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THE VIEWS OF FOREIGN LANGUAGE TEACHERS ON STEM/ STEAM/STREAM CONCEPT IN EDUCATION

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Abstract: The STEM concept is an educational model that integrates science, technology, engineering, mathematics, and more recently arts (STEAM) and reading skills (STREAM). It is a widespread belief that STEM and its derivates encourage creativity, critical thinking, and innovation. Considering their great importance and popularity worldwide, this paper aims to determine knowledge levels, application practices, and teacher's perceptions of STEM/STEAM/STREAM in Serbia. A questionnaire with open- and closed-ended questions was used as the instrument of this survey. The respondents are foreign language teachers in primary and secondary schools in Jagodina. The data obtained through this survey were analyzed quantitatively and qualitatively. The former was carried out with descriptive statistics. Striving to provide guidelines for further education of teaching staff, the paper has a practical value. In addition, it has significant theoretical implications in that the STEM/STEAM/STREAM concept is clearly defined and delimited from related concepts in teaching.

Keywords: STEM/STEAM/STREAM, foreign language, foreign language teachers, attitudes

INTRODUCTION

The rapid development of new technology, as well as social changes in the world, have led to the emergence of a new era, whereby the changes are also reflected in teaching methods and approaches in institutionalized education. Accordingly, and in order to develop students' competencies for the 21st century, the integration of different subject areas is necessary to create opportunities for innovation in teaching and learning. Therefore, the STEM[1] concept has attracted a lot of attention from various researchers in the field of education around the world (Yakman, 2008; Bal & Bedir, 2021; Bažant, 2022; Setyo Uta-

[1] STEAM and STREAM are advanced approaches to STEM. STEAM and STREAM incorporate arts or both arts and reading skills into the existing STEM, which integrates science, technology, engineering, and mathematics.

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miningsih et al., 2023), since it represents an interdisciplinary approach and has many advantages because it facilitates memory, stimulates the learning process, increases cognitive intelligence, enables better time management, and encourages the development of creativity.

The results of this study also provide information about the advantages of implementing STEM/STEAM/STREAM in foreign language teaching and learning, based on emphasizing on the question of which teaching concepts can be developed to fit students' needs.

Current global challenges and socio-political changes require innovations in pedagogic-educational approaches. Therefore, the research also examines the importance of foreign language teacher training in implementing the STEM/STEAM/STREAM approach and the current deficits. Namely, the study highlights the aggravating circumstances that teachers in Serbia perceive as obstacles to STREAM implementation.

Each STREAM subject affects a unique set of skills and expands the spectrum of perspectives in a learning process. Given that the Reading component serves to promote literacy and communication skills (Crum, 2022), it is necessary to determine foreign language teachers' knowledge about the STREAM approach and to analyze their observations on its implementation in foreign language teaching so that future professional support aiming at developing professional competences and improving the foreign language teaching can appropriately target the key deficiencies.

PREVIOUS RESEARCH

The acquisition of literacy and communication skills in a foreign language is essential for solving complex challenges and for meeting professional demands in students' future careers.

The "R" in STREAM stands for Reading, which is an essential component of education but is often neglected in STEM or STEAM (Yakman, 2008; Margot & Kettler, 2019; Bal & Bedir, 2021; Bažant, 2022; Setyo Utaminingsih et al., 2023). Reading is a fundamental skill that supports learning in all subjects and disciplines, promotes critical thinking, improves vocabulary and language skills, and improves understanding and communication skills. Reading is also necessary to promote creativity and self-expression through literary and artistic works. By emphasizing reading as a core component of STREAM education, students can develop the literacy skills necessary for success in school and beyond.

Crum (2022) believes that educational policy-makers and foreign language teachers should take into account the awareness of students about what

language learning is and what it means to be linguistically and interculturally competent and that languages are crucial for improving every aspect of STEAM professions. Advanced language proficiency would pave the way to more lucrative careers for individuals connecting them through target languages, which would require blending STEAM content into the foreign language curriculum. Since communication is the key to learning a foreign language, and its effectiveness is based on the ability to function in a multitude of situations, the goal of language skills within this concept is to integrate language skills into other subjects to provide students with a more comprehensive and engaging learning experience. For example, students may read and analyze scientific articles, technical manuals, or engineering diagrams in the target language to support their understanding of STEM concepts (Crum, 2022: 2).

Previous research has confirmed that the STEM/STEAM/STREAM approach is gaining momentum globally. The attitudes of educators and teachers on the implementation of the approach and its derivates are fairly positive (Trechow, 2013). In addition to the acronym STEM, which is recognized around the globe, the acronym MINT (*Mathematik, Informatik, Naturwissenschaften und Technik*) is confined to the borders of the German-speaking countries (Kucharz et al., 2020). Several studies conducted in Turkey have focused on examining the opinions of teachers who use STEM. Highlighting the necessity of STEM education in contemporary societies, they indicate numerous advantages of this approach, especially for employment opportunities and advocate for the introduction of STEM education even in preschool age (Bakırcıa &Kutlu, 2018; Bal&Bedir, 2021; Akgunduz et al., 2022; Akcan, 2023).

Margot and Kettler (2019) from the USA conducted a thematic analysis of 25 articles on the attitudes toward STEM approaches. The criteria for inclusion in the study were specific research questions, availability of the publication in the English language, and that the study had been published between 2000 and 2016. The results show that teachers have a positive attitude towards STEM education, but a multitude of barriers was also reported such as pedagogical challenges, curriculum challenges, structural challenges, and student concerns (Margot & Kettler, 2019: 4–12).

Research conducted in Croatia also shows that teachers, as well as future teachers, are open to innovations in teaching and are aware of the importance of using the STEM approach in teaching; hence, they have a positive attitude toward its implementation (Bažant, 2022).

METHODOLOGY

As can be deduced from the aforementioned, teachers' opinions about STEM/STEAM/STREAM education and its implementation in teaching are of great importance for increasing the quality of their education and training. It is essential to determine the attitudes of foreign language teachers about STREAM education so that they can encouraged and supported to effectively use it in practice. Therefore, the main goal of this study is to determine the foreign language teachers' knowledge about this interdisciplinary approach and their attitudes toward its implementation in teaching to determine the needs and opportunities for improving the support provided to them. Such support is needed when they implement the given approach to strengthen their professional competence and confidence in carrying on STREAM activities. Therefore, we formulated research tasks to determine whether teachers have appropriate knowledge of what the STEM/STEAM/STREAM approach is, what their opinions on its implementation are, and what they consider as (dis)advantages of implementing the approach within the Serbian context.

For the purposes of this research, a mixed-methods research was chosen, that is, a questionnaire with closed- and open-ended questions was formulated to obtain both quantitative and qualitative data. The qualitative analysis was conducted with the data obtained via open-ended questions in which the respondents were allowed to express their opinions freely.

Sample and Questionnaire

The criterion for the selection into the research study group was the employment status of foreign language teachers. The research was conducted with 30 foreign language teachers who have been predominantly teaching German or English for over 10 years in primary (from 5th to 8th grade) and secondary schools in Jagodina. The survey was conducted between the 20th and the 30th of March, 2024. Participation was anonymous and voluntary.

The questionnaire contained 16 questions that examine the foreign language teachers' knowledge about the STEM/STEAM/STREAM approach and their attitudes toward its implementation, including the advantages and disadvantages.

It was important to formulate the questions understandably and to rely on the experiences of the respondents. One of the imperatives was to provide enough room for respondents to express their ideas subjectively and without any constraints. The first four questions (Q1 – 4) inquire about the gender, workplace, seniority, and foreign language in question. Hence, the study can differentiate the attitudes by gender and professional groups. The fifth

question (Q5) is open-ended, and it asks the respondents to freely elaborate on their knowledge of the STEM/STEAM/STREAM approach. The responses may also manifest whether teachers unequivocally distinguish this approach from the related concepts, such as correlation in teaching. The sixth and seventh questions (Q6 and 7) aim to record whether the textbooks contain tasks or contents that can be used through the STEM approach. The following set of questions (Q8 to Q16) aims to record the attitudes toward the implementation of the STEM/STEAM/STREAM approaches in foreign language teaching and perceived advantages and disadvantages.

RESULTS AND DISCUSSION

The fidnings are presented in this section in the following manner: the questions are presented, explained, and the results are interpreted and processed in percentage terms.

Q1 – 4. The study group consists of 28 female and 2 male foreign language teachers. 67% teach German as a foreign language, and 33% teach English. Also, 60% of respondents are employed as foreign language teachers in the second cycle of primary education, while 40% teach in secondary schools.

Q5. Even though the replies varied, a great emphasis on the positive outcomes of the STREAM approach and its effectiveness can be observed:

> *A useful addition to the teaching…*
>
> *Use of multimedia in the form of audio or video recordings in teaching…*
>
> *Multidisciplinary approach to solving problems from everyday life through the development of critical thinking.*
>
> *A multidisciplinary approach to teaching that combines knowledge and skills from different subjects and areas, and develops students' abilities that are important for everyday life in the modern world.*
>
> *I am not very familiar with the program.*
>
> *STEM stands for Science, Technology, Engineering and Math*
>
> *I positively evaluate the approach, as it encourages the application of linking different subjects; it is the approach to solving tasks, enhancing thinking, and working together.*
>
> *I am not informed so much.*
>
> *Excellent approach…*
>
> *STREAM is an interdisciplinary concept in teaching that requires a purposeful connection between the learning objectives of the curriculum, standards, assessment, design, and implementation of a teaching unit.*

"R" (reading) means reading as a skill for learning and improvement in various fields.

A non-traditional approach to learning…

STEM skills are the skills and practical knowledge of the key subjects for today's age listed above and the correlation between them.

An innovative interdisciplinary approach in teaching at the preschool, elementary, and high school levels that enables quality learning by applying acquired knowledge to solve tasks that are very similar to situations and problems in real life, whereby students acquire new knowledge, skills, and values in a way that is close to them, motivates them and instills confidence. Working in a group to solve interesting problems, students improve their knowledge in the STEAM field and at the same time, acquire skills necessary for modern life and success in the profession, such as critical thinking, creativity, cooperation, successful communication in native and foreign languages, empathy and reflection on their progress.

Integration of science, technology, engineering, and mathematics when learning and concrete and clear application of what has been learned by solving real problems…

In addition to the fact that 47% of respondents define the STEM/STEAM/STREAM approach as an integrative approach in teaching, in which students connect knowledge from different subjects and use them to solve problems, 33% confuse it with the introduction of multimedia in teaching or correlation with some other subject(s) and 20% confess they are not fully familiar with the approach.

The respondents generally believe that the mentioned approach represents a positive incentive for foreign language teaching, but the answers indicate the need for professional support in the form of additional training on the application of the STEM/STEAM/STREAM approach in foreign language teaching.

Q6. 73% of the respondents gave an affirmative answer on the question inquiring whether the textbooks used by teachers contain tasks or content that can be taught via STEM/STEAM/STREAM. This means that foreign language textbooks are quite well equipped and provide some material for including the STEM/STEAM/STREAM approach. However, there is room for improvement.

The following textbooks have been mentioned as predominantly used in STEM/STEAM/STREAM activities: *Prima Plus* (Jin & Rohrmann, 2021) for the German language and *English Plus* (Wetz & Pye, 2013) and *Kid`s Box* (Nixon & Tomlinson, 2017) for the English language.

Q 8 – 10. Three statements were tested with a Likert-type scale. 67% of the respondents answered with *I strongly agree* to the first statement (*I am interested in using the STEM/STEAM/STREAM approach in foreign language teaching*). The remaining group claims that they *neither agree nor disagree* is the answer that best describes teachers' attitudes.

33% of the respondents agree with item 9 (i.e. *I am familiar with STEM/STEAM/STREAM activities that can be applied in foreign language teaching*). The rest of the subjects either have no opinion or disagree with this statement.

73% agree with item 10 stating that the STEM/STREAM/STREAM approach improves language skills in a foreign language. This means that 27% of foreign language teachers do not have an opinion about the potential benefits of STEM/STEAM/STREAM activities. This is in line with the aforementioned findings. The respondents are not equally familiar with STEM/STEAM/STREAM activities so it is reasonable that they do not have firm opinions about the positive impacts such activities can have.

Q 11. The question was optional in that only teachers who had had previous experience with STEM/STEAM/STREAM activities could answer. They were required to evaluate their experience as *very positive*, *positive*, *neutral*, *negative*, or *very negative*. 24 teachers replied. The experience in applying the STEM/STEAM/STREAM approach is considered *very positive* by 25% of the surveyed teachers and *positive* by 33%. 42% remained neutral. Although the majority of the surveyed teachers have a positive experience, one should not ignore the large number of teachers who do not think that this teaching approach has any positive effect on teaching foreign languages.

These data indicate a lack of motivation and awareness of the importance of using the STEM/STEAM/STREAM approach, which is again an indication that systematized professional training of teachers related to the mentioned approach is necessary.

Q 12 and 13. This question was also optional since it referred to those with prior STEM/STEAM/STREAM experience. The question inquired whether teachers preferred using the ready-made materials or choosing and preparing the materials themselves. 22 teachers answered. 82% confessed they prepared materials for their STEM/STEAM/STREAM lessons. This may also be one of the reasons why the respondents do not implement this approach regularly. Namely, Q13 (*How often do you use the STEM/STEAM/STREAM approach in teaching?*) reveals that 67% of the surveyed teachers *sometimes* use the approach, while only 13% use it *often*. Others confessed that they never use the approach.

Q 14. The teachers were asked whether they would use STEM/STEAM/STREAM activities if there was more professional training available for them. 67% of the surveyed teachers gave an affirmative answer, while 33% of them

had no opinion about it. These results also illustrate the level of teachers' motivation to apply and to work on STEM/STEAM/STREAM topics.

Q 15 and 16. The last two questions focus on the respondents' insights about the advantages and disadvantages of applying the STEM/STEAM/STREAM approach in foreign language teaching. The obtained responses were diverse. However, most teachers agree that the approach equips the students with the skills and competencies needed to analyze and solve problems during class, but also in their everyday lives. There is a certain consensus that the approach can facilitate the development of technological literacy and critical thinking.

For the respondents, the largest drawback is the inconsistency with the foreign language curricula for elementary and high schools. They also highlight the lack of training on the possibilities of applying the STEM/STEAM/STREAM approach in teaching.

Based on the results presented above, it can be concluded that it is necessary to integrate STEM/STEAM/STREAM content into the curriculum thematically for foreign languages. In addition, training for foreign language teachers should be mandatory in order to raise awareness of the importance of this approach.

CONCLUSION

This study aimed to determine the level of knowledge about the STEM/STEAM/STREAM approach among foreign language teachers and their views and motivation toward the application of the approach. The analysis of the received answers reveals that the views towards the application of the STEM/STEAM/STREAM approach in foreign language teaching are mostly positive.

The respondents define the STEM/STEAM/STREAM approach differently and confuse it with multimedia and correlation in teaching. This is an indicator that training and professional support for foreign language teachers is needed when it comes to the mentioned approach.

The participants have different opinions about the benefits of STEM/STEAM/STREAM education, ranging from helping students to gain a deeper understanding of the importance of logical-semantic concepts, to developing technological literacy and critical thinking. Most importantly, teachers seem to be aware that the approach is highly beneficial for developing problem-solving skills in students.

The results indicate some difficulties that hinder the implementation of the given approach to foreign language teaching, such as the inconsistencies

with the curriculum for the foreign language subject for elementary schools and high schools in Serbia, as well as the lack of training on the possibilities of applying the STEM/STEAM/STREAM approach in teaching.

Although the results of the research show that the emphasis is mainly on the positive incentive that the approach has for foreign language teaching, some respondents who have a neutral attitude towards the implementation of STEM/STEAM/STREAM in their teaching should not be ignored. Their attitudes indicate a deficit of personal motivation for the implementation of a given approach. The reason for this is the fact that views or attitudes are deeply rooted in our belief-system, that is very stable and rarely changes by itself. Therefore, tailored training is necessary so that teachers can develop further their beliefs and be encouraged to apply the approach. From the point of view of professional competence and development, this work suggests that teacher training is needed when it comes to the STEM/STEAM/STREAM approach.

However, there are also certain limitations regarding the research itself, and they concern a small number of respondents. Since this research is just the beginning of efforts to investigate the field of STEM/STEAM/STREAM and foreign language teaching in Serbia, we hope that similar research will follow, which, in addition to this work, can contribute to the development of the national plan and program for foreign language teaching in Serbia by introducing STEM/STEAM/STREAM content and prepared materials.

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