

Chapter 201

Research on Construction of Bilingual-Teaching Model Course for Bioinformatics

Dong Hu, Jiansheng Wu, Han Wei, Meng Cui and Qiuming Zhang

Abstract Bioinformatics is an important professional basic course in Biomedical Engineering, which tells about the important theoretical basis of using information technology in modern medicine and biology. In order to build a bilingual model curriculum and bring up the comprehensive talents who can make active learning and have creativity and teamwork spirits, we should actively explore the teaching system that suits the bioinformatics bilingual curriculum and train a high-quality teaching team. In addition, we also need to accumulate teaching resources for students' independent learning, create an independent learning environment, expand the opportunities for communicating the results of course reform.

Keywords Bilingual teaching · Model curriculum · Curriculum system · Bioinformatics CLC number: Q811

201.1 Preface

Twenty-first century is the era of life science, the information age. The bioinformatics has developed rapidly since it was born internationally in 1987. Broadly speaking, bio-informatics is a discipline that uses theories, techniques, methods of mathematical and information science to study the phenomenon of life, organize and analyze the biological data that presents exponential growth [1]. It reveals the biological significance behind the data by acquiring, processing,

D. Hu (✉) · J. Wu · H. Wei · M. Cui · Q. Zhang
School of Geographic and Biological Information, Nanjing University of Posts
and Telecommunications, Nanjing, 210046 Jiangsu, China
e-mail: hud@njupt.edu.cn

J. Wu
e-mail: jansen@njupt.edu.cn

storing, retrieving and analyzing them from biological experiments. Bio-informatics is more of the essential tools for all the future biological and pharmaceutical research than just a scientific discipline [2, 3]. Bio-informatics is an important basic course in the biomedical engineering field, which is a course about theoretical basis of using information technology in modern medicine, biology researches. It has realized the organic combination of biotechnology, information technology and some other disciplines. It has also developed the high-throughput, high efficiency and high speed method of extracting biological information, innovation of disease detection, a new method of studying the effect of drugs and targets, the computer processing, and analysis and visualization method of genomic data, proteomics data and structural genomics data. In addition, it has analyzed the relationship between the structure and function of biological macromolecule and improve the level of processing, analyzing and utilizing the biological information, laying the foundation for original innovation of China's life sciences and Biotechnology.

Bilingual teaching means utilizing two languages in class, namely, in teaching links such as teaching courses, use of textbooks, class discussion, homework assignment using both Chinese and foreign language for part or all of the teaching activities [4]. In higher education, bilingual teaching especially means a teaching method using outstanding foreign representative original material and teaching courses by foreign language [5]. With the deepening of reform and opening up in China, All trades and professions' pace of convergence with the international has sped up step by step, national demand of the high-quality and compound talents who are proficient in professional knowledge and foreign language has been increasingly urgent, and culturing the talents who understand both foreign languages and professional knowledge has been a pressing matter of the moment in the higher education in China. The Ministry of education pointed out explicitly in the (2001) document 4 that we should actively promote the bilingual teaching in colleges and universities; undergraduate education should create conditions; and use English or some other foreign languages to teach public courses and specialized courses. Particular emphasis is laid on that some specialties like new materials in the field of high technology, biotechnology and information technology should be one step ahead and we should try to make courses teaching by foreign language account for more than 10 % of the courses that are open. Furthermore, what is especially emphasized is that biotechnology needs a step forward more, of which the fundamental purpose is to put our country's higher education in the context of economic globalization to let it reform and develop, in this way, we can establish an international education platform for the students and make students have the opportunity to directly accept professional education in an international advanced level. Not only in the aspect of knowledge, information, but also in such aspects as education idea, education mode should we affected by the world's most advanced and excellent things and cultivate the students to become the modern talents.

201.2 Analysis of the Current Situation at Home and Abroad

As we all know, at present we are still in lack of the bio-informatics professionals. Genetics professor David Potter in Stanford University pointed out that ‘We need the talents who are proficient at computer and biology, just as we need the talents who are proficient at both chemical and biology. In addition, the bilingual teachers of bio-informatics not only need to have strong bio-informatics professional skills, but strong language skills and teaching skills as well. Therefore, domestic universities which have already developed bio-informatics bilingual teaching are now very rare. In order to meet the needs of the cultivating high-quality biological and medical talents with bioinformatics knowledge, we need to change that quickly.

At the moment, after several amendments, many internationally recognized outstanding bio-informatics foreign language textbooks have included latest bio-informatics ideas and researches. Through the bilingual teaching, these foreign language original documents can be passed completely and thoroughly to students with the least time. More significantly, foreign bio-informatics textbooks are mostly written by senior scholars in the field, complied with the characteristics of the discipline of forward-looking and rapid development, showing the unique perspective and the new research methods and conclusions and developing ideas. Meanwhile, they are extremely operable on strict theoretical basis, combining the fact. We can learn from the foreign advanced modern teaching ideas, teaching methods and means from the using of the original teaching materials, getting to know about a new system to cultivate talents of international standards. Therefore, the implementation of bilingual teaching can make bio-informatics realize the leap into the reform on the teaching content and stand directly to the forefront of profession. In the mean time, most information on biological data is shared free globally, mainly including the database of nucleic acid and protein produced by three database system of the United States, Europe and Japan. With the system of whole English interface, only do operators master the correct biological information English terminology, can they easily use the system to study and research in bioinformatics. Therefore, the implementation of bilingual teaching is an effective guarantee to let students obtain biological information knowledge in the shortest possible time. In addition, the students who mastered bio-informatics knowledge and can communicate in English proficiently can be employed easily after graduation and have more opportunities to go abroad for further study.

201.3 Bilingual Teaching Demonstration Course Construction of Biological Information

To promote bilingual teaching and research teaching as an opportunity and cultivate the compound talents of active learning, innovation, teamwork and cooperation, we should create biological information teaching system of bilingual teaching demonstration course actively and provide the independent learning platform for students, bilingual teaching resources for the school teachers and the results of communication curriculum reform as a window of the society.

201.3.1 The Specific Contents of Construction

201.3.1.1 Strengthening the Construction of Teachers' Team

Teachers are the main part of teaching, so the bilingual teachers' quality determines the implementation of bilingual teaching and plays a key role in the realization of the goal of bilingual teaching. Bilingual teachers are not only well versed in the subject content, but also have a high level of foreign languages, skilled at managing foreign language in teaching specialized courses. In order to improve the quality of bilingual teachers, we can carry on the work in the following three aspects:

1. How to actively instruct the bilingual teachers to do some reflective teaching, and achieve self-improvement in reflection.
2. How to strengthen the training of bilingual teachers and establish corresponding incentive mechanism.
3. How to cultivate young teachers with strong scientific research ability to be compound teachers for teaching and scientific research, and take a good 'teaching link'.

201.3.1.2 Arrange the Teaching Content Reasonably

Teaching content refers to the academic quality and organizational structure of the course itself, which is the core element that determines the quality of Bilingual education model curriculum and one of the core content of evaluation index system for the entire. Currently, scientific knowledge about human beings has been increasing about 1-fold every 3 or 5 years. The development and updating speed of the knowledge of bio-informatics is faster than some other disciplines, and its application in various professional fields has been changing with each passing day, which requires teaching to adapt and keep up with development in a timely manner and improve the teaching of bio-informatics in the course of developing. Only in a fresh start or at the forefront of knowledge can we do some pioneering and innovation. Teachers should focus on updating the knowledge structure, and

'learning by teaching as well as teaching by learning'. It mainly includes the following points:

1. Selection of bilingual teaching materials. This is crucial. Writing syllabus according to our own training goals. Finding teaching materials that is acceptable for students' language learning difficulty and have a reasonable structure.
2. Bilingual item pool construction.
3. Course content should include basic knowledge modules (basic theory, basic knowledge and basic skills), practice modules and extension part (trends or developments of the subject) and cannot be confined to the content of textbooks. We should enable students to learn about current hot spots or focus in the study of this discipline through network resources.

201.3.1.3 Research-Based Teaching Exploration of Bio-informatics and Bilingual Teaching's Organic Integration

Europe and the United States's bio-informatics education has penetrated into various subjects of life science. It can follow the discipline's development direction and update knowledge at any time. It lays particular emphasis on cultivating students' ability of doing scientific research so that students have a strong ability to adapt the society. However, there is a big gap between China's current bio-informatics education and the developed countries'. Many domestic colleges and universities have carried out bio-informatics teaching, however, a mature curriculum system has not been formed by now. Students' ability of creativity and researching is in lack of training. Research-oriented undergraduate teaching in colleges and universities is to cultivate innovative talents with international standards and achieve the internationalization of education [6]. It is a new idea, new mode of undergraduate teaching implemented that serves to stimulate students to learn creatively and independently and explore actively. Using research-oriented undergraduate teaching method with exploration, discussion, and students' active participation into teaching science relies on bilingual teaching, because a basic fact is that Europe and some other countries are at the center of development in the field of natural sciences such as biology and the main knowledge carrier of research teaching and learning is English. Bio-informatics is a discipline that develops particularly rapidly and be internationally accepted. Most of its teaching content is from the English literature or English textbooks. Therefore, in the course of the implementation of research-oriented undergraduate teaching, teachers often require students' actively participating in, reasonable scientifically using English literature and databases and using network to trace the frontier and the latest progress of the discipline to carry out research-and-discussion teaching. Obviously, if there is no bilingual education, students and teachers do not have training in listening, speaking, writing and reading English, it will be difficult to carry out research-oriented undergraduate teaching.

201.3.1.4 Construction of Course Websites

Constructing a good course website will provide the students with autonomous learning platform, and provide teachers in and out of schools with teaching resources for bilingual teaching. What's more, it also provides the society with the window of communication course reform results.

201.3.2 Specific Enforcement Steps

We aim at building a bio-informatics bilingual model curriculum teaching system, lying emphasis on cultivating students' capability of active learning and creativity and improving their ability of practice. We want those students who will step into society can adapt the requirement of it and those who are going to pursue advanced studies possess stronger scientific research capability. The specific steps are shown in Chart 201.1.

201.3.3 The Demonstrated Significance of Course

The construction of exquisite and demonstrated course is an important part of the teaching quality and teaching reform project of colleges and universities. From a strategic perspective and the perspective of the overall system it is easy to discover that the construction of demonstration course is a long-term and arduous task, which must be based on reality, focused on improving the quality and the level of teaching, putting the construction of course into the whole teaching activities and curriculum system, realize that creating exquisite course is a breakthrough, increase the intensity of the course construction, promote the quality of course construction from the whole, and develop the demonstration effect of bio-informatics bilingual teaching and push both teaching quality and teaching level to a higher altitude.

201.3.4 Compared with the Traditional Teaching

In the university teaching, experiment teaching is often attached to the theory teaching, the traditional experiment teaching focuses on the validation of theoretical knowledge. In order to consolidate and strengthen the knowledge, students perform the verification experiments and summarize the experimental results, with the steps and methods of regulation experimental guide books. Traditional experimental teaching has the following characteristics: (1) Let all the students adopt the same experimental contents, experimental projects, experimental apparatus, experimental times, experimental time; (2) The teaching contents are mostly

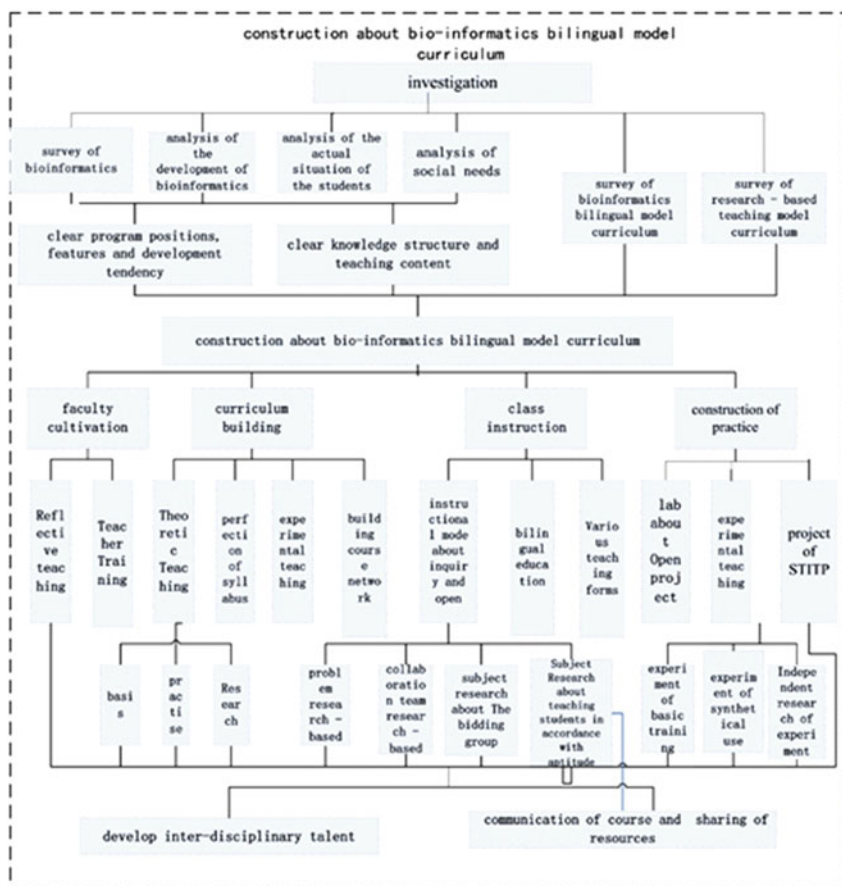


Chart 201.1 Construction about bio-informatics bilingual model curriculum

the verification experiments, much depending on the theory teaching and for theoretical verification methods; (3) The passive learning. The traditional experimental teaching which is much for fixed mode. According to the experimental instructions, the teacher explains the experimental contents, steps and operating demonstrations. And students finish the experiments following the prescribed way. In the whole process of mechanical experiments, students are in the passive learning, where the independent thinking fails. The biggest disadvantage of the traditional experimental teaching is often just like an “assembly” experiment. And the development of students’ individual characters is bound to the single and passive aspects of the experiment. It fails to foster the students’ independence and innovation. Even if successes, it just fosters an assembler, which cannot exercise and train the ability of students to solve problems. So there can be no innovation to speak of [9]. Innovation laboratory, which focuses on the construction of the

opening and innovative experiments, will changes the passive experiments mode that is similar to obtain the medicines according to the prescription completely with the teaching method—“approach, point, dial”. In the innovation laboratory, students can propose the problems to be solved and the goals to be achieved, and design an experiment on their own. Other than that, it succeeds in taking initiative and creativity and displaying their individuality with the independent thought and brave practice, which can result in making up the shortage of the current experiment teaching [10].

201.4 Conclusions and Prospect

In “The Notice of Initiating Project About Bilingual Model Curriculum in 2007”, the government required that the aim of construction about bilingual model curriculum is to form a bilingual education model that can not only connect with the International advanced teaching theories and methods but also fit into the China’s situation with the meaning of demonstration and reference playing an important role in cultivating International competition awareness and ability. As a comprehensive university, Nanjing University of Posts and Telecommunications offers a wide range of courses characterized by information subject and composed mainly of science study. As a cross discipline, bio-informatics not only continues the subject development in the school’s information environment, but also magnifies the school’s feature. So, it is significant to strengthen the construction and development in bio-informatics bilingual teaching model curriculum under the backdrop of school’s information features and driven the need of biology and medical engineering senior specialized compound. “Bio-informatics Guiding Dissertation” is the basic course of biology and medical engineering while less biological course is available in our school. The scientific research in biology is gradually developing through everyone’s effort. However, the related courses still lay behind a little. Thus, we want to take advantage of this biding, focusing on the development of specialized basic course to lay the foundation for future related course and promote advancement of major education and subject development. Therefore, we aim for establishing a high level, unique and colorful bilingual model teaching system and gradually forming a bilingual education model connected with the International advanced teaching theories and methods and suitable to the Chinese condition. We aim for making a new, remarkable achievement of all-around improvement of our country’s higher education and teaching quality with the help of school’s talents majored in information and scientific subject and bio-informatics.

Acknowledgments Foundation item: Nanjing University of Posts and Telecommunications teaching reform research project (No. JG01611JX02 No. JG03212JX67) and Nanjing University of Posts and Telecommunications 2011 lab construction and equipment management research (No. 2011XSG12).

References

1. Tan X, Su Y, Li B (2008) Discussion on bio-informatics teaching. J Shanxi Med Univ (Preclinical Med Educ Ed) (01)
2. Li D (2001) Bioinformatics in the post genome era science. Foreign medical. Physiology. J Pathol Clin Med (04)
3. Lai M (2004) Applications of biological information in medical science research. J Zhejiang Univ (Med Sci Ed) (02)
4. Yang Y, Tian M, Xu L, Chen S (2007) Thinking of the bilingual teaching. Chin J Peking Univ (Philos Soc Sci Ed) (S2)
5. Chen D, Yang M, Yan W (2007) Some understanding of promoting bilingual teaching in colleges. J Peking Univ (Philos Soc Sci Ed) (S2)
6. Yang S (2011) The study of undergraduate teaching and the cultivation of innovative talents. J Guangdong Univ Foreign Stud (02)
7. Wu Z (2001) On the teaching of research study. J Chongqing Educ Coll (05)
8. Zhang Y (2011) Teaching research and training innovative talents. Univ (Acad Ed) (02)
9. Deng W (2011) The integration of multimedia technology and traditional experiment teaching. Teach Instrum Exp (04)
10. Chen S Research methods to improve the classroom teaching efficiency. Teach Instrum Exp 201(04)