

Exploration of Design Thinking in General Knowledge Courses

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Abstract

This research explores the introduction of design thinking in general university courses as a way of helping non-design students discover creative self-confidence, think outside the box, and solve practical problems. Two groups of Business Management and Hospitality students were introduced to the design thinking was over the course of fifteen weeks, followed by reports and final present. By the end of the initial fifteen weeks, the students' ability to grasp the design thinking, it was demonstrated when they were able to express their ideas confidently, conceptualize them via diagrams and drawings, then create a prototype using various materials. Inculcating design thinking to general course can lead the students with different learning experience and thinking approach, and able to achieve the purpose of cultivating cross-disciplinary talent, whereas the instructor and learning environment can be improved, a better learning environment can be more conducive for design thinking and cultivation of ingenuity.

Keywords: Design thinking, general knowledge courses, design education, creative

1. Introduction

The cooperative learning model is the most appropriate teaching strategy for students from non-art-related departments when cultivating their creativity. (Hsieh, 2017) The author of *Change by Design*, Tim Brown (2010) proposed that “reforming everything starts with design”. It refers to the process of analytical and creative problem solving and all the steps involved such as generating ideas, building prototypes, testing the prototypes, obtaining feedback, and integrating new feedback into the original design.

Stanford University d.school students of various learning backgrounds brainstormed problem-solving ideas, and discovered their creative confidence via design thinking. IDEO founder David Kelly was of the opinion that innovation began with looking, and that design thinkers were always observing. Business Weekly article “Lack of Imagination is Brain Deception” brought up the idea of forcing different methods of perception and visual understanding in order to foster new insights. Mark Twain suggested ‘education’ as the key to combining critical thinking and creativity. Another method of stimulating the mind would be to use new experiences to trigger the brain. Einstein once said “Imagination is more important than knowledge because knowledge is limited but imagination is infinite”. Passmore (1985) (Passmore 1986) was of the opinion that imagination had the ability to surpass the limits of experience and that educators should provide students with alternative school of thinking, and diverse life experiences in order to provide the needed external stimulus. Creativity is limitless purely because it is based on limited knowledge. Varying experiences allows for varying stimulus, which in turn allows more room for imagination. Thinkers, economists, inventors, companies have all used thoughts, inspiration, and creativity that stemmed from certain stimulus in order to solve problems. Creativity in design offers people feasible and practical solutions (Dewey 1929).

Design thinking involves the combination of a creative thought process that combines the mental, physical, and material to produce something new (Chen and Chen 2004), showing that design thinking is based on creativity. In 2014, the Taiwanese government advocated two-way learning, showing that they attached importance to the cultivation of thinking ability among students. In the current age of data explosion, design educators have an important role in guiding the thoughts, ideas, and execution of design. Lin Rongtai (2010) mentioned, as a preface to the changes that design wrought across the world, that even though Taiwan’s design thinking was rapidly expanding and developing, design students tended to favor speed in design and creativity instead of the depth of design thinking. Award-winning designs are commendable, but designs that

do not win awards may be more innovative or exhibit more creativity. Lian Chaoyun, Xu Yuling, Liu Yudong, and Li Yuanrong (2011) believe that design education should keep up with the times, continuing to refine and innovate via academic research and practical applications. Compared to a person's inner thoughts, stimulus from physical objects and societal environment are easier to grasp, making them easier to convert into feasible, concrete teaching strategies. In essence, creativity in design thinking is an important assessment and indicator that can solve existing problems.

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Woodman, Sawyer and Griffin (1993) defined organizational creativity among individuals as a complex social system. Through cooperation, valuable and useful products, services, ideas, or operating procedures have been established. According to American Business Weekly 2006, business education – currently highly valued by the industry – will eventually be replaced by innovative design education that emphasizes design thinking. Tim Brown (2010) mentioned that in the era of digital technology and knowledge, product innovation is not something that can be completed by industrial designers or product engineers alone. Aside from a complete professional team, participants with innovative thinking skills are required in order to achieve comprehensive and novel product design. In education, design educators are both guides and gatekeepers. They have to provide guidance and stimulus while maintaining a certain standard of assessment, which will affect a student's creativity on design thinking.

In Taiwan many universities do not include design thinking as part of their general education

courses as it is considered less relevant for non-design students. However, it is hypothesized that students can learn and benefit from design thinking regardless of their learning background. This article aims to explore the possibility of introducing design considerations in general education courses of universities as well as explore the efficacy of introducing design thinking to non-design courses or departments.

2. Design think

In his 1969 seminal text on design methods, “The Sciences of the Artificial,” Nobel Prize laureate Herbert Simon outlined one of the first formal models of the Design Thinking process. Simon's model consists of seven major stages, each with component stages and activities, and was largely influential in shaping some of the most widely used Design Thinking process models today. There are many variants of the Design Thinking process in use in the 21st century, and while they may have different numbers of stages ranging from three to seven, they are all based upon the same principles featured in Simon’s 1969 model. Tim Brown (2008) described design thinking as: “a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos. By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold and supported. He believed that design thinking should be an on-going process that changed with time in order to keep up with people’s needs and if possible, anticipate those needs as well. Industrial and commercial designers use design thinking in order to meet the consumer needs when designing and/or new products or services.

2.1 Design Thinking Process

IDEO is one of the world’s top ten creative companies that applies a human-centered method of design thinking, which makes it an innovative consulting company. Companies such as Acer (Taiwan) and Samsung (Korea) have adopted IDEO’s design flow process. The CEO of IDEO, Tim Brown, believes that design thinking should be used to help solve problems, and capitalize on change. According to him, design thinking is a people-oriented method that takes into account demand, behaviours, and the feasibility of a business or technology, emphasizing the fact that design thinking is a systematic innovation (Tischler 2009). David Kelly, founder of IDEO, spent eight years persuading the Hasso Plattner Institute of Design, Stanford University, California to incorporate design thinking in other non-design related fields of study via a program called “Taking

Design Thinking to Schools Research Program”. Students from fields such as business, law, education, medicine, and engineering were all welcomed to participate as diversity was considered a good thing. The design thinking process was developed and used as a way to develop better products and services that focused on the needs of the end user. Human-centered design involves observation and development of a deep understanding of how people use a product and interact with it, and the role the product plays in their lives. (Coleman, 2016)

Other literature has also supported the importance of design thinking. Simon (1969) believes that design thinking is a practical and creative problem solving solution that can improve outcomes in the future. Cates (1979) believes that creativity is a thinking ability that has an elasticity capable of breaking old thinking patterns. Li Renfang (2010) proposed that a real design thinker does not merely design, but also lives in design. Design thinking is focused on ideas and needs that complement each other; it shows the progression from idea to development to prototype, thus creating a moving experience-based design. Vande Zande (2007) believes that design thinking is a process of creative problem solving that links thoughts and actions. A study done by Goldman & Roth (2010) on high school students showed that design thinking improved the students’ imagination, increasing their creativity and confidence, thus empowering them to change the future.

Design Thinking is a design methodology that provides a solution-based approach to solving problems. It’s extremely useful in tackling complex problems that are ill-defined or unknown, by understanding the human needs involved, by re-framing the problem in human-centric ways, by creating many ideas in brainstorming sessions, and by adopting a hands-on approach in prototyping and testing. Understanding these five stages of Design Thinking will empower anyone to apply the Design Thinking methods in order to solve complex problems that occur around us — in our companies, in our countries, and even on the scale of our planet. The five stages of Design Thinking, according to d.school, are as follows: Empathise, Define (the problem), Ideate, Prototype, and Test. The process can be illustrated as in Figure 2, it’s a non-linear process. Rikke Friis Dam and Yu Siang Teo (2020) define the five different stages of Design Thinking:

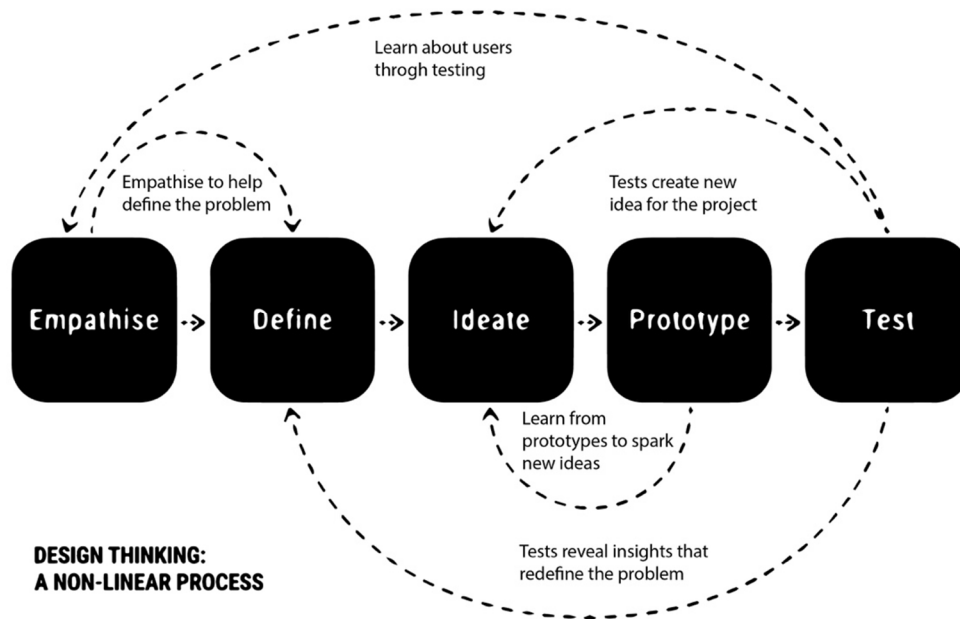


Figure 2. design thinking process

- i. Empathise: The first stage of the Design Thinking process is to gain an empathic understanding of the problem you are trying to solve. (Stevens, 2019)
- ii. Define (the Problem): During the Define stage, you put together the information you have created and gathered during the empathise stage.
- iii. Ideate: During the third stage of the Design Thinking process, designers are ready to start generating ideas.
- iv. Prototype: The design team will now produce a number of inexpensive, scaled down versions of the product or specific features found within the product, so they can investigate the problem solutions generated in the previous stage.
- v. Test: Designers or evaluators rigorously test the complete product using the best solutions identified during the prototyping phase.

2.2 Design Thinking and Creativity

A design may stem from design thinking, but creativity required for creative thinking and continuing the creative process. Hence, the two process complement one another. West (2002) suggest that the process of creating activities can be a type of idea generation and idea implementation. This concept of creativity is similar to IDEO in a sense that it can be divided into

several components, such as the '4P' - person, product, press, and process – described by Rhodes. According to him, creativity does not just involve people and products, but also the press (the environment), and the process of creativity.

Farley (1981) indicated that students would develop creative behavior given the right motivation and the appropriate social support. As such, it can be seen that the environment is a guiding element. Karwowski & Soszynski (2008) mentioned that the teaching of imagination must be combined with student interests and habits, and then developed with role-playing games. Similarly, Liang Chaoyun et. Al (2011) showed that a group atmosphere had a great impact on the imagination of students in the design department. Mentioning past cases, or volunteering information helped to fuel imagination. Diverse thinking, freedom of expression, student-teacher interaction, and individual experiences were all social and environmental factors that drove imagination.

2.3 Benefits of Design Thinking

The standard educational system that focuses on rote learning, memorization, and only targets standard answers may easily cause students to lose their ability to think. The ability to think and adapt is crucial in creating products that exceed expectation and meet user needs.

Csikszentmihalyi & Wolfe (2000) believed that systematic theory can be used to interpret the phenomenon of student creativity, and teachers were the important creative gatekeepers for students. Lin Weiwen (2011) believed that teachers played an important role in the process of cultivating creativity in students. In order to promote diverse answers and create a pluralistic future, it is crucial to develop design thinking ability among students, a process that requires involvement from teachers. Schrage (1999), MIT Media Lab found that 'Serious Play' is a company that's best at stimulating innovation due to their core values, which prioritize people-oriented design thinking. IDEO design director David said that aside from natural products, all human-made designs had room for improvement.

In Mayer, RE (1999), most scholars agreed that the process of creativity and innovation involved ideas and physical items. The output of design thinking could result in novel and useful ideas and products, and the ability to engage in creative problem solving. Taylor (1958) also emphasized that creativity had to be practical in addition to having unique features. This meant that designers had to solve a problem and profit at the same time.

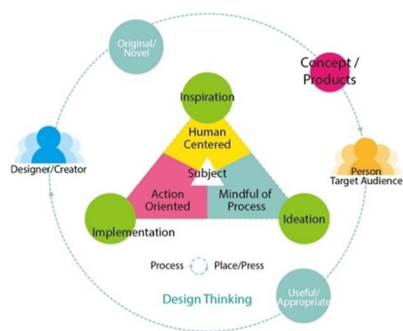


Figure 3. The “3I” Innovation Space and Assessment Cycle Diagram

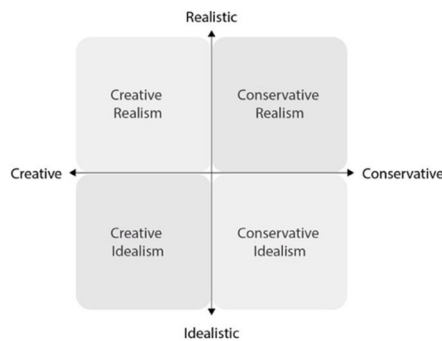


Figure 4. Model of differentiation of creative ideas.

Finke’s (1995) creative concept differentiation model in Figure 3 examines the results generated by design thinking from a practical point of view. Although the process is unconstrained, the result is rooted in practicality and rationality. Educators may use assessments and peer nominations in order to assess the dimensions and attributes of a project as shown in Figure 4. Based on figure 4, design thinking ideas can tend to be creative or conservative, or realistic or idealistic. The more creative an idea, the less conservative it will be. Similarly, the more realistic an idea, the less idealistic it will be.

2.4 Design thinking in General Education Courses

The concept of general education courses originated in the 19th century when the rise of Western society led to the development of research universities, and institutes of higher education. Since the education provided was highly specialized, the knowledge imparted was severely fragmented. To remedy this, experts suggested the implementation of general education courses. These courses would cultivate independent thinking and understanding of different disciplines so that students could integrate different fields of thinking and ultimately cultivate a complete individual. There are two layers to general education: the first is that through a generalized educational course, students would be able to learn and freely expand their knowledge; the second is a holistic personal education where the person is the focus and emphasis is placed on moral values, personality, and societal integration.

One of the general education courses can be traced back to 1958 when the ministry of education introduced ‘University General Education Courses’. In 1984, the ministry of education announced ‘Elective University General Knowledge Courses with Key Implementation Points’. Taiwan’s ministry of education promoted reform in general education and started the ‘Development

Plan for Modern Citizens' in 2011 to help citizens adapt to challenges of the 21st century. Citizens have to focus on important issues in the country and around the world, actively participate in public affairs, and perform community service to give back to society. The general education courses no longer focused on teaching extensive amounts of knowledge, instead aiming to forge core competence, develop multiple styles of thinking, improve teamwork, communication and coordination, value judgement, problem solving, and taking action. The change implicit to explicit knowledge in design thinking and innovation can continuously improve product innovation in different fields. (Nonaka and Takeuchi,1995) Members with different backgrounds, experiences, or knowledge will impact team creativity in varying manners. When tacit knowledge is changed into explicit knowledge, the team involve d has to import the corresponding design practice processes, provide incentives, and a good environment, all of which are conducive to improve creativity and the execution of design education.

2.5 Cross-Sector Education

Cross sector education was derived from increasingly complex social structure and information technology. It is a process that involves integration and reorganization of information and knowledge.

Students from the same department study similar courses (Hou, 2007). General education courses can provide bigger and better perspectives to students, but at the same time may pose a challenge to the integration of cross-sector education (G. Legrady, 2006). Fruchter (1998) and Ke (2009) pointed out that the purpose of cross-sector education was to promote the usage of theoretical knowledge in different areas, invest in teamwork communication, and implementation ideas. Tangxuan Hui, Lin Yingqian (2011) proposed that the method of cross-sector education and collaborative design were methods that could help design students and non-design students learn to work together and improve themselves, thereby increasing the novelty of the design. Cross-sector interactions contain too many unstable variables that can be calculated. However, all cross-sector interactions will require creativity and results.

In accordance with the above the practical courses were designed based on practical operations, feasibility, and efficacy of cross-disciplinary non-design background students in the application of design thinking models for general education courses.

3. Methodology

Design is a purposeful creative work. Being "creative" generally refers to the continuous activities of transformation that creates, renews and manifests things (Ho, 2011). Design evolves recursively or iteratively. Apart from the development of various professional skills, thinking training is an important link in design education. Starting from the latent stage when topics are obscure, people are guided to think for a more specific idea; design educators are to train future designers, so they must respond appropriately to the needs of the times. In 2005, the design community transformed the world by introducing the concept of design thinking into the institute of design of Stanford, changing the original cultivation of talents with professional skills to the cultivation of cross-disciplinary talents who attach equal importance to thinking and hand-work. This concept also confirms that the cultivation of creativity is an important mission of design educators in design education. The process includes the cycle of planning, action, observation and reflection. Researchers need to connect past experience with future action (Carr & Kemmis, 1986; Grundy & Kemmis, 1981). Action research (figure 5.) focuses on course development including planning, design, implementation and evaluation of courses, emphasizes the discovery of and solutions to problems in the process of implementation, and improving curriculum quality through feedback on practice (Lin, 2002; Tsai, 2007).

This study uses the Design Think process to guide students to face problems in life. It will use the core structure in the process to think out of the traditional Taiwanese spoon-feed education system and the traditional mode of unilateral teaching. This study will demonstrate the learning results at the end of the semester and present the participation levels of the participants. We use action research (figure 5) makes the problem of practical teaching more specific. (Chen and Pan, 2019)

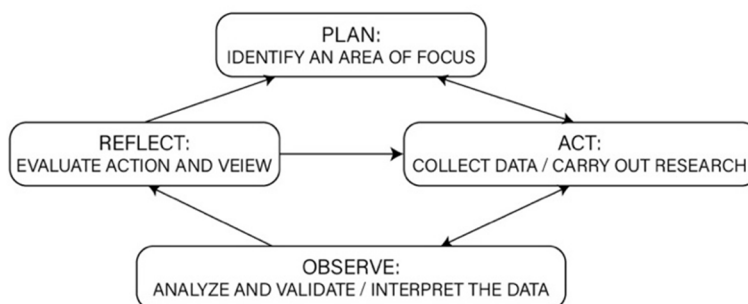


Figure 5. The action research process

Design thinking was a 'people oriented' school of thought commonly utilized by industrial and commercial designers during the design of new products and/or services. The Focus was placed

on two groups of students with non-design learning backgrounds who enrolled in the cross-disciplinary course 'Creation and Life'. This course was designed with design thinking as a basis and was adjusted to fit the direction of each group. Open-ended questions were used to facilitate discussion. Students were encouraged to participate and share their thoughts, ideas, inspirations, and concepts. The study will try to explore the possibility and effectiveness of the implementation of design thinking in the general education curriculum in a project-learning mode.

Course members

The study avoided students with design-learning backgrounds. A non-design department general education course – 'Creativity and Life' was chosen. The students enrolled in the course were those who were in their second year or more, and came from 13 different majors, all of which were based in business management, food and beverage, or hospitality. Two professional lecturers (One from visual design, another from product design), five non-design professional lecturer, and five extra-curricular students were invited to join the course as evaluators. In total, there were 12 people on the evaluation panel.

In the end, there were a total of 90 students who completed the entire course. Students from the first semester were given the code 'A' while students from the second semester were given the code 'B'. Each semester had a total of nine groups.

3-2. Course content

The course content was designed based on design thinking. The 100 minute weekly class was designed to inculcate students with tools commonly used in design thinking. Students were taught to use observational skills, roleplaying, field studies, cultural experiences, dissemination of inspiration, daily logs, brainstorming sessions, mind maps, sketches, drafts, and prototypes during the course. At the end of the course, the 12-person panel evaluated the prototype or solutions according to originality and usefulness.

3-3. Course restrictions

Over the course of the semester, there were limitations in practical operations. In addition, laws and regulations indicate that the exact processes and content from design thinking cannot be implemented. As a result, this study was restricted by the following conditions:

- i. 25-60 students in a limited number of classes;
- ii. Business management and hospitality students make up the entirety of the class;

- iii. The elective is constrained by 2 credits, which amounts to 100 minutes per class;
- iv. As a general education course, classes, discussions, productions, and performances are all restricted to general classrooms only.
- v. The duration of each semester is 18 weeks. However, due to the enrolment system, only 15 of those weeks consist of lecture weeks, a short interim, and exams. In order to maximize the amount of time spent on the project, a general flow was established.

3-4. Method of conducting

Figure 6 shows the general flow of instruction during the semester. In the first three weeks, the course outline and expected outcomes were explained to enrolled students. This was done to prevent students from dropping out because the course differed from their expectations. After the number of students was finalized, they were divided into groups of four or five. The students were then guided on how to use their observations and daily logs to discover problems in their daily life. Next, they were asked to use the design thinking process to discuss the problem in question, visualize the problem, and conceptualize possible solutions.

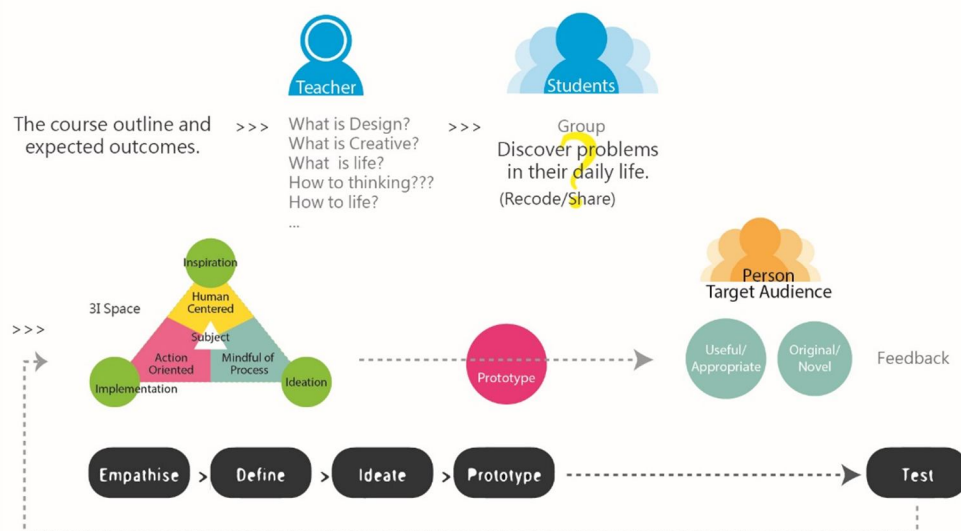


Figure 6. Flow of instruction during the semester

4. Results

As 'Creativity and Life' was a general education elective course, students had to select the course in order to enroll. Facilitators communicated with the students several times over the course of the first three weeks, explaining the course content, the mode of operation, and the importance of the mentality behind the design thinking process.

The twice weekly meetings were not nearly sufficient for an in depth discussion. Hence, the course had to be conducted in a more linear fashion. The first three to four weeks of lecture were dedicated to illustrating the relationship between the design thinking and people. Students learned about various problems and

solutions from records, visits, and observations. Students were also taught horizontal thinking – such as mind mapping and brainstorming – as creative thinking tools that could help conceive, consolidate, conceptualize, and then create the prototype.

Each group was asked to observe a solution to a problem and then conceive ideas on how to solve it. These ideas were executed, tested, and then presented at the end of the semester. After the course ended, participants were asked to share their experience in the class in order to gain a better understanding of design thinking education from a student's point of view.

After repeated evaluations, reflections, and adjustments, each group sent a representative to explain the concept and usage of their design to the facilitator. A score system of 1-10 was used to evaluate the originality and usefulness of each prototype. Only scores above 5 demonstrated originality and usefulness. Designs that met the facilitator's expectations were given a 7 whereas designs that exceeded expectations were given a score of 8 or more. Design outputs are classified into three categories: modular, extrapolation/extension, and novel concept. Modular designs are designs that combine two different types of products/systems ($S \rightarrow A + B$); Extrapolations or extensions refer to in-depth or extensions based on a single or existing concept ($S \rightarrow S_1, S_2, S_3$); whereas novel designs are those that are not attached to or based on an existing product or system ($A, B \dots \rightarrow C$). The design outputs were also classified according to whether it was creative, realistic, idealistic, or conservative.

After evaluation and assessment, the designs were classified into modular, extension, and novel and summarized as in table 1.

Table 1. Evaluation results of design concepts based on originality and usefulness in addition to prototype material.

Group Number	Theme	Originality	Usefulness	Prototype material	Inspiration
A1	USB mobile phone strap	3.6	5.8	Clay	Modular ($S^a + S^b \dots$)
A2	Finishing invoices	5.6	6.8	Paper material	
A3	Carousel	8.1	7.1	Composite media	Modular ($S^a + S^b \dots$)
A4	Mobile phone holder	3.2	6.3	Paper material	Extension ($S^{a1, a2 \dots}$)
A5	Portable shrimp peeler	8	7.2	Composite media	Modular ($S^a + S^b \dots$)
A6	Alarm clock	6.8	4.8	x	Extension ($S^{a1, a2 \dots}$)
A7	Multifunctional bag	5.8	6.9	Cloth material	Extension ($S^{a1, a2 \dots}$)
A8	Simpler pen	8.2	7.9	Paper material	Modular ($S^a + S^b \dots$)
A9	Gloves combined with cloth	8.5	8.4	Composite media	Modular ($S^a + S^b \dots$)
B1	Garlic cutting	5.2	8.1	Composite media	Extension ($S^{a1, a2 \dots}$)
B2	Outfit picker application	4.2	6.1	Composite media	Extension ($S^{a1, a2 \dots}$)
B3	Mood bag	3.6	6.4	Composite media	Extension ($S^{a1, a2 \dots}$)
B4	Multifunctional oven	6.8	5.6	Paper material	Extension ($S^{a1, a2 \dots}$)
B5	Facial mask	4.4	7.3	Cloth material	Extension ($S^{a1, a2 \dots}$)
B6	Transparent refrigerator	8.3	9.0	Composite media	Modular ($S^a + S^b \dots$)
B7	Multifunctional Spice Jar	5.9	5.8	Clay	Extension ($S^{a1, a2 \dots}$)

B8	Dessert bag	7.9	8.2	Paper material	Modular ($S^a+S^b...$)
B9	Drip-free ice-cream	6.8	5.4	x	Extension ($S^{a1, a2...}$)

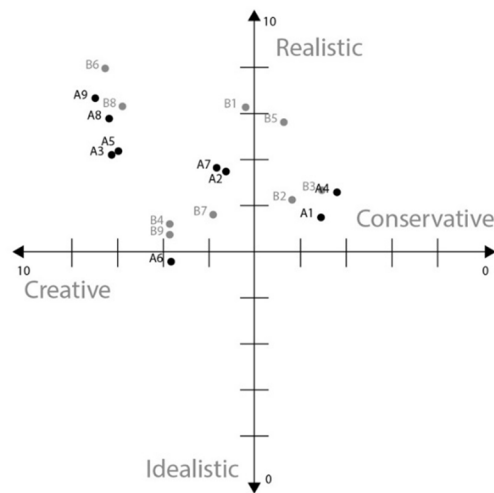


Figure 7. Classification of ideas based on creative, realistic, conservative, and idealistic traits.

As shown in the diagram (figure 7), the majority of the students produced designs that were more realistic than idealistic. Five of the groups proposed designs that were considered more conservative, whereas 13 groups leaned towards the creative side. Only group A6 proposed a design that was creative-idealistic.

From the analysis, we can see that in this course, a process through design thinking, reaches the expectations of originality and usefulness for non-design background students. It proves that design thinking is not limited to design. The thought process is a human-centered activity. If you can combine it with prototype to test an experiment's, "usefulness", it is easier to get approval than groups without prototype testing. As for "originality", it is based on extension and combination. From the gatekeeper's perspective, gatekeepers with the same experience, facing in different fields of output, can provide more brilliant suggestions and directions. Gatekeepers without relevant experience will give a high affirmation and encouragement for the result. It is obvious that we can take average in exploring the learning effectiveness of students. Somehow, it's not possible to understand the "originality" of the thinking process in terms of numbers. The following is the design thinking process of A9 (Figure 8):

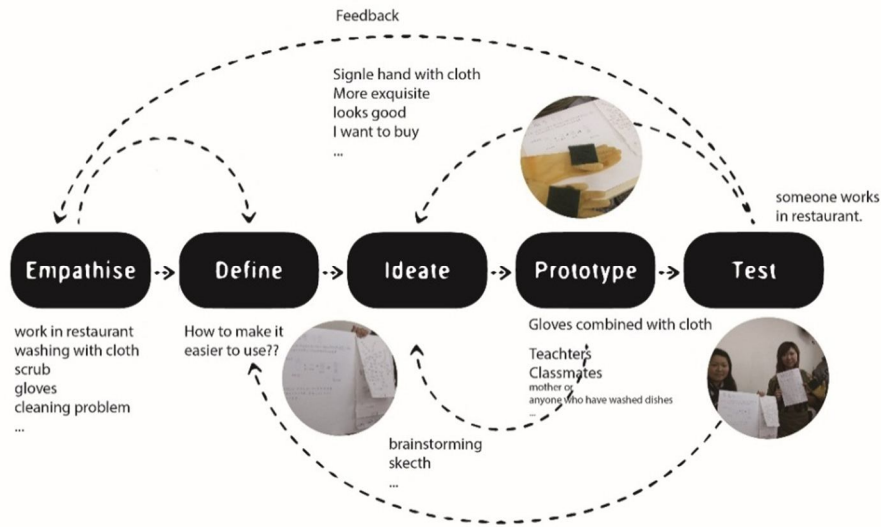


Figure 8. The design thinking process of team A9

In the thinking process of empathies, if the designer can project himself into a situation of needs or problems, he can find the definition of the problem more precisely. But "originality" is mainly subject to problem definition and thinking. In a limited time and learning environment, coupled with the lack of life experience and professional skills of most students, it is not easy to make better use of originality.

Therefore, Multidisciplinary collaboration is the trend of the future. A year of observing "Creation and life" and design thinking can be integrated into the general curriculum. Although there are doubts about insufficient software and hardware, the implementation process is not limited by time and space, but can be, perhaps, unlimited. This is the most fascinating value of creativity. During class feedback and sharing, students in group A5 said they spent a lot of time in the kitchen and did not think that their professional lives had much to do with the design department. However, the class showed them that design could be integrated into their professional and personal lives. Despite initial failure of the prototype, they enjoyed designing the device to help people peel shrimp without dirtying their hands.

Student's feedback: Students from group A9 initially thought that there were only classes followed by a test. However, they ended up spending a lot of time discovering problems, discussing the problem with their group members, designing and testing the prototype. Since the group was diverse, everyone had their own opinions and it took a lot of thinking for them to justify their own point of view. Although they intended to approach the task simply, validation from group members provided affirmation and hope, thus giving worth to the time invested in the design. The teacher had

said that modelling the prototype was difficult, but as the week passed, the students found that the seemingly impossible task was in fact, possible.

Group B2 students said that they thought of designing something related to the kitchen after seeing classmates peeling shrimp during class. After deciding to tackle the issue of garlic cutting, they tried their best to create a perfect model. Students from group B6 said that they were encouraged to take the class to see what their seniors were doing in the previous semester. They also wanted a challenge and to be involved in different areas. The students felt a great sense of accomplishment after finishing their transparent refrigerator. Another student said that the course was the most intensive that they had ever taken, admitting to shedding tears after completing their work.

5. Discussion

The guidance provided during the teaching process produced new designs. However, Class A showed higher creativity in their designs compared to Class B. Although the design thinking process can provide students with direction and guidance, it cannot change the inherent personality, life experiences, and thoughts of the students. Different motivations for learning will affect the results of design thinking even if the teaching environment provides equal mechanisms because individual creative factors become force majeure factors. However, the addition of design education can change the motivation and efficacy of student learning.

This research uses action research to observe and record the teaching process to consider whether general courses can be introduced into the design thinking process, and to escape the traditional examinations and reports, and to be converted into a display and co-evaluation mechanism. Although, we encountered a lot of administrative difficulties during the process, the feedback from the students was relatively positive. I was originally worried that the course was different from the previous model, resulting in pressure and responsibility of the students, which may not continue. However, after the actual implementation, it was found that project-based learning uses the design thinking process. The students' response was very positive, and they were highly confident in their work. After two semesters of raw of operations we compared the results. We found that they were a little different: the originally of Class B is lower than Class A. It is not the qualifications of students' life experience, but the addition of a "reference to the works of senior students" in the course guidance method.

5.1 Fear and confidence

Some of the students mentioned that the class required a lot of brainpower and was very draining. Initially thought to be easy, the curriculum provided a lot of challenge that required critical thinking and discussion. Due to the diversity in class composition, not all the students understood the course content or the teaching methods. One student asked to leave the class during the first lesson because they were intimidated by the student-based discussion. Ten students withdrew from class A within the first three weeks, including the allowed withdrawal period. An additional five students withdrew in the middle of the semester. These students had a 100% attendance rate and complete the coursework as expected, but were afraid to share their opinions during class. One of the reasons for withdrawal was the fear of not being able to complete the course within expectations. Students from non-design learning backgrounds may face constraints in terms of not being able to adapt to learning styles different from their own. Constrained by conservative thinking and conventional learning systems, the open learning system may be very intimidating. This shows that a good course description is extremely important because it can help students determine whether they are up to the challenge of meeting the course objectives or not, thus minimizing the chance of students dropping out halfway. It was crucial for teachers and facilitators to maintain a friendly and accepting attitude towards the students in order to encourage the students to share their ideas. Part of this was aided by the fact that the final results only constituted 30% of the total grade whereas the rest were evaluated by the gatekeepers and peers.

In the thinking process of empathies, if the designer can project himself into a situation of needs or problems, he can find the definition of the problem more precisely. But "originality" is mainly subject to problem definition and thinking. In a limited time and learning environment, coupled with the lack of life experience and professional skills of most students, it is not easy to make better use of originality.

Therefore, Multidisciplinary collaboration is the trend of the future. A year of observing "Creation and life" and design thinking can be integrated into the general curriculum. Although there are doubts about insufficient software and hardware, the implementation process is not limited by time and space, but can be, perhaps, unlimited. This is the most fascinating value of creativity.

5.2 Development of Design Thinking Skills

Students – lacking life experience because of their preoccupation with academia, social acceptance, and romance – may find it difficult to gain inspiration in the beginning. The

introduction of design thinking courses is a way to ensure students leave the classroom in search for experience and According to the students' feedback, they found that design was closely related to real life and was useful in solving day-to-day problems.

Students who completed the course, exposed to the 4Ps of creativity – person, product, press, and process, successfully carried out the 3I of design thinking: inspiration, ideation, and implementation. They succeeded in designing solutions for issues in real life. Group discussions involved real-life experiences, role-play, simulations, mind-maps, brainstorming, and reflections, allowing students to actively participate in generating ideas and feedback.

Greater amounts of input and adjustments made it easier for students to innovate and create a practical design. Active participation in the process of prototyping, introspection, and experience contributed to insights and observations as per the IDEO school of thought. Thoughts and memories stemming from life experiences in work, travel, or university life can be used as learning materials. By introducing design thinking courses, students will be required to go out and experience life in order to better understand user needs.

The production of prototypes is more accurate for the implementation of ideas, but ideas and thinking are an important basis for prototypes. Whether it is courses, work or travel in college life, we have a record of ideas and thinking which come mainly from the experience of life, these experiences are the key to material selection. This course is basically for students from the Department of Tourism, Catering, International business and Foreign Languages. The direction for students of business management's ideas is more for daily life, such as being stylish, changing facemasks, using waste or transforming something. The direction for students of sightseeing and catering is focused more on kitchen supplies and cooking utensils, such as: ovens, refrigerators and ingredients, convenient handling of cleaning, etc. Some people say: "You are only qualified to be a designer when you turn forty years old." This may cause many people to misunderstand, but it shows that designers need a wealth of life experience. When the course planning is no longer just lecture in the class, but you are walking out of the classroom, into the crowd, into life, and experiencing the needs of "people" in the way that is closest to life, you can see the needs by comparing one's heart to another's. This is the definition value of formal design thinking: insight, observation, and empathy. In fact, most students' lives are very simple. The three compulsory credits: school, work (part time jobs), extra curriculum and romance have occupied their lives. Most of the students because of lack of life experiences or living in the virtual world of the Internet for a long time, have led them to have some limitations in concepts. Therefore, by introducing design thinking

into the curriculum, students are required to walk out of the classroom and enter the crowd, experience from life and then give feedback to life, so that life can be more cheerful and meaningful.

6. Conclusions

Although the sample size is insufficient, preliminary studies on similar stimulus have shown that teaching content and appropriate method of instruction can influence the thinking and degree of investment of students. Since design is not constrained by intellect, and creativity is not finite, it is possible to achieve a lot despite limited resources. The current environment may not necessarily conducive to educators, so design educators should use design thinking in order to produce a good curriculum for students.

From the results, it is possible to observe that the usage of design thinking concept in the general education course 'Creation and Life' has promoted the creativity and problem solving process of the students from in non-design learning backgrounds. The introduction of design thinking in general education courses is a feasible method of teaching students of non-design background creative problem solving skills. However, more input and planning is needed before the course can be used to provide a 'people-oriented' quality education.

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