Case Design of Discipline Teaching Integration Based on Artificial Intelligence and Information Technology

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ABSTRACT

In view of the problems of poor integration effect of current discipline teaching, and generally low teaching level, this paper adopts the method of literature and case study to conduct in-depth research, and proposes the case design of discipline teaching integration based on artificial intelligence and information technology. Firstly, the theory of multidisciplinary integration and systematic science is analyzed and parameterized. Then combining the theory of multidisciplinary integration to construct the subject teaching integration model based on artificial intelligence and information technology. Finally, according to the constructed model, the case design of "face recognition system development" is carried out. The experimental results show that the model designed in this paper has high practicability, and learning through this model, students can acquire rich knowledge and results. Furthermore, the learning initiative is significantly improved, and innovative thinking is significantly improved, so as to improve the teaching integration effect and teaching level to a large extent.

Keywords: *Discipline teaching integration; artificial intelligence; information technology*

1. INTRODUCTION

With the rapid development of artificial intelligence and information technology in the field of education, the integration of subject teaching supported by scientific and technological forces has entered a stage of rapid development, which drives the process of education modernization in China. At present, there are many studies on the teaching design of a single subject supported by information technology, but less research on the integration of multi-disciplinary teaching supported by information technology. This paper starts from this perspective and follows the "Literature Review-Theoretical Analysis-Building Model-Case Design" research ideas, theoretical research and case analysis for the integration of subject teaching based on artificial intelligence and information technology.

2. STATUS QUO AND THEORETICAL BASIS OF DISCIPLINE TEACHING INTEGRATION BASED ON ARTIFICIAL INTELLIGENCE AND INFORMATION TECHNOLOGY

2.1. Research status quo at home and abroad

Researches on discipline teaching integration have a relatively early development in foreign countries, with fruitful result achieved in both theoretical and practical exploration during long-term exploration and practice. For example, the United States started to offer the STS (Science-Technology-Society) course as early as the 1960s, which integrated multidisciplinary knowledge. In addition, the United States also proposed two influential multidisciplinary teaching integration models—— The theme-centered model and the multidisciplinary model, both of which can realize the penetration and integration of knowledge of multiple disciplines [1]. Japanese high schools set up a "comprehensive study time" to guide students to study in multiple disciplines, thereby cultivating students' ability to solve comprehensive problems [4].

Domestic research on the integration of discipline teaching started relatively late, and the interdisciplinary studies at the higher education stage initiated in the 1980s, which is considered the starting point for domestic researches. In 1992, Hong Kong proposed the "Curriculum Integration Plan" to break the isolation between disciplines through "coordinated teaching of disciplines" and "thematic teaching of many disciplines". [2]. In 2001, the "Curriculum Integration" was proposed in the new curriculum reform, and elementary schools offered some comprehensive courses. For example, the subject "Science" included teaching content such as topics, features, and units.

2.2.   *Theoretical basis*

2.2.1.   *Multidisciplinary integration*

At present, there has not been a consensus as to definition of "multi-disciplinary integration" in the academic world; the same is true for a series of related concepts, including "interdisciplinary", "curriculum integration", "science and technology connection", "disciplinarity", etc. [3]. "Multidisciplinary integration" can be decomposed into two parts: "multidisciplinary" and "integration". The former refers to teaching activities conducted with integrated thinking and multiple thinking, involving two or more disciplines, and the latter refers to the interplay among knowledge, thinking and methods of multiple disciplines, expressing an educational concept. Multidisciplinary integration is not simply a pure accumulation of knowledge and methods among multiple disciplines, but the selecting, processing and integrating the knowledge and methods of different disciplines based on the basic knowledge and commonalities of disciplines. The discipline teaching integration based on artificial intelligence and information technology discussed in this paper, refers to the integration of multiple disciplines with artificial intelligence and information technology. Artificial intelligence and information technology not only provide conditions for the implementation of discipline teaching integration, but also serve as a high-end technical means to improve the teaching effect.

2.2.2.   *System Science Theory*

System science theory includes system theory, cybernetics and information theory. System theory points out that a system is composed of several elements, and these elements together form a whole; the various elements within the system are interconnected and interacted, rather than simple superposition. Functionally, the system exhibits overall characteristics. Education is a system that integrates elements such as educators, educators, teaching facilities, and teaching processes. The knowledge that students learn is also a system, which covers the knowledge of multiple disciplines, and there is a close relationship among different disciplines.

Therefore, it is necessary to strengthen the connection of knowledge among disciplines in teaching, so as to help students build a complete knowledge system.

3.   A DISCIPLINE TEACHING INTEGRATION MODEL BASED ON ARTIFICIAL INTELLIGENCE AND INFORMATION TECHNOLOGY

3.1.   *Theoretical basis*

3.1.1.   *Artificial intelligence and information technology and curriculum integration theory*

The integration of artificial intelligence and information technology and curriculum introduces artificial intelligence and information technology into multi-disciplinary integration, creates an information-based teaching environment, and creates a teaching method of "independence, inquiry, and cooperation", with teachers as the leading role and students as the main body. Break the teacher-centered teaching structure in traditional teaching.

Artificial intelligence and information technology have brought a huge impact on teaching. First of all, the form of teaching content has become more diversified and visualized. Teaching content can not only be presented in static text and pictures, but also in dynamic animation and video, making full use of the advantages of artificial intelligence and information technology. It can mobilize multiple organs of students to work at the same time in learning, which greatly improves students' perception. Secondly, artificial intelligence and information technology have realized the function of human-computer interaction. In classroom teaching, different forms of teaching activities are organized and implemented, such as inquiry learning, group discussions, etc., which not only help strengthen teacher-student interaction, but also provide teachers with timely feedback to help teachers adjust their teaching plans in time. Finally, artificial intelligence and information technology have created a variety of communication channels, including WeChat, QQ, E-mail, etc., so that teachers can communicate with students, leaders, and parents timely and effectively.

3.1.2.   *Multidisciplinary integration model*

There have been many researches on multidisciplinary integration models at home and abroad. For example, Fogarty proposed three types of discipline integration models, namely: integration within a single discipline, integration across disciplines, and integration of learners' internal and external mentalities [5]. The discipline teaching integration as discussed in this paper, is a continuous dynamic process in which, teachers, based on discipline-specific curriculum system, independently

carry out the integration of different content sections within a single discipline in a vertical manner, and the integration of knowledge, skills, and methods across multiple disciplines in a horizontal manner, according to the needs of students and specific teaching conditions.

The integration of subject teaching can be divided into two types: intra-disciplinary and inter-disciplinary curriculum integration. Intra-disciplinary curriculum integration includes intra-unit integration and intra-semester integration. The former refers to the integration of related knowledge, skills, methods, etc. in the same unit, while the latter refers to the integration of the related knowledge in the same subject and semester according to teaching needs. Integrate. Curriculum integration between disciplines mainly includes two modes of parallel integration of disciplines and auxiliary integration of disciplines. The former refers to the parallel relationship between multiple disciplines, organizing the content of disciplines around a theme, and serving with the same theme together through the integration of time and space. The latter refers to the mode of taking one subject as the main subject and integrating the relevant knowledge of other subjects into the main subject to serve the main subject (He, 2008).

3.2. Construction and analysis of discipline teaching integration model based on artificial intelligence and information technology

Centering on the research objective of this paper, this section capitalizes on the theory of multi-disciplinary integration to construct a model of discipline teaching integration based on artificial intelligence and information technology. The connotation of this discipline teaching integration model based on artificial intelligence and information technology includes: 1. before class, teachers in the teaching team collectively discuss teaching content and teaching activities, communicate and exchange with each other, and determine teaching topics and select teaching methods based on student characteristics and teaching environment; 2. In the class, teachers of different disciplines cooperate in teaching towards staged problems, use modern information technology tools to interact with students, jointly guide students' learning, and deepen their understanding of teaching contents; 3. after class, teachers use the recording and broadcasting system to reflect on the teaching process, discover and correct teaching problems, and give feedback on teaching practice.
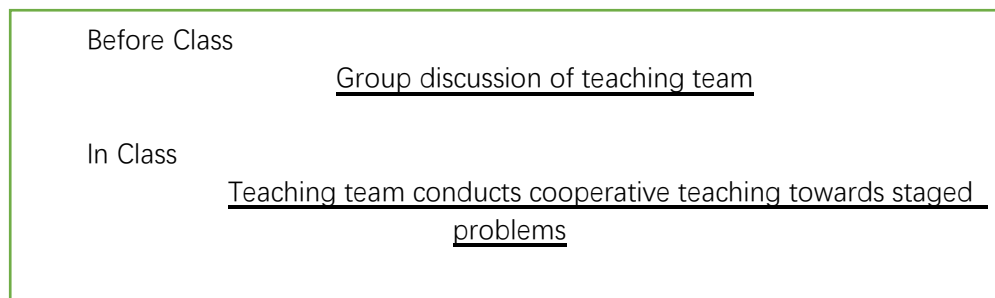

Before Class

Group discussion of teaching team

In Class

Teaching team conducts cooperative teaching towards staged problems

Figure 1 The connotation of discipline teaching integration model based on artificial intelligence and information technology

An education system is composed of elements such as educators, educatees, and educational media. Classroom teaching involves elements such as teaching theme, objective, environment, content, methods, and evaluation. Among them, the teaching objective is the center of classroom teaching, which guides the design and implementation of teaching. The subject of teaching, teaching content, teaching methods, and teaching environment are interconnected and interacted with each other in order to achieve teaching goals. Teaching evaluation acts on the process elements of teaching subject, content, methods, and environment, and provide feedback for teaching objectives, and basis for further revision of teaching objectives.
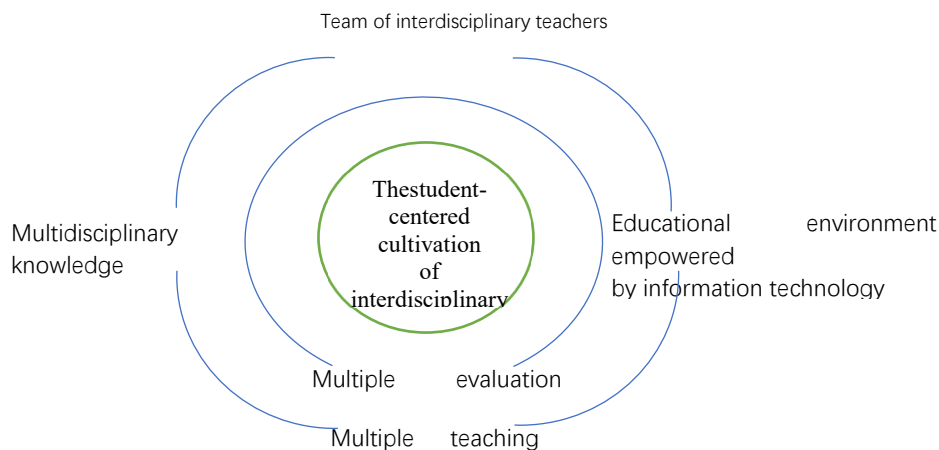
Team of interdisciplinary teachers

Figure 2: The diagram of the relationship among elements of discipline integration teaching model

As seen in the above figure, the discipline teaching integration model based on artificial intelligence and information technology, includes six elements, namely, interdisciplinary teachers, multidisciplinary knowledge, teaching environment empowered by information technology, multiple teaching objective, multiple teaching methods, and multiple evaluation methods [7]. Among them, the elements such as interdisciplinary teachers, multiple teaching methods, teaching environment empowered by information technology, and multidisciplinary knowledge are connected in a clockwise direction, while multiple evaluation methods run through the entire teaching process, working together to serve multiple teaching objective (that is, to cultivate interdisciplinary talents). In summary, the team of interdisciplinary teachers uses multiple teaching methods to teach students multidisciplinary knowledge in a teaching environment empowered by information technology, and uses multiple teaching evaluations to provide teaching feedback, the purpose of which is to train students into interdisciplinary talents.

4. CASE DESIGN AND IMPLEMENTATION EFFECT

This chapter designs the case of "face recognition system development" for the model constructed in 2.2, and tests the practicability of the model.

4.1. Case design and implementation process

The traditional teaching of face recognition, focuses more on technical aspects such as tool-based operation when teaching objective is set. Teaching activities focus more on practice and operation, while theoretical learning and thinking training are largely ignored. This paper proposes that that students should understand the principles and algorithms of face recognition in a problem-oriented context. They are supposed to find problem, trace the source of problem, and solve it by themselves, in the process of which, they form an engineering thinking and develop a computational thinking. According to it, a teaching objective matrix is established, as shown in the following Table:

Table 1 Teaching objective matrix

	Knowledge and skills	Process and methods
S (Science)	Grasp the core concepts and understand the working principle of face recognition.	Guide students to master the method of realizing face recognition
T (Technology)	Understand the functions and uses of face recognition	Develop a face recognition system, discuss the advantages and disadvantages of it
E (Engineering)	Understand the basic principles of face recognition	Master the process and method of solving problems
A (Art)	Learn to describe the characteristics of human faces	Master the aesthetic skills in the design and evaluation of works
M (Teaching)	Understand how computer recognition of human faces transforms facial features into vectors	Master the methods of using data

According to the project objective and flow chart, students, based on the needs of problem-solving, collect and organize information through various channels such as consulting materials and browsing the Internet to continuously improve their independent learning ability and information awareness. Teachers guided students to explore the principles of face recognition through games, which activated the atmosphere of the classroom teaching. While achieving the teaching objective, students extensively grasped multi-disciplinary knowledge.

In the later stage of course teaching, teachers organized students to conduct inquiry activities. For example, students independently combed the concepts and applications of face recognition. Some students described face recognition as " A kind of technology which uses computer technology to analyze facial features and compare identities; in simple terms, face recognition is to find a face in a picture, and recognize the person information according to the biometrics of the face, and then make further business processing according to the needs in different scenes"; besides, student sat up in groups to explore face recognition principles and algorithms. One group performed an in-depth interpretation of the core algorithm of face recognition technology, that is,

$$\rho(X,Y) = \frac{\mathrm{Cov}(X,Y)}{\sqrt{D(X)}\sqrt{D(Y)}} \tag{1}$$

another group transformed it and established the following formula,

$$R_{XY} = \frac{\sum_{i=1}^{N}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{N}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{N}(Y_i - \overline{Y})^2}} \tag{2}$$

4.2. Effectiveness evaluation

First of all, students learnt a lot. Teachers act as mentors to create problem situations, publish projects, and guide students to think. Students completed project learning through cooperative exploration. Students displayed a high degree of awareness, and their understanding of professional knowledge improved.

Secondly, students' learning initiative improved significantly. Using network information tools, students obtained knowledge and information through multiple channels and chose appropriate methods to solve problems, students' learning initiative has been greatly improved.

Finally, students' innovative thinking improved significantly. Multidisciplinary integration under artificial intelligence and information technology requires students to think divergently. Teachers only provided models or ideas. Students also put forward their own ideas and carried out innovative practices from different angles.

5. CONCLUSION

This paper first sorts out multi-disciplinary integration theory and system science theory and other related theories, and then establishes a discipline teaching integration model based on artificial intelligence and information technology, and comprehensively outlines the interrelationships of the six teaching elements. Carrying out the case design of "Face Recognition System Development", and objectively evaluating the implementation effect, it is confirmed that the integration of subject teaching based on artificial intelligence and information technology can be recognized by most teachers and students. It also helps improve students' ability to understand comprehensive knowledge.

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