

CONSTRUCTING A TEACHING AND LEARNING SYSTEM IN HIGH DESIGN EDUCATION

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ABSTRACT

In the face of a rapidly changing era, how to construct an adaptable design education framework is a thought-provoking question. This study explores three fundamental issues related to design education: what constitutes the elements of design education, how these elements are interconnected, and why they are interconnected in such ways. By investigating these questions, the research aims to explore what kind of system should be established for design education, how to construct this system, and the reasoning behind such construction. The goal is to provide a conceptual framework for universities planning to initiate design education and offer insights for improvement and development to those already engaged in design education.

Keywords: Design education, teaching and learning, management organization, interconnect of elements, mechanism

1 INTRODUCTION

Sheila Pontis and Karel van der Waarde (2020) found that the need for change in design education has been a topic for discussion for more than twenty years, but still, there seems to be a lack of concrete advice in the form of structural models or practical strategies that can ballast the required change [1]. As to this research, the author believes the key focus to build a structural model should be on how to construct a teaching and learning system that adapts to future change. To address the issue, this research will explore three sub-questions:

1. What are the elements of design education?
2. How do the elements of design education interconnect with each other?
3. Why the elements of design education interconnect in these ways?

The first sub-question involves systematically outline the essential elements of designing educational subjective and objective elements. It should be noted that different universities should have different objective elements in teaching and learning.

The second sub-question suggests that, through the coordinated efforts of management organizations, teachers, and students, the subjective and objective elements should be linked together in curriculum development, and improvement and enhancement of both subjective and objective elements should be promoted through the PDRA cycle (Plan→Do→Reflect→Adjust. Replacing Control by Reflect and moving from PDCA to PDRA).

The third sub-question discusses the underlying logic of linking the subjective and objective elements through curriculum and through the PDRA cycle.

2 RESEARCH METHODS

This research utilizes methods such as literature review, interview research, quantitative analysis, and qualitative analysis. The literature review method is primarily concentrated in Part 3, conducting research on publications by teaching faculty from internationally renowned design schools to extract the essential elements of design education. The interview method is mainly focused in Part 4, involving interviews with teaching faculty and alumni from a university in Shanghai, China. The interviews in this study provide crucial insights into the modes of carrying design education elements, the current status and issues of the linkage of design education elements and offer important clues for finding solutions to in-depth linkage of design education elements. The qualitative analysis method includes both inductive and deductive approaches. In the section on the linkage of design education elements in Part 4, the study

extensively uses inductive analysis to summarize and analyse the content of interviews with teachers and alumni. In the section on the mechanism of linking design education elements in Part 5, the explanation of the process and methods of curriculum-linked design education elements and the process and methods of PDRA cycle-linked design education elements is mainly accomplished through deductive reasoning.

3 WHAT ARE THE ELEMENTS OF DESIGN EDUCATION?

Building upon the foundation of literature research, the elements of design education are initially categorized into two parts: subjective elements and objective elements.

3.1 Subjective Elements of Design Education

Shang Hua et al. (2013) proposed that the subject of the design education system consists of five parts, namely administrative managers, organizers of design education institutions, operators, teachers, and students. They consider educational administrators, organizers of design education institutions, and operators as the management subjects of design education, while teachers and students are viewed as the academic activity subjects of design education [2]. To avoid dedicating excessive efforts to the study of different subjects in design education management and to focus on the construction of the teaching and learning system, this research adopts the term "management organization" to collectively represent the entities defined by Shang Hua – educational administrators, organizers of design education institutions, and operators. This term is used in parallel with "teachers," the subjects of teaching behaviour, and "students," the subjects of learning behaviour, as the three main subjective elements of design education.

3.2 Objective Elements of Design Education

Zhao Juming (2017) points out that by referencing the terminal point, starting from the end, it becomes clear what is needed, why it is needed, when it is needed, and how various parts should coordinate. This makes it less likely for the objectives to be lost during the process, which is particularly crucial in professional design [3]. The terminal point, in this context, refers to the educational philosophy and goals. Different design educational philosophy and goals will impact the definition of objective elements. Based on the "Integration of Knowledge, Skills, and Personality" educational philosophy at a university in Shanghai, China, this research classifies the objective elements of design education into knowledge elements, skill elements, and personality elements. By combining cognitive psychology's understanding of the types encompassed by knowledge, skills, and personality, specific content for the objective elements is extracted from relevant literature on design education.

3.2.1 Scope for Extracting Objective Elements of Design Education

To extract literature on objective elements, two conditions must be met: 1. Authors must be teaching faculty from design schools consistently ranked in the top 50 in the QS "Art and Design" discipline for five consecutive years; 2. The literature must be indexed in the Web of Science.

The retrieval process for these authors' papers involves three steps:

1. Restricting the research direction to Education Research, Education Scientific Disciplines, and Art, using "Design Education" as a keyword to search the subject heading field, resulting in 4599 papers.
2. Refining the search by adding the keywords "course," "education," "learn," and "teach" in the abstract, focusing on the research theme of "design education teaching and learning," resulting in a total of 183 papers.
3. Considering the relatively small number of 183 papers, the scope of the research literature is expanded to include 15 papers published in two education special issues of "She Ji: The Journal of Design, Economics, and Innovation." In total, 198 papers¹ are used for extracting literature on the objective elements of design education.

¹ Due to the length of this paper, the 198 papers cannot be listed in the REFERENCES section. They can be accessed at the following link:

<https://pan.baidu.com/doc/share/p4CO9dZPaXM58eXggegWw-34080061269626>. Access code: invz.

3.2.2 Extracting Objective Elements of Design Education

There are three steps involved in extracting and summarizing the elements of "knowledge, skills, and personality" in academic literature on design education:

(1) Element Extraction: This includes vocabulary and phrases directly mentioned in the literature related to objective elements, as well as sentences or paragraphs that indirectly reflect objective elements. For both types of elements, they are compiled in their original states, and relevant information from the literature is retained, laying the foundation for subsequent data source tracing.

(2) Element Coding: For sentences or paragraphs that do not directly mention but reflect objective elements, the themes of the elements are determined through first-level coding. The vocabulary or phrases of the directly extracted themes from the previous stage are unified in this step to account for differences in terminology and regional variations in different languages.

(3) Element Classification: The content of the uniformly coded elements is classified into three major modules: knowledge elements, skill elements, and personality elements.

Through these steps, the extraction and classification of knowledge elements, skill elements, and personality elements in design education are completed.

3.2.3 Content of Objective Elements in Design Education

Through a detailed study of the 198 papers, the specific content of knowledge elements, skill elements, and personality elements mentioned in design education is summarized.

1. Knowledge Elements

Categorized according to cognitive learning theories, knowledge elements are divided into declarative knowledge and procedural knowledge. According to the definition by Zhao Weijun (2011), declarative knowledge refers to an individual's knowledge about the facts, background, and relationships of the objective environment, explaining "what things are." Procedural knowledge includes both action skills and cognitive skills and is, to some extent, dynamic and variable. In comparison to declarative knowledge, procedural knowledge not only describes the state of things but also indicates how things should be done. It needs to be gradually stored in the human brain through repeated practice [4].

Through literature review of top-tier teaching faculty at international high-level universities, 16 specific elements of knowledge have been extracted. Declarative knowledge encompasses history, philosophy, sociology, design theory, anthropology, ergonomics, psychology, and business. Procedural knowledge includes rhetoric, data science and analysis, design tools, design techniques, design language, experimental skills, design methods, and research methods.

2. Skill Elements

Peng Danling (2019) suggested that ability can be divided into cognitive ability, operational ability, and social ability. Cognitive ability is the capacity of the human brain to process, store, and retrieve information. Operational ability refers to the ability of individuals to manipulate their own bodies to perform various activities. Social ability are the abilities demonstrated by individuals in social interaction activities [5].

Through literature review of the 198 papers, 13 specific elements of abilities have been extracted. Cognitive ability elements include problem definition, prediction and decision-making, aesthetic ability, thinking skills, reflection ability, and self-education ability. Operational ability elements include problem-solving, interdisciplinary skills, and research skills. Social ability elements include communication, cooperation, leadership, and management.

3. Personality Elements

Costa and McCrae proposed a metatheoretical framework based on the Five-Factor Model in 1992, which encompasses the majority of personality theories – the Five-Factor Personality Theory [6]. Categorized according to the Five-Factor Personality Theory, personality elements are divided into openness, conscientiousness, extraversion, agreeableness, and neuroticism.

Through the review of literature, 8 specific elements of personality have been extracted. Openness elements includes imagination, inclusiveness, emotional richness, and creativity. Conscientiousness elements includes self-drive and a strong desire for knowledge. Extraversion element includes being proactive. Agreeableness element includes empathy. Within the established scope of academic literature, does not feature descriptions related to neurotic personality element.

At this point, through the analysis of literature, the extraction of knowledge elements, ability elements and personality elements are completed. It should be pointed out that, the analysis and refinement of design education object elements in this study represent just one approach to element refinement.

Moreover, this approach is conducted based on the educational philosophy and positioning of a specific university in Shanghai, China. The methods and processes can be considered as a reference, but the results do not represent universally applicable standards. Each university should choose a suitable refinement method according to its own educational philosophy to determine the objective elements of design education.

3.3 Overall Framework of Subject and Object Elements in Design Education

The three main subject elements – management organization, teachers, and students – form an overall framework through the layout, impartation, and learning of different combinations of object elements. This composition encompasses the relationships among the subject elements, the object elements, and the interactions between the subject and object elements, as illustrated in Figure 1.

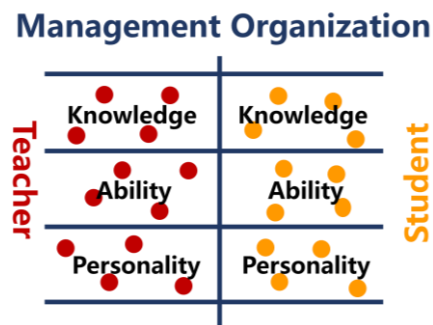


Figure 1. Overview of Design Education Subjective Elements and Objective Elements

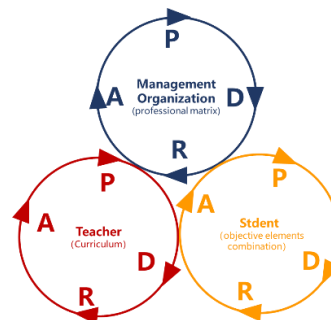


Figure 2. the interconnection of design education elements through the PDRA cycle

4 HOW DO THE ELEMENTS OF DESIGN EDUCATION INTERCONNECT WITH EACH OTHER?

Colm O’Kane and Robert TULLY (2018) argue that success manifests itself from bringing the right constituent elements together and managing them through the process [7]. Once the essential elements of design education, both subjective and objective, are determined, these elements need to be gathered and interconnected to form an organic talent development system. To analyse the interconnection of design education elements, starting from the frontline participants in actual design education institutions would be the most direct approach. The author conducted interviews with 30 frontline design educators and 15 alumni from the design school from Shanghai, China. Based on these interviews, the author carried out further analysis.

4.1 Achieving the Interconnection of Design Education Elements through Courses

Based on the data analysis derived from interviews with frontline teaching faculty at a design institute in Shanghai, China, it can be concluded that the courses offered by this institute have the capacity to accommodate the cultivation of the three major objective elements of design education: knowledge, skills, and personality.

In higher education institutions, "courses" serve as the primary medium for conducting educational activities and play a crucial role in facilitating the integration of design education elements. Firstly, the management organization needs to structure a professional matrix, which is composed of multiple courses, gathering all objective elements. Secondly, teaching faculty take on the task of delivering specific courses, each responsible for imparting certain objective elements. Lastly, through the study of courses, students acquire various objective elements and eventually form a diverse combination of these elements, achieving the educational goals of design education. It can be observed that, among the three subjective elements and the three different forms of objective element modules, "courses" serve as a continuous carrier, a concept affirmed through interviews with teaching faculty at the design school in Shanghai, China.

4.2 Shortcomings in Achieving the Interconnection of Design Education Elements through Courses

At the same time, feedback from interviews with teaching faculty also highlighted the limitations of solely relying on courses to achieve the interconnection of design education elements. Specifically, when facing the demands of educational reform, focusing only on reforming courses to improve the

layout of design education objective elements within the professional matrix has limitations in terms of the comprehensiveness, standardization, and capacity to accommodate the development of reform.

4.3 Achieving the Dynamic Interconnection of Design Education Elements through the PDRA Cycle

In response to these shortcomings, the researcher attempted to find improvement strategies during interviews with alumni from the university. During these interviews, alumni were asked to provide suggestions for improving teaching at their respective institutions and offer advice or share experiences for current students. Through the analysis and synthesis of alumni feedback, it was found that the improvement suggestions from alumni for the three subjective elements - management organization, teachers, and current students - all included three aspects: "plan," "do," and "reflect." Combining these aspects with the goal of "adjust," a framework was constructed consisting of "Plan→Do→Reflect→Adjust", abbreviated as the PDRA cycle. This solution approach was integrated with the PDCA cycle, a scientific quality management procedure from management science. The researcher proposed the viewpoint of utilizing the PDRA cycle to dynamically interconnect design education elements, as illustrated in Figure 2.

5 MECHANISM OF INTERCONNECTING DESIGN EDUCATION ELEMENTS

"Mechanism" refers to the processes and approach of interaction between components or parts within a working system.

5.1 Mechanism of Achieving the Interconnection of Design Education Elements through Courses

In terms of the process, the mechanism involves utilizing the course as a carrier to establish the professional matrix by management organization, construct and impart course content by teachers, and acquire objective elements by students. This process results in the personalized combination of the three subjective elements - management organization, teachers, and students - and the three different modules of objective element combinations - professional matrix, course content, and the absorbed objective elements. In terms of the approach, achieving the interconnection of design education elements through courses, whether at the level of subjective elements or objective elements, follows a sequential order, demonstrating characteristics of temporality and linear linkage. The mechanism of achieving the interconnection of design education elements through Courses is shown in Figure 3.

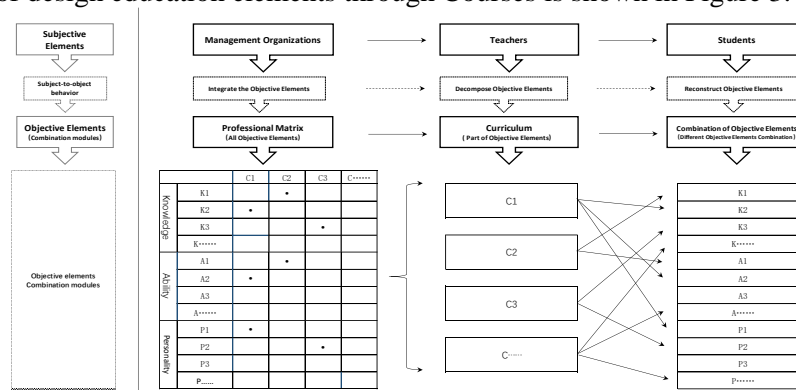


Figure 3. Mechanism of Achieving the Interconnection of Design Education Elements through Courses

5.2 Mechanism of Achieving the Dynamic Interconnection of Design Education Elements through the PDRA Cycle

In terms of the process, the three subjective elements of design education, in their respective PDRA cycles, influence each other during the "Do" and "Adjust" phases. They absorb the behavioural performances changes and generate new demands brought about by the other two subjective elements during the "Plan" and "Reflect" phases. In terms of approach, each subjective element actively engages in a high-quality execution of its own PDRA cycle, simultaneously interacting with the other two subjective elements in a cycle of "active absorption - natural influence - active absorption - natural influence." This interplay occurs while fulfilling the tasks carried by the object elements of design

education. The mechanism of Achieving the Dynamic Interconnection of Design Education Elements through the PDRA Cycle is shown in Figure 4.

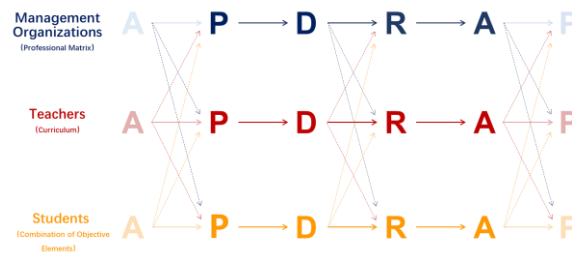


Figure 4. Mechanism of Achieving the Dynamic Interconnection of Design Education Elements through the PDRA Cycle

6 CONCLUSIONS

Through the study of the elements of design education, their interconnections, and the inherent logic of these interconnections, the research addresses the overarching research question of "how to construct the design education teaching and learning system," specifically:

1. Constructing a comprehensive framework for design education subjective and objective elements, with the objective elements being extracted using suitable methods guided by design education principles.
2. Using curriculum development to interconnect design education subjective and objective elements. During the curriculum development process, adherence to the sequential principles of the activities of the three design education subjects – management organization, teachers, and students – is crucial. This ensures the smooth transmission of the professional matrix, course content, and objective elements.
3. Propelling the iterative update of the design education teaching and learning system through the PDRA cycle (Plan→Do→Reflect→Adjust). In the iterative process, each subjective element should pay attention to absorbing the "Do" and "Adjust" situations of the other two subjective elements during the "Plan" and "Reflect" phases. Simultaneously, considering that one's own "Do" and "Adjust" behaviour may influence the other two subjective elements, stability of the "Do" should be ensured after formulating the "Plan." Unless there is evidence through "Reflect" behavior that improvements are needed, arbitrary adjustments should be avoided without a valid basis.

Building courses through the PDRA cycle to construct the teaching and learning system of design education theoretically applies to design education/curriculum development in different locations. The difference lies in the objective elements, as different universities in different places may vary due to their environmental conditions, developmental backgrounds, and educational philosophies. However, the overall development approach is applicable beyond these differences.

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