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ISSUES OF THE INTEGRATIVE STEM LESSON FOR SCHOOL

Abstract. This study was designed to determine the level of STEM integration, particularly in chemistry lessons, and what difficulties/benefits this action may have. The study included 18 articles by different authors on different topics, but with one goal - STEM integration. The result showed that out of 18 articles, 16 partially contain the idea of integrating STEM methodology. In particular, 7 articles were designed to integrate STEM in high school. the rest were intended for teachers in general. None of the articles were intended for elementary school.

Keywords: STEM education, integrated STEM in school

Introduction

In modern education, there is a gap between traditional teaching methods and the needs of modern society. As the study shows, many schools and educational institutions still adhere to the lecture approach, ignoring the principles of active and practical learning. (Felder, R. M., & Brent, R. 2024). However, in a dynamically changing world, where the skills of applying knowledge in practice and solving real problems are in demand, standard teaching methods become ineffective. In this context, stem education plays a key role, combining science, technology, engineering and mathematics into a whole educational process. This research is aimed at developing software for teaching the basics to school,

taking into account that it can contribute to the development of critical thinking, new methods of problem research and creativity. The basis of this approach is the constructivist philosophy of learning, which emphasizes the importance of active interaction of students with educational material. In addition, in the context of modern educational requirements, special attention is paid to the integration of technologies that not only facilitate the learning process, but also develop digital literacy, which is necessary in the modern information society.

Literature review

Implementation of stem in school play vital role in creating advanced education at all. And to reach this goal for example I took an article of Roehrig, G. H., Dare, E. A., Ring-Whalen, E., & Wieselmann, J. R. (2021). This work was carried out to research integrated STEM curricula. It created conceptual flow charts (CFGs) for 50 such programs to categorize and understand the nature of curriculum integration and coherence. The study identified four main types of integrated STEM programs: scientifically coherent units with a vaguely related engineering assignment (EDC), units focused on engineering design with limited connections to scientific content, units where engineering design is used as a context for scientific content, and fully integrated and coherent STEM units. The findings indicate that engineering practices can serve as a contextual integrator within the STEM curriculum, and the use of EDC provides the potential for conceptual integration, since engineering is based on the application of science and mathematics.

Also, in opinion of Jamal, S. N., Ibrahim, N. H., Surif, J., Suhairom, N., Abdullah, A. H., & Jumaat, N. F. (2017) make a study about understanding STEM in Chemistry in their region and their study was conducted among 20 chemistry teachers in order to identify their understanding of STEM education and develop a teaching strategy in accordance with this understanding. The study was conducted in eleven schools in Malacca County and used the Tengah approach and qualitative research methodology. Open-ended questions were used to collect data, which were analyzed using thematic analysis. The results showed that most teachers defined STEM education as the integration of science, technology, engineering and mathematics. However, some of them did not feel confident in understanding or implementing STEM education into their practice. This study aims to highlight the importance of STEM education in modern education and help teachers and students better understand and implement it in the learning process.

According to methods of introducing STEM chemistry in school Fitriyana, N., Wiyarsi, A., Pratomo, H., & Marfuatun, M. (2024) make research in Indonesia and they notice that The various goals facing secondary schools and vocational schools in Indonesia play an important role in shaping the preparedness of chemistry teachers to use the STEM approach in their work. Despite this, both high school chemistry teachers (HSCT) and chemistry teachers in vocational schools (VSCT) should be positive about STEM, as it offers students a more meaningful study of chemistry. This study examined the views of chemistry teachers on the potential of STEM learning in their classrooms. 131 chemistry teachers from Indonesia participated, the study was conducted using a saturated sample method. The STEM Perception Scale (PC-STEM) was used to collect the data. The results showed that both HSCT and VSCT are positive about STEM. This means that integrated STEM learning can be successfully used in chemistry lessons in both categories of educational institutions. However, no statistically significant differences were found in the views of HSCT and VSCT on the use of STEM in chemistry teaching. Despite the positive attitude, both groups of teachers noted a lack of experience in using STEM in

chemistry lessons. Thus, in order to successfully integrate STEM-based chemistry education, chemistry teachers need a special STEM professional development program.

If we will look at the idea of integration STEM, there will be some problem Aydin-Gunbatar, S., Tarkin-Celikkiran, A., Kutucu, E. S., & Ekiz-Kiran, B. (2018) researched the impact of a 12-week design-based STEM course on pre-service chemistry teachers' content knowledge, STEM conceptions, and engineering perspectives. Through five STEM activities addressing real-life problems and an iterative engineering design process, eight junior pre-service teachers participated voluntarily. Data analysis revealed a significant deepening of content knowledge and a shift in perceptions towards integrated STEM education and engineering design. Implications for integrating STEM courses into pre-service teacher education programs were discussed.

The purpose of the study to investigate the key issues of Integrated STEM in secondary schools according to the various literature. The research question is “what kinds of issues were discussed in literature”.

Methodology

And Also, while searching information for this article I use google scholar platform, especially I was looking for those articles that conducted to key word “integrate STEM education” and all articles that I found I read and then make a result table. In the course of my research work, I studied the works of other authors, comparing them with the topic of integrating STEM into education, in particular, into teaching chemistry. To show a more accurate result in this article, I used 18 articles taken from the Google Scholar platform. After a long and thorough analysis of the articles, I found that 16 of them fully meet the objectives of the study, offering valuable information on the practical application and effectiveness of project-based learning as part of the implementation of the modular plan for an integrative STEM lesson in school.

Result

Article №	Key issue	Author, main idea	№ of articles	Percentage of key issue
1	STEM education	Felder, R. M., & Brent, R. 2024	8	44,72%
2		Kubat, U. (2018).		
3		Jamal, S. N., Ibrahim, N. H., Surif, J., Suhairom, N., Abdullah, A. H., & Jumaat, N. F. (2017).		
4		Ananda, L. R., Rahmawati, Y., & Khairi, F. (2023).		
5		Hasanah, S. S., Riandi, A. P., & Kaniawati, I. (2022).		
6		Altan, E. B., & Ercan, S. (2016).		

7		Farwati, R., Metafisika, K., Sari, I., Sitinjak, D. S., Solikha, D. F., & Solfarina, S. (2021).		
8		El-Deghaidy & Mansour (2015).		
9	Integrated STEM	Roehrig, G. H., Dare, E. A., Ring-Whalen, E., & Wieselmann, J. R. (2021).	5	27,78%
10		Fitriyana, N., Wiyarsi, A., Pratomo, H., & Marfuatun, M. (2024).		
11		Du, W., Liu, D., Johnson, C.C., Sondergeld, T.A., Bolshakova, V.L.J., & Moore, T.J. (2019).		
12		Honey, M., Pearson, G., & Schweingruber, H. (2014).		
13		Bryan, L.A., Moore, T.J., Johnson, C.C., & Roehrig, G.H. (2015).		
14	Professional development in STEM Education	Asghar, A., Ellington, R., Rice, E., Johnson, F., & Prime, G. M. (2012).	1	5,5%
15	STEM courses	Aydin-Gunbatar, S., Tarkin-Celikkiran, A., Kutucu, E.S., & Ekiz-Kiran, B. (2018).	1	5,5%
16	STEM effectiveness	Fatayah, F., Yuliana, I. F., & Priyasmika, R. (2022).	1	5,5%
17	pedagogical content knowledg	Kulgemeyer, C., & Riese, J. (2018).	1	5,5%
18	STEM inquiry-based learning	Abdurrahman, A., Nurulsari, N., Maulina, H., & Ariyani, F. (2019).	1	5,5%
Total			18	100%

In this table, I have given examples of the studied works and reduced the percentage of their binding to a specific keyword. As we can see, there are more than 44% of articles on STEM education, which indicates that generalized information about STEM is very popular and perhaps easy to research and explain. On the contrary, there were fewer works on the question of integrating the STEM methodology

by 16.94% less, and this leads to the idea that explaining the integration of the methodology is more complex and difficult for research. As for other articles, we can see that their main idea is probably not popular, since there were not so many such articles. Based on these figures, it can be assumed that in the future these topics need to be explored much more, since it is possible that they contain answers to the questions that we still cannot answer

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STEM – БАСТАУЫШ СЫНЫПТА БІЛІМ БЕРУДІ САПАЛЫ ҰЙЫМДАСТЫРУДЫҢ НЕГІЗГІ ҚҰРАЛЫ

Аңдатпа. Бүгінгі таңдағы алуан түрлі цифрлық білім ресурстары кіші жастағы балаларға мүмкіндік бере отырып, оқушыларға әр түрлі құбылыстарды оқып зерттеуге, модельдер құруға және тәжірибеден өткізуге, өз күші мен ұмтылыстарымен өзінің интеллектуалдық әлемін көрсетуге көмектеседі.
Осыған байланысты қазіргі заманғы жалпы білім беретін мектептерде мақсатқа бағытталған ғылыми-зерттеу жұмыстары оқушылардың әртүрлі өмірлік жағдайларда қолдануға болатын тәжірибелік дағдыларды дамытатын тәсілдерінің бірі болып табылады.

Түйінді сөздер: STEM, технология, роботтехника, конструктор.

STEM технологиясы білім алушылардың белсенділігін арттыруға мүмкін беретін оқу ортасын құру. Кез келген жағдайдың шешуін анықтап, тауып, өзара пікірлесе отыра қорытынды жасайды. Осы тұста белсенділіктері артып, кез келген ақпаратты, тұжырымды, ережені жақсырақ естерінде сақтап қалады. Себебі, STEM технологиясы оқушыларды сыни ойлауға, креативті ойлауға, өз бетінше білім алуға жетелейді. Мұғалім кез келген технологияны, әдіс тәсілді пайдаланғанда оқушылар үшін тиімдісін іздейді. Оқушы жаратылыстану, дүниетану, математика т. б сабақтар бойынша білімдерін толықтырып, түрлі ақпараттармен танысып жұмыс жасайды. Бірақ кейбір жағдайларда оқушылар үшін анықтамаларды, түсіндірмелерді бірден түсіну қиынға соғады. Ал, кейбір оқушыларға кез келген ақпарат түсінікті болады, өз шамасына қарай түсінеді.