors in design programs work toward enhancing these abilities in their students to prepare them for future success in their design careers.

Undoubtedly, in contrast to the theoretical academic fields, industrial design departments need to offer more applicable, practical and realistic subjects to students. All four of the participants believed that practical courses

would better develop their professional abilities and prepare them for their future career following graduation from the university. In addition, the four participants had fairly similar answers when asked how they thought instructors could help enhance their creativity and learning interests. They all wished that teachers would listen to students' explanations of how they designed their products, and how they thought their products were creative and helpful in solving problems. They wanted the instructors to function as facilitators to help students learn better, and not to frustrate students' motivation. In addition, they believed that in order to give appropriate advice to students, teachers should recognize students' strengths and weaknesses.

To conclude, most university professors in industrial design programs have been trained as designers, and have not been trained to teach highly creative students. In addition, instructors of industrial design have not been trained to recognize students' strengths and individual needs. If industrial design programs are to be successful, we need to better understand the creative personalities and characteristics of industrial design students. Once we better understand these perceptions, we will be able to develop industrial design programs that enhance their creative talents and likelihood of being successful. With this knowledge, educators will be able to create psychologically safe environments with appropriate curriculum and instructional approaches to nurture creativity in industrial designers.

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APPENDIX

Appendix A. Summaries of creative characteristics of the research.

Participant	Joy Fang	Kalki Young	Aurora Wu	Carpenter Liu
Similar Creative Characteristics	Leadership, Willing to change, Inventive, Good at designing things, Hardworking attitude, Broad interests, Motivated, Open mind			
Individual Creative Characteristics	<ul style="list-style-type: none"> ■ Imaginative ■ Logical ■ Outgoing ■ Practical ■ Questioning ■ Sense of Humor 	<ul style="list-style-type: none"> ■ Abstract thinking ■ Artistic ■ Disagree with teacher ■ Divergent thinking ■ Expressive ■ Imaginative ■ Intuitive ■ Questioning ■ Sense of humor 	<ul style="list-style-type: none"> ■ Abstract thinking ■ Divergent thinking ■ Endurance ■ Intelligent ■ Intuitive ■ Logical ■ Reasoning 	<ul style="list-style-type: none"> ■ Artistic ■ Intuitive ■ Quiet ■ Logical ■ Practical ■ Reasoning
Learning Styles	<ul style="list-style-type: none"> ■ Visual learner ■ Prefers concrete and practical knowledge ■ Leaping thinking style 	<ul style="list-style-type: none"> ■ Prefers chaos ■ Enjoys finding order in his own way ■ Appreciates ambiguity ■ Highly intuitive 	<ul style="list-style-type: none"> ■ Visual learner ■ Able to visualize theories ■ Prefers diagrams ■ Sensitive to symbols ■ Highly respects expertise 	<ul style="list-style-type: none"> ■ Appreciates practical ■ Highly respects expertise ■ Prefers to follow teachers' instructions to learn
Strengths	<ul style="list-style-type: none"> ■ Spatial ■ Logical and analytic 	<ul style="list-style-type: none"> ■ Spatial ■ Intuitive ■ Communicative 	<ul style="list-style-type: none"> ■ Verbal skills ■ Logical and analytical 	<ul style="list-style-type: none"> ■ Spatial ■ Logical and analytic

Appendix B. Summary of participants' perceptions of creativity and successful creative individuals.

Participants	Definition of Creativity	Perception of Successful Creative Person
Joy Fang	<ul style="list-style-type: none"> ■ Cannot be valued ■ Creativity is all equally valuable ■ Effects of creativity are different in terms of degree ■ Ethical acceptability ■ Everyone is creative ■ Novelty ■ Originality 	<ul style="list-style-type: none"> ■ Self-aware of creative ability ■ Accepted by society ■ Friendly ■ Humble ■ Open-minded
Kalki Young	<ul style="list-style-type: none"> ■ Acceptability to end-user ■ Imagination ■ Novelty ■ Originality ■ Result of having an open mind 	<ul style="list-style-type: none"> ■ Pure-minded thinking style ■ Personal designing style ■ Open-minded attitude ■ Superior communication skills ■ Good interpersonal relationships
Aurora Wu	<ul style="list-style-type: none"> ■ Flexibility ■ Free-Association ■ Intuition ■ Originality ■ Result of having an open mind 	<ul style="list-style-type: none"> ■ High EQ ■ Listening to others ■ Superior communication skills ■ Good interpersonal relationships
Carpenter Liu	<ul style="list-style-type: none"> ■ Acceptability to the most people ■ Flexibility ■ Novelty ■ Originality ■ Reflection of one's thoughts 	<ul style="list-style-type: none"> ■ Acceptability to most users ■ Superior communication skills ■ Good interpersonal relationships ■ Personal designing style

Appendix C. Summary of participants' perceptions of learning environments to enhance students' creativity.

Participants	Psychological and Physical Environment	Curriculum Contents and Instructional Approach
Joy Fang	<ul style="list-style-type: none"> ■ Open climate for discussion ■ Flexible furniture ■ Discussions in a big group ■ Furniture can't be too comfortable ■ Traditional classroom can better get attention 	<ul style="list-style-type: none"> ■ Teacher can't be too critical ■ Curriculum should be applicable and practical ■ Instructors' knowledge must be most up-to-date ■ Guest speakers can help bring new info from the real world
Kalki Young	<ul style="list-style-type: none"> ■ Open climate for discussion ■ Some small group discussion ■ Isolated room for independent study and incubating ideas ■ Physical environment does not matter 	<ul style="list-style-type: none"> ■ Teachers can't be too critical ■ Encourage students to be creative ■ Emphasize the practical design skills and their usages ■ Listen to students' thoughts about their design ■ Teachers can't be too assertive ■ Teachers can admit what they don't know ■ Curriculum should be integrated
Aurora Wu	<ul style="list-style-type: none"> ■ Open climate for discussion ■ Some small group discussion ■ Semi-open working space 	<ul style="list-style-type: none"> ■ Recognize students' strengths and needs ■ Some instruction can help initiate learning ■ Listen to students' thoughts about their design ■ Encourage students to be creative ■ Curriculum must be practical ■ Curriculum should be integrated
Carpenter Liu	<ul style="list-style-type: none"> ■ Open climate for discussion ■ Isolated room for independent study and incubating ideas ■ Visiting design companies 	<ul style="list-style-type: none"> ■ Curriculum must contain both practical and theoretical ■ Guest speakers can help bring new info from the real world ■ Pay attention to students' progress ■ Teacher should update knowledge more often