Journal of Contemporary Educational Research, 2025, Volume 9, Issue 2
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

A Study on Penetration Strategies of Infectious Disease Prevention and Control Education in High School Biology Teaching

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Abstract: The outbreak of COVID-19 pneumonia has had a serious impact on the world and has led to a greater awareness of the importance of infectious disease prevention and control. Biology is closely related to life sciences and is an ideal discipline to penetrate infectious disease education. Conducting infectious disease prevention and control education can help increase students' knowledge of infectious disease prevention and control and prompt them to form good living habits.

Keywords: High school biology classroom; Infectious disease prevention and control education; Penetration education

Online publication: March 7, 2025

1. Introduction

Infectious diseases are still the current global focus of attention, the outbreak and prevalence of infectious diseases have brought about an impact on the world, infectious diseases not only threaten the safety of human life and property but also adversely affect the stability of society. In 2020, the outbreak of the COVID-19 epidemic fully exposed the lack of health awareness among citizens. Due to the characteristics of rapid transmission and strong morbidity of infectious diseases, the prevention and control of infectious diseases are facing a serious test [1], which makes people further recognize the importance of infectious disease prevention and control. Therefore, it is of great significance to strengthen the education of infectious disease prevention and control and improve the citizens' awareness of prevention and control. Biology and life sciences are closely related; high school biology, as a basic science subject, covers a wealth of knowledge on infectious disease prevention and control and is the ideal subject to penetrate infectious disease education. Educating students about the prevention and control of infectious diseases can help increase their knowledge of infectious disease prevention and control and cultivate healthy living habits.

2. Significance of penetrating infectious disease prevention and control education in high school biology classrooms

2.1. Increasing students' knowledge base and cultivating healthy life habits

Many problems were exposed during the prevention and control of the COVID-19 epidemic, which made people realize the importance of biosafety education [2]. Penetration of infectious disease prevention and control education in high school biology classrooms can help improve students' safety awareness and prompt them to develop healthy living habits.

First of all, school is the primary path of education [3]. The high school biology curriculum is closely related to the knowledge of infectious disease prevention and control. For example, there is knowledge related to the immune system set in the selective compulsory high school biology 1 "Homeostasis and Regulation" published by People's Education Publishing House. Through high school biology teaching, it can help students learn and understand how the organism fights against infectious diseases, and learn the structural composition of the virus as well as how the virus proliferates, so as to enable students to understand the mechanism of infectious disease occurrence. Therefore, the knowledge of infectious disease prevention and control penetrating into the classroom of high school biology teaching can increase students' learning interest and help them understand and master key knowledge. Secondly, the infiltration of infectious disease prevention and control education in the process of high school biology teaching can help students learn the transmission channels of infectious diseases and understand the methods of preventing infectious diseases, so that students can realize that the prevention and control of infectious diseases need to start from everyone, to improve students' safety literacy and develop a healthy life habit.

2.2. Enhancing students' sense of social responsibility

It is clearly pointed out in the Biology Curriculum Standards for General Senior Secondary Schools (2017 Edition Revised in 2020) that the biology curriculum should emphasize the cultivation of students' social responsibility, so that students can pay attention to social issues related to biology, participate in discussions and make rational explanations, and form a scientific worldview, outlook on life, and values. The penetration of infectious disease prevention and control education is in line with the requirements of this curriculum standard, students learn about infectious disease prevention and control in the biology classroom, understand the impact of infectious diseases on themselves and their families and society [4], and realize that not only do they need to protect their own health in life, but also pay attention to the health of others, and actively participate in the prevention and control of infectious diseases. For example, when learning about viruses, the transmission pathways of infectious diseases can be incorporated, so that students understand that their own behavior may affect the people around them, thus encouraging the development of healthy habits, such as washing their hands diligently, wearing masks, and so on.

After learning how infectious diseases spread, the hazards they bring, and understanding the measures to stop the spread of infectious diseases, students further realize the importance of the prevention and control of infectious diseases. They pay more attention to the biosecurity problems caused by infectious diseases, which increases their sense of social responsibility and enables them to take the initiative to maintain the hygienic environment of their campuses and classes, which will invariably play a supportive role in the prevention and control of infectious diseases.

2.3. Improving students' biosafety awareness

High school biology classroom is an important place for biosafety education [5], and students' biosafety awareness can be enhanced through the penetration of infectious disease prevention and control education.

In the process of teaching high school biology, teachers can show students the transmission process of infectious

diseases and the harm caused by infectious diseases through vivid cases. Students can intuitively feel how the virus spreads in the host body and realize the serious threat of infectious diseases to human health, which will enhance students' biosafety awareness and prompt students to establish the concept of prevention and proper control of infectious diseases in their lives when they occur.

Teachers in the teaching process penetrate the impact of infectious diseases on the ecological environment and social economy. For instance, infectious diseases can cause massive deaths of animals, destroying the ecological balance; large-scale outbreaks of infectious diseases can cause significant losses to the social economy, affecting the stability of the country and so on. Through the penetration of these cases, students are able to comprehensively recognize the importance of biosecurity.

In general, the penetration of infectious disease prevention and control education in high school biology classrooms can not only help students realize the importance of infectious disease prevention and control, but also help students form a certain sense of social responsibility, so that they realize that everyone can contribute to the process of preventing and controlling infectious diseases, and develop healthy habits in life and form a consciousness of consciously prevent infectious diseases.

3. Combination of high school biology and infectious disease prevention and control education

3.1. Combination of viral structure and education on prevention and control of infectious diseases

High School Biology Compulsory 1 textbook, published by the People's Education Publishing House, includes content on viruses in the "Molecules and Cells" section, specifically in Section 1: "The Cell as the Basic Unit of Life Activity." This expanded content explores the application of virus-related knowledge, emphasizing its close connection to the occurrence of infectious diseases. Students learn about viruses and realize that viruses are the main pathogens that cause infectious diseases, which can be divided into plant viruses, animal viruses, and bacterial viruses according to different hosts [6]. Viruses have no cellular structure and are mainly composed of external proteins and internal genetic material [7]. Knowledge of the human immune system is presented in Chapter 4 of the Humanistic Version of Selective Compulsory 1, Homeostasis and Regulation, which can help students understand how the body defends itself against infectious diseases by incorporating knowledge of infectious disease prevention and control into the teaching and learning process. Using Chapter 4, Section 1, The Composition and Function of the Immune System as an example, the teacher can introduce a video demonstrating how the immune system responds when the novel coronavirus invades the human body. Since students in Compulsory 1 have already learned about viruses, they will have a foundational understanding of the topic. The teacher can then pose the question: When a virus invades the body and causes an infectious disease, how does the immune system respond? To enhance students' interest in learning, the teacher first explains the components of the immune system, clarifying their structure and functions. Finally, students are guided to summarize effective methods for preventing and controlling infectious diseases while fostering good habits for a healthy lifestyle (**Figure 1**).

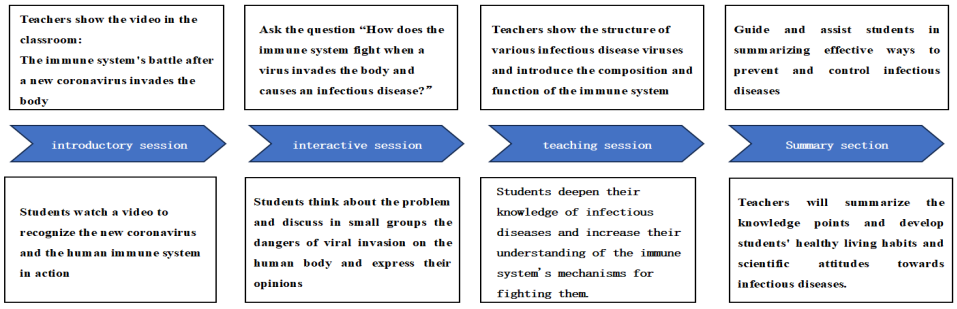

Figure 1. A case of combining virus structure with education on prevention and control of infectious diseases

3.2. Integration of the immune system and infectious disease prevention and control education

The knowledge of the immune system in high school biology textbooks provides an important theoretical basis for infectious disease prevention and control education. The human immune system has the functions of immune defense, immune monitoring, and immune self-stabilization, including non-specific immunity and specific immunity [8].

Non-specific immunity is innate and provides some resistance to all pathogens, including barriers such as skin and mucous membranes and immune cells such as phagocytes. Specific immunity is acquired immunity to a specific pathogen or antigen, including humoral and cellular immunity. Humoral immunity destroys pathogens through the production of antibodies by plasma cells; cellular immunity activates target cells or destroys pathogens through T cells.

Students can learn about how the human immune system works and how to prevent infectious diseases by boosting immunity. For example, when explaining the human immune system, students can be guided to think about how to enhance the immune system by maintaining good personal hygiene habits, so as to better protect themselves against infectious diseases. At the same time, practical cases can be incorporated, such as the outbreak of the COVID-19 pandemic, which students are familiar with. Due to the public's initial lack of understanding of the virus, many people failed to take precautions, leading to the rapid spread of the epidemic and severe consequences for our country. Subsequently, students were reminded of the strategies for combating the pandemic, including vaccination, self-protection, and maintaining good hygiene. This case helps students recognize the dangers of infectious diseases and the crucial role of the immune system in their prevention and control (**Figure 2**).

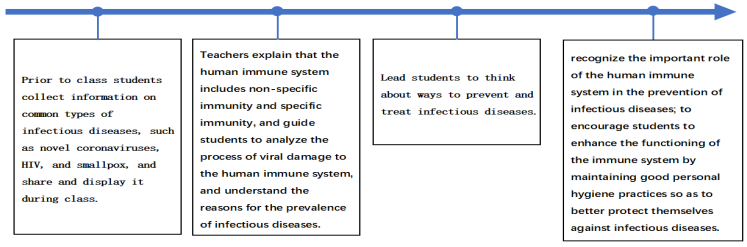

Figure 2. A case of integration of the immune system with education on prevention and control of infectious diseases

The high school biology textbook under discussion contains a chapter titled "Protein is the Main Bearer of Life Activities." This chapter is designed to instruct students in the structure and function of proteins, as well as the formation of structure and function. Teachers who wish to incorporate this chapter into their curriculum may do so by using it to explain the function of proteins in the process of preventing and controlling infectious diseases. For instance, the immune function of proteins can be elucidated by displaying the image of "common infectious

diseases in life" and posing the question, "What is the causative agent of infectious diseases?" This prompts the notion that viruses and bacteria can be the causative agents of infectious diseases. Subsequently, the question, "What are the common methods of preventing and treating infectious diseases in our lives?" can be posed. The subsequent discussion will center on the role of vaccines in this context, highlighting the significance of antibodies as a crucial component of the immune system. The concept of antibodies as proteins will then be revisited and the implications for disease prevention and control will be explored. The discussion will then shift to the importance of hygienic practices, emphasizing the necessity of adhering to the recommended vaccination schedule. This will be followed by an examination of the role of hygienic habits in preventing the onset of infectious diseases. Through this multifaceted learning process, students not only acquired the knowledge that proteins have immune function but also the knowledge of infectious disease prevention and control. This learning also enhances their understanding of infectious disease prevention and control and strengthens their ability to prevent and control the concept of infectious diseases (**Figure 3**).

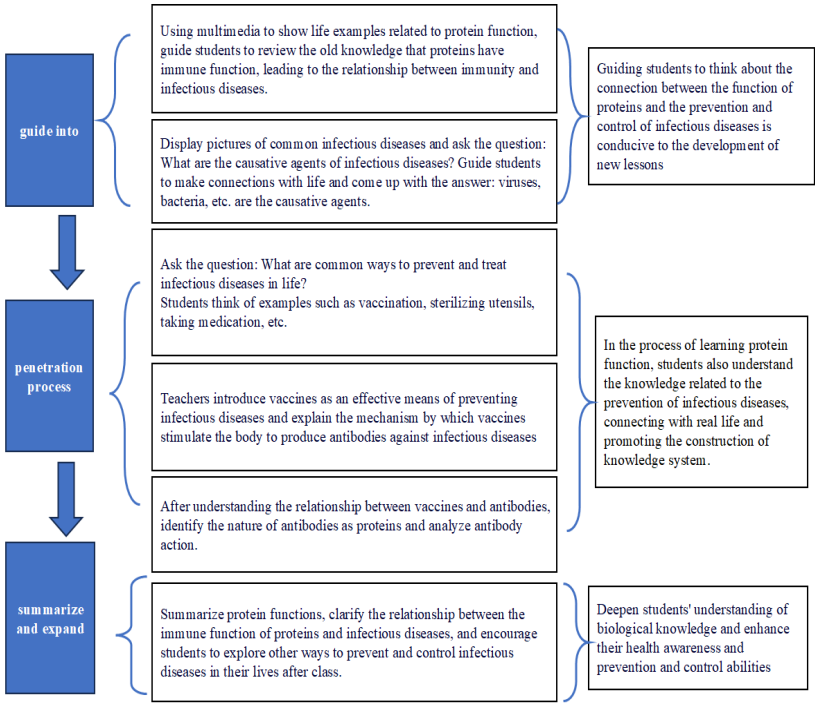

Figure 3. Example of combining protein function with education on infectious disease prevention and control

4. Challenges of penetrating infectious disease prevention and control education in high school biology teaching

4.1. Insufficient teachers' knowledge

Teachers' professional knowledge is indispensable for the penetration of infectious disease prevention and control education in high school biology teaching, and insufficient professional reserves cannot combine infectious disease-related knowledge with teaching. On the one hand, the knowledge structure of high school biology teachers focuses on traditional biological theories, with limited knowledge about infectious diseases, such as the characteristics of emerging infectious diseases and the latest prevention and control technologies. On the other hand, infectious disease prevention and control education involves the cross-fusion of multiple disciplines, which requires teachers to know biology, medicine, sociology, psychology, and other aspects of multi-disciplinary knowledge. However, in reality,

teachers' lack of interdisciplinary knowledge may not be able to guide students to fully understand the phenomenon of infectious diseases from multiple perspectives, limiting the breadth and depth of infectious disease prevention and control education.

4.2. Insufficient students' interest

Biology has abundant high school academic tasks, with a huge knowledge system that includes cell biology, genetics, ecology, and many other knowledge points. In the face of heavy academic pressure, students may have a low interest in knowledge on infectious disease prevention and control. They may think that this knowledge has little to do with their own lives, thus lacking motivation and enthusiasm to learn; some students may think that the prevention and control of infectious diseases is the doctor's responsibility and pay little attention in class, thus the teaching effect is poor and fails to achieve the expected learning purpose. This means that when infectious disease prevention and control education is infiltrated into the biology classroom, attention should be paid to improving students' motivation.

5. Strategies to address the challenge of penetrating infectious disease prevention and control education in high school biology teaching

5.1. Increasing teachers' professional knowledge reserve

In response to the lack of teachers' professional knowledge reserve, teachers should continue to learn and increase their knowledge reserve. Teachers should learn and accumulate knowledge about infectious diseases in their daily lives. For example, learning the classification of infectious diseases, sources, transmission channels, etc., to understand the latest infectious disease prevention and control technology. Secondly, teachers should also pay attention to interdisciplinary knowledge learning, to understand other disciplines about infectious disease prevention and control education, in order to better carry out infectious disease prevention and control education.

5.2. Stimulating students' interest in learning

In infectious disease prevention and control education penetration, first of all, biology teachers should stimulate students' interest through multimedia, such as playing animation and videos about infectious disease knowledge, showing common infectious disease pathogens pictures, setting up infectious disease knowledge Q&A, etc., to arouse students' curiosity and stimulate their interests. In addition, teachers can introduce real social cases, so that students can realize the impact of the outbreak of infectious diseases on society and individuals, prompting students to change their concepts and realize that the prevention and control of infectious diseases are closely related to everyone, encouraging students to study the knowledge of infectious disease prevention and control, understand the principle of the outbreak of infectious diseases, and learn to reasonably cope with the occurrence of infectious diseases and move forward towards a healthy life.

6. Conclusion

In conclusion, integrating infectious disease prevention and control education into high school biology teaching not only helps to increase students' knowledge base about infectious diseases and enhance their awareness of biosafety but also helps to cultivate students' healthy living habits. However, the penetration of infectious disease prevention and control education in biology teaching cannot be separated from the high professional quality of teachers. This means that biology teachers need to keep learning, pay attention to, and explore biological knowledge related to the prevention and control of infectious diseases, and look for content that can be integrated with high school biology

teaching. Only in this way can infectious disease prevention and control education penetrate into high school biology teaching, and ultimately achieve the purpose of cultivating students' awareness of biosafety and literacy, and promoting the development of healthy living habits.

Funding

(1) Anqing Normal University School-Level Teaching and Research Project (2022aqnujyxm32)

(2) Anqing Normal University Provincial Graduate Online Course

(3) Anhui Province Graduate Student Online Course on Animal Ecology

Disclosure statement

The authors declare no conflict of interest.

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