

The Study of teaching equipment needs for design thinking activities

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Abstract

This study aims to discuss the equipment demand of design thinking teaching activities, and then sort out the design thinking teaching activities as the basis of the interviews. Taking the equipment for discussion space of a National University of Technology as the case, 8 interviewees involved in the activities are surveyed and the study explores the equipment demand of teaching activities through understanding the demands of interviewees by in-depth interviews.

The study results show that the dimensions of equipment demand of teaching activities can be constructed by assist ideate, physical sensations and function operation. (1)The dimension construction of assist ideate demand includes visualization assist and technology assist, and the visualization assist has the prime importance. (2) The dimension construction of physical sensations demand involves the security and comfort, and the comfort is the most obvious. (3)The dimension construction of function operation demand contains mobility, convenience and flexibility, and the flexibility is considered the most important. From the comprehensive comparison, we can find that, the function operation is the most important and the flexibility demand of the equipment is most concerned about. The students can conduct the design thinking teaching activities more efficiently if they can master the above factors.

Key words: Design Thinking, Teaching Activities, Teaching Equipment

Introduction

Affected by the global competition, the competitiveness of Taiwan, which used to rely on technology and manufacturing technology in the past, has been challenged in the international market. In May 2015, the National Development and Reform Commission put forward the Asia-Silicon Valley Promotion Plan and the purpose is to inject the innovative thinking into the industry in Taiwan so as to make it to conform from the past emphasis on hardware strength to the integration of hardware and software. So Taiwan can create new value and improve the competitiveness of the industry. With the coming of the knowledge-based economy, not only the domestic industries need to transform to the integration of hardware and software, but also people need a change in the thinking. Today, Innovation has become an important indicator of the international competition, many scholars focus on the innovative approaches. Among them, Tim Brown (2010), based on his own experience develop the argument proposed with the other scholars and put forward the innovative methodology for design thinking, in which design thinking is a people-oriented design spirit. They find the problems from the needs of people, behavior, technology

or commercial feasibility so as to inspire lots of creative ideas, and finally propose the right solutions. Domestic design thinking expert Professor Liang You-zhao had introduced this method together with the IDEO 20 years ago and mainly proposed the two structures. He analyzed the product development opportunities based on the macro situation and then find the design factors needed by the users in target through the micro-situation to facilitate follow-up product development and planning of industry perspectiveness[3].

Now the demand for innovation is rising and the cultivation of creative talents has become the key of education today. Different greatly from the previous traditional teaching methods, the operation takes the teacher who impart knowledge to students in the narrative way as the center[4]. And the students can understand the knowledge and enhance their abilities through lots of exercises and tests[5]. This model is lack of interaction with learners and they are not likely to think the information conveyed by the teachers in the lessons actively[6]. D. School of Stanford University in the United States set the course on design thinking based on the talents demand of the industry and the architecture standard modes include Empathize, Define, Ideate, Prototyping and Test[2](as Figure 1). It is conducted with the cooperation with the five major activity structures through the way of holding workshops to make the academic community scramble to study with the industry and use it in their own field. Therefore, the innovation can be practiced through methods.

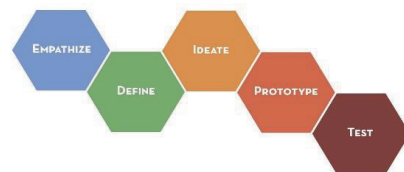


Fig.1 Design thinking procession

Obviously, there are innovative ways to assist the ideating of creativity. Without the standard to deal with, it will be easy to get half the result with twice the effort. This study aims to sort out the characteristics of design thinking activities, and describes the three aspects in order.

1. We must have lots of good ideas at first so as to explore good ideas. We shall encourage any crazy ideas rather than criticizing.
2. To visualize and crystallize the concept. It is limited to express the good idea in characters and the faces of the ideas can be extended through the sketch and model.
3. To establish the optimistic culture. If the team

members are conservative and silent so it will be not easy to stimulate creativity. So we shall maintain a good attitude of optimism so as to inspire the ability of innovation in each member's mind.

At present, most of the design thinking activities are promoted and implemented in the form of workshop[3] while now most of the workshops hold the activities with the use of the existing equipment. Most of the related research is on the human engineering and operation of the equipment[7] and there are few study on the equipment demand of the activities. Therefore, this study aims to discuss the equipment demand for the design thinking teaching activities and the improving methods of the equipment so as to provide reference for the following study.

Research Design

A. Research Methodology

In this study, interviewing method and grounded theory were used to explore the equipment demand for the teaching activities of the interviewees and the following two study methods were described in order.

1. Interviewing method: This method is to visit others based on a specific purpose and obtain the view on specific events of the interviewees through the way of interviews. Among them, this study uses the in-depth interview for the questions and answers and emphasizes on the process of meaning construction by the interviewees and interviewers together. It belongs to qualitative study [8].
2. Grounded theory: This method is to conceptualize the information and establish a set of systematic knowledge [9]. This study analyzes the oral information through grounded theory and concludes and encodes the information. The coding method is from bottom to top, namely, open coding, axial coding and selective coding, respectively[9]. (1)The open coding includes the usability issues and demands for the equipment proposed by the interviewees in the activities; (2) The axial coding is to integrate the open coding and about the capacity of the users' ideal equipment in the design thinking teaching activities;(3) The selective coding is to sum up the axial coding and arrange the demand dimensions of the activities equipment based on the design thinking teaching activities and contents. The study analyzes the information and constructs dimensions for the equipment demands from assist ideate, physical sensations and function operations. In addition, this study counts the amount of the oral data to compare the importance degree of the demands.

B. Research Process

This study is to explore the equipment demand of design thinking teaching activities, and its process is mainly divided into three parts.

1. First of all, we will discuss the design thinking teaching activities to understand the status of the activities and then will participate in the two-day activities workshops so as to understand the operation mode of the entire workshops and get the overview of the activities and outline the interview.
2. Then, we will interview the students participating in their activities and let the interviewees to put forward their own ideas in the way of in-depth interview to explore the

impact factors.

3. Finally, we will analyze the above oral information, and then explore the equipment demands in the activities for reference in the following study.

C. Research sample

1. Activity space: This study takes the I-share semi-open discussion space of a University of Technology as the venue for the activities and there are walls, seats and tables for the equipment configuration. Among them, a group takes the semi-curved wall as a place for discussion. In the walls, there is the whiteboard of each wall to be used for the members to write and discuss and the status of the teaching equipment is as follows (as shown in Figure 2).

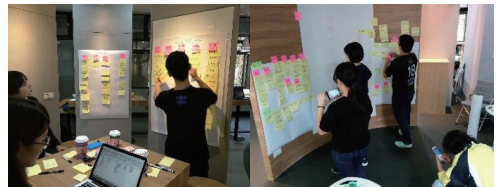


Fig.2 Teaching equipment situation

2. Interviewee: In order to understand the current situation of design thinking teaching activities in Taiwan, this study takes the students aged 20-26 with at least one university degree or higher who participated in at least one design thinking workshop as the interview object. There are 8 people meeting the interview conditions, including four men and women and there are two interviewers not in the design field. The interviewees propose the demands on the equipment of this workshop and integrate the oral information to explore where of the equipment need to improve and provide reference for the organizers and instructors in the activities.

Research analysis

A. Analysis on assist ideate demands

Design thinking is an activity that needs lots of discussions and thinking. In the discussion process, sticky notes and hand-made materials which help not only to watch, but to visualize others' ideas are very important. As a result, the assist ideate of the equipment is arranged as selective coding. In the assist ideate demands, the visualization assist and technology assist these two demands can be taken as the axial coding, as shown in Table 1.

1. Visualization assist: As the activities need to stimulate lots of ideas and present them in a visual way. For example, the equipment can assist to watch can improve the efficiency of activities; Second, if there is no tools to assist the ideating then it will be not easy for the students to hit new ideas. For example, the visual model, even touch tools can help creative thinking; Finally, in addition to the brainstorm of students imagination, the manual prototype, the actual touch, and thinking with hand help the creation of the innovation.
2. Technology assist: Current teaching equipment help the activities basically. However, with the help of

technology, it will bring convenience to activities as well as remove unnecessary actions such as sticking white newspapers and writing sticky notes and so on, reducing the activity time and improving efficiency.

TABLE 1
Coding process of assist ideate demand
Unit: times

Selective coding	axial coding	Open coding
		Tools for assist ideate(5)
		Model for assist ideate (9)
Assist ideate (54)	Visualization assist(30)	Materials for making models(7)
		Assist watching(9)
		Technological assist(14)
	Technology assist(24)	Technology value added of process recorded(10)

According to oral information's statistics, the assist ideate demands are proposed by 5 times as a total while the visualization assist of the interviewees is the most obvious with a total of 30. The tools to assist the ideating are essential for innovative activities that reflect a great deal of ideas. For example, the visual pictures, concrete models, and even the materials students' touch are inject the different ideas for innovation.

B. Analysis of physical sensations demand

Creativity is motivated by continuous good discussions. If the team members remain silent, then creativity will be curtailed. The spirit of design thinking also emphasizes the optimism activity culture to promote creativity. However, influenced by the innovative activities, the feeling brought by the equipment is very important that the physical sensations demand is encoded as the selective coding. In the physical sensations demands, the demands of security and comfort are taken as the axial coding, as shown in Table 2.

1. Security: It focused on that the students are tend to think while walking about in the innovative activities and has the active effect on the thinking in mind. The security of the equipment is much more important because the motion. If the fillet of the equipment is safe, the students will be protected.
2. Comfort: Moderate rest can effectively save the students from getting tired after thinking and brainstorming for ideas. No matter resting on the equipment with comfort seats or even sitting on the ground disengaged, we can break through the framework of current equipment and environment to innovate continuously.

TABLE 2
Coding process of physical sensations demand
Unit: times

Selective coding	axial coding	Open coding
Physical sensations (20)	Security (5)	Easy to be hit down in walking about(3)
		Fillet (2)
	Comfort (15)	The equipment can be rest on(6)
		White board must not be non-glare (3)
		Seats must be comfortable (6)

According to oral information's statistics, the physical sensations demands are proposed by 5 times as a total and the comfort demand are proposed more with a total of 15 due to that it has broken through the basic function of the traditional teaching equipment. In the creative activities, students expect that the equipment can be more comfortable, which on one hand can release the students from the trouble of uncomfortable feelings and on the other hand can help them to rest comfortably in the activities to re-active the thinking in mind.

C. Analysis of function operation demand

Design thinking involves not only the single activity but also the brainstorming and prototypes making and so on. In view of different activities, the interviewees think that the operation will be adjusted so the function operation is encoded as the selective coding, including mobility, convenience and flexibility as the axial coding, as shown in Table 3.

1. Mobility: Due to the students move or turn frequently in the activities so demand for the equipment that can be moved is mentioned by the users.
2. Convenience: Although now the equipment tends to develop in the scientific and technological way, as the motivation states that the equipment used in innovative activities is still the traditional ones. So the electronic equipment is not easily connected to the power supply underneath. If they can embedded in teaching equipment they will help the students in using the electronic products. Besides, the design thinking requires to visualize the ideas quickly so the probability to modify and re-paste their own ideas will increase.
3. Flexibility: As the activities need so many tools such as sticky notes, scissors and other for model making and ideate that they are easily cluttered and difficult to organize at the end of the activities. Hence, the equipment with the storage function can assist the arrangement fast. In addition, the small desktop can use the telescopic function to extend a new platform which not only can be used but also can increase space for storage. Moreover, because the user's height, the demand for free adjustment is also important here.

TABLE 3
 Coding process of function operation demand
 Unit: times

Selective coding	axial coding	Open coding
Function operation (103)	Mobility (30)	Free to move (17)
		Equipment is not easy to move (13)
	Convenience (28)	Convenient to be connected with power (14)
		Easy to change (8)
		Easy to paste (6)
		Telescopic desktop (5)
	Flexibility (45)	Folding storage (10)
		Height can be adjusted freely (4)
		Dual function (26)

According to the analysis of oral information of the interviewees, we can find that the function operation demand is mentioned the most as 103 totally and among them, the flexibility demand of the equipment is the most significant, with 45 times being mentioned. Due to the space size and changeable design thinking activities, the equipment shall be flexibly adjusted. As the interviewees mentioned, the table and chairs can be combined with each other to provide more space for the equipment needed and the height can be adjusted flexibly according to the need of the users to improve the efficiency of the activities.

Conclusion

This study aims to discuss the equipment demand of design thinking teaching activities and conduct the interview according to the activity content in the literature. Based on the grounded theory, we can find that this activity's dimensions can be constructed from assist ideate, physical sensations and function operation as the equipment demands.

1. The dimension construction of assist ideate demand includes visualization assist and technology assist and the visualization assist has the prime importance.
2. The dimension construction of physical sensations demand involves the security and comfort and the comfort is the most obvious.
3. The dimension construction of function operation demand contains mobility, convenience and flexibility and the flexibility is considered the most important.

From the comprehensive comparison, we can find that, the interviewees consider the dimensions construction of function operation demand as the most important while the importance degree of dimensions construction of physical sensations demand is the lowest. In a word, as the design thinking activities not contains only one but they inspire and astringe ideas continuously. Coupled with that it is needed to make models fast, so that we need to give priority to consider the function operation demand of the equipment. If we can master the above factors then the students can

conduct the design thinking teaching activities more efficiently.

Acknowledgement

We are grateful to the Executive Yuan and Ministry of Science and Technology for funding under project No. MOST 106-2221-E-027-079.

Reference

- [1] National Development Commission (2015).Asia Silicon Valley Development Agency(ASVDA), Retrieved from: https://www.ndc.gov.tw/Content_List.aspx?n=6896300CE7D419D7&upn=52E3C17E62E1162F.
- [2] Brown, T.(2010).Change by Design : How Design Thinking Transform Organizations and Inspires Innovation(Wu Li-jun, Trans.).Taipei : Linking Publishing.
- [3] Ding-Hau Huang, Yu-Chao Liang, Wen-Ko Chiou(2009). A pilot study of the application and effectiveness of user oriented scenario experienced innovation design, Tsinghua International Design Management. Symposium, Beijing, pp.86-89.
- [4] Ewing, B.F. (2011). Direct instruction in mathematics:Issues for schools with high Indigenous enrolments:A literature review. Australian Journal of TeacherEducation, 36(5), pp.63-91.
- [5] Myers, T., Monypenny, R., & Trevathan, J. (2012).Overcoming the glassy-eyed nod: An application ofprocess-oriented guided inquiry learning techniquesin information technology. Journal of Learning Design,5(1), pp.12-22.
- [6] Mazur.(2011).From questions to concepts : interative teaching in physics.Retrieved frome.<http://www.youtube.com/watch?v=IBYrKPoVFWg>.
- [7] Oyewole, S. A., Haight, J. M., & Freivalds, A. (2010). The ergonomic design of classroom furniture/computer work station for first graders in the elementary school. International Journal of Industrial Ergonomics, 40(4), 437-447.
- [8] Mishler, E. G. (1986). Research Interviewing : Context and Narrative, Cambridge, MA : Harvard University Press, pp.52-65.
- [9] Strauss, A., & Corbin, J. (1997). Basics of qualitative research: Grounded theory procedures and techniques (Hsu, Tsung-Kuo, Trans.). Taipei, Taiwan:Chuliu Publisher. (Original work published 1990)