

An Analysis of the Problems Existing in the Experimental Teaching of Ecology in Local Applied Universities in North Anhui Province

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Abstract: Ecology experiment is a crucial component of ecology courses. It is the most extensive and effective teaching link for cultivating students' comprehensive qualities such as practice ability, thinking ability and innovation ability, which plays an irreplaceable role in improving students' comprehensive quality. This study analyzed the problems existing in ecological experiments in northern Anhui Province, including the weak ecological knowledge base of students, the single regional habitat, insufficient experimental equipment, traditional teaching methods and single assessment system by taking Suzhou University as an example. This study expounded the practical methods of ecological experiment courses from the aspects of reforming the teaching content, teaching methods, teaching means and examination methods, and put forward some countermeasures. It aims at improving the quality of ecology experiment teaching, enhancing students' practical ability and innovation consciousness, and providing theoretical basis for the cultivation of ecology talents in local applied colleges and universities in northern Anhui Province. Furthermore, this study can also provides a reference for the reform of ecological experimental teaching in similar colleges and universities, which is helpful to promote the overall development of ecological education.

Keywords: Application-Oriented Universities; Experiments of Ecology; Teaching Methods; Problem Analysis

1. Introduction

Ecology is a discipline that studies the relationship between biology and environment, and its course teaching undertakes the

important mission of promoting public awareness of ecological environmental protection [1-2], while experimental teaching is an indispensable link in ecology teaching [3]. Ecological experiments serve as a critical pathway to cultivate students' integrated practical innovation capabilities and scientific research literacy. It is not only enables students to deepen their understanding of ecological theoretical knowledge, master the basic methods and basic skills of ecological research, but also plays an important role in improving students' practical skills and cultivating students' innovative thinking [4]. However, the development of many ecological experiment courses is severely restricted by the excessively long experiment period of some experimental projects, the lack of experimental equipment and regional differences in China [5-6]. Currently, there are deficiencies in various aspects of existing ecological experiment teaching, including content, instructional models, and assessment methods, which deviate from the comprehensive development goals of talent cultivation [7]. This course has the characteristics of wide knowledge coverage, outstanding practical application and remarkable inquiry. As an application-oriented university, Suzhou University is in pressing need of a thorough reform, innovation, and practical exploration of the teaching system and instructional model for this course. This effort aims to better align with the institution's mission of cultivating application-oriented talents while enhancing students' independent learning capabilities and practical skills. Therefore, this study took the ecology experiment course of Suzhou University as an example, discussed the problems encountered in the course of ecological experiment in the north of Anhui province, and put forward the actionable

solutions.

2. Current Status of Ecology Experiment Teaching

In recent years, with the increasing national emphasis on ecological civilization construction, many universities have begun to expand ecology laboratory courses. In response to national initiatives, Suzhou University has accordingly adjusted its talent cultivation program. However, as ecology experimental teaching was only introduced at Suzhou University in recent years, and the ecology course is still in its infancy. Combined with the characteristics of the subject, this course mainly includes several instruments and application methods for the determination of ecological factors, the determination and comparison of ecological factors in different ecosystems, the impact of environmental factors on plant (leaf) structure, competition among plant species, community investigation and analysis, and the design and production of ecological environmental protection as the theme of several experiments. The course aims to develop students' analytical and practical abilities in applying ecological theories and methods to address regional eco-environmental issues. It cultivates interdisciplinary talents that align with the university's "application-oriented and regionally-focused" educational positioning, thereby serving regional ecological conservation and sustainable development needs. Through the study of this course, students will be familiar with and master the use of general instruments and equipment for ecological research, master general experimental skills and methods of ecology, thus consolidating classroom learning, improving students' hands-on ability, analytical ability and innovation ability, deepening students' understanding of basic knowledge and basic theories of ecology, and facilitating students to acquire knowledge, develop skills and cultivate abilities in the research process. It can enable students to establish ecological ideas in life and work, expand ecological knowledge and improve ecological awareness in the future.

At present, the biotechnology major in our college offers a course in the second semester of the junior year, which is a professional elective course, with 16 class hours and more

content. It is mainly based on basic and confirmatory experiments, supplemented by demonstrative, comprehensive and innovative experiments. The teaching methodology remains predominantly teacher-centered, with students passively receiving knowledge. The instructional model emphasizes one-way knowledge transmission from instructor to students, resulting in insufficient student engagement, a lack of interactive and practical components [8]. It is difficult to fully cultivate their ability of independent inquiry and problem solving. In terms of assessment, the experimental results mainly include the attendance of the examination group (whether it is late, early leave, etc.), the experimental report (the completeness of the report and data analysis, etc.) and the experimental operation (whether the operation is standardized). Usually students finish the experiment first and then finish the experiment report after class. For biotechnology majors, students are very interested in ecological experiments, because most of the experiments of students in this major are in the laboratory, such as biochemistry experiments, microbial experiments, cell biology experiments, etc., while ecological experiment is mostly outdoors or a combination of indoor and outdoor. Some students reported that the indoor experiment was rather boring, and they were happy to "activity" outside. In addition, the experiment contents include some plant experiments, such as the competition between plant species and the growth competition of plants. Students are more interested in this kind of experiment involving plant cultivation and daily observation of growth competition dynamics.

3 Problems in Ecological Experiment

3.1 Insufficient Knowledge Background of Students

The main courses of biotechnology majors are biochemistry, microbiology, cell biology, cell engineering, molecular biology, genetic engineering, etc., and the foundational courses directly linked to ecology, such as botany and zoology, are lacking. Therefore, students lack relevant knowledge background to learn ecological experiments. For students of biotechnology, it is impossible to explain in

detail. This lack of knowledge background not only reduces students' participation in experiments, but also affects their ability to discover and analyze problems.

3.2 Geographical Limitations

Traditional ecological experiment textbooks generally include basic experiment, comprehensive experiment and exploratory experiment. Currently, there is a limited number of ecological experiment textbooks available in China, most of which exhibit regional characteristics and inherent limitations. These constraints fail to meet the increasing demands of universities establishing ecological experimental courses [5]. Many experiments can be conducted on campus or off campus. Due to geographical reasons, Suzhou, which is part of the Huaibei Plain, has a relatively single habitat despite its vast territory and is basically surrounded by broad plains. The campus is in the construction area and does not have as many habitat types as agriculture and forestry schools. Such as Fujian Agriculture and Forestry University, one of the earliest agriculture and forestry colleges in China, surrounded by mountains on three sides and rivers on two sides, the campus has wetland ecological park and Chinese Famous and Excellent Botanical Garden. At the same time, experiments on different ecosystems are largely impossible to carry out. Suzhou institute of ecology experiment mainly on campus, many of them are artificial landscape, the lack of natural ecological landscape diversity. Indoor teaching and a single campus landscape can not meet the diversified and practical needs of teaching content.

3.3 Limited Investment in Teaching Resources

The backwardness of instruments and methods has weakened the cutting-edge nature of ecological experiments. Due to the limitations of funds and teaching resource investment, the construction of ecological laboratories is incomplete, and it is difficult to popularize new instruments and new methods in undergraduate experiments. The ecological experiments at Suzhou University have only been carried out for three years. Currently, there are no clear ecological experiment instruments. The experiments conducted are

limited to thermometers (such as measuring atmospheric temperature), incubators (such as cultivating the seed germination of plant interspecific competition), ovens (measuring soil moisture content), measuring ropes (such as measuring the breast diameter of plants), soil thermometers (measuring soil temperature), pH meters (measuring soil pH), etc. Some precise experimental instruments such as colorimeters, or more advanced equipment such as leaf area meters and optical action meters are temporarily lacking, making it impossible to conduct in-depth experiments and affecting students' enthusiasm for participating in ecological experiments and their exploration initiative.

3.4 Problems in the Teaching Process

There are only 16 class hours in ecology experiment, so many experiment contents can not be arranged in depth. In the examination, the examination method is single, the student study evaluation is not comprehensive, which is a common problem in many experimental classes [9]. The experiment results mainly include attendance check, experiment report and experiment operation, and the number of experiment distribution groups is more, which are randomly distributed in the campus. Individual experiment teachers can not carry out field examination on experiment operation of each group for each experiment. Some students do not participate in the experiment and can only remember the names of good students and lazy students. In addition, the results of experiment report give corresponding scores, which cannot fully reflect the completion of students' classroom experiment and actual operation level; In the form of teaching, lack of modern teaching equipment, such as mainly with blackboard writing, many teaching content is not intuitive expression, can not achieve good teaching results. Some problems were found in the review of the experimental report. For example, there is plagiarism in the experimental report, no specific summary description in the experimental summary, or failure to correctly analyze the results and draw conclusions.

4. Reform Countermeasures of Curriculum Teaching System

4.1 Develop Appropriate Teaching Materials

For the students majoring in biotechnology, they should supplement the professional names or experimental characteristics encountered in ecological experiments in the theoretical class to help them adapt to the situation as soon as possible. At present, many kinds of experiments are involved in the teaching materials of ecology experiment in colleges and universities, but most of the experiments have not been carried out, and the teaching materials of ecology experiment are only for reference and have not been applied in practice [10]. The scope of ecology is very wide. Many university campuses are close to rivers, lakes, streams and high mountains. Relevant ecological experiments have been carried out, such as the change of water quality, the detection of soil and the investigation of plants. Suzhou is located in Huaibei Plain, and the campus is far away from high mountains and lakes. Therefore, some experiments related to river pollution ecology, soil detection, plant population and community can be carried out. Therefore, in the process of setting up ecology experiment in local colleges and universities in the north of Anhui, we should compile the teaching materials of ecology experiment suitable for the characteristics of north Anhui and the teaching materials suitable for the specialty of biotechnology. At the same time, teachers often use modern teaching methods such as video teaching and simulated field ecology experiment in the teaching process. After the experiment, communicate with students in time, pay attention to the feedback of students, constantly improve the design of experiment contents and teaching methods, and teachers summarize and reflect after class. The experiment is the verification and extension of the theory. Combining with the characteristics of the professional courses, the school and college closely adhere to the training objectives of "application-oriented" and "local-type" and compile the instruction book of ecology experiment. It is suggested that in the new practice of ecology experiment, we can adopt the method of practice and improvement. According to the results of students' feedback, the teachers should optimize the experiment project according to the teaching situation, and prepare the

practical experiment teaching materials according to the existing resources and local characteristics. For example, in the experiment practice of ecology in the first year, the experiment of "making of ecological bottle" is too simple and students are unwilling to use their brains and do not actively think about it. For example, there is a phenomenon of laziness, such as randomly finding a bottle to be filled with algae as the experiment result, and the experiment effect is not good. We replaced the design and production with the theme of "ecological environmental protection". The students actively thought about the design and production by using a lot of waste products in life to design and make and speak their own design idea.

4.2 Improve Teaching, with Competition as a Substitute for Teaching in Part

First of all, we should purchase the corresponding instruments in the teaching equipment to improve the content of ecological experiments. Through the form of investigation report to students, select students' interest and classic experiments for teaching.

Secondly, the teaching process should be student-centered. For confirmatory experiments, a group with a fixed number of students can be formed before the start of the experimental class. Through negotiation and discussion, the group can select the name of an experiment in the teaching content, and arrange members to search for literature and carry out corresponding experiments. The team members explained the experiment content and the teachers supplemented it. It is not only increases students' initiative, but also improves students' thinking ability and teamwork ability, and also cultivates students' innovative spirit. In addition, for the design experiments, each group can propose research topics related to the course by searching materials and asking teachers for help. For teams with excellent performance, they can be guided to participate in course-related competitions such as provincial and national comprehensive and open competition projects. For example, for the design and production of "ecological environmental protection" as the theme, each group is encouraged to think positively, prepare for the work to participate

in the competition, apply to the school or college to hold such activities, and participate in relevant types of competitions at home and abroad. By taking the place of the class, the students not only completed the course content, but also enhanced their own innovative consciousness and ability to solve practical problems.

Finally, in terms of students' lack of ability to analyze the experimental results, it is suggested that in the explanation of the experiment, the mistakes often made by students and their reasons should be introduced through case analysis, so as to guide students to analyze the results and cultivate their thinking ability. For example, in the experiment on the influence of environmental factors on the structure of plants (leaves), there were no stomata in the leaves of submerged plants. Many students did not analyze the specific reasons when analyzing the results, and only came to the conclusion that submerged plants had no stomata. This kind of experiment can promote students to think, and through the explanation of each experiment, students can gradually learn some methods of result analysis from the experiment.

4.3 Improve Assessment Methods

The traditional test of experimental course is mainly based on experimental report and process [11]. For example, the ecology experiment course of Suzhou University mainly includes indoor and outdoor experiments. The content of evaluation of experimental course score mainly includes attendance, experiment report and experiment operation. Since most ecological experiments are carried out in small groups and many of them are conducted in outdoor experiments, teachers cannot fully take into account each student, resulting in many students being lazy and copying other students' data and experiment reports, which is difficult to reflect each student's mastery of experiments and hands-on ability. Therefore, it is suggested to improve the assessment method. Laboratory experiments can be evaluated by class check-in, check-out, experimental operation standards, experimental reports, classroom performance, hygiene and cleaning. For outdoor experiments, due to the large number of groups, field assessment of each

group cannot be carried out. It is suggested that the experimental scope be divided into regions, and a group leader should be responsible for supervision in each region. During the experiment, teachers randomly checked and guided the progress of each group and tried their best to check each group and solve the problems in the experiment in time. The experimental operation of each group of students was scored as experimental operation results. After the experiment, the teacher checked the experimental data of each group one by one, and randomly selected the students for the experiment operation assessment. In addition, it is suggested that self-evaluation of experimental operation within the group can be carried out, and the results can be included in the total score. The phenomenon of plagiarism in the experiment report reflects the problem of learning attitude of some students. In order to solve this problem, we should start from the experimental report review to solve the problem, before the experiment divided into groups, each group of data is different, for different groups of the same data appear in the experimental report, all call back and ask to do again.

4.4 Recommend Bibliography to Improve Students' Knowledge Background

For biotechnology majors, ecological experiment is a unique course, and without certain knowledge background, it may be difficult to master the content of the course. It is suggested to appropriately add explanations of basic theories to the experimental course, and learn about the knowledge background related to ecology through recommending extracurricular reading materials, organizing special lectures and related video learning methods such as MOOCs. So as to deepen the understanding of ecological experiment, help students to build a more complete ecological knowledge system. At the same time, teachers can pay attention to combining theory with practice in the experimental guidance, and guide students to combine experimental phenomena with ecological principles, so as to gradually improve their professional quality and learning interest.

5. Conclusion

The experimental course of ecology in

Suzhou University has been set up for a short time, and it is still in the stage of exploration and improvement in the aspects of experimental content design, teaching method and evaluation system. This study analyzed the specific problems existing in the course implementation process and put forward improvement countermeasures, aiming at optimizing the experimental teaching system, effectively improving the teaching quality, and making the ecological experimental course really play the role of cultivating students' practical ability and scientific literacy. Simultaneously, the teacher team should further enhance the awareness of curriculum construction, combine the modern educational technology and the cutting-edge trends of disciplines, and continue to innovate the teaching mode. Through teaching reflection and experience summary, optimize the design of experimental projects, improve the assessment mechanism, and ensure the teaching effectiveness of each lesson. Additionally, inter-university exchanges and collaborations should be prioritized, high-quality teaching resources shared, and the standardization and high-quality development of ecological experimental teaching in applied universities jointly promoted, thereby providing robust support for nurturing talents with innovative capabilities and professional competence.

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