Project Based Interdisciplinary Learning In The Environment Of Smart Education

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Abstract—**In the information age, facing the complex social life, learners need to improve the ability of interdisciplinary thinking and knowledge integration. In recent years, many undergraduate colleges and universities have set up interdisciplinary majors to cultivate talents with interdisciplinary thinking and professional ability. The interdisciplinary learning of undergraduates usually faces the contradiction between the depth and breadth of learning. How to establish the connection between different disciplines and improve the dimension of interdisciplinary learning is the main problem faced by interdisciplinary learners. The project-based learning strategy is to integrate the knowledge of multiple disciplines by completing project tasks, stimulate learners' learning motivation, and promote learners' interdisciplinary learning. The role of smart education in project-based learning is reflected in learning resources, communication space, recording learning behavior and so on. Teachers should provide support for students on making choices among massive learning resources, maintaining the cultural atmosphere of the learning community, and establishing online and offline hybrid teaching strategies.**

Keywords—*PBL, Interdisciplinary learning, smart education;*

I. Introduction

In the Internet environment, the mode of knowledge generation has changed from a single discipline and cognitive context to an interdisciplinary context[1]. The traditional subject based knowledge system is not enough to deal with the increasingly complex society and life[2]. It requires the ability of interdisciplinary thinking and knowledge integration, as well as the ability to understand the relationship between different professional knowledge[3]. In order to meet the needs of the times, many colleges and universities have set up interdisciplinary undergraduate majors with multi-disciplinary integration, such as bioinformatics, e-commerce, financial engineering and so on, so as to cultivate talents with interdisciplinary thinking and professional ability.

Project Based Learning(PBL) which is an effective interdisciplinary learning strategy is a student-centered learning strategy. Students focus on a project involving interdisciplinary knowledge, formulate personalized learning objectives, build an interdisciplinary learning community in the form of groups, and improve interdisciplinary learning ability and learning autonomy.

Smart education is a new stage in the development of educational informatization. The new generation of intelligent technology provides effective support and environment for project-based interdisciplinary learning. The rational use of intelligent education technology is of positive significance to promote the interdisciplinary learning effect of undergraduates. This paper discusses the role of Smart Educational Technology in problem-based cross learning of college undergraduates and interdisciplinary teaching strategies in the new technology era.

II. Interdisciplinary learning of College Students

The characteristic of interdisciplinary learning is to integrate multi-disciplinary knowledge into one theme. Learners break through the boundaries between disciplines, develop higher abstract cognitive ability, and promote the improvement of critical thinking and interdisciplinary thinking ability. Cultivating interdisciplinary cognitive ability requires a learning process. Lana ivanitskaya proposed the structural levels of interdisciplinary learning, including Uni-structure (uni-disciplinary), multi-structure (multi - disciplinary), relational and extended abstract levels[4].

Compared with learners of traditional disciplines, learners of interdisciplinary majors often face emerging professional fields and broader knowledge space. For example, the curriculum system of e-commerce majors includes both technology development courses and business management courses. The interdisciplinary learning of undergraduates usually starts from the perspective of each independent professional discipline, and gradually constructs the knowledge structure of the discipline, from being familiar with the context of each discipline to constructing multidisciplinary knowledge, so as to reach the multi-disciplinary learning stage. At this stage, learners' knowledge structure presents the characteristics of discipline segmentation. Cognitively, it is the juxtaposition of several disciplines, and there is no direct attempt to integrate[4]. At this time, learners have more choice space for the direction of in-depth learning, which makes learners feel confused, makes learning lose direction, affects the efficiency and motivation of learning, and causes learners to jump between different professional directions. The construction of knowledge in various disciplines is difficult to go deep, and the abstraction ability between disciplines is difficult to enter a higher level. Therefore, the difficulty of

improving the interdisciplinary learning effect in the undergraduate learning stage lies in how to establish the learning goal, integrate the knowledge of different disciplines, reach a higher level of abstraction, develop metacognitive skills, span from the multi structure level to the relationship level, and improve the learning ability.

III.   Project based interdisciplinary learning

Project Based Learning is an interdisciplinary project for students. This project usually needs to use two or more discipline knowledge (such as designing an app product) to establish their own learning objectives in the form of group discussion. Students collect learning resources according to their learning objectives, feed back to the group after learning, reflect on their learning experience and communicate with group members. The core values of PBL are mainly reflected in learners' independent decision-making of learning objectives, stimulating internal learning motivation, respecting each student's knowledge background, paying attention to communication and cooperation, improving learning initiative and promoting lifelong learning. PBL's learning strategy is consistent with interdisciplinary learning, which is embodied in clarifying learning objectives, promoting communication among learners and improving metacognitive skills.

- Clarify learning objectives and improve learning motivation. The project objectives provide learners with learning direction and direct motivation [5]. When learners engage in a task out of their own interest, they will have internal motivation. When the project objectives are achieved, learners' self-efficacy is further improved and their internal learning motivation is stimulated

- Establish multi-disciplinary links and promote the integration of knowledge in all parts .In order to achieve the project objectives, learners need to constantly build the knowledge of different disciplines, promote learners to understand the role of the knowledge of various disciplines, organize the knowledge of different disciplines, and unconsciously establish the connection between disciplines in the process of solving problems. In the process of completing the project, the application ability of relevant knowledge is trained to enhance the depth of learning.

- Enhance communication and collaboration. PBL is a group learning strategy, which is an interdisciplinary learning community composed of multi-disciplinary learners. Group members contribute their professional abilities and resources. In the process of discussion, learners analyze the same problem from different disciplinary perspectives, provide opportunities for communication among learners, expand learners' perspectives, and train interdisciplinary thinking and critical thinking.

- Improving metacognitive skills. Metacognitive skills refer to learners who know when and how to use different learning strategies and can independently plan, monitor and control their learning[6]. The improvement of metacognitive skills by PBL is mainly reflected in two aspects: (1) PBL learners' independent learning is carried out under their own control and adjustment. Usually, students make their own learning plans and implement self-monitoring and self-adjustment; (2) After independent learning, learners should reflect on their learning process and learning results and share them with the group. This link is helpful to observe the differences between their own learning and other members and better identify their own learning mode.

PBL is consistent with interdisciplinary learning objectives in training students' critical thinking, improving the level of abstract thinking and training high-level thinking ability. The learning strategy of PBL needs learning support. Its effectiveness is based on the assumption that students have strong self-guidance and learning enthusiasm. If students' learning initiative is not strong and their learning skills are low, they may have insufficient enthusiasm for group discussion, insufficient learning effect and sustainability, and affect the effect of learning.

IV. THE CONCEPT AND FUNCTION OF SMART EDUCATION

IBM first proposed the concept of "smart earth" in the report "Smarter Planet: the next leadership agenda " [7]. The report believes that with the support of new technologies, people's lives have become instrumented, interconnected and intelligent The wisdom of the earth is mainly reflected in the application of computing power to all kinds of things. Almost tasks can realize digital perception and networking, which makes the system process and infrastructure more efficient and sensitive. Smart education is the application of this concept in the field of Education [8].

A.   The concept of Smart education

Many Chinese scholars have explained the concept of wisdom education. Zhu zhiting believes that smart education is to use intelligent technology to build an intelligent environment and enable teachers and students to implement "smart" teaching and learning methods, so as to cultivate talents with good value orientation, high thinking quality and strong implementation ability [8]. Huang Ronghuai believes that smart education is a smart education system which is an educational behavior (system) with high learning experience, high content adaptability and high teaching efficiency provided by schools, regions or countries. It can use modern science and technology to provide a series of differentiated support and on-demand services for students, teachers and parents. It can comprehensively collect and use the status data of participant groups and education and teaching process data to promote fairness, continuously improve performance and breed excellence in education[9]. Zhong shaochun believes that smart education means that with the support of Internet, big data, artificial intelligence, virtual simulation and other information technologies, students can take the initiative to learn, learn on demand, find their own learning environment and learning methods, find the most suitable partners to learn, get the most suitable teachers to help them learn, and gradually form systematic thinking ability and innovative thinking ability [10].

To sum up, scholars generally agree that smart education is to integrate the new generation of smart technology with the field of education, build a smart learning environment,

innovate teaching methods and promote learners to carry out smart learning. Smart education technology mainly includes big data, Internet of things, cloud computing, artificial intelligence, mobile Internet, virtual reality / augmented reality, etc.

B. The role of Smart education

The combination of intelligent educational technology and problem-based interdisciplinary learning can provide learners with learning support, reduce learning difficulty, expand communication space, record learning process and so on Specifically reflected in:

- Provide open learning resource platform and personalized intelligent recommendation system. Learners could access learning resources of different disciplines through the Internet. These resources could provide effective support for learners' interdisciplinary autonomous learning and personalized learning.

- With the help of VR / AR technology and virtual simulation technology, create an immersive learning space to help learners understand knowledge, reduce learning difficulty of interdisciplinary learning and improve learning efficiency in a more intuitive way.

- Provide network communication space and create connection opportunities for learners of different subjects. The virtual platform widens the space for learning and communication, breaks the boundaries of majors and grades, helps learners establish connections, takes task as the center, and flexibly combines interdisciplinary learning groups.

- Provide mixed learning space. Learners are no longer confined to online or offline learning scenarios. Online information and learning resources can be obtained at any time during offline learning. Offline learning content can be converted into data form and shared online. Online learning content can be shared and discussed with offline partners.

- Intelligent technology helps learners record the learning process. Learners can record their online and offline learning processes, including learning resources, learning status, learning experience and learning results, through Internet, sensors, intelligent recognition and other technologies and multimedia terminal devices, so as to form a variety of storage to help learners observe themselves and improve their self-awareness. Through data analysis technology, more comprehensive records, in-depth analysis of learners' characteristics, and assist learners to establish personalized learning strategies.

The technical means of smart education provide assistance for PBL interdisciplinary learning, reduce the threshold of knowledge acquisition, open the bridge between learners, and provide reference for learners with different professional backgrounds and ability levels. This allows more learners to achieve their goals. Personalized learning strategies can provide reference and help for students with insufficient self-guidance.

V. PROJECT BASED INTERDISCIPLINARY TEACHING STRATEGY UNDER INTELLIGENT EDUCATIONAL TECHNOLOGY

Under the PBL strategy, the role of teachers is transformed from knowledge disseminator to learning organizer and leader. Teachers need to put forward interdisciplinary learning problems, observe and appropriately guide students' group discussion, provide support for students' independent learning, and supervise and evaluate learners' learning process. Under smart education technology, teachers' support for project-based interdisciplinary learners includes:

A. Design project tasks with interdisciplinary and open characteristics

Interdisciplinary learning oriented projects should cover interdisciplinary knowledge and skills, so that learners can deepen their understanding of knowledge and establish links between interdisciplinary knowledge in the process of completing tasks. Task objectives should be open to a certain extent, providing learners with a space for independent choice. It is more helpful for learners to set their own task goals according to their interests to stimulate their internal learning motivation.

B. Selection of learning resources

After determining the learning objectives, learners need to choose from a large number of learning resources. At present, all kinds of curriculum resources are mostly based on the traditional single subject curriculum system. In order to realize problem-based interdisciplinary learning, the learning resource should be reintegrated around the needs of the project and a clear learning path should be built. Teachers need to fully understand the leading and subsequent relationship of the curriculum in their respective professional system, and understand the different functions of multidisciplinary knowledge required to solve problems and the level of mastery of the subject knowledge to solve problems, so as to guide students to choose from a large number of learning resources.

C. Maintain an open and integrated online community culture

Encourage learners to access the network communication platform, share the learning process and display the learning results. Learners are encouraged to cooperate with learners from different disciplines through the network platform to enhance the communication between learners from different disciplines in the process of solving problems. Pay attention to the diversity of the platform, support the personal growth and development of each learner, and respect the contributions of all project participants [11].

D. Use mixed teaching strategies to promote the connection and circulation of online and offline learning

Combine traditional classroom teaching with online learning space, take the problems and learning results found in online virtual space as the theme of offline physical classroom, apply the knowledge obtained online to offline physical space, and encourage learners to use the Internet to record their learning path, learning experience and learning results.

VI. A TEACHING CASE OF PROJECT BASED INTERDISCIPLINARY LEARNING STRATEGY

We took the course "mobile e-commerce" as an example to carry out the teaching practice of project-based interdisciplinary learning strategies. "Mobile e-commerce" is a comprehensive course for students majoring in E-commerce. The course content covers mobile network technology, business model, electronic payment, marketing and other disciplines. The content covers a wide range and the knowledge structure is relatively loose. In order to deepen students' understanding of the course content and improve students' comprehensive application of the learned knowledge, PBL strategy is used in the course teaching process. The specific implementation process is as follows:

- Design of project tasks. The project task of the course is to design a mobile application product in a group, including the business model of the application, product function prototype, product marketing and promotion scheme, and display the product. In order to complete the task, students need to integrate the knowledge of each chapter of the course, and realize the connection between the learned knowledge in the process of completing the task, so as to achieve the interdisciplinary learning goal.

- Put forward open task requirements and provide online learning resources. The project task does not limit the specific design theme and content. Students can decide the design theme by themselves. Open task keeps the space for students' personalized learning and innovation, and allows students to establish personalized learning goals. Teachers provide self-made teaching videos, courseware and other learning resources through the network platform to support students' autonomous learning and personalized learning.

- Establish an independent evaluation mechanism and respect the contributions of each member. Students submit their design works through the Internet, display their works to all students, and encourage students to exchange and evaluate each other. The project performance evaluation is completed by students and teachers. The evaluation is carried out from two dimensions: the work evaluation and the member performance evaluation. Work evaluation is to evaluate the completion of group work according to the established evaluation criteria, with the participation of teachers and students. Member performance evaluation means that each group evaluates each member according to their contribution to the work, which is carried out independently by students in the group.

- Using mobile learning tools to realize hybrid teaching strategies. In classroom teaching , with the help of Rain Classroom, a mobile learning tool, online and offline learning can be connected. By using this tool, students could put their speeches on the screen of teachers' playing courseware in real time through mobile phones. This method helps to reduce students' expression pressure and encourage more students to express their views, so as to create a good classroom atmosphere. At the same time, Rain Classroom could store students' learning data and classroom teaching resources on mobile phones for students' preview and review.

At the end of the course, we collected students' feedback on the course through a questionnaire survey. The survey results show that the students generally believe that through the project design, they have deepened their understanding and mastery of the course knowledge, have a further understanding of the role of each part of the knowledge in the practical application, and have a certain help in understanding the relationship between the knowledge of each chapter. They have often exchanged and communicated in the group cooperation. More than 85% of the students said that they were inspired by the works of other students. In terms of technical support, 77% of the students checked the teaching resources on the network platform when completing the task. 76% of the students said that they prefer to express their views through the rain class rather than speaking in class. 87% of the students thought that the rain class could help them study and review effectively. The results show that the information technology used in the curriculum plays a supporting role in promoting communication and autonomous learning.

VII. SUMMARY

PBL strategy help interdisciplinary learners establish personalized learning goals, stimulate internal learning motivation, build multidisciplinary knowledge centered on projects, understand the roles and connections of different disciplines, train critical thinking in the process of group discussion, improve metacognitive skills, and promote the abstraction level of interdisciplinary learning. Intelligent technology provides a new technological environment for higher education. It provides support in providing interdisciplinary learning resources, promoting the communication between learners with different disciplinary backgrounds, formulating personalized learning strategies，recording learning behavior and so on.

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