

Research on the Infiltration of Scientific Spirit in High School Biology Teaching Under the Background of Curriculum Ideology and Politics

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Abstract

Curriculum thinking and politics is an exploration of moral education reform and a strategic measure to carry out the fundamental task of cultivating people. High school is a key period for students to form correct values. In addition to ideological and political courses, other courses also need to play the function of educating people, and take courses as the carrier to provide value guidance to students in the process of knowledge imparting and ability training. High school biology is a fundamental course in natural sciences and an important carrier for cultivating students' scientific literacy. However, through questionnaire surveys and interviews at internship schools, it was found that the infiltration of scientific spirit into high school biology teaching is not ideal. Teachers have insufficient understanding of ideological and political education in the curriculum, and they cannot fully tap into educational materials in textbooks. The methods for infiltrating scientific spirit are relatively single, making it difficult to balance ideological and political infiltration with knowledge teaching. This article selects the scientific spirit as an ideological and political element based on the needs of national development and the characteristics of the discipline, and permeates it into biology teaching. Finally, the teaching effectiveness is evaluated through various methods. The aim is to enrich the theoretical research of thinking and politics in senior biology curriculum, and to provide teaching reference for teachers to cultivate students' scientific spirit in biology teaching. After conducting questionnaire surveys and interviews with students and teachers, the following conclusions were drawn: firstly, although the teachers and students of the school have a limited understanding of ideological and political education in the curriculum, most of them support the integration of ideological and political education into biology teaching. Secondly, some teachers still place more emphasis on imparting knowledge in their teaching and have not fully utilized the educational value of biology. The implementation of ideological and political education in biology teaching is not ideal. Thirdly, overall, the penetration of scientific spirit in biology teaching is not satisfactory and needs further strengthening. In summary, teachers need to strengthen their exploration of textbooks and deepen their understanding of teaching design in their daily teaching process, in order to continuously improve their ideological and political education for students and fully leverage the educational value of biology. Integrating scientific spirit into biology teaching is not only in line with the ideological and political concepts of the curriculum, but also in line with the core competencies of the discipline, which can better leverage the educational value of biology.

Keywords: Biology teaching; Course ideological and political education; scientific spirit; Permeation.

Article History

Received: 19 August, 2024

Revised: 30 September, 2024

Accepted: 23 October, 2024

Published: 10 November, 2024

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1. Course Ideological and Political Education

1.1. The Proposal of Ideological and Political Concepts in the Curriculum

A century long plan, education as the foundation; Moral education is the top priority in educating people. The moral education in primary and secondary schools in our country mainly relies on ideological and political courses. In fact, each course has a dual attribute of knowledge and education, and every teacher has the responsibility of education. Providing ideological education to students solely through ideological and political courses can easily cause boredom and fatigue, and cannot fully realize the educational value of other courses. Shanghai has taken the lead in exploring reforms in moral education, successively proposing disciplinary moral education and curriculum ideological and political education, focusing on implementing teaching and education in the main channel of classroom teaching, deeply exploring ideological and political education resources in various courses, exerting the educational functions of all courses, and fulfilling the educational responsibilities of all teachers (Deyi and Aidong, 2017). At the 2016 National Conference on Ideological and Political Work in Colleges and Universities, General Secretary Jinping Xi put forward that we should make good use of classroom teaching as the main channel, and all courses should be well guarded and planted with responsibility fields, so that all courses and ideological and political theory courses can walk in the same direction and form a synergistic effect (Jing *et al.*, 2017). The "Guidelines for Moral Education in Primary and Secondary Schools" issued by the Ministry of Education in 2017 pointed out that curriculum education is the most important way to achieve moral education. We should fully tap into the moral education resources contained in each course according to the characteristics of different grades and courses, and organically integrate moral education content into the teaching of each course (Ministry of Education, 2017). In the following years, relevant documents such as "Opinions on Deepening the Reform of the Education System and Mechanism", "Several Opinions on Deepening the Reform and Innovation of Ideological and Political Theory Courses in Schools in the New Era", "Guidelines for the Construction of Ideological and Political Courses in Higher Education Institutions", and related conferences such as the School Ideological and Political Theory Course Teacher Symposium and the National Education Work Conference all mentioned the need to fully explore the moral education connotation in each course and play the educational function of all courses.

1.2. The Connotation of Ideological and Political Education in Curriculum

There are several views on the ideological and political education in the curriculum: Deyi Gao and Aidong Zong believe that the essence of ideological and political education in the curriculum is a kind of curriculum view, which is not to add a new course or activity, but to integrate ideological and political education in universities into various aspects and links of curriculum teaching and reform, achieving the goal of cultivating morality and nurturing people silently (Deyi and Aidong, 2017). Weiguang Qiu believes that the curriculum of ideological and political education points to a new concept of ideological and political work, that is, "the curriculum carries ideological and political education" and "ideological and political education is integrated into the curriculum" (Weiguang, 2017). Lige Lu believes that curriculum ideological and political education is a social practice activity that takes curriculum as the carrier, fully explores the inherent moral education factors and resources of various courses, and develops and applies them in accordance with the laws of curriculum education and teaching (Lige and Kaili, 2020). Regardless of the viewpoint, the essence of ideological and political education and moral education in the curriculum remains unchanged.

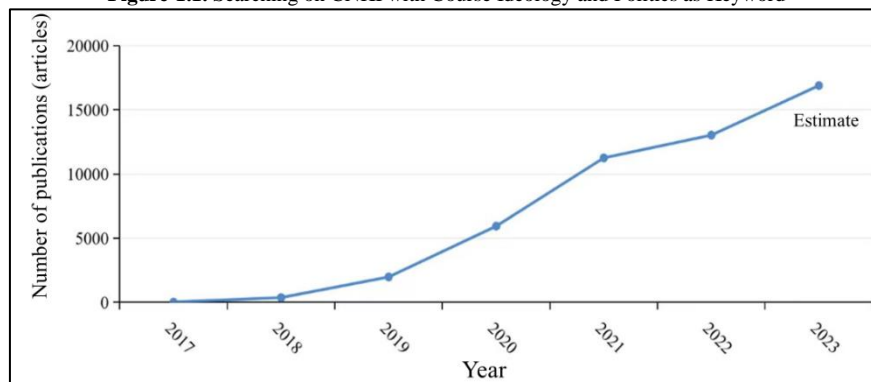
The most crucial aspect of curriculum ideological and political construction is to explore the ideological and political elements contained in the curriculum. Each course contains rich ideological and political elements to varying degrees and aspects. However, these ideological and political resources are not directly displayed in the course content, but are hidden behind various knowledge points and deep in subject theories, forming in the process of knowledge exploration. Teachers need to actively explore, refine, and integrate into classroom teaching (Xianzhong, 2019). "Ideological and political education" is the abbreviation of ideological education, moral education, and political education (Yiming, 2021). The elements of ideological and political education include political identity, four consciousnesses, four confidences, and socialist core values, but are not limited to these. Moral education elements or positive energy that can nourish the healthy growth of students can all be called ideological and political elements.

1.3. The Current Research Status of Curriculum Ideological and Political Education

Since the proposal of the course of ideological and political education, it has achieved full coverage of universities and gradually penetrated into basic education in various regions. The literature on curriculum ideology and politics on China National Knowledge Infrastructure (CNKI) was first published in 2017, and the number of papers has significantly increased in 2021 and 2022, becoming a research hotspot in recent years (Figure 1.1). The curriculum of ideological and political education in primary and secondary schools is still in its early stages, but multiple disciplines such as physics, geography, chemistry, mathematics, English, and biology have explored it. Qingfeng Yin explores the implementation path of ideological and political education in high school physics curriculum from two aspects: secondary development of physics textbooks and active expansion of ideological and political time and space (Qingfeng, 2020). Jingjing Xu elaborates on the connotation of "ideological and political education in high school geography curriculum", and takes "water cycle and flood disasters" as an example to propose the implementation path of adding ideological and political education goals, creating problem scenarios, and multi-dimensional teaching evaluation from the aspects of teaching objectives, teaching methods, and teaching evaluation (Jingjing, 2021). From the existing research results, the vast majority of studies have focused on practical

cases of integrating ideological and political education with different disciplinary courses, such as exploring the ideological and political elements of this discipline and exploring specific implementation paths. There are also a few studies that involve the connotation, characteristics, and historical evolution process of curriculum ideological and political education (Yuancai, 2022). As a new educational concept, the exploration of ideological and political education in curriculum is still ongoing in various disciplines of middle schools.

Figure-1.1. Searching on CNKI with Course Ideology and Politics as Keyword



2. Scientific Spirit

2.1. The Connotation of Scientific Spirit

The spirit of science originated in ancient Greece (Holmyard, 1934) and flourished in modern Europe (Wei and Jia'an, 2004). The spirit of science in China prevailed during the May Fourth Movement, but Mr. Hongjun Ren was the first to clearly propose the concept of scientific spirit. In 1916, he proposed in his article "On the Spirit of Science" that the pursuit of truth through the spirit of science is already possible (Hongjun, 2015). Kezhen Lan proposed that the spirit of science is "only asking right and wrong, disregarding interests.". The "Core Literacy for the Development of Chinese Students" released in 2016 pointed out that the spirit of science mainly refers to the value standards, thinking patterns, and behavioral norms exhibited by individuals in learning, understanding, and applying scientific knowledge and skills, including basic points such as advocating true knowledge, rational thinking, and the courage to explore (Core, 2016). This article believes that the spirit of science is the concentrated embodiment of the behavioral norms, value orientations, and ways of thinking formed by science in its development process (Xiujie *et al.*, 2020), which should be possessed by every ordinary citizen. Gang Chen believes that the scientific spirit contained in high school biology courses mainly includes the lofty aspiration of loving and dedicating oneself to science, the rigorous attitude of seeking truth from facts and respecting laws, the enterprising consciousness of daring to criticize and innovate, and the team spirit of unity, mutual assistance, and division of labor and cooperation (Gang, 2021). Zhenyu Du believes that the scientific spirit in the ideological and political education of biology courses mainly includes three aspects: objective and rational thinking traits, rigorous and pragmatic work style, and value orientation of exploration and innovation (Zhenyu, 2020). The specific infiltration of scientific spirit in biology teaching should be determined based on the teaching content and the scientific spirit materials explored.

2.2. The Relationship between Scientific Spirit and Ideological and Political Education in Biology Courses

The essence of ideological and political education in the curriculum is to cultivate students with moral character. In subject teaching, in addition to imparting knowledge and cultivating abilities to students, it is also necessary to guide their values. Curriculum ideological and political education is not a simple addition of curriculum and ideological and political education, but a search for the convergence of the two, seamless integration and organic integration (Daokun, 2018). High school biology is a fundamental discipline in natural sciences, which embodies the rigor of science everywhere. This is the characteristic and advantage of biology, and it is also an important educational value of biology (Shuhui, 2023). The scientific spirit is the concentrated embodiment of the behavioral norms, value orientations, and thinking patterns formed by science in its development process (Xiujie *et al.*, 2020), and is one of the most unique attributes of natural science courses. Yuancai Jiang believes that all ordinary high school courses have systematicity, purposefulness, and uniqueness in achieving the goals of ideological and political education. The natural science curriculum should focus on cultivating students' scientific and innovative spirit. Taking biology as an example, the ideological and political elements of the discipline include ecological environment, human health, biological weapons and world peace, scientific history and scientific spirit, etc (Yuancai, 2022). As a natural science course, the study of ideological and political education in biology courses cannot be separated from the cultivation of students' scientific spirit.

2.3. The Relationship between Scientific Spirit, Scientific Thinking, and Scientific Exploration

The New Curriculum Standards for High School Biology (2017 Edition, 2020 Revision) propose four core competencies that best reflect the characteristics and educational value of biology, but do not explicitly state the

scientific spirit. Scientific spirit is indirectly reflected in various parts of the core competencies of biology, and the two core competencies of scientific thinking and scientific exploration are inseparable from scientific spirit. The scientific spirit in the ideological and political education of biology courses and the scientific thinking and scientific exploration in core competencies have both intersection and differences. The new curriculum standard points out that "scientific thinking" refers to the habit and ability of respecting facts and evidence, advocating a rigorous and pragmatic attitude towards knowledge, and using scientific thinking methods to understand things and solve practical problems. "Scientific exploration" refers to the ability to discover biological problems in the real world, observe, ask questions, design experiments, implement plans, and communicate and discuss results for specific biological phenomena (Ministry of Education of the People's Republic of China, 2020). Scientific thinking and scientific exploration focus more on cultivating students' thinking and abilities, while the scientific spirit under the curriculum of ideological and political education focuses more on guiding students' spirit and value, with richer connotations. In addition to cultivating students' spirit of positivity, criticism, and innovation, teaching also pays more attention to their spirit of exploration, perseverance, and dedication to fame and fortune, as well as their dedication to the country.

The concept of ideological and political education in the curriculum is in line with the educational value of core competencies in the field of biology. Integrating scientific spirit into biology teaching not only conforms to the concept of ideological and political education in the curriculum, but also helps to implement core competencies, which can better play the educational function of biology courses.

2.4. Current Status of Research on the Scientific Spirit of High School Biology

According to the information searched on CNKI, relevant literature on cultivating students' scientific spirit in biology teaching in China was first published around 2000. For example, Bochuan Qiu proposed to cultivate students' scientific literacy in middle school biology teaching, which includes scientific knowledge, scientific methods, and scientific thinking. Scientific thinking mainly refers to scientific attitude, scientific spirit, and scientific value. Subsequently, relevant literature was published one after another, and the trend of literature publication showed a wave like increase. However, through searching for information, it was found that in recent years, the relevant literature on cultivating students' scientific spirit in middle schools has mainly focused on ideological and political disciplines and physics, with relatively few and earlier studies on high school biology.

After the concept of ideological and political education in the curriculum was proposed, some frontline teachers began to explore the ideological and political elements contained in this course. Most of the existing literature on ideological and political education in high school biology courses mentions the scientific spirit as an ideological and political element. Mingfen Wang proposed in his article "On the Effective Infiltration of Ideological and Political Education in High School Subject Teaching" that useful materials can be used to demonstrate the development of biology in China, the wisdom and greatness of contemporary Chinese scientists, etc., to inspire students' patriotism and scientific psychology. In the teaching of biology experiments, emphasis should be placed on cultivating the spirit of collaboration, rigorous and pragmatic scientific attitude, and exploratory spirit among students (Mingfen and Guozhong, 2019). The proposal of the concept of ideological and political education in the curriculum has enhanced the educational awareness of biology teachers. Under the background of ideological and political education in the curriculum, it is important to infiltrate the spirit of science. It is important to excavate, sort out, and extract materials related to the spirit of science in textbooks, and then find the connection between the spirit of science and classroom teaching. In a flexible way, it can be seamlessly integrated into classroom teaching, subtly influencing students' values. It focuses on "deep exploration, organic integration, and silent moistening", while also possessing distinct political and value orientation, that is, we ultimately aim to cultivate talents who serve socialist construction, and to infuse scientific spirit with patriotism as the foundation.

3. Research Design

3.1. Research Tool

Survey on the Implementation Status of Scientific Spirit in High School Biology Teaching under Curriculum Ideology and Politics (Teacher Questionnaire); Survey on the Implementation Status of Scientific Spirit in High School Biology Teaching under Curriculum Ideology and Politics (Student Questionnaire); Survey questionnaire on students' interest in learning biology; Survey questionnaire on student scientific spirit; Student interview questionnaire; SPSS software; EXCEL.

3.2. Survey Subjects

The participants of the teacher questionnaire and interview were all biology teachers in the first year of their internship school. A total of 20 questionnaires were distributed and 20 were collected, with a response rate of 100.0%. 90.0% of biology teachers in the first year of high school have a teaching experience of 1-5 years, and 10.0% have a teaching experience of 11-20 years. The high school has a relatively short history of establishment, and most of the recruited teachers are outstanding young teachers. The newly recruited teachers also start teaching from the first year of high school, so most of the biology teachers in the first year of high school have a relatively short teaching experience. The student questionnaire was distributed to first-year high school students, and 8 classes were randomly selected for distribution. A total of 327 questionnaires were distributed and all were collected. Among them, 294 valid questionnaires were collected, and any missed or random answers were considered invalid.

The effective response rate of the questionnaire was 89.9%, and the male to female ratio of the surveyed students was about 4:6.

3.3. Research Method

3.3.1. Bibliographic Method

Literature method refers to a research method that aims to discover the essential characteristics of things through consulting, analyzing, and organizing literature. Around the research topic of this article, we will search for relevant literature and materials on curriculum ideology and scientific spirit through multiple channels and methods, understand the relevant connotations, implementation paths, theoretical foundations, and development status, and obtain some reference and inspiration from them.

3.3.2. Questionnaire Survey Method

The questionnaire survey method is a method used by researchers to obtain relevant information and data through pre designed questions. Researchers provide a series of questions related to the research purpose in written form, allowing respondents to provide answers. By collecting, organizing, and analyzing the answers to the questions, relevant information is obtained (Baoping, 2005). In order to understand the implementation status of scientific spirit in high school biology teaching under the background of ideological and political education in the curriculum, teacher questionnaires and student questionnaires were developed. By analyzing the questionnaire results, problems were identified and adjusted and improved in subsequent teaching design. Before and after teaching practice, a scale will be used to measure students' scientific spirit, in order to test the effectiveness of teaching.

The purpose of this survey is to understand the current situation of the infiltration of scientific spirit in high school biology teaching under the background of ideological and political education in the curriculum. The survey is mainly conducted in two forms: questionnaire and interview. The questionnaire includes teacher questionnaires and student questionnaires, which were compiled based on the research on the integration of middle school biology teaching and curriculum ideological and political education in basic education in Xi'an, and were appropriately adapted according to actual needs. The teacher questionnaire is divided into three parts and consists of 15 questions, all of which are multiple-choice questions, including single choice and multiple choice questions. Among them, questions 1-2 are basic information about teachers, questions 3-8 are teachers' understanding of curriculum ideology and the specific implementation of curriculum ideology in high school biology teaching, and questions 9-15 are basic information on the infiltration of scientific spirit in biology teaching. Teacher interviews are supplementary teacher questionnaires with three questions. The student survey questionnaire consists of three parts and 13 questions, which are also multiple-choice questions, including single choice and multiple choice. 1-2 questions are basic information about students, 3-6 questions are students' views on integrating ideological and political education into biology teaching, and 7-13 questions are a survey of students' basic attitudes and actual teaching situations towards incorporating scientific spirit into biology teaching. The survey questionnaire and interview outline can be found in Appendix A.

3.3.3. Interview Survey Method

Interview survey method refers to the survey method in which the investigator collects the necessary information through conversation with the research subject, and is a research-oriented conversation (Jianjun, 2020). When investigating the current situation of incorporating scientific spirit into high school biology teaching, teacher interviews were also used. In order to better understand the specific problems and personal opinions of teachers in the teaching process, which cannot be obtained through survey questionnaires, interviews are needed as supplements. After the teaching practice is completed, students will be interviewed to gain a deeper understanding of their true inner feelings.

3.3.4. Educational Experiment Method

Selecting all students from two classes in the first year of a regular high school as the research subjects, one class is subjected to experimental teaching and the other class is subjected to routine teaching. Then, SPSS software is used to analyze whether there are significant differences in biology learning interests and scientific spirit between the two classes, in order to test their rationality and effectiveness.

4. Current Situation Investigation and Result Analysis

4.1. Survey Questionnaire Results and Analysis

4.1.1. Cognition and Attitude towards Biology Ideological and Political Courses

According to the survey results, the vast majority of teachers have a basic understanding of ideological and political education in the curriculum, and 5.0% of teachers do not understand it (Figure 2.1). 51.0% of students can correctly view the relationship between biology curriculum and ideological and political education, 21.8% of students cannot explain it clearly, and 27.2% of students believe that the two are separate systems and not related to each other (Figure 2-2). All teachers believe that integrating curriculum ideology into high school biology teaching is necessary, and 95.0% of teachers believe that implementing curriculum ideology in biology teaching is feasible (Figure 2-3). At the same time, only 3.1% of students do not agree with teachers integrating ideological and political

education into biology teaching (Figure 2-4). Overall, although the teachers and students of the school have a limited understanding of ideological and political education in the curriculum, most of them support the integration of ideological and political education into biology teaching.

Figure-4.1. Do you understand the relationship between curriculum ideological and political education (teacher)

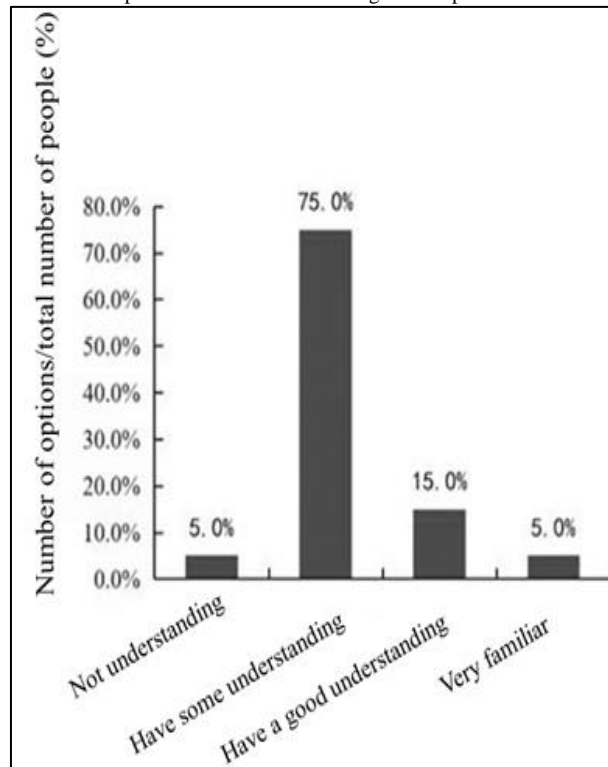


Figure-4.2. How to view the relationship between biology curriculum and ideological and political education (student)

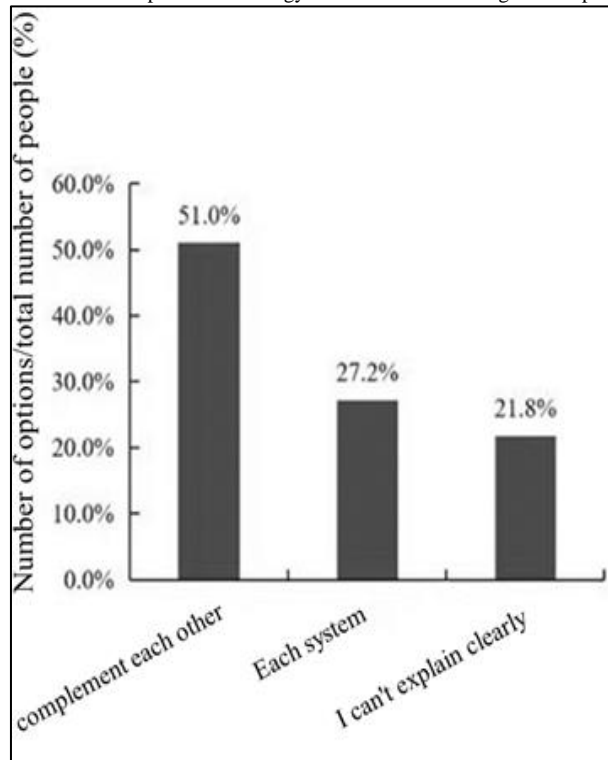


Figure-4.3. is it feasible and necessary to integrate ideological and political education into high school biology teaching (teacher)

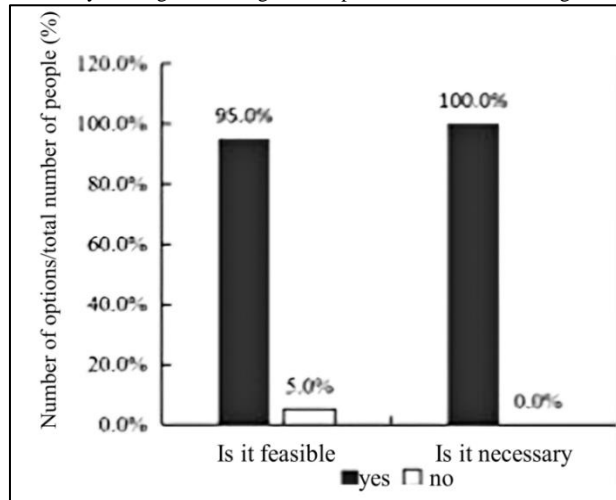
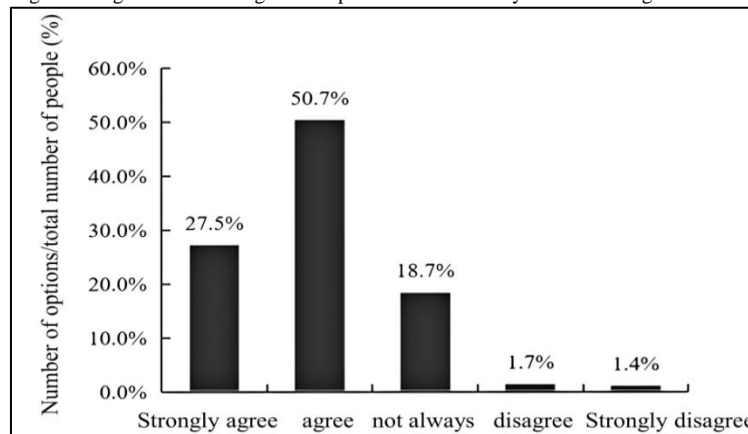


Figure-4.4. How to view the organic integration of ideological and political education by teachers in high school biology teaching (students)



4.1.2. Integrating Ideological and Political Education into Classroom Teaching for Biology Teachers

75.0% of teachers believe that integrating ideological and political education into subject teaching will have a partial impact on students' thoughts and behaviors, while 5.0% of teachers believe that it is unclear whether there is an impact (Figure 3-5). 42.5% of teachers occasionally incorporate ideological and political education into classroom teaching, while 26.2% of teachers rarely provide ideological and political education to students in classroom teaching (Figure 3-6). Some teachers still attach more importance to knowledge transmission in their teaching, and have not fully utilized the educational value of biology. The implementation of ideological and political education in biology teaching is not ideal.

Figure-4.5. Do you think integrating ideological and political education into subject teaching has an impact on students' thoughts and behaviors (Teacher)

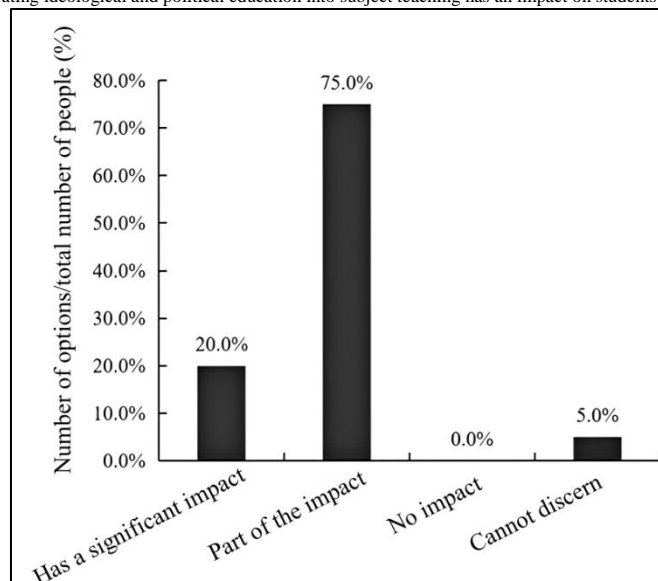
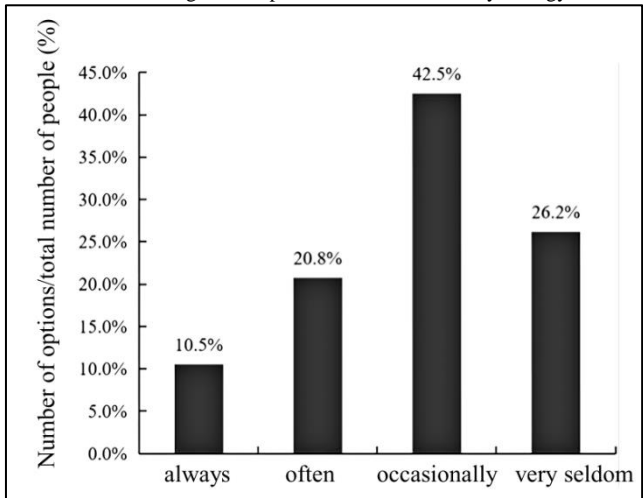


Figure-4.6. Have teachers infiltrated ideological and political education in daily biology classroom teaching (Students)



4.1.3. The Ideological and Political Elements Suitable for the Integration of Biology

Most teachers agree to integrate life education (95.0%), patriotism education (85.0%), ecological civilization education (80.0%), and scientific spirit education (80.0%) into biology teaching (Figure 3-7). Students believe that the biology classroom is more suitable for integrating ideological and political education, including life education (70.8%), scientific spirit education (64.6%), ecological civilization education (64.3%), and patriotism education (41.2%) (Figure 3-8). It is worth mentioning that some students believe that high school biology can provide students with sex education and ethical and moral education, which is also a missing part of our current education. The results obtained from the teacher questionnaire and the student questionnaire are basically consistent, and these aspects also best reflect the characteristics and advantages of biology, which are important contents of ideological and political education in biology courses.

Figure-4.7. What aspects of ideological and political education do you think can be integrated into high school biology teaching (teacher)

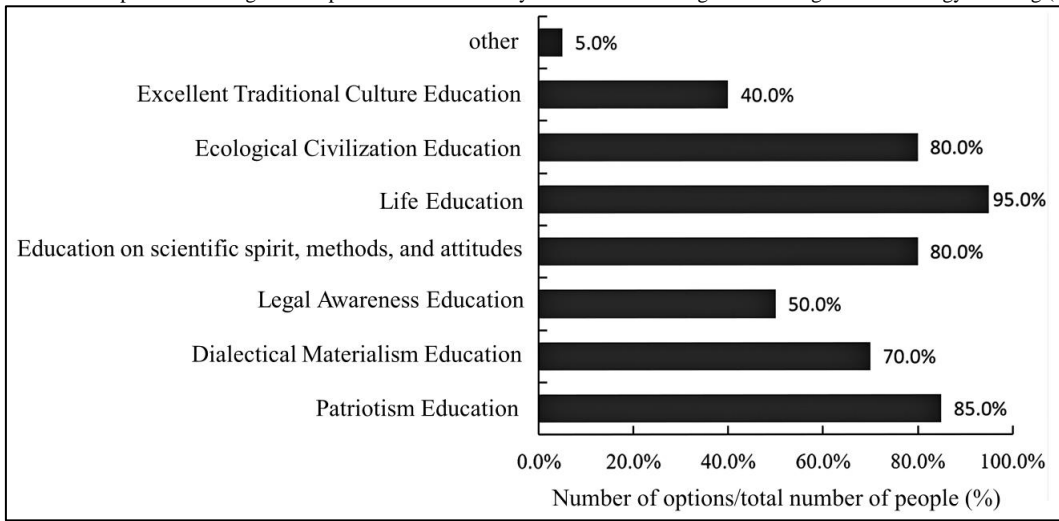
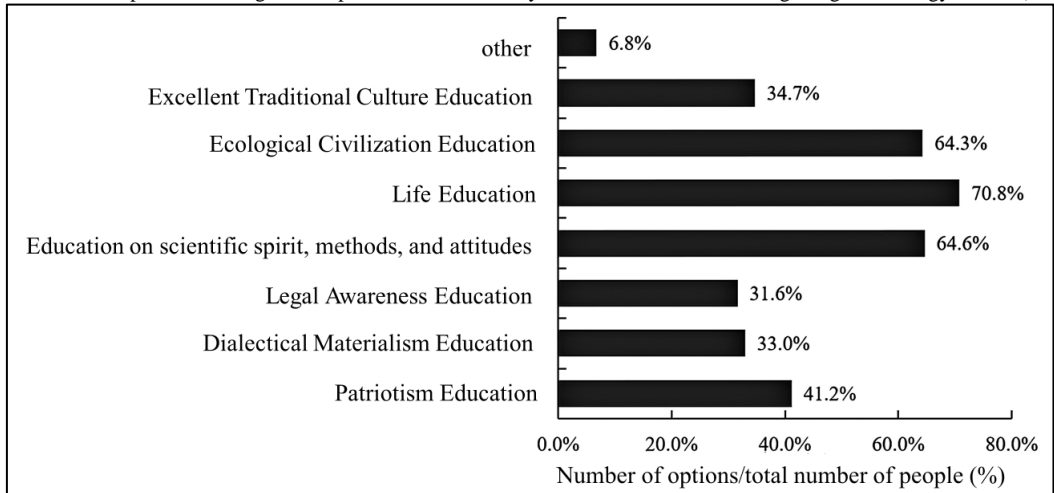


Figure-4.8. What aspects of ideological and political education do you think are suitable for integrating into biology classes (students)



4.1.4. The Penetration of Scientific Spirit in Biology Teaching

The vast majority of students agree that teachers should infuse scientific spirit into classroom teaching (Figure 3-9) and believe that it is helpful for themselves (Figure 3-10). The biology teachers at the school believe that it is more suitable to cultivate students' spirit of exploration, innovation, empirical evidence, rationality, skepticism, and collaboration in biology teaching (Figure 3-11). 15.3% of teachers always infuse scientific spirit into students in classroom teaching, while other teachers often or occasionally also infuse scientific spirit into students. Although most teachers do not have a deep understanding of ideological and political education in the curriculum, they also consciously cultivate talents. However, 7.5% of teachers place more emphasis on students' ability to learn biology knowledge and neglect the cultivation of their scientific spirit (Figure 3-12). Overall, the penetration of scientific spirit in biology teaching is not satisfactory and needs further strengthening.

Figure-4.9. Attitudes towards the Infiltration of Scientific Spirit in Teacher Teaching (Student)

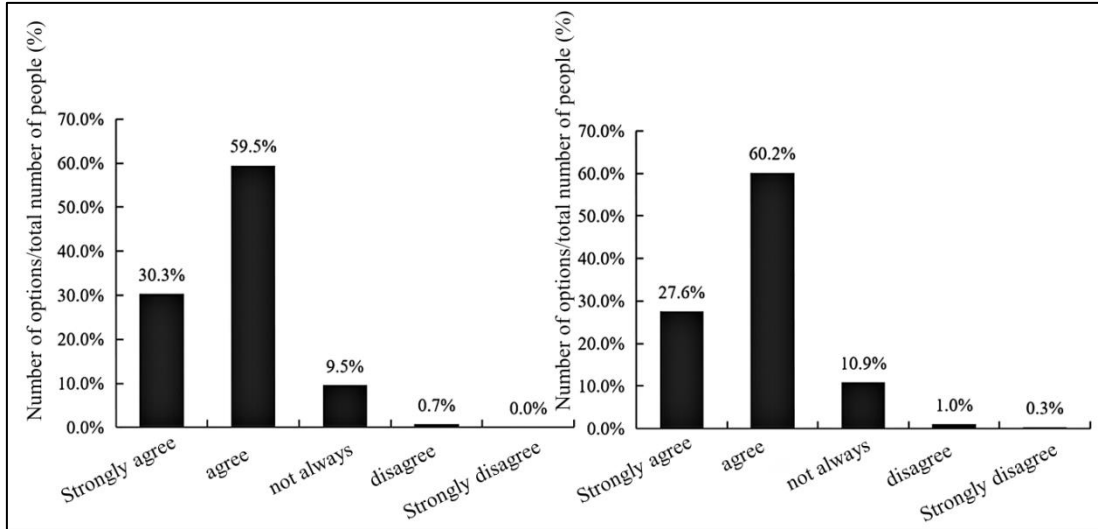


Figure-4.10. Infiltration of Scientific Spirit in Teaching Helps You (Student)

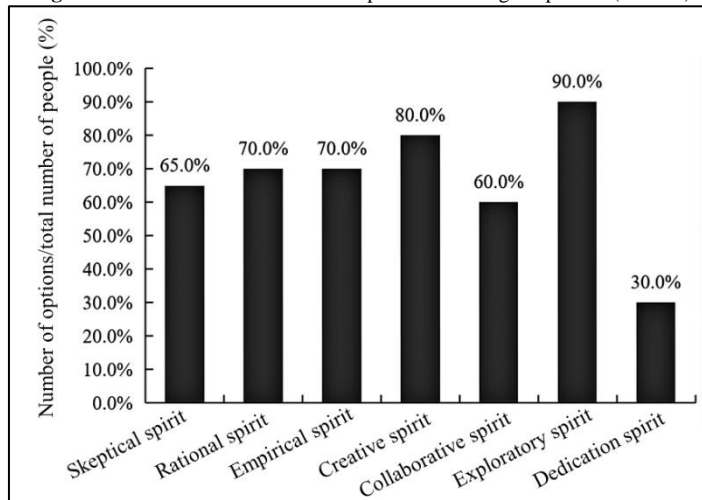


Figure-4.11. what aspects of scientific spirit do you think biology can cultivate in students (teacher)

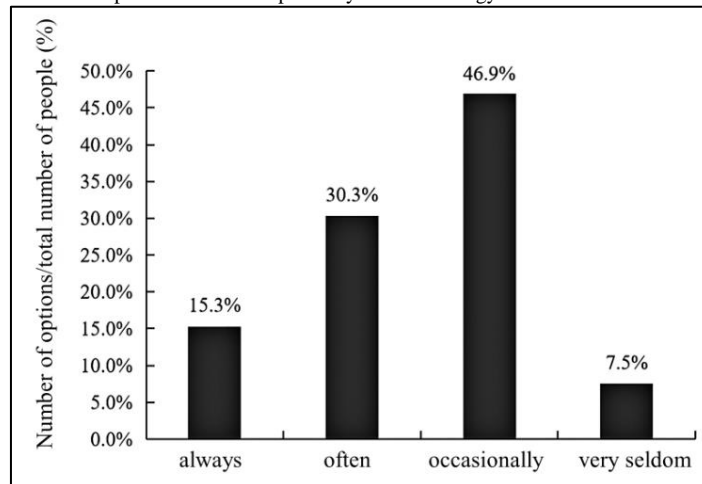
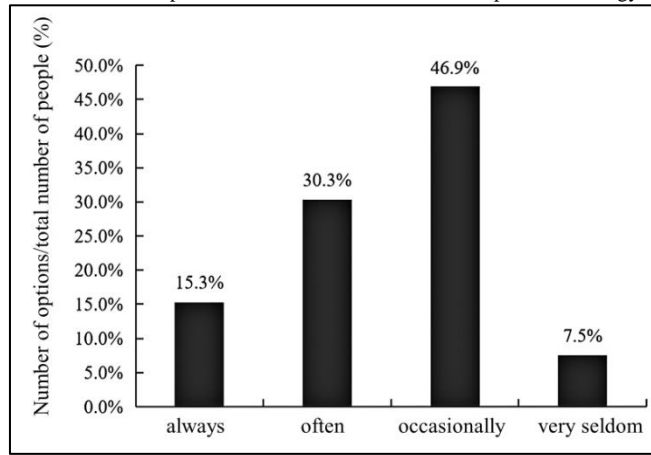


Figure-4.12. Does the teacher incorporate education related to scientific spirit into biology teaching (students)



All teachers tend to infuse scientific spirit into new teaching, while there is little infiltration in review and evaluation classes (Figure 3-13). But these types of classrooms can also provide education on scientific spirit. For example, current exam questions are no longer simply examining a certain knowledge point, but creating various scenarios and adding background information, which are good materials for educating students on scientific spirit. 90.0% of teachers infuse scientific spirit through classroom teaching, while biology experiments and extracurricular practice are underutilized (Figure 3-14). Biology is a subject based on experiments, and experiments and practice are important ways to cultivate students' scientific spirit. The ideological and political education in biology courses has not been integrated into the entire process of biology teaching.

Figure-4.13. More inclined to penetrate in which course type (teacher)

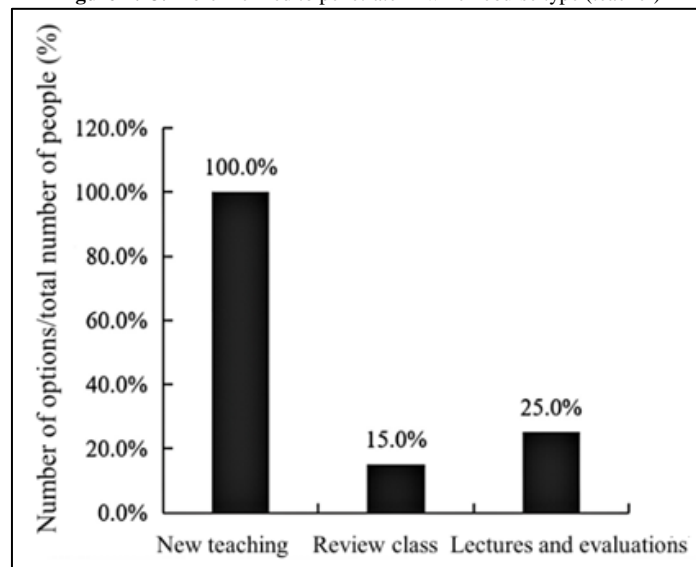
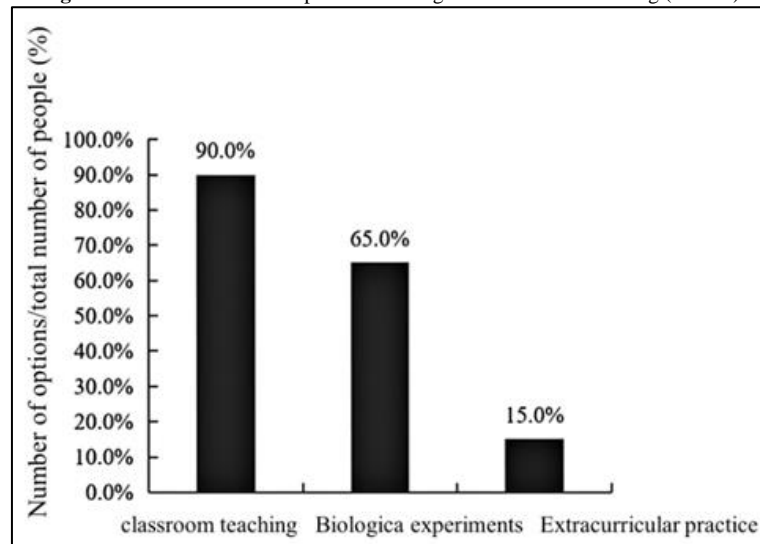


Figure-4.14. More inclined to penetrate through which form of teaching (teacher)



4.1.5. The Sources and Infiltration Methods of Scientific Spirit

Textbooks and students' learning materials are the main ways for teachers to select ideological and political materials. Most teachers sometimes combine current affairs hot spots or use WeChat official account, video website and other network resources to obtain materials (Figure 3-15). Although textbooks are the main source of ideological and political materials in teacher teaching, teachers have not fully explored the scientific spirit materials in textbooks, and do not attach enough importance to the characteristic columns in textbooks. Most teachers agree that the sections on biological science history, interviews with scientists, scientific exploration practices, and advances in biotechnology are more suitable for cultivating students' scientific spirit (Figure 3-16). However, the fact is that some students and teachers still ignore these columns, 41.5% of students do not actively read the content of the characteristic columns in the textbook, 26.2% of teachers do not explore the educational materials in these characteristic columns, and do not fully realize their educational value (Figure 3-17, Figure 3-18). The exploration of textbook content relies more on teachers. If teachers do not guide and value these columns, students may not be able to achieve the expected results even if they notice them.

Figure-4.15. In biology teaching, which channels do you mainly use to obtain materials (teacher)

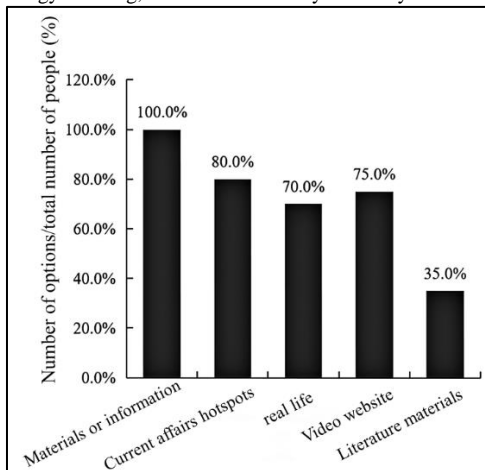


Figure-4.16. Which section of the biology textbook do you think is more suitable for cultivating students' scientific spirit (teacher)

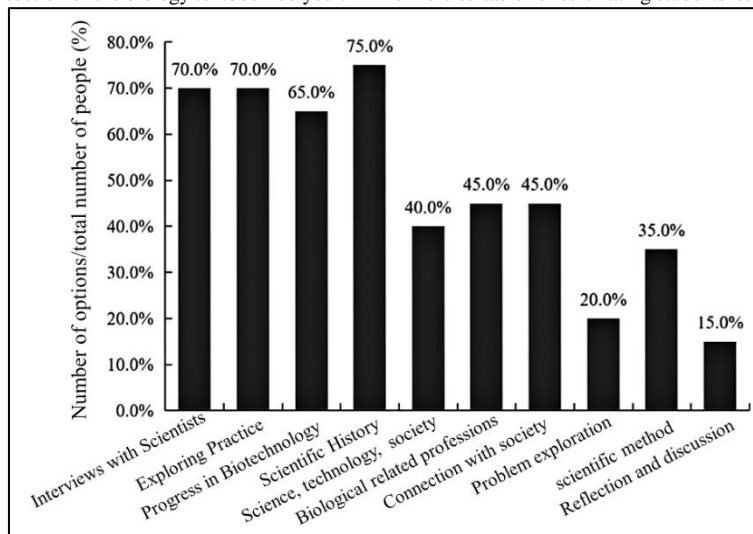


Figure-4.17. Do you pay attention to the characteristic columns in the textbook (students)?

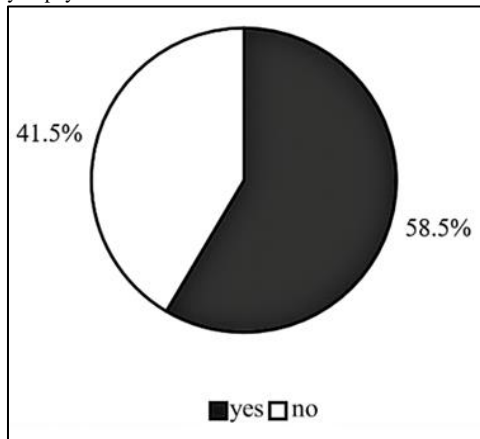
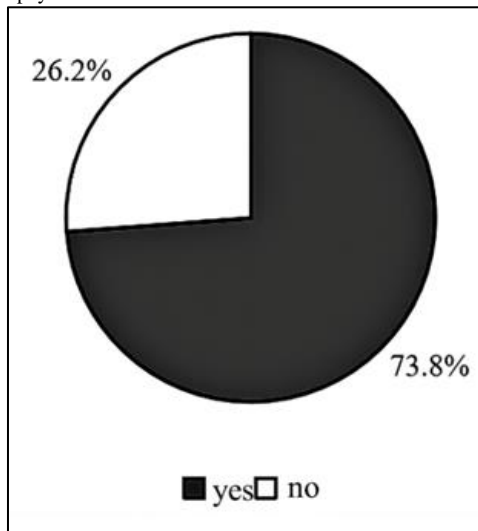


Figure-4.18. Does the teacher pay attention to the characteristic columns in the textbook during teaching (students)



In biology teaching, the vast majority of teachers tend to use teaching methods such as lecturing, situational teaching, and case teaching to infuse scientific spirit, among which the most commonly used is lecturing (Figure 3-19). The use of teaching methods to provide moral education and value guidance to students may be efficient but ineffective, and may appear rigid and abrupt. Students prefer diverse teaching methods, and the vast majority of students prefer teachers to infuse scientific spirit through creating real-life situations, interspersed with biological animations, videos, and telling scientific stories in teaching (Figure 3-20). Some students also pointed out that teachers should frequently interact with students and guide them step by step.

Figure-4.19. which teaching method do you prefer to adopt in biology teaching to infuse scientific spirit (teacher)

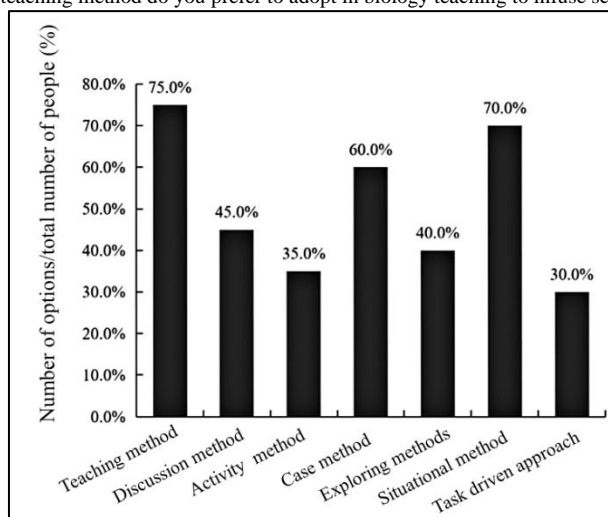
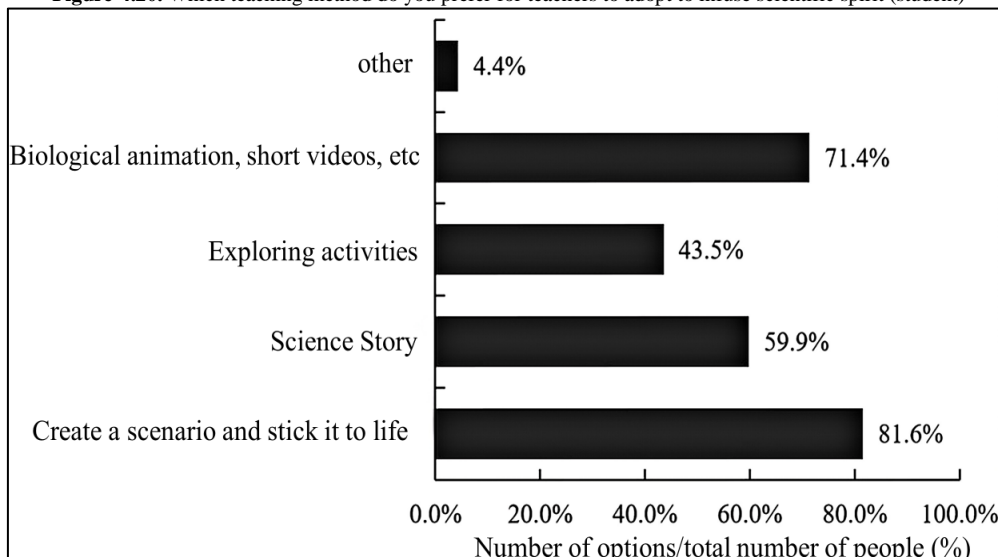


Figure-4.20. Which teaching method do you prefer for teachers to adopt to infuse scientific spirit (student)



4.2. Results and Analysis of Teacher Interviews

4.2.1. What are the Advantages of Incorporating Scientific Spirit into Biology Courses in Your Opinion?

Based on the responses from all the teachers, it can be concluded that incorporating scientific spirit into biology teaching has the following advantages: The scientificity of the course. Biology is a fundamental discipline in natural sciences, and the curriculum itself contains rich scientific spirit, methods, and theories. A large amount of scientific history and exploratory practice. There are also a large number of scientific historical materials, scientific exploration practices, etc. in the textbooks, which are more convenient to infiltrate the scientific spirit. Biology experiments can cultivate students' spirit of exploration, doubt, and seeking truth from facts. Scientific historical materials can help students understand the contributions of scientists in the development of biology, and help students form scientific thinking and correct values closely connected to life. Biology is closely related to life, and students can use their life experiences to help them understand biological knowledge, as well as to use biological knowledge to explain life phenomena. Life examples can also stimulate students' interest in learning biology.

4.2.2. What Do You Think Are The Difficulties Faced In Incorporating Scientific Spirit Into High School Biology Teaching?

① The teaching content is diverse and the class schedule is tight

The interview results show that more than half of the teachers believe that the biggest difficulty in incorporating scientific spirit into high school biology teaching is the tight class hours. Biology is a "side subject" in high school, with fewer class schedules (internships in the first year of high school only have 3 main classes and 2 evening self-study sessions per week), and the course content is extensive and the knowledge is tedious. Teachers almost always rush to attend classes, leaving less time for students to think independently, making it difficult to have time to infuse scientific spirit.

② Restricted experimental implementation

Biology is based on experiments, but due to limited classroom time, incomplete experimental materials and tools, many exploratory practices cannot be carried out. Students do not engage in practical operations, cannot personally experience the experimental process, lack practical experience, and have poor hands-on abilities.

③ No clear training regulations

Some teachers believe that high school biology courses do not have clear regulations on the spirit of science, so there is no way to start infiltrating the spirit of science. It is not part of the exam content, so it is not highly valued.

④ Insufficient materials and limited embedding opportunities

Some teachers believe that there is insufficient material for scientific spirit in biology courses. If teachers lack sufficient understanding of the richness of moral education content in textbooks, they will unconsciously weaken the moral education function of biology. Each course will have varying degrees of ideological and political education elements. If we delve deeper, we will find that the ideological and political elements it contains are much richer than we imagine. This actually indirectly reflects the teacher's failure to correctly understand the ideological and political education in the curriculum, only seeing the explicit theoretical knowledge and exploration process in the textbook, without delving into the educational materials hidden behind these theoretical knowledge and exploration processes. The materials may not necessarily come from textbooks, but can also be social hot topics, life examples, etc. Some teachers also believe that there are relatively few opportunities to infuse scientific spirit into teaching. Integrating scientific spirit into biology teaching does not mean deliberately leaving a period of time for scientific spirit education, but rather infecting students through certain situations, cases, or stories when explaining theoretical knowledge. It does not mean that every class needs to be permeated, but rather determined based on specific teaching content and progress.

⑤ Penetration ability needs to be improved

Several teachers also suggested that they want to integrate ideological and political education into classroom teaching, and there are appropriate educational materials available. However, during the implementation process, it is easy to become preaching, which students cannot listen to and the effect is not ideal. Because these teachers are mostly young and have not received relevant training, the way to infuse scientific spirit is relatively rigid, and their infiltration ability needs further improvement.

4.2.3. Do You Have Any Suggestions for Incorporating Scientific Spirit into Biology Teaching Under the Background of Ideological and Political Education in the Curriculum?

Some teachers suggest using the history of science in textbooks to cultivate students' scientific spirit, and teaching them more about China's achievements in biology, such as the use of artificially synthesized proteins and somatic cloned monkeys in textbooks. Some teachers have also pointed out that classroom teaching time is tight and there is little time to infuse scientific spirit. However, they can make use of their spare time, such as assigning homework for making biological models when students return home from vacation. The textbook only provides partial experiences of scientists in scientific exploration, allowing students to use multimedia in the classroom to collect more character information outside of class.

5. Conclusions

This study starts with investigating the current situation of the infiltration of scientific spirit under the ideological and political education curriculum in high school biology teaching, and analyzes the results of the current survey. It is understood that most first-year teachers and students in internship schools agree to integrate ideological and political education into biology teaching, and believe that this can have an impact on students' thinking and behavior. Both teachers and students agree to integrate life education, scientific spirit education, ecological civilization education, and patriotism education into biology teaching. Students prefer teachers to infuse the spirit of science by creating real-life situations, playing biological animations, videos, and telling scientific stories. At the same time, it has also been found that there are some problems in the actual teaching of the school, such as teachers having a shallow understanding of ideological and political education in the curriculum, and the teaching focus is biased towards knowledge transmission; The penetration of scientific spirit is not ideal, the materials in textbooks are not fully explored, the educational value of scientific history and biological experiments is not fully utilized, and the problem scenarios and background information in biological test questions are not utilized. In response to some shortcomings in existing teaching, improvements will be made in subsequent teaching design. Insert more biological videos, scientific stories, etc. in teaching, and carry out ideological and political education in a way that students enjoy. Combining student interviews and post class reflections, the following conclusions are drawn:

Firstly, the vast majority of teachers have a basic understanding of ideological and political education in the curriculum. 51.0% of students can correctly view the relationship between biology curriculum and ideological and political education. All teachers believe that integrating curriculum ideology into high school biology teaching is necessary, and 95.0% of teachers believe that implementing curriculum ideology in biology teaching is feasible. At the same time, only 3.1% of students do not agree with teachers integrating ideological and political education into biology teaching. Overall, although the teachers and students of the school have a limited understanding of ideological and political education in the curriculum, most of them support the integration of ideological and political education into biology teaching.

Secondly, 75.0% of teachers believe that integrating ideological and political education into subject teaching will have a partial impact on students' thoughts and behaviors. 42.5% of teachers occasionally incorporate ideological and political education into classroom teaching, while 26.2% of teachers rarely provide ideological and political education to students in classroom teaching (Figure 3-6). Some teachers still attach more importance to knowledge transmission in their teaching, and have not fully utilized the educational value of biology. The implementation of ideological and political education in biology teaching is not ideal.

Thirdly, 15.3% of teachers in the school always infuse scientific spirit into students in classroom teaching, while other teachers often or occasionally also infuse scientific spirit into students. Although most teachers do not have a deep understanding of ideological and political education in the curriculum, they also consciously cultivate talents. However, 7.5% of teachers place more emphasis on students' ability to learn biology knowledge and neglect the cultivation of their scientific spirit. Overall, the penetration of scientific spirit in biology teaching is not satisfactory and needs further strengthening.

In summary, teachers need to strengthen their exploration of textbooks and deepen their understanding of teaching design in their daily teaching process, in order to continuously improve their ideological and political education for students and fully leverage the educational value of biology. Integrating scientific spirit into biology teaching is not only in line with the ideological and political concepts of the curriculum, but also in line with the core competencies of the discipline, which can better leverage the educational value of biology.

Acknowledgments

This work was financially supported by the Graduate Education Reform Project of Henan Province (2023SJGLX278Y), Project of Institute of Tutor Team Construction in Henan Province (2024YJZX13), UGS Teaching Reform Research Project of Xinyang Normal University's Basic Education "Strong Teacher Plan" (2022-GTTYB-04); Research Project on Teacher Education Curriculum Reform of XYNU (2022011, 202420); Model Course on Ideological and Political Education of XYNU (Genetics); Research and Practice Project on Higher Education Teaching Reform of XYNU (2024046).

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