Research on information system analysis and design curriculum teaching innovation based on design thinking

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Abstract. Adhering to the concept of 'student development as the centre', we start from solving the teaching pain points, taking the design thinking and project-driven STEM subject line integration framework as the core, discovering, analysing and solving real problems in real projects, and researching and practicing as the idea to achieve teaching according to the IT project lifecycle, doing as needed and learning by doing Process. Through the teaching method of strengthening the three-level design thinking and layered assignments, it achieves the cultivation of composite and innovative talents, improves students' information system analysis and design ability, and cultivates students' creative and systematic thinking, teamwork and spirit of excellence.In this paper, the foundation of system information analysis based on design thinking is combined with the innovation of course design to integrate research and analysis. Under a certain theoretical foundation, it explores and researches the information system analysis of curriculum design, and lays a useful foundation for the research in the field of integration.

Keywords: design thinking; Information system analysis and design; Teaching innovation.

1 Introduction

Information System Analysis and Design is a comprehensive course for information system construction in application scenarios for students majoring in information management after the basic theoretical courses basically completed. It is a course to train students' ability to comprehensively apply professional knowledge, and a course combining theory and practice. Under the traditional teaching mode, this course has the following pain points:

(1) The theory course has many knowledge points, involving both professional theoretical knowledge and business knowledge of application scenarios, which is easy to be "fragmented" and difficult to understand in teaching. Students know the importance of the course but have no enthusiasm for active learning, and the class is boring;

(2) Virtual application scenarios, virtual projects, virtual problems and virtual systems are adopted in the course practice, resulting in students having no real perception of the business process of application scenarios, and the process of information system

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construction appears empty, which reflects the serious homework plagiarism of middle school students in the practice process;

Research has shown that STEM and design thinking are effective in cultivating creativity and engineering practical abilities. The research on STEM in developing children's creative self-efficacy [1], the cultivation of empathy [2], and the promotion of students' engineering practice ability [3]. This study will innovate and reform the system analysis course based on STEM and design thinking[4].

2 Innovative Ideas to Solve The "Pain Points" of Curriculum Teaching

(1) Adhering to the concept of "student development as the center", the course takes the "integration framework of STEM disciplines based on design thinking and project drive" as the core. Breaking the traditional teaching method of subject-by-subject, course-by-knowledge point [5];

(2) Driven by the project, the teaching process of "teaching according to the life cycle of IT projects", "doing as needed" and "learning by doing" is realized with the idea of finding, analyzing and solving the real problems of "researchable" and "practicable" real projects. The teaching process can make up for students' lack of interest and participation in the projects, and improve students' sense of accomplishment in solving practical problems with professional knowledge [6];

(3) With the teaching methods of "three-level design thinking strengthening", the system thinking is improved and project experience is accumulated [7] [8].

Subject-centred

Common to this type of curriculum design is the use of content as the basis for the horizontal and vertical structure of the curriculum, with other curriculum components (aims, objectives, learning activities, etc.) playing a minor role in the organisation of the curriculum. Three specific designs exemplified in this category of curriculum design are the subject design, the discipline design, and the broad scope design.

2.1 Subject Design

Subject design emphasises the organisation of the curriculum into a large number of subjects, each of which consciously articulates a specialised, homogeneous body of knowledge. Subjects may be divisions of study such as physics, chemistry, history, literature, philosophy, etc. It also contains practical areas such as home economics, typing, automobile mechanics, etc.

Those in favour of subject design argue that it is the most systematic and effective form of organisation for familiarising students with the elements of cultural heritage, and that by studying an organised system of subjects, students will be able to construct their own body of knowledge efficiently and economically. The underlying assumptions of this argument are, of course, that the internal ‘logic’ of the subject is consistent

with the mental processes of the student in learning the subject, and that such an organisation makes the storage and retrieval of the subject matter easy in order to be able to use it in future life situations.

Of course, this design has been subject to some criticism. It has been argued that the nature of the design tends to fragment knowledge and thus students‘ comprehension, is divorced from real-world concerns and occurrences, does not take proper account of students’ needs, interests, and experiences, and is an ineffective organisation of the curriculum in terms of learning and use, and so on.

2.2 Discipline Design

Subject design emerged after World War II. Like subject curricula, subject design is based on the intrinsic organisation of content. However, there are important differences between the two. Whereas subject design is completely unambiguous about the principles used to establish what a subject actually is, and areas as diverse as mathematics, home economics, and driver's training can be accepted as ‘subjects’, subject design establishes a body of knowledge as a subject.

Advocates of subject design see complete familiarity with the subject of knowledge as the foundation of education, but they emphasise understanding the elements of the subject, rather than appropriating material and information as in subject design, encouraging students to make explicit the underlying logic or structure of the subject, i.e. the relationships of its key concepts, ideas and principles, and the distinctive modes of enquiry of the subject. In addition, the lecturing process and memorisation that characterise subject design are replaced in subject design by a ‘ discovery approach ’ to learning that allows students to discover conclusions at their own pace of learning.

The basic argument in favour of subject design is essentially that it is the most systematic and effective form of organisation for the transmission of cultural heritage and for the preservation of the totality of human knowledge. Moreover, it provides students with subject matter in a rational way, not as a set of facts and principles to be memorised and recalled when needed, but as concepts, relationships and rational processes that derive from the students' own activities and thinking.

This design has likewise been subject to much criticism. For example, it presented students with a fragmented curriculum without providing the means to integrate knowledge; it did not address the relationship between schooling and life, and it did not take sufficient account of students' interests and experiences. While it improves in many ways on the artificial linear logic of subject design, it insists on subject structure as the organising principle and fails to take account of the variety of learning styles that psychological research has shown to exist.

3 Innovative of Curriculum Reform

3.1 Course Content Selection and Organization

The course of Information system Analysis and design divides the 5 stages of IT project construction according to the main line of problem finding, problem analysis and problem solving, and constructs the IT project-driven STEM curriculum framework based on the design thinking model, as shown in the FIG.1[9]. The curriculum framework transforms the abstract subject knowledge involved in its construction process into the ability node to solve the actual IT project problems. These ability nodes form a logically related ability knowledge network according to the 5 stages of the IT project life cycle, so as to realize the effective cultivation of STEM ability.

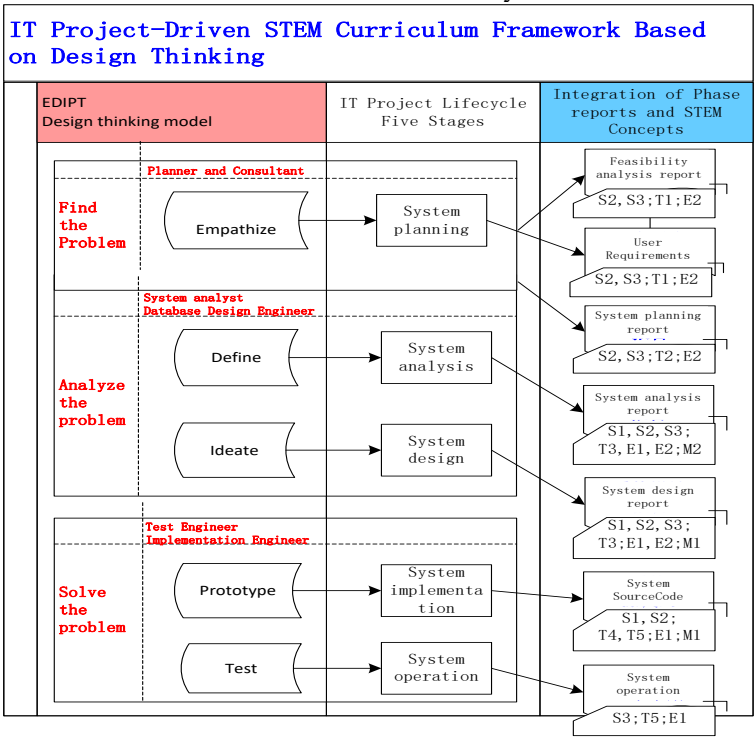

Fig. 1. IT project-driven STEM curriculum framework based on design thinking

3.2 Construction of "Three-Level Design Thinking Strengthening" Teaching Method

Take the actual IT project in a certain business field as the design theme, and design the modular course content based on design thinking model and STEM concept, starting from the simple transaction logic in the business field, to the redesign of specific cases, and finally to the design challenges of real IT projects that can be investigated and practiced, and complete the three whole processes of design thinking method step by

step. Three levels of design thinking strengthening were realized, as shown in Figure 2[10], namely, the construction of STEM knowledge map oriented by multidisciplinary STEM knowledge preparation, knowledge application and solving practical IT project problems.

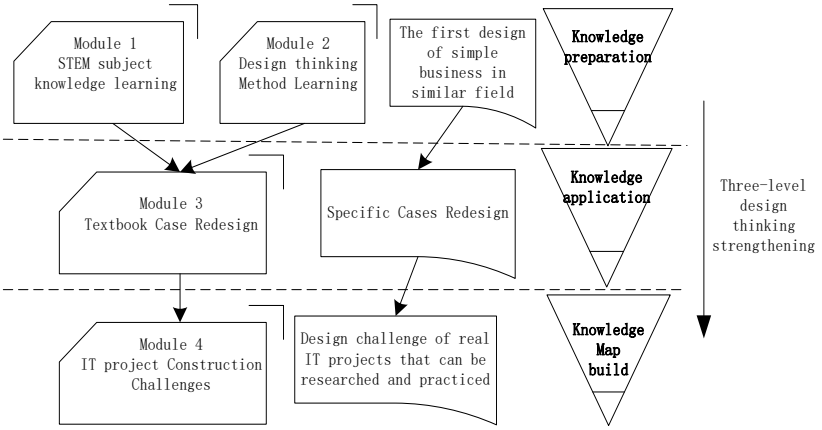

Fig. 2. Three-level design thinking strengthening model

4 Conclusion

A high-quality curriculum must have a certain degree of challenge, i.e. students need to invest a certain amount of time and energy in order to achieve the objectives of the programme, and can experience the learning challenge of 'jumping to reach it', so as to enhance their own sense of achievement in learning. To enhance the challenge of the curriculum, on the one hand, teachers can consider increasing the research, innovative and comprehensive content, forcing students to increase their learning input, such as creating complex problems and integrated problem situations to challenge students' advanced thinking.

The teaching reform and innovation of Information System Analysis and Design course takes 'the integration framework of STEM disciplines based on design thinking and project drive' as the core, and takes the discovery, analysis and solution of real problems of real projects that are "researchable" and "practical" as the idea, and realizes the teaching process of "teaching according to IT project life cycle", "doing as needed" and "learning by doing". With the teaching methods of "three-level design thinking reinforcement", it inspires students' ability of scientific inquiry, problem identification and solution, design innovation and team cooperation by actively integrating multi-disciplinary knowledge. IT enriches students' practical experience in IT projects, completes the active construction of new knowledge, promotes the cultivation of innovative thinking and systematic thinking, and realizes the cultivation of compound and innovative talents shaped by the spirit of teamwork and excellence. The teaching mode of this course provides an effective way for the training of compound and innovative talents.

Schooling occupies the most important place in every country's educational endeavours and is also the stage of learning that everyone must go through in modern life. The development of modern education has gone from a focus on university education to secondary education, to a focus on primary education, and even down to early childhood education. Early childhood education is a stage of initiation, where knowledge learning begins in primary school and becomes a truly fundamental stage together with junior high school, with the formation of habits and emotional qualities and abilities as the goal. High school is the transitional stage for the development of talents, and university is the stage of fulfilment.

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