

Practical Research of Application Technique in Molecular Biology Course Reform and Innovation Based on Capacity Need of Nucleic Acid Inspector

Junhui Jia*, Lu Han, Yumei Li, Zhanhao Gao

Tianjin Institute of Biological Engineering, Tianjin, China

*Corresponding author: jiajunhui2012@126.com

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Abstract: With the rapid development of biomedicine, the demand for nucleic acid inspector is increasing. In order to deepen the integration of school and enterprise and give better service for bio-pharmaceutical enterprises talent cultivation in Beijing-Tianjin-Hebei region, innovation and application of Application Technique in Molecular Biology course has been completed based on the require of the new career——nucleic acid inspector that announced by the Ministry of Human Resources and Social Security of the People's Republic of China in May 2020 and the advantages of talent training for biological products inspection and quarantine professionals.

1. Introduction

At present, coronavirus disease 2019 (COVID-19) is rapidly spreading all over the world and is constantly mutating. More than 300 million people around the world have been diagnosed with COVID-19. The rapid detection method of Dovid-19 is the nucleic acid detection by real-time fluorescence quantitative PCR. With the rapid outbreak of COVID-19 across the country, in order to solve the problem of shortage of nucleic acid inspector, stereo training video resources of nucleic acid inspector [1] has been developed by changing the traditional way of training talents, reforming the teaching method of professional core courses and introducing enterprises to the school.

2. The basic paths of curriculum reform of Application Technique in Molecular Biology course

2.1 Investigation on working post of molecular biology experimenter

In order to fully implement the reform of "San Jiao" in Higher Vocational Education (teachers, teaching materials, and teaching methods), the core course Application Technique in Molecular Biology was offered through the investigation on the job content of molecular biology experimenter in bio-pharmaceutical enterprises in Tianjin-Beijing-Hebei region, which including the core skills and core theoretical knowledge and practical skills of molecular biology experimenter. The video resource shooting standard of the course was developed by professional engineers of Beijing Bo'ao Biological Co., LTD. And Tianjin Jingneite Gene Biotechnology Co., Ltd. provided the production and laboratory environment for the video. In this way, the course was carried out deep integration of production and education, the unification of knowing and doing, and the combination between work and study.

2.2 Develop shared curriculum resources of Application Technique in Molecular Biology course [2]

There are 58 video resources with a total length of 557 minutes, which mainly includes the standard operation technology of micropipette, extraction technology of plant genomes, and detection technology of plant genomes, enterprise production practices, PCR amplification technology and construction technology of recombinant plasmids six parts. In addition, the resources also include 4 enterprise production video resources, with a total length of 67 minutes. See Table 1 for details. The resources also includes 25 course materials, 58 video bullet tests, chapter test of 60 questions, and final

exam question bank with 286 questions. Website: <https://coursehome.zhihuishu.com/courseHome/2067258>.

Table.1. Statistical table of teaching resources of Application Technique in Molecular Biology course

Serial Number	Training Projects	Number of Subproject Videos	Length of Videos
1	Standard operation technology of micropipette	9	59min
2	Extraction technology of plant genomes [3]	7	76min
3	Detection technology of plant genomes	17	119min
4	Enterprise production practices	4	67min
5	PCR amplification technology	8	90min
6	Construction technology of recombinant plasmids	13	146min
	Total	58	557min

2.3 Brief introduction to nucleic acid inspector

Nucleic acid inspector is a new profession who uses instruments and reagents to manage, extract and test nucleic acid samples and issue corresponding test reports, which announced by the Ministry of Human Resources and Social Security of the People's Republic of China in May 2020. The task of nucleic acid inspector includes 8 items, covering nucleic acid extraction, detection, library construction, high-throughput sequencing and report issuing, and etcetera. Work content of nucleic acid inspector comes from the work content of molecular biological experimenter. Before the promulgation of professional standards of nucleic acid inspector, the job requirements of molecular biology experimenter is not only the working ability standards for experimenter in biological testing enterprises, but also training orientation of Application Technique in Molecular Biology course, and therefore, shared resources of the course fully meets the need of nucleic acid inspector.

3. Practical effect of Application Technique in Molecular Biology course reform

3.1 Served curriculum teaching inside and outside of the school and expansive learning

The Application Technique in Molecular Biology course is not only applied to intramural course teaching, but also applied to extracurricular teaching, various skills competitions and non-credit learning model. The course has been learned by 1044 students in related majors and completed 2997 interactions, which from 8 universities including Mudanjiang Normal University, Wuhan University of Bioengineering, Chongqing Normal University and Harbin Sport University since the course went online. See Table 2 for details. In addition, the course was served as theoretical question bank and standards of experimental operation for 40 competitors and guiding teachers, who from Tianjin Institute of Biological Engineering, Tianjin Bohai Vocational Technology College, Tianjin Medical College and Tianjin Vocational Institute in the "BGI" Cup Biotechnology Skills Competition held by Tianjin Biomedical Industry Vocational Education and Teaching Steering Committee in 2019. A total of 438 people have studied the shared course in non-credit mode from November 2019 to January 2022. More people have learned about the job knowledge of nucleic acid inspector, while many people have developed a strong interest in molecular diagnosis and detection projects in medical laboratory through the open platform, which greatly enriched online teaching resources during the COVID-19 pandemic.

Table.2. Statistical table of operation situation of Application Technique in Molecular Biology course

Serial Number	Running Time	Number of Course Selection School	Total Number of Students (Number of Students in School)
1	2021 Fall semester	1	151(151)
2	2021 Spring semester	2	99(95)
3	2020 Fall semester	1	383(383)
4	2020 Spring semester	2	198(194)
5	2019 Fall semester	4	173(149)
	Total	8	1044(972)

3.2 Improve the skills of employees in bio-pharmaceutical enterprises

Shared achievement of school and enterprise, the course has fully solved the dilemma of lack of standardized training resources for the skills training of new employees of enterprises by introducing enterprise standards for course teaching design and increasing videos of the actual production and inspection, and helping improve skills of enterprise on-the-job employees. As a result, school-enterprise win-win cooperation has been achieved.

3.3 Improve teaching ability of teachers

By integrating the resources of Application Technique in Molecular Biology course, project host led team members to win many awards, such as first prize of the third Higher Vocational Education Scientific Research and Teaching Excellent Achievement Selection held by Tianjin Municipal Association of Higher Vocational & Technical Education, third prize of the first Tianjin “University-Middle School” Popular Science Innovation Competition, third prize of 2019 Pharmaceutical Micro Courses Competition held by China Food and Drug Vocational Education and Teaching Steering Committee, and honorary title of “excellent guiding teacher” in “BGI” Cup 2019 Biotechnology Skills Competition held by Tianjin Biomedical Industry Vocational Education and Teaching Steering Committee etcetera. Supported by the course, teachers in the team have won several awards, for instance, second prize of the Institute's 2020 Information-Based Teaching Competition, third prize of Institute's 2021 Teachers' Teaching Ability Competition, third prize in the first Labor Education Curriculum Design and Teaching Implementation Competition. In addition, on behalf of the institute, they participated in the Teaching Ability Competition of 2020 Tianjin Vocational Colleges and selective trial of the Teaching Ability Competition of 2020 National Vocational Colleges Teaching Ability Competition.

3.4 Improve innovation and entrepreneurship ability of students

The students under the guidance participated in the 2020 Tianjin Science Experiment Exhibition and Performance with the experiment named Application of Multi-channel Micropipette in Detecting COVID-19 by real-time fluorescence quantitative PCR and won an award of excellence. In this way, not only strengthened students' application of professional knowledge, but also showed the basic principles and operating steps of real-time fluorescence quantitative PCR for rapid detection of COVID-19 to the public. In the meantime, I have guided students to improve training equipment in practice training and applied utility model patent. The patent name is glue making device used for isozyme agarose gel electrophoresis experiment, with the application number: 202123274737.7. This patent has obtained the Notification of Acceptance of Patent Application issued by China National Intellectual Property Administration. In addition, many students obtained excellent records in the theme practice activities of Tianjin Higher Learning Institutions “New Era · Practice of Belt and Road Initiative” and the 6th China International “Internet plus” University Students Innovation and Entrepreneurship Competition.

4. Conclusion

4.1 Original resource

Relying on international advanced enterprises, standard operation videos of molecular biology experiment and enterprise standardized production operation videos have been recorded, which added to the course resources, solved the problem that the current course teaching content cannot meet the job requirements of nucleic acid inspector.

4.2 Accurate service

Tailored for nucleic acid inspector, the course has solved the problem of lack of stereo teaching material and improved students' professional quality and ability with integrating labor and moral values into curriculum resources throughout classroom teaching, from which a batch of outstanding

students and employers for fighting against COVID-19 were emerging. The employment rate of biological products inspection and quarantine major was 95.6%, among which the graduates engaged in nucleic acid inspector accounted for 45.4% in 2021.

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