

Exploration of Teaching Reform in Animal Science Cell Biology Integrating BOPPPS Model with Curriculum Ideological and Political Education

Xiaomin Du, Shuyun Ji, Wen Feng, Fenghong Wang, Yan Zhang, Lei Zhang, Xiaoyue Song, Lei Qu, Haijing Zhu*

The College of Advanced Agricultural Sciences, Yulin University, Yulin 719000, Shaanxi, China

*Corresponding author: Haijing Zhu, haijingzhu@yulinu.edu.cn

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: Taking the Animal Science major of the College of Advanced Agricultural Sciences, Yulin University as an example, this paper explores the teaching reform path of Cell Biology by integrating the BOPPPS teaching model with curriculum ideological and political education. By deeply excavating ideological and political elements in the Cell Biology course and organically integrating them into the six stages of the BOPPPS teaching model (Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary), a new student-centered teaching paradigm is constructed, where knowledge imparting and value guidance resonate at the same frequency. Teaching practice shows that this model effectively improves students' learning participation and independent learning ability, while cultivating their scientific spirit, professional literacy, and feelings for the country and the nation, and provides a practical reference case for the construction of curriculum ideological and political education in professional courses of agricultural and forestry universities.

Keywords: BOPPPS; Curriculum ideological and political education; Cell biology; Animal science; Teaching reform

Online publication: April 21, 2026

1. Introduction

As a core basic course for Animal Science majors, Cell Biology plays an important role in cultivating innovative talents for modern animal husbandry ^[1]. The traditional teaching model has many drawbacks: first, teacher-centered knowledge indoctrination leads to passive learning of students, making it difficult to stimulate their learning interest; second, curriculum teaching focuses on the transmission of theoretical knowledge, ignoring the cultivation of students' scientific thinking and professional literacy; third, the phenomenon of "separation between two aspects" between ideological and political education and professional education is serious, and

the educational function has not been fully realized^[2]. Faced with these problems, we attempt to explore a new teaching model that integrates the BOPPPS teaching model into knowledge imparting, ability training, and value guidance.

BOPPPS is a modular teaching model that emphasizes student participation and teaching interaction^[3]. It constructs a closed-loop teaching process through six closely connected links (Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary), which effectively ensures teaching effectiveness. In recent years, this model has shown unique advantages in the construction of curriculum ideological and political education in China. For example, Wenzhou University has built a blended teaching system with explicit knowledge lines and implicit ideological and political lines based on the BOPPPS teaching model, achieving remarkable results^[4]. The School of Life Sciences of Yunnan Normal University introduced the BOPPPS teaching model into the experimental teaching of Cell Biology, redesigned the teaching process around the student-centered educational philosophy, and effectively activated the ideological and political education in the course by increasing students' participation^[5].

Taking the Animal Science major of the College of Advanced Agricultural Sciences, Yulin University as an example, this paper focuses on the teaching reform of Cell Biology, systematically expounds the integration path, practical strategies, and effect reflection of the BOPPPS model and curriculum ideological and political education, aiming to provide references for the professional course teaching of similar universities.

2. Relevance between BOPPPS model and curriculum ideological and political education

2.1. Structural characteristics of the BOPPPS model

The BOPPPS model features an elaborate structural design and emphasizes interactive participation. The six links are interlocking, forming a teaching closed loop: the Bridge-in link stimulates students' interest through questions, cases, or scenarios, and naturally leads to the teaching content; the Objective link clarifies specific learning goals to guide students' targeted learning; the Pre-assessment link explores students' prior knowledge and experience to provide a basis for teaching adjustment; the Participatory Learning link promotes students' active participation through diverse teaching activities; the Post-assessment link tests the achievement of teaching goals and evaluates learning effects; the Summary link sorts out knowledge points, consolidates learning achievements, and expands learning content^[6]. This model breaks the linear process of traditional teaching, constructs a dynamic teaching cycle with feedback and continuous optimization, and provides structural support for the organic integration of curriculum ideological and political education.

2.2. Compatibility between BOPPPS and curriculum ideological and political education

The BOPPPS model provides methodological support for curriculum ideological and political education, while curriculum ideological and political education injects a value core into the BOPPPS model^[7]. The "Bridge-in" link of the BOPPPS model provides a natural entry point for the integration of ideological and political elements. Through carefully designed introduction scenarios, connections can be established between professional content, students' lives, and social reality, making value guidance take place naturally. For example, guided by the OBE educational philosophy and relying on the BOPPPS model, the School of Life and Environmental Sciences of Wenzhou University has built a teaching system of "explicit knowledge lines and implicit ideological and political lines" in the blended teaching of Cell Biology. The "Participatory Learning" link provides diverse paths

for the experience and internalization of ideological and political connotations. Through participatory activities such as case discussions, role-playing, and group cooperation, students can deepen their understanding of values through ideological collisions and emotional experiences^[8,9]. The closed-loop structure of the BOPPPS model provides a monitoring mechanism for the evaluation of the effect of curriculum ideological and political education. Through the comparison between pre-assessment and post-assessment, teachers can understand the changes in students' cognitive values and adjust teaching strategies in a timely manner to ensure educational effectiveness.

3. Teaching application example: The chapter “cell differentiation and stem cells”

Based on the characteristics of the Animal Science major and talent training requirements, taking the core chapter “Cell Differentiation and Stem Cells” of the Animal Science major in the College of Advanced Agricultural Sciences, Yulin University, as an example, the integrated application of the BOPPPS model and curriculum ideological and political education is demonstrated in detail.

3.1. Bridge-in: Stimulating mission with national major needs and cutting-edge science and technology

In the Bridge-in link, we abandon the traditional way of directly explaining concepts and instead play a short video showing China's breakthroughs in the field of stem cells, such as the pioneering research of Academician Zhou Qi's team in induced pluripotent stem cells. Then, we raise the question: “How will this technology innovate the breeding efficiency of local excellent breeds such as Northern Shaanxi White Cashmere Goats?” This design not only instantly captures students' attention but also closely connects abstract knowledge with national scientific and technological achievements and local industrial needs, and naturally stimulates students' national pride and the sense of mission to know and love agriculture. This design is similar to the approach in Cell Biology teaching, where experimental results are used as carriers to integrate the scientific spirit and ideological and political elements into various links of Cell Biology experiments, allowing students to fully experience the process of scientific exploration and cultivate scientific thinking and attitudes^[10].

3.2. Objective: Establishing trinitarian learning expectations of knowledge, ability, and literacy

Teaching objectives adopt a two-way clarification method, clarifying both knowledge and ability objectives and ideological and political education objectives with specific and measurable expressions^[11]. We have set clear three-dimensional teaching objectives. The knowledge objective is to master the concept of cell differentiation and the characteristics and classification of stem cells; the ability objective is to initially design application schemes of stem cells in animal breeding; the ideological and political objective focuses on cultivating students' awareness of scientific ethics, social responsibility, and innovative spirit by discussing the ethical boundaries of stem cell applications. This ensures that value guidance and knowledge imparting proceed simultaneously^[12].

3.3. Pre-assessment: Diagnosing learning situation and accurately locating the entry point of ideological and political education

Through an online pre-assessment questionnaire, we found that most students have a vague understanding of “whether stem cell research should be unrestricted”. This diagnosis of students' learning situation enables us to

accurately focus on the teaching difficulties and ideological and political focus on the “balance between scientific and technological development and ethical norms”, laying the foundation for in-depth discussions later ^[13].

3.4. Participatory learning: Realizing value internalization through speculation and inquiry

Participatory Learning is the core link of the BOPPPS model and the key path for the internalization of ideological and political values. We organized an ethical debate on “Is stem cell technology a blessing or a threat?” Students were divided into groups to play roles such as scientists, ethicists, breeding enterprise owners, and consumers, and conducted a heated debate around a fictional project of “breeding super livestock using stem cell technology”. In this process, to support their views, students must deeply understand professional knowledge, such as the “stemness” of stem cells and differentiation regulation, and actively think about the social responsibility, ecological impact, and business ethics behind the technology. This immersive role experience makes the value of “responsible innovation” no longer empty talk, but a conclusion independently drawn by students through speculation ^[14].

3.5. Post-assessment: Comprehensive evaluation of knowledge mastery and value recognition

The Post-assessment design focuses on multi-dimensional evaluation, assessing not only the mastery of knowledge but also the development of abilities and the formation of value recognition. The Post-assessment adopts a hierarchical design: basic questions examine core concepts, comprehensive questions require analyzing the feasibility and risks of a stem cell breeding case, and sublimation questions are set as: “Please discuss how to uphold ethical bottom lines in the application of stem cell technology as a future animal science and technology worker.” Students’ answers can not only reflect their mastery of knowledge but also clearly show the establishment of their scientific ethics and social responsibility ^[15].

3.6. Summary: Condensing knowledge system and sublimating value guidance

In the Summary link, teachers first guide students to jointly draw a knowledge map of this chapter. Finally, the theme is sublimated with a concise remark: we should not only marvel at the unlimited potential of stem cells as “seeds of life” and bravely explore the unknown, but also respect the natural laws of life and abide by the ethics of scientific research. It is hoped that all students will become outstanding animal husbandry talents with both an innovative spirit and a strong sense of responsibility in the future. In this way, professional education and ideological and political education achieve a perfect integration and conclusion.

Through the closed-loop design of the above six links, the BOPPPS model ensures that the teaching of the chapter “Cell Differentiation and Stem Cells” is no longer a one-way knowledge transmission, but an organic process in which students actively participate and deeply speculate to construct both knowledge systems and values.

4. Teaching reform effects and reflections

4.1. Reform effects

After two rounds of teaching practice, the teaching reform integrating the BOPPPS model with curriculum ideological and political education has achieved remarkable results. Specifically, students have shown obvious

positive changes in the following aspects: first, enhanced learning initiative, the classroom has changed from “teacher speaking and students listening” to “teachers and students discussing together”, and the classroom interaction coverage rate has increased from 35.2% before the reform to 76.8%; second, deepened understanding of knowledge, students can connect Cell Biology knowledge with practical problems in Animal Science, and the average score of the final exam has increased by 3 points; third, improved scientific literacy, students show a more rigorous attitude in experimental design and report presentation; fourth, strengthened professional identity, students have a more positive cognition of the value and development prospects of the Animal Science major, and the course recognition score has increased from 3.8 points (5-point scale) to 4.4 points.

4.2. Reflections and improvements

In the process of teaching reform, we also found some problems that need to be solved and improved: first, the depth and naturalness of ideological and political integration need to be further optimized. In the initial stage, the implantation of ideological and political elements in some courses was relatively rigid, with the phenomenon of “labeling”. In the future, through more careful teaching design, we will integrate ideological and political connotations into professional content naturally, like “salt dissolving in water”. In the reform of integrating curriculum ideological and political education with Cell and Molecular Biology for Animal Science majors, it is important to emphasize natural integration rather than simple superposition. Second, the evaluation system needs to be further improved. The effect of curriculum ideological and political education is difficult to fully evaluate through traditional written examinations. It is necessary to construct a diversified evaluation system, incorporate students’ classroom performance, project assignments, social practice and other aspects into the evaluation scope, and pay attention to the combination of process evaluation and summative evaluation. Third, differentiated teaching design needs to be strengthened. In view of the differences in students’ cognitive foundations and values, more targeted teaching plans should be formulated, such as setting discussion topics of different difficulties and designing hierarchical participatory learning activities, so that each student can make progress on their original basis.

In the future, we will continue to deepen the research on the integration of the BOPPPS model with curriculum ideological and political education. Especially in the context of the deep integration of information technology and teaching, we will explore new variants of the BOPPPS model in the smart teaching environment, such as the blended BOPPPS model combining online and offline teaching. At the same time, we will further strengthen the connection with the local animal husbandry industry, develop more teaching cases closely related to the development of animal husbandry in Northern Shaanxi, and make the curriculum ideological and political education more regional and contemporary.

5. Conclusion

The BOPPPS teaching model provides a scientific framework and effective path for the construction of curriculum ideological and political education in Cell Biology. Through the careful design of six links (Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary), the organic unity of professional knowledge imparting and value guidance is realized. Teaching practice shows that this model not only improves students’ learning effects but also cultivates their scientific spirit, humanistic literacy, and feelings for the country and the nation, realizing the fundamental task of “fostering virtue through education”. Facing the future, the Animal Science major of the College of Advanced Agricultural Sciences, Yulin University will continue to

deepen the teaching reform of Cell Biology, continuously improve the integration mechanism of the BOPPPS model and curriculum ideological and political education, and contribute to cultivating new animal husbandry talents who know agriculture, love agriculture, strengthen agriculture and revitalize agriculture. At the same time, the practical experience of this research can also provide a reference for the ideological and political construction of professional courses in similar universities, and jointly promote the connotative development of higher education.

Funding

National Natural Science Foundation of China (Project No.: 32560814); Yulin University Model Course Project for Ideological and Political Education in All Courses (Project Nos.: KCSZ2410; KCSZ2429; KCSZ2546)

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Zhai ZH, Wang XZ, Ding MX, 2011, Cell Biology. Higher Education Press, Beijing.
- [2] Gao RC, Wang XY, 2021, Preliminary Exploration of the Application of BOPPPS Teaching Model in Cell Biology Experimental Teaching—Taking the “Permeability of Cell Membrane Experiment” as an Example. Chinese Journal of Cell Biology, 43(11): 2186–2190.
- [3] Yao WQ, She NF, 2022, Analysis of Teaching Design Elements and Case Design of BOPPPS Teaching Model. Chinese Journal of Chemical Education (Chinese & English), 43(18): 51–57.
- [4] Wang ZM, Chen Y, 2025, “Integration Model, Alternating Explicit and Implicit”——Design and Practice of Blended Teaching of Cell Biology Course. Chinese Journal of Cell Biology, 47(4): 880–892.
- [5] Qiu XY, Xiao X, 2021, Practice and Exploration of the “Smart Classroom” Teaching Model in Cell Biology. China Journal of Cell Biology, 43(12): 2377–2381.
- [6] Zou Q, Sun LC, Chen ZY, et al., 2025, Research on BOPPPS Teaching Model Promoting the Development of Postgraduates’ Critical Thinking Ability. Journal of Biology, 2025: 1–5.
- [7] Wang SQ, Ma MX, Gao SY, et al., 2023, Design and Practice of Curriculum Ideological and Political Education in Veterinary Immunology Experiment Course Based on BOPPPS Teaching Model——Taking Anthrax Diagnosis and Fur Quarantine Experiment as an Example. Chinese Journal of Immunology, 39(6): 1199–1202.
- [8] Liu YF, Wang LN, Liu W, et al., 2025, Research on BOPPPS Teaching of Medical Immunology Based on OBE Concept Under the Background of “New Medical Science”. Chinese Journal of Immunology, 2025: 1–12.
- [9] Li ZX, Lin YQ, Xiong Y, 2021, Exploration and Practice of BOPPPS Teaching Model in Animal Breeding Science Teaching Under the Background of New Agricultural Science Construction. Heilongjiang Animal Science and Veterinary Medicine, (18): 137–140.
- [10] Ding L, Ding FJ, Liu D, et al., 2025, Exploration of Integrating Scientific Spirit and Ideological and Political Elements into Cell Biology Experimental Course Teaching Under the OBE and Design Concepts. Chinese Journal of Cell Biology, 47(7): 1656–1667.
- [11] Li J, Zhang Y, Li M, 2024, Construction and Practice of Curriculum Ideological and Political Education System for

- Professional Courses Based on BOPPPS Model. *Journal of Higher Education Research*, 47(2): 89–94.
- [12] Zhang H, Liu J, Wang Y, 2023, Application of BOPPPS Model in the Teaching of Animal Biochemistry Course with Curriculum Ideological and Political Education. *Journal of Agricultural Education*, 39(3): 102–106.
- [13] Chen W, Zhao L, Zhang X, 2023, Exploration of Curriculum Ideological and Political Education in Cell Biology Teaching for Agricultural Majors. *Journal of Anhui Agricultural Sciences*, 51(18): 278–281.
- [14] Wang L, Chen J, Li S, 2022, Blended Teaching Design of Cell Biology Integrating Curriculum Ideological and Political Education Based on BOPPPS Model. *Digital Education*, 8(4): 56–61.
- [15] Zhao Y, Sun H, Zhang Z, 2022, Practice and Reflection on the Integration of Curriculum Ideological and Political Education into Animal Science Professional Courses Based on BOPPPS Model. *Journal of Yulin University*, 32(5): 98–102.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.