Received: 5 Apr .2023 | Revised:21 Apr. 2023 | Accepted:8 May. 2023 | Published online:25 May. 2023

RESEARCH ARTICLE

Contemporary Education and Teaching Research
2023, Vol. 4(5)200-204
DOI: 10.47852/bonviewCETR23209870502

The Deep Integration of High School Biology and STSE Under the View Valve of Core Literacy

Jingting Chen[1], Liwei Yin[1,*], Zhu Huang[1], Shuzhen Li[1], Yiying Li[1] & Wenjing Li[1]
[1]Anqing Normal University , China

Abstract: With the increasing emphasis on core literacy, the concept of STSE education has been widely used in high school biology courses. This paper analyzes the three levels of lesson preparation, teaching and evaluation, and finds that there is still much room for improvement in the implementation of STSE education, i.e., misunderstanding of the connotation of STSE education and homogenization of the selection of materials, lack of wholeness and participation in the teaching process, and "mechanization" or "randomization" of the educational evaluation. We have discussed how to select and optimize STSE teaching materials, strengthen the holistic and participatory nature of STSE teaching, and enrich the main body and content of evaluation.

Keywords: core literacy; high school biology; STSE

STSE (Science, Technology, Society, and Environment) is a new educational concept that aims to explore the relationship between science, technology, society, and the environment and makes STSE theory more deeply rooted through the new round of curriculum reform and the implementation of quality education.STSE first appeared in the world in 1996, and originated from the National Science Education Standards (NSE) in the United States, aiming to integrate this educational idea into the practice of science curriculum in order to enhance people's knowledge about science, technology, society, and their environment (Zhang, 2012). Since the 1990s, STSE education has been widely incorporated into curriculum standards and has become an important part of enhancing the scientific literacy of citizens, and has gained wide recognition worldwide. China's late introduction of STSE education and the subsequent implementation of related educational policies have contributed to the rapid development of STSE education, which has triggered widespread concern and heated discussions in China(Yu, 2022). STSE education is comprehensive, humanistic, practical and contextually interactive. In terms of educational value, STSE meets the requirements for the development of core literacy in high school biology, teachers' professional growth and students' development.(Liu & Chen, 2019).

Cui Zhilin (Cui , Zhang , et al., 2020) (Guo et al., 2021)pointed out that applying the STSE concept to biology classrooms can enhance scientific inquiry and also awaken enthusiasm for learning through creative contexts, thus revolutionizing the traditional education approach. Pan Xiaohui (Pan, 2022) explored in depth the 5E teaching model based on the STSE education concept and proposed that the four dimensions of STSE are integrated into the five aspects of the 5E teaching model. Yang Deng (Yang & Wang , 2020) argued that a variety of measures should be taken, including classroom infiltration, extracurricular activities, integration of STSE knowledge into experiments and exercises, and close integration of STSE educational concepts with students' daily life. Xue-Ping Wang (Wang , 2021) proposed four methods for implementing STSE

Corresponding Author: Liwei Yin
Anqing Normal University , China
Email: kaixinliwei@163.com

education: classroom discussion, role play, experimental inquiry, and practical experience.

1. Problems of STSE education practice

Scholars have tried many effective ways to improve high school biology STSE education, but in the three levels of lesson planning, teaching and evaluation, they found that there are still a lot of root problems, such as misunderstanding of the connotation of STSE education and homogenization of the selection of materials, a lack of wholeness and participation in STSE education, and the "mechanization" or "casualization" of the evaluation of STSE education.

1.1 Misconceptions about the meaning of STSE education and singularity in the selection of materials at the lesson preparation level

With the in-depth dissemination of STSE in high school biology teaching, teachers are fully aware of the importance of STSE education in cultivating and improving students' core biological literacy subjectively. Most teachers have formed their own STSE education concepts, but they do not deeply understand the essence of STSE and still regard it as STSE version 1.0, thinking that STSE is only the addition of environmental education (E) to STS. In fact, the content of STSE has gone beyond traditional environmental education. 2.0 version of STSE incorporates social science issues (SSI) courses with seven types, namely, application/design orientation, historical orientation, logical reasoning orientation, value-centred orientation, sociocultural orientation, nature-conscious orientation, and socio-ecological justice orientation; its dimensions mainly include environment and sustainable development, science and technology events and their sociocultural context. development, scientific and technological events and their socio-cultural contexts, the nature of science, science, technology and social applications, social risks and impacts of science and technology, social dimensions of scientific topics, controversies and ethical and moral reasoning, and decision making and action, which are eight dimensions(Guo et al., 2021).

At present, the content of the new Hanyu version of high school biology textbooks on STSE has been greatly increased in terms of quantity. The topics covered are so broad that they can be divided into four modules: scientific and technological development, ecology and environment, social life and medical health. At the same time, the presentation of STSE in the new textbook has become diversified, such as combining it with literary ancient poems. This makes high school biology textbooks a major venue for conducting STSE education (Zhang , 2021). However, in the process of using STSE materials, teachers may not dig deeply into the textbooks and use them adequately, and they may take the textbooks as the only source of STSE materials, for example, they mainly use a single type of materials such as biology and science and technology, biology and society, and biology and environment, and they do not choose enough materials that are interrelated and comprehensive while ignoring innovation and modernity.

1.2 Lack of integration and participation in STSE education at the instructional level

In-depth research on STSE has revealed many effective methods, such as contextual teaching, role-playing, classroom discussion, and experimental investigation. These methods provide some feasible references for STSE education in high school biology. However, at the lecture level, STSE teaching is still superficial and a formal phenomenon. the overall goal of STSE education should not only be reflected in the opening of a new lesson but also exist in the review and consolidation at the end of the lesson, so as to improve students' learning more effectively. If we only provide students with generalized and abstract knowledge in teaching, it is very easy to make subject knowledge become empty words and symbols that are far from children's nature and social experiences, which is what the famous educator Dewey called "the greatest waste" in education(John, 2005). Due to the unbalanced distribution of

educational resources and the influence of many factors, STSE education in high school biology is still stuck in the traditional mode of teachers' verbal explanations, multimedia presentations and students' independent learning, without providing more experimental exploration, group cooperation and research reporting activities, and students do not have enough time for active learning. It is regrettable that the educational value of STSE has not been fully realized.

1.3 At the level of evaluation, STSE education evaluation is limited to "mechanization"or "randomization".

It is found that the proportion of STSE questions in the current biology entrance examination has been increasing year by year, and the questions originate from the textbook and are higher than the textbook, with a high starting point and a low drop point, closely related to real life, focusing on comprehensive ability, ecological environment, and social responsibility, etc. (Luo, 2019). This makes it easy to fall into the dilemma of evaluating the quality of high school biology STSE education by mainly paper-and-pencil tests. There are fewer methods to evaluate learning files, and the scientificity, standardization, and regularity of the application of activity performance evaluation still need to be improved; the evaluation subject is mainly evaluated by teachers, and the functions of peer mutual evaluation and student self-evaluation are not given enough attention; the evaluation content is still mainly the cognitive level of core knowledge of high school biology, and the scientific attitudes shown in the application of biology knowledge to deal with practical problems, as well as problem-solving and Insufficient attention are paid to the level of scientific attitude and social responsibility in applying biological knowledge to practical problems and problem-solving.

2. Strategies for implementing STSE education

The problems of STSE education in high school biology are the result of a combination of factors. Based on an in-depth analysis of the reasons behind them, the author will propose strategies to optimize the selection and organization of STSE materials, teaching sessions, and evaluation feedback for front-line teachers' reference.

2.1 Selecting and optimizing STSE teaching materials

In selecting materials, teachers need to fully explore STSE materials in curriculum standards and textbooks based on the seven educational types and eight dimensions of STSE, curriculum standards, and college entrance examination questions. The New Curriculum for High School Biology provides a large number of resources for STSE contextual materials, including those that have been incorporated into the textbook and those that have not yet been incorporated into the textbook; the text, series of columns, and exercises in the new Renmin Biology textbook all demonstrate the educational value of STSE content, highlighting its timeliness and diversity. Teachers should deeply understand the writing intention of the textbook, actively pay attention to and organize the STSE materials in the textbook, and teach with the actual situation, using innovative methods and introducing more thoughtful questions and activity designs to improve the teaching effect. In addition, as biology is a subject of continuous progress and new research results are constantly emerging, teachers should actively use Internet technology to obtain cutting-edge information about biology in order to better access and disseminate this latest knowledge.

In organizing and optimizing materials, we should focus on the comprehensiveness of STSE materials. There are various STSE materials in the high school biology curriculum, including "biology-society," "biology-technology," "biology-environment," "biology-technology-environment," and "biology-trade. Biology-Technology-Environment", "Biology-Technology-Society", "Biology-Society-Environment", "Biology-Technology-Society-Environment" are the most common, with the first three being of a single type, while the last four are comprehensive. The first

three are single types, while the last four are integrated. The single type of contextual material can clearly expose the connection between them, while the integrated type is more helpful to deepen the understanding of the relationship between biology on production, life, social development and environmental protection, to develop students' comprehensive understanding of STSE, and to promote the development of "social responsibility" core literacy. Each STSE contextual material has a unique value and should be carefully selected and combined according to the needs.

2.2 Strengthen the holistic and participatory nature of STSE teaching

In a lesson, STSE should have a core line, and it should be used to decide how to choose and choose among the parts in order to make a good connection between them. At the same time, the design should have strong internal logic and should follow a certain step-by-step progression to facilitate the smooth progress of teaching. STSE questions are introduced in the introductory part of the class, and a series of activities are used to help students understand the concepts. In the concluding phase, the concepts are integrated into real-life situations and new STSE scenarios are created to deepen their understanding and application. Education is primarily about people, and if the STSE process is so flawlessly designed that students have no interest in the content, it will be an exercise in futility. On the one hand, the use of multimedia, such as images, videos and animations, can be used flexibly to enhance the effectiveness of the classroom. These media can effectively capture students' attention and arouse their interest. However, care needs to be taken not to over-entertain. On the other hand, clever implementation of teaching methods such as question introduction style, classroom debates, and flipped classroom makes the focus of teaching return to the students themselves, so that the return to the basics and value of student-oriented teaching can be recreated.

2.3 Enriching the content, methods and subjects of STSE teaching evaluation

Evaluation is the "barometer" of the effectiveness of STSE teaching in high school biology. In terms of evaluation content, it should be structured, such as using the factor decomposition method to divide classroom teaching into objectives, content and process, methods and results, and other indicators; using the goal analysis method to judge whether the content, process, and results help to achieve the teaching objectives; and adopting the relationship analysis method to determine indicators from the relationship between teachers and classrooms, students and classrooms, and teachers and students(Yang , 2021).

The evaluation approach can be carried out in the form of segmented classification successive progressions (Liu & Xu , 2022). Segmented evaluation includes classroom evaluation and homework evaluation for a particular lesson, and unit evaluation, midterm evaluation, and final evaluation for a particular semester; categorized evaluation means that there are process evaluation, performance evaluation, and paper-and-pencil exams, etc.; continuous progression evaluation means focusing on the continuity of students' knowledge learning, spiral cascading changes, and horizontal cooperation between subjects, etc.

In terms of evaluation subjects, students' initiative and participation should be emphasized, and they should be encouraged to improve their abilities through mutual evaluation and independent thinking. Through mutual evaluation, students can establish a good learning atmosphere, while self-evaluation helps to improve learning ability and develop a lifelong learning spirit.

3. Conclusion

In the past, teachers were always compared to hard-working gardeners, but the author agrees with the analogy that teachers are educational engineers. Like engineers, teachers should use engineering thinking to design and implement feasible teaching solutions from the educational objectives and the practicalities of various educational theories with flexible trade-offs and integration(Wang & Xu ,

2015). In the context of the era of core literacy, the concept of STSE teaching in high school biology has its specific meaning and value. Therefore, the deep-rooted problems and causes of the current STSE education in high school biology are analyzed at three levels from lesson preparation to lecture and evaluation, and more feasible strategies are explored, that is, in lesson preparation, the selection and optimization of teaching materials for STSE; in lecture, the enhancement of STSE as a whole and student subjectivity; and in evaluation, the need to enrich the evaluation subjects, contents and ways. In conclusion, it is necessary for teachers to look at how the STSE teaching concept can be applied to high school biology teaching from an engineer's perspective, and to develop practical educational programs to implement and promote high school biology STSE education.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

Acknowledgement

This research was funded by 2020 Key Teaching and Research Project of Anhui Provincial Department of Education (2020jyxm1081); Provincial Quality Engineering Project of Education Department of Anhui Province in 2022 (2022 sshqygzz031; 2021 xskc058)

References

Zhang, H. (2012). From STS to STSE and STEM: The interpretation of science education from concept to the curriculum in the world. *Journal of Secondary School Biology*, *2012*(09), 10–12.

Yu, S. (2022). *The design andpractice ofhigh school biology teaching based on the concept of STSE education*. Harbin Normal University.

Liu , Y., & Chen, Q. (2019). Research and practice of STSE teaching context creation. *Science and Education Wenhui*, *2019*(10), 70–71.

Cui , Z., Zhang , W., & Zhao, P. (2020). The application of the STSE education concept in the contextual teaching method of biology. *Modern Communication*, *2020*(35-36), 35–36.

Cui, Z., Zhang, W., & Zhao , P. (2020). Discussing the significance of infiltrating STSE education in biology teaching. *Talent*, *2020*(08), 44.

Pan, X. (2022). *Practical research on the application of STSE education concept to high school biology teaching*. Guangxi Normal University.

Yang, D., & Wang , B. (2020). How to permeate STSE education concept in high school biology teaching. *Read and Write (Journal of Educational Teaching)*, *17*(02), 51–55.

Wang , X. (2021). *Research on the implementation of STSE education in high school biology teaching. 2021*. Huazhong Normal University.

Guo, G., Xiao , B., & Liu, X. (2021). STSE education: Connotation, types and dimensions. *Chemistry Teaching*, *2021*(11).7-12

Zhang , Q. (2021). *A comparative study on the content of STSE education in the new and old high school biology textbooks of the People's Republic of China*. Tianjin Normal University.

John, D. (2005). School and society - the school of tomorrow . *Beijing: People's Education Publishing House. Beijing: People's Education Publishing House*, *2005*, 61–62.

Luo, S. (2019). *Research on the proposition of STSE test questions in college entrance examination* . Guangxi Normal University.

Yang , Q. (2021). School classroom teaching evaluation: judgment, excavation and enhancement of value. *Educational Science Research*, *2021*(11), 61–65, 71.

Liu , Z., & Xu , B. (2022). Challenges and responses to changes in curriculum and teaching evaluation under the new curriculum standards. *Curriculum. Teaching Materials. Teaching Methodology*, *42*(08), 4–10, 24.

Wang , A., & Xu , W. (2015). On teachers as educational engineers. *Educational Research and Experimentation*, *2015*(04), 28–32

How to Cite: Chen, J., Yin, L., Huang, Z., Li, S., Li, Y., & Li, W. (2023). The deep integration of high school biology and STSE under the view valve of core literacy. *Contemporary Education and Teaching Research,* 04(05), 200–204.
https://doi.org/10.47852/bonviewCETR23209870502