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Based on SPOC+PBL Teaching Mode, it is Integrated into the Application and Practice of "Water Resources Planning and Utilization" Course in Colleges and Universities

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Abstract: During the epidemic, the rich network resources provided good learning conditions for today's students, but also posed great challenges to teachers' teaching methods. At present, the "cramming" teaching in the "Water Resources Planning and Utilization" class of the major of water conservancy and hydropower is difficult to meet the diverse needs of students. SPOC+PBL classroom, as a brand-new online teaching method, adapts to the development trend of the current teaching reform, and effectively integrates online courses and offline classrooms. In order to clarify the characteristics of SPOC, PBL and blended teaching, analyze the course of "Water Resources Planning and Utilization" from the content of the curriculum, the standards achieved and the current development status, and optimize the "Water Resources Planning and Utilization" from the perspective of SPOC+PBL. The actual path of the course is analyzed, so as to provide reference for the construction of similar courses.

1. Concept Definition

1.1. Spoc

The full name of SPOC is Small Private Online Course, which is translated as a small and dedicated course. Among them, small is relative to massive, which means that the number of students is usually in the dozens to hundreds, while private is relative to open, which means that not everyone can learn, and access conditions need to be set to enter [1]. According to different teaching objectives, teaching content and learner characteristics, MOOC should be used as a teaching resource, and at the same time, micro-lectures, online high-quality teaching resources should be combined with traditional classroom teaching, and the concept of blended teaching should be integrated. In order to improve students' learning autonomy and teaching quality, and make

classroom teaching more efficient. It can be seen that SPOC is essentially a teaching model designed for the individual differences of learners, which combines online autonomous learning with offline physical classrooms. According to the characteristics of MOOC, the advantages of SPOC are mainly reflected in the following aspects: (1) The total number of learner groups faced by SPOC teachers is small, because the total number of learner groups is small, so teachers are more able to monitor learning It increases the interaction between teachers and enables teaching to be carried out efficiently in a safe and fair atmosphere [2]. (2) Pay attention to the learning experience of the learners, can record the learning process of the learners more comprehensively, and can also detect, record and strengthen the activities of the learners, which is convenient for the supervision and management of the activities of the learners, thus greatly improving the motivation of the learners , enhance the interest and enthusiasm for learning, and then improve the learning efficiency. (3) The production cost is low and it is easy to operate. Compared with MOOC, SPOC pays more attention to small-scale and practical curriculum development. It is a new model for the sustainable development of MOOCs. The learning results can be fed back in time in the form of data, and can also be deduced through analysis, which helps the course to be more intelligent. (4) The functions of teachers and students have changed. Before the class, the teacher is the organizer and learner of the classroom materials, while the student is the leader of the whole learning process; in the class, the teacher is the guide and host of the teaching, and the student is the explorer of the course; The teacher is the evaluator and instructor of the teaching process, and the student is the presenter of the works and the summarizing and reflecting of the learning. Through the transformation of the role of teachers before, during and after class, learners are encouraged to change from passive receivers of cognition to active explorers, discover knowledge through inquiry and cooperation, and improve their autonomous learning ability [3].

1.2. Pbl

PBL is a new teaching method that is problem-centered, student-led, and teacher-led. PBL was established in McMaster Medical College in England in 1965, and its full name is Problem-Based Learning, which means problem-based knowledge [4]. PBL refers to "learning that arises from the process of understanding or solving problems". It was further defined by Dr. Howard Barros in 1988 as the Curriculum Strategy and Process Approach. PBL can give learners more control over their ongoing research to develop a viable solution to a defined problem. PBL can integrate theory, practice, knowledge and skills to enable students to find feasible solutions to problems. Described as a method based on student learning by solving complex problems for which there is no single correct answer. Therefore, compared with the traditional teaching mode, the central idea of PBL is to activate existing knowledge through problem situations and promote the learning of new knowledge. The PBL teaching model first emphasizes that teachers should place students in a practical or specific problem environment, let students interact and cooperate in a group form, and solve real, practical or complex problems for the convenience of students , so that students can learn some relevant knowledge hidden behind the problems in the content in this way, not only can students form a more scientific way of logical thinking or problem-solving skills to help us solve similar practical problems , It can also help us cultivate students' curiosity and the ability to master the basic knowledge they have learned. More importantly, the PBL teaching model can also help us cultivate and improve students' deeper thinking skills, such as critical thinking ability, innovative thinking ability and computational thinking ability, is shown in Figure 1[5].

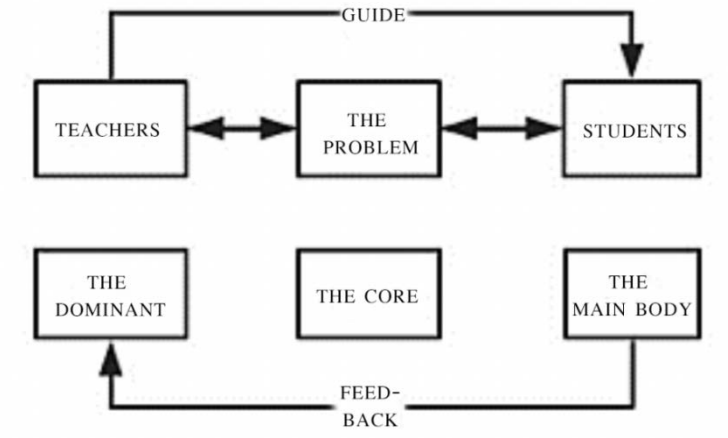

Figure 1: PBL teaching mode

1.3. Blended Teaching Model

Blended classroom is a model that integrates online platform courses with offline traditional classrooms. Compared with the traditional teaching method, which is mainly based on theoretical teaching and centered on textbooks, although it adheres to the "student-centered" educational purpose, it does not weaken the leading role of teachers. Combining the online platform class with the offline face-to-face class can broaden the learners' thinking and vision, so that students can absorb more different viewpoints [6]. In addition, the blended teaching method does not simply add online and offline teaching, but combines the two teaching methods to learn from each other's strengths and weaknesses. In online teaching, learners can achieve the autonomy of learning "time and space" , and can complete their studies in full accordance with their own needs, thereby improving the ability of independent learning. In offline classroom teaching, teachers can connect problems through the whole classroom teaching process, and in the process of teacher interaction and inquiry, make teachers get closer to students, go deep into students, interact with students more effectively, and mobilize their subject ability. In this process, they have mastered the skills of using existing knowledge to analyze problems. Blended teaching is a kind of concept of "teacher-led, student-centered", which fully integrates online teaching and traditional offline teaching, and gives full play to both. Advantage of teaching methods.

2. Development Status of "Water Resources Planning and Utilization Course"

2.1. Course Teaching Content

With the rapid development of China's water conservancy and higher education, and the further strengthening of education and teaching reform, China's water conservancy engineering education has also expanded and improved significantly. In order to meet the requirements of the teaching structure of water resources planning in the new curriculum era and the overall situation of my country's economic and social development, in order to train engineers of water resources planning courses, the National Colleges and Universities Water Resources Management Course Steering Committee was established. The course of "Water Conservancy and Water Energy Planning" was discontinued and changed to "Water Resources Planning and Utilization" as the main course of "Water Management Planning" of the engineering degree, and the training content was also adjusted

and expanded on the original basis [7]. The teaching goal of this course is to provide learners with the basic knowledge of engineering theory related to water resources planning, development and utilization by understanding the basic knowledge of various professional fields of engineering hydrology. The teaching focuses on: water resources planning and its comprehensive utilization, water resources Evaluation and balance analysis of supply and demand, comprehensive utilization of reservoirs and regulation of profits, flood control and disaster reduction, water energy development and utilization, comprehensive river utilization planning, water resources management and protection, etc. , in the teaching process, focus on training learners' engineering and technical literacy and the basic ability to use knowledge and technology to deal with complex engineering and technical problems in the fields of water resources planning, development and utilization, and pay attention to training learners in innovation and continuous learning in teaching practice. and the ability to adapt to development.

2.2. Course Teaching Objectives

"Water Resources Planning and Utilization" has a wide range of content, and both theory and practice can be considered. The main task is to provide learners with the theoretical cornerstone and professional knowledge of water resources planning and utilization on the basis of mastering the theoretical basis of the basic content of engineering hydrology. Through the study of this course, students will understand and master the theory and specific technical methods of water resources planning and reservoir dispatching, and master the principles and methods of calculation of runoff (volume) regulation, water energy calculation, and flood regulation calculation. The acquired knowledge can be used for engineering design issues in the planning, construction and operation management stages of water conservancy and hydropower projects, as well as in water resources planning, reservoir operation management and other aspects. Master the analytical methods and calculation methods related to this field, and in practical practice, lay a good foundation for future teaching.

When this course is completed, students must meet the following basic conditions: (1) Master the current water resources status, existing problems in water resources, the main content of water conservancy calculation, and understand research methods and the relevance of learning content to future work. (2) Learn the relevant content of revitalization regulation, master the purpose of revitalization regulation, classification of runoff regulation, characteristic water level and characteristic storage capacity, as well as the relevant content of the design guarantee rate, and seek water for known incoming water and known water for storage capacity in revitalization calculation Different solution methods are used for calculation. (3) Proficient in the use of flood control and adjustment calculations, understand the concept, hazards and prevention methods of floods, and learn to list and test algorithms and graphical methods for flood control calculations, determination of dam crest elevation, and flood control scheduling. (4) Learn to calculate water energy, including the derivation of water energy formula, power system load diagram, guaranteed output and its calculation, multi-year average electric energy calculation, installed capacity composition, working capacity and repeated capacity selection, understand the concept of reservoir dispatching diagram, anti-damage Line and drawing method of limit output line [8].

2.3. Current Situation of Course Teaching

(1) Course schedule is outdated

Practical training courses fail to meet the needs of the industry as it evolves in the new situation.

Judging from the content of the curriculum framework, the curriculum structure is outdated, the class hours are short, and the time is concentrated. Students do not get the opportunity to experience practice and learn about current developments in the industry. Practical courses should provide students with the opportunity to learn about practical issues and current industry developments. However, the current curriculum does not meet the needs of industrial development under the new situation, and the practical content is outdated. Courses and learning time are short, and practical knowledge is easy to be lacking and outdated, which is not conducive to the rapid integration of high-quality talents in the hydrology industry in today's new situation.

(2) The teaching platform is not fully utilized

Various learning platforms in schools are not fully exploited. And students' innovative ability in practice is still insufficient. The form of "Water Resources Planning and Utilization" course focuses on experiential learning, and experiential learning is mainly based on verification experiments. The course uses comprehensive tests to assess students' knowledge. Teachers use various rich teaching platforms to explain knowledge to students in depth, so that students can think and solve problems autonomously and spontaneously, which is the important meaning of teaching [9].

(3) The goal of talent training is not clear

"Water Resources Planning and Utilization" lacks clear talent training goals and is out of touch with social needs. Especially after my country entered the 1990s, problems such as water shortage and flood disasters became prominent along with the social and economic development, and the pollution of the water environment continued to increase. This has become one of the key issues restricting China's social and economic development. However, because the teaching content of the original hydrology and water resources course is still based on traditional engineering hydrology, the knowledge structure and overall ability of students cannot meet the needs of current social development. The course content of "Water Resources Planning and Utilization" is not reasonable enough, and the learning content is relatively simple.

3. The Blended Teaching Mode Is Integrated into the Curriculum Application Path

On the one hand, SPOC-based blended learning is a model that combines SPOC-based online courses and offline promotion-based physical teaching. According to the connotation of blended learning, this model relies on constructivist learning theory and uses the basic principles of systematic learning theory. built for guidance. Chen Ran's SPOC hybrid learning model is shown in Figure 2. The model mainly includes three stages, the first part is the preparatory stage. At this stage, it is necessary to analyze learners, learning content and learning environment, set teaching goals and design and develop learning resources according to the above analysis, and build a SPOC teaching platform. When developing SPOC online resources, we can not only directly introduce high-quality MOOC resources on the Internet, but also transform existing excellent courses into SPOC videos according to the students' current level, and we can also analyze the characteristics of learners and teaching content to create micro Courses are uploaded to the SPOC platform; the second part is the design phase for blended learning activities. At this stage, teachers adopt problem-solving and task-driven teaching methods. Before class, teachers guide students through the task list and play video tutorials. Students can walk into the classroom with questions. Teaching records and discussions are used to solve problems, and teachers give advice to students who cannot answer them to promote in-depth learning of knowledge. After class, teachers arrange after-class teaching assignments and conduct after-class tests to timely reflect students' knowledge point learning status, promote the formation of their own learning strategies, and improve autonomous learning ability;

the third part is the implementation and evaluation stage of learning activities [10]. Through the results of after-class evaluation, the classroom teaching with this management mode is evaluated and fed back, and the classroom teaching process is further optimized. This model emphasizes the main position of learners in the teaching process, makes full use of the quality of online high-quality MOOC resources, and combines the advantages of SPOC technology platform and offline classrooms, providing theoretical and practical value for the reform of teaching practice in my country.

On the one hand, the "PBL teaching model" emphasizes the problem as the center and the students as the main body of the teaching, analyzes the problem in the problem situation, thinks continuously, and uses the creative thinking, critical thinking and auxiliary model construction to solve practical problems and master it. complete body of knowledge. Therefore, the theory of situational cognition and situational learning is an important theoretical basis for the "PBL teaching model". From the literature survey method, it can be seen that the main features of the "PBL teaching model" can be summarized as follows: (1) The students are the leaders of the classroom and the teachers are the auxiliary guidance: in the classroom teaching, the students carry out a series of discussions and exchanges on the issues raised , in which the method of group discussion can be used. ② Take the problem as the core: create a suitable situation, students ask relevant questions in the situation, and the question should be related to the teaching purpose. ③ In group cooperative learning, each member of the group completes his own task, Then collaborate and communicate. Specifically for biology courses, Liu Fang believes that the entire educational process can be set as "establishing an organization - setting problems - solving - showing results - starting to reflect"; the classroom teaching process of architectural design by Professor Chen Guojuan and others is "creating questioning scenarios" —Defining questions—analyzing questions—collecting resources, proposing suggested learning approaches—solving problems and expanding and expanding"; Zhang Xumei and Xu Zuoying designed the classroom teaching link based on the "PBL teaching model" as "creating problem situations, raising general questions—presenting materials and Refinement of problems-solving problems-results display and communication-summary evaluation".

Course video design. (1) The duration of the video: First, the course content is divided into knowledge modules, and then further divided into knowledge points, and teaching videos are recorded in units of knowledge points. According to the characteristics of learning attention, the video duration should be 5~15min; (2) Display form: there are currently two modes: teacher + slideshow, teacher + student, which are better produced by professional companies, but the cost is high, and the first time Teachers who are carrying out teaching reforms can use devices such as tablets and mobile phones to record screens.

Course Interaction Design. Focus on the subjectivity and participation of students in teaching activities: (1) Retrieval learning: PBL-based knowledge retrieval and knowledge reconstruction teaching video embedded knowledge test module; (2) Proficient learning: each teaching The unit knowledge test module at the end of the module and the team-based preview effect test module after class sign-in; (3) Interactive learning: pay attention to the application of various participatory teaching methods and smart teaching platforms, such as voting, questionnaires, rush answers, (4) Team-based learning: there are fixed grouping based on classroom learning, self-grouping based on pre-class preview and after-class review, and random grouping based on completion of after-school homework, etc.; (5) Expanded learning: extracurricular reading test modules about typical cases, industry hotspots, extracurricular reading, etc., and curriculum construction contribution modules that provide materials for curriculum construction and mutual aid learning, etc.; (6) Discussion learning: mainly case analysis, hot issues Discussions, group questions, mutual aid and Q&A, etc.

Course evaluation design. Diversify the assessment methods and focus on the process assessment. Take enterprise management training as an example: (1) Self-study test (20%): embedded test and independence test automatically graded by smarter teaching system; (2) Team mutual evaluation (10%): to expand The introduction of course materials for the purpose of the learner's vision, such as the PPT for case analysis with the team as a unit, the recording of lecture videos, and the scores based on the mutual evaluation between teams; (3) Teacher evaluation (40%): such as attendance , classroom performance, extended learning, course contribution, coursework and other activities; (4) final exam (30%): such as options, judgments, nouns, short answer, discussion, case analysis, review paper and other types of questions.

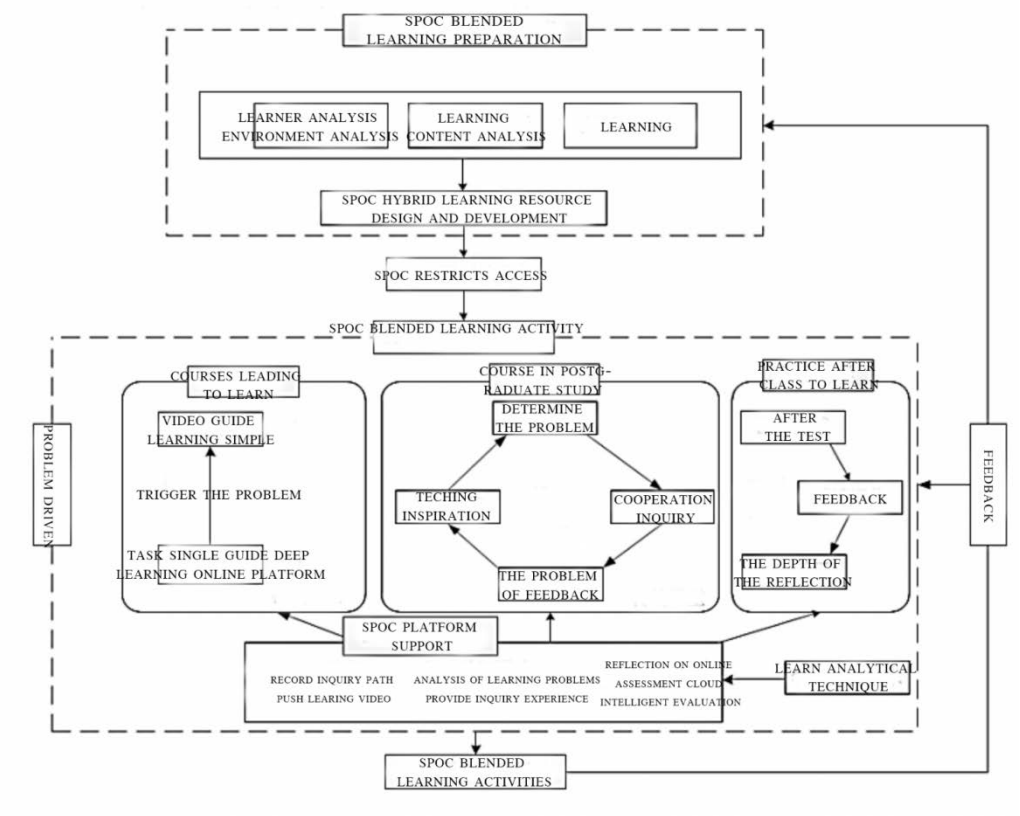

Figure 2: SPOC+PBL blended learning

Teaching mode design. (1) Teaching method: The most participatory teaching structure method at present is flipped teaching and paired teaching, such as independent preview and test with PBL as the core → class knowledge competition → student group work and mutual evaluation; (2)) teaching method: such as before class (self-learning method + task-driven method) → during class (participatory teaching method + lecture method + discussion method) → after class (peer-assisted learning method); (3) education method: such as learning through , Duoyiyi, Rain Classroom, Blue Moyun, Cloud Classroom and other platforms.

4. Conclusions

Since the beginning of the 21st century, the development of modern electronic computers, especially the popularization of the Internet, has promoted the reform of education and teaching. In the "Ten-Year Development Plan for Educational Informatization (2011-2020)" and other

documents, it is proposed that modern technology should be used reasonably to implement heuristic, research-based, discussion-based and activity-based education, and teachers should be encouraged to develop Efforts should be made to build an innovative model of education and teaching with learners as the core, encourage network communication and collaborative teaching, and further improve the level of school network education management. Premier Li Keqiang of the State Council also pointed out many times in the recent government work report of the State Council that it is necessary to develop "Internet + education" and promote the sharing of high-quality educational resources. It can be seen that the use of modern information technology to improve the current situation of the "Water Resources Utilization and Planning" curriculum, promote the flow of high-quality educational resources, and improve the level of water resources management education and teaching will be the development trend of China's water resources professional education in the future. This study is looking forward to exploring the effective use of the classroom teaching model based on SPOC+PBL, using abundant online resources, improving educational and teaching practice methods, realizing educational equity as much as possible, and promoting the learning of the course "Water Resources Planning and Utilization". Using the "PBL teaching mode" in classroom practice, students can form a good habit of asking questions, and at the same time, students can consciously use their knowledge to deal with real problems, and in the process, they have completed group collaboration exercises. , The process of asking new questions and solving them again, through independent exploration, developing a variety of thinking abilities, changing the receptive teaching method into an inquiry-based and active teaching method, improves the meaningful learning of students and enhances the construction of their knowledge. To improve scientific thinking. The use of "PBL teaching mode" in the classroom promotes students' knowledge construction and transfer, focusing on the links of raising questions, group cooperation, solving problems, and re-exploring problems, which is more conducive to students' knowledge mastery and transfer.

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