

The Applied Research of Bioinformatics in Modern Biology Teaching

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ABSTRACT

With the rapid development of science and technology, bioinformatics has emerged in the field of education, especially on the senior three biology teaching. This research focuses on its application in modern biology teaching, and expounds the expansion of teaching resources, teaching method innovation, students ability training and other practices. By integrating massive biological data resources, provide cutting-edge knowledge cases for teaching; innovate experimental teaching with the help of bioinformatics tools, stimulate students desire for exploration; cultivate students ability of information processing and interdisciplinary thinking, and improve biological literacy. The aim is to reveal the path of bioinformatics to improve the quality and efficiency of biology teaching in senior three, provide theoretical support for teachers teaching innovation, students preparation for college entrance examination and long-term discipline development, and promote biological education to keep pace with The Times.

KEYWORDS

senior three biology teaching; bioinformatics; teaching resources; teaching methods; students ability training

In todays digital age, biological science research changes with each passing day, massive data is emerging, bioinformatics arises at the historic moment. For the senior three biology teaching, it is facing the dual challenge of not only consolidating the foundation to deal with the college entrance examination, but also keeping up with the frontier of the subject to broaden students horizons. The traditional teaching mode is gradually limited, and it is difficult to meet students in-depth exploration of dynamic and complex biological knowledge. With its powerful data integration and analysis ability, bioinformatics is just like a key to open a new door for biology teaching in senior three. It can not only enrich teaching materials, innovate teaching methods, but also stimulate students enthusiasm for biology in the key third year stage, cultivate comprehensive literacy to adapt to the future scientific research, and pave the way for students college entrance examination sprint and long-term academic development. Therefore, it is urgent to explore its application value deeply.

1 Bioinformatics helps to expand teaching resources

1.1 Introduction of frontier knowledge

In the teaching of biology, bioinformatics provides a convenient way to introduce cutting-edge knowledge. For example, teachers can obtain the research progress and application cases of the latest gene-editing technologies such as CRISPR-Cas 9 through bioinformatics databases and online platforms, and introduce them into the classroom. This can not only let students understand the frontier dynamics in the field of biology, stimulate their interest in biology and their desire to explore it, but also enable students to better understand the application of gene structure and function, genetic molecular basis and other basic knowledge in practical scientific research. In addition, bioinformatics can also help teachers to introduce knowledge in emerging fields such as synthetic biology and systems biology, broaden students horizons, make them feel the charm and infinite possibilities of biology, and provide more choices and inspiration for students future learning and research direction.

1.2 Customize personalized learning resources

Using bioinformatics technology, teachers can customize personalized learning resources for students according to their learning conditions and characteristics. For example, through online learning platforms and educational software, students learning data, such as homework completion, test scores, classroom performance, etc., are collected to analyze students learning advantages and weak links. For students who have difficulty in understanding gene expression regulation, teachers can push relevant animation, video, simulation experiment and other resources to help students intuitively understand the process of gene expression and control mechanism; for students who are interested in biological evolution, teachers can provide more practical cases and learning materials about species evolution tree construction and gene sequence comparison, so as to meet students personalized learning needs. This customization of personalized learning resources can improve students learning enthusiasm and initiative, so that each student can get

better development on their own basis.

1.3 Resource utilization of biological databases

Biological database is an important part of bioinformatics, which has an important application value in the senior three biology teaching. For example, teachers can guide students to access databases such as NCBI (National Center for Biotechnology Information), and ask students to personally query gene sequences and protein structures. When learning the structure and function of a gene, students can search the sequence of a specific gene to understand the structure and function of the protein encoded, as well as the orthology and evolutionary relationship of the gene in different species. In addition, using the genomic data in biological databases, teachers can organize students to conduct group discussions and analysis, and cultivate students ability of data interpretation and analysis. By exploring and analyzing real biological data, students are able to have a deeper understanding of biological knowledge and improve their ability to solve practical problems.

1.4 Expansion of virtual experimental resources

Virtual experiment is a major highlight of bioinformatics in teaching. For some experiments that can not be actually carried out in class due to the limited experimental conditions, such as gene cloning and protein crystallization, etc., teachers can use the virtual experimental platform to provide students with experimental opportunities. Students can conduct experimental operations in the virtual environment, simulate the experimental process, and observe the experimental results. Virtual experiment can not only reduce the cost and risk of the experiment, but also allow students to practice repeatedly and deepen their understanding of the principles and steps of the experiment. For example, when learning DNA sequencing technology, students can personally operate the sequencing instruments, analyze the sequencing data, and understand the whole process of DNA sequencing. The expansion of such virtual experiment resources can enrich the teaching content and form, and improve students practical ability and innovative thinking.

2 Bioinformatics drives the innovation in teaching methods

2.1 Problem-oriented and inquiry-based teaching

In the biology teaching of senior three, problem-oriented inquiry teaching combined with bioinformatics can greatly stimulate students interest and initiative in learning. According to the cutting-edge research results and practical applications of bioinformatics, teachers can raise enlightening and challenging questions, such as "how to use bioinformatics methods to predict the pathogenic gene of a certain disease", "the potential risks and coping strategies of gene editing technology in agricultural production", etc. Around these questions, students can conduct independent inquiry and group cooperation by searching biological databases and using bioinformatics software. In the process of inquiry, students can not only deeply understand the basic concepts and principles of biology, but also cultivate the ability of data analysis, logical reasoning and critical thinking. For example, in the study of gene expression regulation, the teacher put forward "how to bioinformatics analysis under different environmental conditions of gene expression differences and regulation mechanism", students can obtain related gene expression data from the database, using data analysis tools for differential expression analysis, and further explore the possible regulatory elements and signal pathways. This teaching method enables students to change from passive acceptance of knowledge to active exploration of knowledge, and improves students ability to solve practical problems and innovative spirit.

2.2 Data-driven teaching decisions

Bioinformatics provides rich data resources for the teaching of senior three biology, enabling teachers to make data-driven teaching decisions. Teachers can analyze students' performance data in bioinformatics related assignments, tests and practical activities to understand students' learning situation and difficulties, so as to adjust the teaching content and methods accordingly. For example, if students are found to have more problems in genetic sequence analysis, teachers can increase the relevant teaching content and exercises, or provide more detailed guidance and cases. At the same time, teachers can also use bioinformatics data to evaluate the teaching effect, such as comparing the changes in students' understanding and application ability before and after using bioinformatics tools to judge whether the teaching method is effective. In addition, teachers can also update the teaching content in time according to the latest research data and development trends in the field of bioinformatics, so that students' knowledge can be closely combined with practical scientific research and application, and cultivate students' scientific literacy and sensitivity to the frontier of the subject.

2.3 Interdisciplinary and integrated teaching

Bioinformatics itself is an interdisciplinary subject of biology and information technology. The introduction of bioinformatics in the teaching of senior three biology can promote the interdisciplinary integration of teaching. On the one hand, teachers can integrate the knowledge and methods of computer science, mathematics, physics and other disciplines into biology teaching, for example, when explaining the gene sequence alignment algorithm, involving the application of computer programming and mathematical model; When analyzing the structure and function of biological macromolecules, they need to use the knowledge of mechanics and chemistry in physics. On the other hand, through interdisciplinary integration teaching, students can broaden their horizons, cultivate interdisciplinary thinking and the ability to comprehensively use knowledge to solve problems. For example, when carrying out bioinformatics projects, students need to use computer skills for data processing and analysis, mathematical knowledge for statistics and modeling, and biological knowledge to interpret results and interpret biological significance. This kind of interdisciplinary integration teaching helps to break the disciplinary boundaries, cultivate all-round development and innovative talents, and make students better adapt to the demand of compound talents in the future society.

2.4 Strengthening of visual teaching means

The visualization technology in bioinformatics provides a more intuitive and vivid teaching means for biology teaching in senior three. For example, through bioinformatics software, the structure of genes, the 3 D structure of proteins, and the interaction of biomolecules can be displayed in visual forms, so that students can understand abstract biological concepts more clearly. When explaining cell signal transduction pathways, using visual signal pathway diagram and animation, students can intuitively see how signal molecules transmit and regulate gene expression within cells, so as to better grasp the complex physiological processes. In addition, visual teaching methods can also be used to show the results of bioinformatics data analysis, such as gene expression heatmap, phylogenetic tree, etc., to help students understand the biological significance behind the data. This visual teaching method can enhance students interest in learning and memory effect, improve the quality and efficiency of teaching, and enable students to better understand and master biological knowledge.

3 Bioinformatics promotes students ability cultivation

3.1 Information acquisition and processing capability

In the teaching of biology, bioinformatics provides students with rich information resources and practical opportunities, which effectively promotes the improvement of students information acquisition and processing ability. On the one hand, students need to obtain a variety of biological information from a large number of biological databases, online literature, professional websites, such as gene sequence, protein structure, biological evolution data, etc., which makes them learn to use web tools and database search skills to quickly and accurately find the required information needed. On the other hand, in the face of massive complex data, students need to use bioinformatics software and tools to process, analyze and interpret. For example, sequence alignment software is used to analyze the similarity and difference of genes, and to draw gene expression map through data analysis software, so as to cultivate students ability of sorting, classification, statistics and visualization of data. In this process, students have gradually mastered the methods of extracting key information, discovering rules and solving problems from complex data, which improves the efficiency and accuracy of information acquisition and processing, and lays a solid foundation for the future study and research in biology and other fields.

3.2 Scientific thinking and innovation ability

The application of bioinformatics in senior three biology teaching plays an important role in the cultivation of students scientific thinking and innovation ability. Through the analysis and research of bioinformatics data, students need to use a variety of scientific thinking methods, such as logical thinking, critical thinking and creative thinking. For example, when exploring the gene regulation network, students need to use logical reasoning to build a possible regulation model according to the existing gene expression data and regulatory element information, and modify and improve the model through further data verification and analysis, which cultivates students logical thinking and critical thinking ability. At the same time, the continuous emergence of new technologies, new methods and new discoveries in the field of bioinformatics provides students with a broad space for innovation. In the process of learning and practice, students can be exposed to cutting-edge scientific research results and unsolved scientific problems, so as to stimulate their innovative consciousness and inspiration. For example, students can try to use new algorithms or software to analyze biological data,

put forward new research ideas and hypotheses, or improve and optimize the existing bioinformatics tools to cultivate innovation ability.

3.3 Cooperation and communication ability

The introduction of bioinformatics projects and activities in the teaching of senior three biology provides students with rich opportunities for cooperation and communication. Many bioinformatics tasks, such as genome annotation, phylogenetic analysis, often require students to complete in groups. In the group cooperation, the students work together with each other to undertake different tasks, such as data collection, analysis, interpretation of results, etc., and jointly complete the project objectives through mutual cooperation and support. This not only cultivates the students team spirit, but also improves their communication and coordination skills and organizational and management skills. In addition, when the students communicate and discuss with the team members, they can share their ideas and experiences, broaden their thinking horizon, and create the sparks of innovation. At the same time, students also need to show to the class and report the team research results, which further exercise their expression ability and communication ability, enable them to clearly and accurately their research ideas, methods and results to others, and accept others questions and Suggestions, so as to constantly improve their research results and ability.

3.4 Independent learning and lifelong learning ability

The rapid development and wide application of bioinformatics encourage senior three students to continuously improve their ability of independent learning and lifelong learning. Because bioinformatics involves biology, computer science, mathematics, and other disciplines of knowledge and technology, students in the process of learning will encounter a variety of problems and challenges, which requires them to have the consciousness and ability of autonomous learning, take the initiative to access to information, learn new knowledge and skills, in order to solve practical problems. For example, when students encounter difficulties in using some kind of bioinformatics software, they need to find relevant tutorials, manuals or online forums to learn the methods and techniques of using the software. At the same time, the knowledge and technology in the field of bioinformatics update, students learned in the third stage is just the tip of the iceberg, this requires them to set up the concept of lifelong learning, in the future study and work continue to focus on the development of bioinformatics, constantly learning and master new theories, methods and tools, to adapt to the changing social needs and the needs of scientific research, realize their own sustainable development.

4 Summary

Bioinformatics is like an innovative force, deeply penetrating into all aspects of biology teaching in senior three. From greatly enriching the "ammunition pool" of teaching resources, to leverage the transformation and upgrading of teaching methods, and then to enabling the growth of students core abilities in all aspects, to inject new vitality into the teaching of senior three biology. It makes the classroom closely follow the pulse of The Times, students knowledge reserve, thinking vision, practical ability to obtain a qualitative leap, calmly respond to the challenges of the college entrance examination, more in the future biological science journey steady start. Looking forward to the future, with the continuous development of bioinformatics, teachers and students will work together to continuously tap their educational potential, which will surely promote biological education to a higher peak and cultivate more biotechnology talents to meet the needs of The Times.

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References

- [1] Gaudio A H ,Padmanabhan V ,Landis P W , et al.A novel translational bioinformatics framework for facilitating multimodal data analyses in preclinical models of neurological injury[J].Scientific Reports,2024,14(1):30710-30710.
- [2] Yu H ,Song H ,Li J , et al.Identification of Anoikis-related potential biomarkers and therapeutic drugs in chronic thromboembolic pulmonary hypertension via bioinformatics analysis and in vitro experiment[J].Scientific Reports,2024,14(1):30663-30663.
- [3] Dejun W .Training Model of Students' English Creative Thinking Ability Based on Big Data Analysis[J].International Journal of High Speed Electronics and Systems,2024,(prepublish).
- [4] Mekuria A ,Bushisho W E ,Wubshet H .The effects of reading strategy training on students' reading strategy use and critical reading ability in

- EFL reading classes[J].Cogent Education,2024,11(1).
- [5] Luo K .Training Path of Computer Application Ability and Computational Thinking of Normal University Students under the Background of Teacher Professional Certification[J].Frontiers in Education Technology,2024,7(2).
- [6] Fan X .Research on Training Strategies of Students' Autonomous Learning Ability in Anatomy Teaching[J].Occupation and Professional Education,2024,1(6).
- [7] Wang Yanzhong, but Qing, Zhang Jun. Research progress of bioinformatics in medical laboratory and its significance and application in postgraduate teaching [J]. Clinical and Education in General Practice, 2023,21 (3): 242-244,255.
- [8] Jiang Yan, Wu Xueqing, Yu Yunsong. Application and Thinking of Bioinformatics in Graduate Teaching in the Field of Medical Microbiology [J]. Clinical and Education in General Practice, 2022,20(6): 534-537.
- [9] Lu Sari, Li Pengping, Li Yan, Wang Qianghu. On the Necessity of Innovating the eaching Model of Bioinformatics in Modern Times [J]. Education and Teaching Forum, 2020(38): 174-175.