Reform Exploration of Project-based Teaching to Improve Students' Application Ability under the Background of Education Informationization - A Case Study of "Planning and Design of Nature Reserve"

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Abstract. Education informatization can improve the efficiency of education and optimize the allocation of educational resources. The combination of educational informationization and project-based teaching methods which focus on enhancing students' practical abilities and teamwork, can effectively promote educational innovation and teaching reform. This study selects the content of "planning and design of nature reserves" in the course of Conservation Biology, which is one of the main ways to protect biodiversity, and designs it in a project-based teaching method. By using information technology such as network resources and teaching platforms, it breaks through the temporal and spatial limitations of traditional offline teaching, enhances students' ability to acquire and master knowledge, and further promotes educational innovation.

Keywords: Education informatization, Project-based teaching, Biodiversity conservation.

1 Introduction

The education informatization is a key driving force for promoting the modernization of education. With the development of computer and internet technologies, the construction of educational information infrastructure has accelerated, and the digitization process of educational resources has been expedited. New technologies such as big data and artificial intelligence are widely applied in the field of education, promoting personalized teaching. At the same time, new models such as flipped classrooms and blended learning are gradually becoming mainstream, cultivating students' information literacy and innovation ability to meet future social demands[1,2].

Project-based teaching originated from the "learning by doing" advocated by American educator John Dewey. It is a student-centered teaching that enables students to design and implement a series of experiential exploration activities in teamwork learning by completing specific and real learning tasks, so as to express, communicate and display the learning results. Project-based teaching not only attaches

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importance to students' independent exploration of course content and knowledge internalization, but also cultivates students' ability to cooperate and solve problems, enabling them to have the ability of lifelong learning.

Traditional teaching methods are unable to meet the talent development needs under the integration of industry and education. Meanwhile, online open courses, supported by modern information technology, have rapidly emerged. The Ministry of Education has emphasized the promotion of blended learning, integrating information technology and big data into teaching, and implementing project-based learning to enhance students' problem-solving abilities while improving the quality and inclusiveness of education[3].

Therefore, it is essential to explore the reform of project-based teaching within the context of educational informatization. This study focuses on the chapter titled "In-Situ Conservation" from the course on Conservation Biology to investigate the integration of information-based and project-based teaching methodologies. Biology is a science that studies biodiversity conservation, and its curriculum inherently incorporates elements of ideological and political education, aligning with contemporary priorities in biodiversity preservation and ecological civilization construction. Consequently, an increasing number of universities and educators are emphasizing the development of this course along with innovative teaching methods. For instance, Northeast Normal University and Sun Yat-sen University have examined the incorporation of ideological and political components into their conservation biology curricula[4,5], while Anhui University has enhanced instructional outcomes through a blended teaching model that combines online and offline learning experiences[6]. However, currently in many institutions, Conservation Biology remains predominantly theoretical; there are significant challenges in translating knowledge into practical application - much like how successful ecological civilization relies on tangible environmental improvements. Therefore, enhancing processes that effectively integrate theory with practice is crucial for fostering students' comprehension as well as their ability to apply knowledge - an important step toward supporting biodiversity protection, advancing ecological civilization initiatives, and promoting sustainable development. Based on this, the course will incorporate big data, educational platforms, etc., into the course design repeatedly. In light of this, the course integrates big data and education platform into the course design, and reconstructs the course content on the basis of education informatization. Project-based teaching materials is designed and reformed in the form of knowledge block. By leveraging the advantages of informatization, this approach aims to enhance students' ability to apply theoretical knowledge in practical contexts while fostering their capacity to acquire effective information through online resources. Ultimately, it seeks to provide innovative reform ideas for project-based teaching within the framework of educational informatization.

2 Teaching Design of Project-based Content

This study explores the informatization and project-based teaching reform of the "In-Situ Conservation" section in the course of "Conservation Biology". In the early stage

of curriculum reform, teaching content is synchronized with teaching platforms such as Rain Classroom, Tencent Meeting, MOOC, and Treenity. Teachers select and optimize resources from teaching platforms based on the curriculum objectives and talent training program to establish project-based resource packages for pre-class preview, in-class activities, post-class consolidation and innovation. The project-based resource package includes video resources, document resources, online question banks, online discussion groups etc., providing basic conditions for online + offline flipped classroom before class, during class and after class. Taking the teaching project of biodiversity conservation - "Planning and Design of Natural Reserve" as an example, video resources in the project-based resource package include authoritative course videos from Treenity and MOOC as well as self-made micro-courses and news videos related to natural reserves. Document materials include course PPTs, relevant news webpages about natural reserves design and planning, and reference literature on natural reserve design and planning. The online question bank is designed and improved based on the teaching objectives and contents for classroom quizzes and post-class reviews while discussion groups can conduct group discussions and learning before class, during class, and after class. The theme of this project is to select based on the current international, domestic, and regional demands for biodiversity conservation. Global climate change is one of the major challenges facing human society today, and it is changing the natural environment and ecosystems of the earth at an unprecedented speed and scale. Therefore, in the context of global climate change, protecting biodiversity is particularly important. In-situ conservation is one of the main ways to protect biodiversity, including establishing natural reserves and other forms. These are all derived from the needs of a large number of countries, regions, and industries such as national parks, nature reserves, construction management of zoos and botanical gardens, prevention and control of alien species etc. The core theoretical content selected by this institute, namely, "Planning and Design of Nature Reserve," belongs to an important knowledge block of in-situ conservation.

The specific teaching design and operation are as follows.

(1) First, determine the project theme - planning and design of nature reserve. The educational objectives of this project are to enable students to master the principles of nature reserve design, possess the ability to plan and design nature reserves, enhance students' awareness of ecological conservation of biodiversity, and cultivate their teamwork and problem-solving abilities.

(2) Pre-class preview. In order to avoid the impact of the lack of clear purpose on the learning effect during independent study, teachers should inform students in advance about the thematic content of project-based courses, so that students can complete online video and document studies with tasks and questions in mind. Through an information platform, authoritative courses related to knowledge points, self-made micro-courses, relevant news and literature on nature reserves are released in advance. Students are grouped through the teaching platform and each group is required to select a nature reserve to understand its location characteristics, basic settings, and functions. At the same time, an online Q&A section is set up on the teaching platform to create cross-space connections between students and teachers.

(3) Implementation in class. Provide in-depth explanation of the theoretical knowledge related to project-based content, such as the basis for selecting natural reserves, their significance and functions, principles of planning and design; then distribute satellite maps of the natural reserve to be designed and planned through the Rain Classroom, and provide a brief introduction to the surrounding area, guiding students to think deeply and explore independently; group discussions (Fig.1) are conducted to divide the natural reserve into functional zones, using the information platform (the submission function of Rain Classroom) to share and explain each group's planning and design basis (Fig.2a); based on each group's actual planning situation, teachers conduct case reviews and analyze the strengths and weaknesses of the plans. By combining theoretical knowledge from this course and other prerequisite courses, teachers provide students with possible optimal solutions for planning a case study on a natural reserve; groups further revise and improve their plans based on their own planning designs combined with teacher explanations by searching for information online resources (Fig.2b); each group presents their improved plan designs for explanation, answering questions from other students and teachers (Fig.3); after the case study presentation ends, inter-group evaluations are conducted based on plan designs. During the implementation of the course, the use of information-based teaching platforms (Rain Classroom) is used for attendance, the use of bullet screen function for question submission and discussion content submission, and the use of submission function for works submission, in order to improve students' learning motivation and classroom participation.

(4) Post-class review and further adjustment plan. Encourage students to further search for relevant information through the internet, and combine with classmates' and teachers' questions (opinions or suggestions) to further improve and adjust the design plan (guide students to summarize and think further), and make a pros and cons analysis of the current planning design based on the case status, and propose optimization or improvement suggestions, forming a project-based group report (extension and expansion of course knowledge). Tailor personalized training for students who have extra capacity, encourage students to collect data on nature reserves they are interested in through big data searches on the internet, and combine with project-based ability training to plan and design or optimize the design of nature reserves as a team or individual; encourage students to analyze evaluate the current situation of their interested nature reserve collected from internet searches using what they have learned, as well as proposing improvement plans.

Fig. 1. Information collection and discussion of students are carried out in the course.

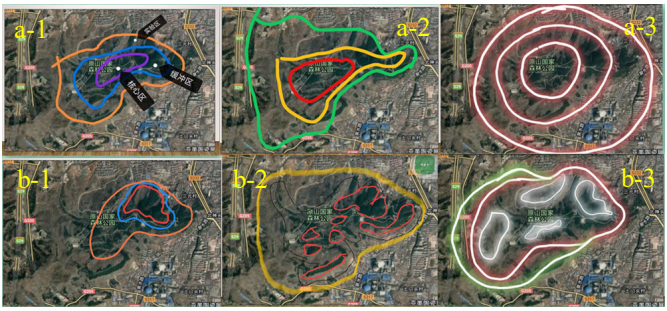

Fig. 2. Functional zoning map of nature reserve submitted twice. The pictures are all the planning and design proposals submitted by students through the submission function of the Rain classroom teaching platform. Among them, a-1, a-2 and a-3 are the first plan of the functional area planning map of the nature reserve after group discussion; b-1, b-2, b-3 are the functional area planning map of the nature reserve modified by the group after the teachers commented and explained the results of the first scheme for each group.

Fig. 3. Students give presentations on the revised nature reserve plan.

(5) Finally, establish a database of design cases for project implementation, which can be used as a reference and learning resource for students in the same grade but different classes or for future students.

3 Characteristics of Educational informatization + Project-based Teaching and Discussion

The implementation of project-based content can guide students to utilize online resources and digital teaching materials for independent learning, thus enhancing their comprehensive abilities. Teachers are no longer just knowledge transmitters, but also builders and guides of knowledge systems, striving to improve the effectiveness of teaching through innovation and reflection. Furthermore, the implementation of project-based content promotes students to become active seekers of knowledge, cultivating their methods and capabilities in acquiring knowledge through the internet. This helps them develop personalized directions for growth, ultimately improving their ability to apply knowledge, think innovatively, and engage in continuous learning.

By integrating online and offline, in-class and out-of-class, as well as pre-, in- and post-class teaching, and leveraging the implementation of educational informatization

and project-based teaching content, we can break through the temporal and spatial limitations of teaching[3].

When students access information about nature reserves through the Internet, they will come into contact with the development history of in-situ Conservation, cutting-edge research and current research results from universities and research institutes, as well as current national policies and demands. This not only broadens their horizons and accumulates optional pathways for their future life planning and development, but also subtly strengthens their awareness of ecological protection (guided by ideological education). In the process of curriculum implementation, students participate in the course through the use of information technology teaching platforms (such as Rain Classroom's functions like attendance check-in, bullet screen, submission, in-class practice and other functions), which also provide a basis for process-based assessment scores. The increase in the proportion of regular grades in current teaching reforms (from 5% to 20%) is more specific at this time and can enhance students' participation and learning enthusiasm. The group presentation of project-based course content not only evaluates students' learning outcomes but also enhances their confidence. Group collaboration improves students' teamwork skills, while guidance from teachers on obtaining and using effective information from "Internet" big data enhances students' internalization ability for knowledge acquisition and lifelong learning skills[1,2].

4 Teaching Evaluation

Through questionnaire analysis, it is show (Fig.4) that students are generally satisfied with the project-based teaching design (100%). Following the integration of information technology into the curriculum, students engaged in project-based tasks not only enhanced their knowledge structure with the support of online resources (satisfaction rate > 97%), but also acquired effective strategies for obtaining useful information (> 100%). Furthermore, they demonstrated a greater capacity for independent learning of content (> 93%). Therefore, in the context of educational informatization, project-based teaching can enable students to learn, accumulate, and expand their knowledge. Not only can they effectively combine related theories and practices, but they can also acquire the ability to carry out ecological civilization construction while understanding the current needs of the country and region.

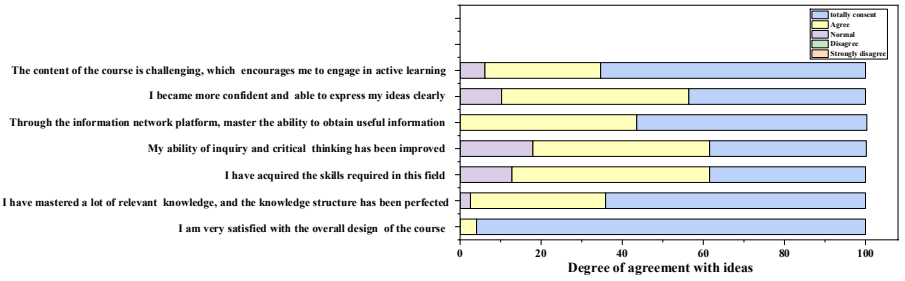

Fig. 4. Evaluation results of instructional design and student ability improvement.

5 Conclusion

The successful implementation and smooth operation of this project case are rooted in the actual needs of the country and region (the silent integration of ideological and political elements into the curriculum). Through the use of information technology platforms, students have been able to integrate theory with practice before, during, and after class, effectively exercising their practical abilities and enhancing their teamwork skills. In the process of learning, students have achieved the knowledge objectives, skill objectives, and quality objectives set by the curriculum. Therefore, in the current context of educational informatization, it is both successful and worthwhile to further promote reform explorations in project-based teaching through online networks.

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