



3-сурет. «ЕКО Болашақ» жобасы

Осы практикалық аспектілердің барлығы оқушыларға химияны тереңірек және толық түсінуге, сыни ойлауды дамытуға және алған білімдерін іс жүзінде қолдануға мүмкіндік береді, болашақ ғылыми мансапқа сәтті дайындалудың кілті болып табылады.

Қорытындылай келе, химияны оқытуда STEM технологияларын қолдану бүгінгі таңда оқу процесінің тиімділігін арттырып қана қоймай, оқушылардың дағдыларын дамытуда шешуші рөл атқарады. Виртуалды зертханалар мен интерактивті қосымшалар сияқты инновациялық әдістер оқушыларды қызықтырып, сонымен қатар оқытуды дараландыруға және заманауи ақпараттық қоғамға сәтті бейімделу үшін қажетті дағдыларды дамытуға ықпал етеді. Осылайша, химияны оқытуда STEM технологияларын қолдану ғылым мен технология саласындағы құзыретті және болашаққа дайын мамандарды қалыптастыруға ықпал ететін заманауи білім берудің ажырамас бөлігі болып табылады.

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CHALLENGES OF CHEMISTRY TEACHERS IN SCHOOLS

Abstract. The STEM education system is one of the most important areas in demand for the 21st century. (M. Biasutti and H. El-Deghaidy, 2014) However, the full implementation of Stem education in the field of education is currently causing some difficulties for school teachers, school heads, and administration. In the study of this issue, since chemistry is one of the 4 subjects included in the integrative STEM education system, the main attention was paid to the works of scientists who study the problems encountered in STEM education in general. In the research work, more than 10 articles of

foreign scientists studying the general field of STEM education were reviewed and about 9 problems faced by chemistry teachers in STEM education were identified. The article used the literature review method of research.

Key words: STEM education, Challenges of STEM education, Chemistry teacher

Introduction

Development of various skills of schoolchildren, realizing modern interests, allows training of intelligent and competitive specialists. Concurrent development and systematic learning in core academic areas such as science, mathematics, technology, and engineering are critical to an integrated STEM education. Currently, chemistry as a subject cannot fully realize the actual goals of integrative STEM education. In the course of identifying the problems faced by chemistry teachers in integrative Stem teaching, some scientific literature was studied and analyzed. Nadelson and Seifert (2017) discussed developing interdisciplinary lesson plans, lab experiments, technology-based learning tools, or online platforms for learning materials, while Shernoff, D. J., Sinha, S., (2017) suggested that teachers only have one issue such as educational orientation, training of stem teachers are considered. This theoretical study aims to explore the challenges faced by chemistry teachers in Integrative STEM teaching. Identifying these issues is important because it allows for the improvement of pedagogical practices and contributes to the advancement of STEM education. Additionally, it aims to identify and dissect specific barriers chemistry teachers face when integrating STEM subjects. Based on these given facts, I will study the level and relevance of these issues in Kazakhstan.

Theoretical part

It is true that the full implementation of Stem education in the field of education is currently causing some difficulties for school teachers, school leaders and administration. Since chemistry is one of the 4 subjects included in integrative STEM education, I recommend paying attention to the works of scientists who study the problems encountered in STEM education in general.

Vietnamese scientists Le, L.T.B., Tran, T.T. and Tran, N.H. (2021) described in their article the challenges faced by Vietnamese chemistry teachers in teaching STEM. The study was conducted through interviews and questionnaires with teachers in Vietnam. The results of the study showed that there are 4 different problems. In particular, there is insufficient knowledge of teachers in Integrative Stem teaching, insufficient curriculum and materials, and insufficient time and space, special resources. The same problems in the studies of K. Margot and T. Ketler (2019). K. Margot and T. Ketler studied 25 articles in this direction during the research and classified all the problems encountered into 6 groups. They are pedagogical challenges, curricular challenges, structural challenges, student concerns, assessment concerns, and teacher supports. The following work by J. Shernoff, S. Sinha (2017) addresses the following questions for teachers. The cited article aims to identify challenges and needs in promoting integrated approaches to STEM education. Using a key informant approach, 22 K-12 teachers and four administrators were interviewed as potential leaders in STEM education in an unknown state on the east coast of the US. The research results showed the following new problems in addition to insufficient teacher education: insufficient time for lesson planning, school structure and organization, state testing, assessments for STEM achievement, perceived lack of resources, and teacher education. In addition, the study participants provided specific recommendations for teacher education needed to strengthen integrated STEM education. The next research paper is an article by Buber A. (2023), this study explored

the experiences and perceptions of 20 third year science teachers involved in STEM practices in a Turkish public university. The study addressed three main questions: (1) What are the attitudes of STEM teacher candidates? (2) What benefits and challenges did they experience during their STEM experience? (3) How do they perceive STEM education and its implications for students and teachers? A qualitative case study approach was used to gather insights from the PSST. Content analysis was used to analyze the collected data. As for the results of the research, the most frequently mentioned problems in the research were 32% - Difficulty with time management, 12% - Insufficient materials, 10% - Challenges in classroom management.

Nadelson, L. S., & Seifert, A. L. (2017) address the same issues in their article. In the paper, scholars consider the advantages and disadvantages of integrative and distributed STEM teaching in general. The authors, noting the difficulty of teaching 4 subjects together in Integrative STEM education, put forward critical issues such as creating a curriculum in STEM education, organizing evaluation and teaching, and teachers' knowledge and professional thinking. The work of H. El-Deghaidy and N. Mansour (2015) is the first study to describe the STEM education system in Saudi Arabia. This research work aims to identify the factors that facilitate and hinder STEM education. Teacher reflection and interview protocol were used as research tools. 21 teachers from 21 different schools in Saudi Arabia participated in the study. According to the authors, there is no concrete plan for integrative STEM teaching in Saudi Arabian schools, but all conditions are created in the laboratory for practical teaching of science subjects. And the plan of the work to be done in the laboratory, the curriculum has not been started. Based on these factors, we can consider curriculum and curriculum as a problem.

Summarizing the above information, teachers and education system in STEM education were somewhat discussed in the works of the above-mentioned scientists, and a literature study was conducted. Based on this, the purpose of this research work was to determine the problems of chemistry teachers in STEM education by studying the works of foreign and domestic scientists. Two research questions guided the research: (1)What are the main problems in STEM education? (2) What are the problems of chemistry teachers in integrated STEM teaching?

Methodology

A literature review research method was used to carry out the research. About 20 works of foreign and domestic scientists written on STEM education were studied. These articles were about the Stem education system, the common mistakes made in Stem education, the shortcomings of current Stem education and the problems faced by teachers. Research works of scientists were taken from the Google Scholar platform. Keywords such as STEM education, problems in the STEM education system, and problems of chemistry teachers in STEM education were used to search for the article. The scientific articles were shown in the following table (Table 1). Each challenge or issue was presented with frequency and percentage calculation as analysis method.

Article	Number
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Büber, A., 2023; El-Deghaidy, H., & Mansour, N., 2015; Lee, M. H., Chai, C. S., & Hong, H. Y., 2019; Le, L. T. B., Tran, T. T., & Tran, N. H., 2021; Margot, K. C., & Kettler, T., 2019; Nadelson, L. S., & Seifert, A. L., 2017; Oztay, E. S., Aydin Gunbatar, S., & Ekiz Kiran, B., 2022; Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L., 2017; Shidiq, A. S., Permanasari, A., & Hernani. (2020, March); M. Biasutti and H. El-Deghaidy., 2014	10 articles
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Table 1. Presentation name of the searched articles

Result

After a comprehensive study of the data, 8 different problems faced by chemistry teachers in STEM teaching were identified. The results of the research work are shown in table 2. The table provides a breakdown of the various issues and research articles in STEM education, along with their frequency and percentage in the literature. Among the identified problems, the most common are Lack of a curriculum framework (60%) and Teachers' knowledge and professional thinking (60%). This result indicates that the main problems in STEM teaching are the lack of curriculum and teachers' knowledge. And the least common problems Insufficient time for lesson planning (10%), Insufficient time for lesson planning (10%) do not require research or do not mean that these problems do not exist.

	Problems	Article name	Frequ ency	Percen tage
1.	Assessment concerns	Le, L. T. B., Tran, T. T., & Tran, N. H. (2021); Margot, K. C., & Kettler, T. (2019).; Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017).	3	30%
2.	Challenges in classroom management, organizing evaluation and teaching	Büber, A. (2023); Nadelson, L. S., & Seifert, A. L. (2017); El-Deghaidy, H., & Mansour, N. (2015).	3	30%
3.	Difficulty with time management	Büber, A. (2023).	1	10%
4.	Inflexible school structure and organization	Le, L. T. B., Tran, T. T., & Tran, N. H. (2021); Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017).	2	20%

	Problems	Article name	Frequency	Percentage
5.	Lack of a curriculum framework	Le, L. T. B., Tran, T. T., & Tran, N. H. (2021); Margot, K. C., & Kettler, T. (2019); Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017); Nadelson, L. S., & Seifert, A. L. (2017); El-Deghaidy, H., & Mansour, N. (2015); Oztay, E. S., Aydin Gunbatar, S., & Ekiz Kiran, B. (2022).	6	60%
6.	Insufficient time for lesson planning	Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017).	1	10%
7.	Teaching materials and resources	Le, L. T. B., Tran, T. T., & Tran, N. H. (2021); Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017).	2	20%
8.	Teachers' knowledge and professional thinking	Margot, K. C., & Kettler, T. (2019); Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017); Nadelson, L. S., & Seifert, A. L. (2017); El-Deghaidy, H., & Mansour, N. (2015); Shidiq, A. S., Permanasari, A., & Hernani. (2020, March); Lee, M. H., Chai, C. S., & Hong, H. Y. (2019).	6	60%
9.	STEM cannot be applied to all chemistry materials	Shidiq, A. S., Permanasari, A., & Hernani. (2020, March).	1	10%

Conclusion

At the end of the study, 10 different articles written in the field of STEM education were studied, and 8 different problems faced by chemistry teachers in STEM education were identified. As the main ones, we can consider such critical issues as Assessment concerns (30%), Challenges in classroom management, organizing evaluation and teaching (30%), Lack of a curriculum framework (60%), Teachers' knowledge and professional thinking (60%). As a solution to these problems, I propose the preparation of model STEM education programs and lesson plans for general education schools and the preparation of special qualification courses that teach STEM education.

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EFFECTIVENESS OF HANDS-ON CHEMISTRY EXPERIMENTS IN HIGH SCHOOL EDUCATION

Abstract. Practical laboratory work is essential to secondary school education, especially when it comes to chemistry and other related disciplines. This study assesses how well-developed skills, piqued scientific curiosity, and improved learning outcomes are all achieved through hands-on chemistry activities. In Kazakhstan, data was gathered from 75 students in the 10th and 11th grades of state general education schools through the use of a mixed-method technique that combined questionnaires and interviews. The majority of students confirmed that laboratory work helps with memorizing, improves enjoyment of chemistry, increases motivation, and improves general attitude towards the topic. The results show that these comments were overwhelmingly positive. Despite these advantages, problems including a lack of resources and equipment keep hindering thorough practical training. Ensuring fair access to high-quality education requires addressing these issues. This study highlights the importance of innovative teaching approaches and adequate resources to promote student engagement and success in science and technology.

Keywords: Hands-on laboratory work, Practical Chemistry, Chemistry

Introduction