An Analysis of Microbiology Curriculum Reform for the Cultivation of New Engineering Talents

Mingchun Lin, Yanru Si, Junfeng Chen, Lujiang Hao*
School of Bioengineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, Shandong, China
**Corresponding Author*

Abstract: **Microbiology course is one of the basic courses for biology majors in colleges and universities, with strong theory and practice. In the face of the implementation of the new engineering talent cultivation strategy, colleges and universities should actively explore the effective strategy of microbiology course reform, in order to lay a solid foundation for the cultivation of highly educated bioengineering talents. This paper is based on the new engineering talent cultivation demand, the microbiology curriculum reform work to discuss, in order to provide more references for the talent cultivation of biology class professional.**

Keywords: New Engineering; Talent Development; Microbiology Curriculum. ; Artificial Intelligence.

1. Introduction

The new engineering discipline requires colleges and universities to pay more attention to innovation ability, practical ability and international competitiveness when cultivating talents, so that the talents can serve the national strategy, so that the results of the construction of the new engineering discipline can be smoothly connected to the industrial sector and point out the right direction for the future development. Therefore, as one of the new engineering disciplines, biology majors should also actively explore ways of reform and development in order to meet the new needs of the future industry. Microbiology course is one of the main courses in biology majors, including theoretical courses and experimental courses. In the face of the needs of talent cultivation in new engineering disciplines, microbiology courses should carry out active reforms to output more highly educated and complex talents for the development of the bio-industry.

2. Constructing an Online-Offline Hybrid Teaching Model

With the rapid development of information technology, the Internet has become an indispensable and important tool for people's daily work and life, which has also had a very important impact on the field of education. In order to better meet the needs of the training of new engineering talents and improve the quality of student training, microbiology courses should actively introduce advanced Internet teaching techniques and tools, such as micro-teaching videos, catechism and so on, to create a hybrid teaching mode combining online and offline, so as to achieve an all-around coverage of the teaching work for students. Through the online learning platform, teachers can assign pre-study tasks to students, so that students can grasp the key knowledge points through independent study, and guide them to think deeply about some open subjective questions, so that they can have preliminary knowledge and understanding of the knowledge they are about to learn. In the classroom, teachers do not need to repeatedly instill basic knowledge, but let students become the main body of the classroom, through the problem-driven and inquiry-based tasks to guide students in cooperative learning, analyse and discuss all kinds of cases provided by the teacher, and try to use the knowledge of microbiology to solve practical problems, encourage students to boldly express their opinions and ideas in the classroom to establish students' sense of innovation and the spirit of inquiry, so that the students can continue to think and cooperate. Students are able to make progress in thinking and co-operation, so as to grow into highly educated new engineering talents.

For example, in leading students to microbiology experimental learning, teachers can change the traditional teaching methods, before the class to record a good experimental video, and highlight the details of the operation of the experimental

process and standard requirements. This experimental teaching video time is generally less than 20 minutes, while with the text and explanation can be in the key links to remind students, is conducive to deepen the students' impression of the experimental operation, but also to avoid the teacher on the podium when the operation of the students cannot see the problem. Students can watch the experimental video in the pre-study, master the precautions and methods of operation, can shorten the teacher's experimental explanation in the classroom, leaving more sufficient time for students' practical operation. This not only allows students to ensure the normality of experimental operation, but also allows students to reduce errors in operation, helping students to verify theoretical knowledge while enhancing the hands-on ability to meet the objective needs of the training of new engineering talents.

3. Artificial Intelligence: Unlocking the Future of Microbiology Teaching and Learning

Artificial Intelligence (AI) is profoundly changing our world, with its influence permeating every field, from transport to entertainment, from healthcare to education. AI has many manifestations in contemporary classroom teaching. Deep learning technology breakthroughs in image recognition, speech recognition, and natural language processing provide the technological foundation for the application of AI in education. For example, deep learning algorithms can automatically identify students' facial expressions so as to assess their learning status and emotional responses [1]. AI is gradually changing the traditional teaching mode by combining virtual labs and virtual operations in the teaching of microbiology experimental courses to provide students with a safer, more flexible, and more efficient learning experience. The core applications of AI-driven virtual labs include the following aspects, such as intelligent experimental environment construction, intelligent experiment guidance system. Intelligent experimental environment construction refers to the use of Generative Adversarial Networks (GAN) and physics engines to simulate the real-time growth, metabolism, and mutation processes of microorganisms under different cultivation conditions (e.g., the effects of temperature and pH on antibiotic sensitivity), as well as 3D reconstruction of electron microscopy data through deep learning, to generate interactive structural models of complex microorganisms, such as drug-resistant bacteria, phages, and other complex microorganisms, and to support molecular-level observation. Intelligent experimental guidance system means that computer vision analyses students‘ virtual operation trajectories in real time, provides millisecond-level warnings for 60+ common errors, such as incomplete cauterisation of inoculation rings and overdensity of plate scribing, etc., and analyses students’ operation data based on knowledge mapping, dynamically recommending special training modules (e.g., intensive training for gram staining techniques). And AI can automatically assess students' learning outcomes and provide feedback to help students improve their learning. For example, an automatic grading system can use machine learning algorithms to automatically assess students' essays, programming assignments, etc., and provide feedback [2]. With the popularity of AI, teachers have transformed from traditional knowledge transmitters to learning guides and student growth mentors, which can help teachers with instructional design, instructional management, and instructional assessment to improve teaching efficiency and quality. For example, the intelligent teaching assistance system can help teachers analyse students‘ learning data, identify students’ learning difficulties and provide teaching suggestions [3]. The relationship between AI and the cultivation of new engineering talents is a two-way empowerment: on the one hand, AI technology innovates the mode and path of engineering education; on the other hand, new engineering education cultivates composite talents for the in-depth application and innovative development of AI technology. This interaction is reshaping the ecosystem of future engineering education.

4. Creating a Teaching Model for The Integration of Industry, Academia and Research

The development of talents is often guided by the development of industry, so in the process of cultivating new engineering talents, we should always keep the cultivation goal in line with the needs of the industry, so as to realise the in-depth collaboration between education and

industry, so that the cultivation of talents can better meet the needs of the industry and the needs of society. Therefore, when reforming the microbiology curriculum, we should combine the application of this field in reality, cooperate deeply with relevant enterprises, integrate the production and R&D of enterprises in the process of curriculum practice, so that students can gradually adapt to the job responsibilities of enterprises in the process of learning, improve the comprehensive quality and vocational level of students, lay a good foundation for the future development of students, and at the same time set up a good model for the cultivation of new engineering talents. It also sets a good example for the cultivation of new engineering talents.

For example, when leading students to learn the content of the section "microbial growth and reproduction and control", the teacher can introduce the case of organic fertiliser production of Anrun Biological Enterprises into the classroom to lead students to understand the microbial strains that need to be used for fermentation of organic fertiliser in the real production and analyse the criteria and conditions for strain selection together with the students, so as to let the students form a preliminary understanding of the fertiliser production process. the production process of fertiliser to form a preliminary understanding. On this basis, through experimental teaching and case study teaching, students are led to understand what kind of effect the addition of probiotic strains in bio-organic fertiliser will have on the growth of plants. In addition, teachers can also introduce the document "Zero Growth Action Plan for Chemical Fertilizer Use by 2020" into classroom teaching, let students watch relevant documentary videos and scientific research materials, guide students to understand the harm brought by blind fertilizer, and at the same time, guide students to explore the benefits and advantages of bio-organic fertilizers according to the knowledge they have acquired, such as helping to improve the soil environment, helping to revitalize the nutrients, and avoiding the waste of resources and so on. resource wastage and so on. After the students have a more complete understanding of bio-organic fertiliser, the teacher guides the students to explore the impact of the introduction of this document on the transformation and upgrading of the agricultural industry, the quality of national agricultural products, agro-ecological protection and food security, so that the students will have a deep understanding of the significance of microbiological learning.

After completing the relevant theoretical research and study, teachers can rely on the school and the relevant groups to actively carry out industry-academia cooperation and collaborative education projects, for example, for the screening of strains of bio-organic fertiliser, to carry out the "polyglutamic acid high-yielding strains of screening and optimisation of the conditions" scientific research project, to lead the students to visit the actual R & D process and production process of the enterprise. In order to let students have a more intuitive understanding of the application of microorganisms in actual product research and development, students are encouraged to actively explore the design problems of the relevant products in the research project, and carry out experimental design through group cooperation to verify their own views and ideas, and put forward improvement suggestions on the research project with the experimental results, so as to promote the iterative optimisation of the enterprise's research project.

Through the combination of industry-university-research, students not only have a deeper understanding of microbiology courses, but also learn the effective way to apply microbiological knowledge in practice, appreciate the great role that a bioengineer can bring to the development of the society and the country, and enhance the sense of responsibility and mission of the students, so that they can really grow up to be the new engineering talents with high quality needed by the country and the society.

5. Innovative Entrepreneurial Practices to Expand Teaching Content

The cultivation of new engineering talents also pays attention to the cultivation of innovative and entrepreneurial talents, which is not only an important goal for the cultivation of talents in colleges and universities, but also an important way to promote the smooth connection between students and enterprises. At present, the reform of the teaching mode of industry-university-research has created good conditions for students' innovative and entrepreneurial practice, and also provided a new carrier for the cultivation of students' innovative and entrepreneurial ability. Therefore, microbiology courses should actively explore the new content

of innovation and entrepreneurship practice, further expand classroom teaching, and achieve the effective integration of microbiology classroom and students' innovation and entrepreneurship from different dimensions and different levels, so as to provide more help for students to grow into new engineering talents. First of all, in the microbiology laboratory classroom, teachers should design more diversified comprehensive experiments for students, so that students can carry out microbiology experiments in the classroom more independently. Teachers can design a certain theme or related experimental content for students, within the scope of the theme does not limit the students' experimental projects. Students can choose what they are interested in to carry out related projects, but also according to their own participation in the innovation and entrepreneurship projects to choose the corresponding experimental theme, using the results of experimental investigation to pave the way for innovation and entrepreneurship projects. Secondly, teachers can also combine classroom teaching content to provide guidance for the incubation of students' innovation and entrepreneurship projects, provide assistance for students' innovation and entrepreneurship projects through theoretical teaching, practical teaching and other forms, and encourage students to actively participate in the Life Science Innovation and Entrepreneurship Competition for College Students, the "Internet +" Innovation and Entrepreneurship Competition for College Students and other activities, so that students can be in the competition. It also encourages students to actively participate in many activities such as Life Science Innovation and Entrepreneurship Competition, "Internet+" Student Innovation and Entrepreneurship Competition, etc., so that students can deepen their understanding of microbiological knowledge and experiments in the process of the competition, and apply microbiological knowledge to solve the problems encountered in the process of innovation and entrepreneurship, and constantly improve their own new abilities and entrepreneurial skills, inject more new ideas for the industry's development and upgrading of the industry and push forward the continuous progress of China's biological engineering.

6. Conclusion

In summary, for the cultivation of new engineering talents, the reform of microbiology curriculum should actively carry out the hybrid teaching mode combining online and offline, further promote the teaching practice of the integration of industry-university-research, and at the same time, promote the effective articulation of microbiology curriculum and the cultivation of students' innovation and entrepreneurship ability, so as to promote the continuous improvement of their comprehensive quality, so that the students can really grow up to be the high-quality new engineering talents required by the country and the society.

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