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# STUDENTS' PERCEPTIONS OF THE STEAM APPROACH IN UNIVERSITY TEACHER EDUCATION

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*Abstract*: Constant technological changes require generations of students able to solve problems in newly emerging circumstances quickly and efficiently. Nowadays, it is crucial to concurrently promote the skills for the 21st century among our students, get them actively involved in the social flows, and develop an interest in arts (including music) and natural sciences. The STEAM approach to university teaching allows students to draw conclusions about the phenomena covered by natural sciences through creative thinking developed by music education. This paper aims to investigate the attitudes of the final-year undergraduate students attending the Faculty of Education in Jagodina toward the STEAM approach in a university setting and their perceptions of the advantages and disadvantages of the STEAM approach. Furthermore, the paper examines the students' perceptions of the significance of teacher collaboration in STEAM activities/projects. The sample (N=89) was surveyed via a questionnaire. The findings indicate that university students have positive attitudes about the STEAM approach and the professor's initiative to combine different fields by promoting the active participation of all participants in the teaching process. The results demonstrate that the STEAM approach encourages students to think creatively and reason logically by enabling a unique symbiosis of "the mind of the scientist" and "the mind of the artist." One of the main disadvantages of the STEAM approach in university teaching stems from the impossibility of using it constantly. Consequently, combining STEAM with other innovative approaches is a requisite.

*Keywords*: STEAM approach, university teaching, students, music education, natural sciences

## INTRODUCTION

Incessant and rapid technological changes in the world require new generations of students who will be able to solve newly-emerging problems swiftly

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and efficiently. Consequently, it is very important to equip students with the skills and competencies needed to solve real-life problems, follow current social trends, and develop an interest in art (music) and natural sciences. University education needs to follow global business trends which demand competent students who will be capable of responding to the demands imposed by the contemporary world and participate in the exchange of information about scientific achievements, while constantly strengthening their capacities (Wahyuningsih et al., 2020; Milić & Mladenović, 2022).

According to Dyer (2011), certain music-based activities can enhance their literacy skills, increase engagement, and improve memory during literacy instruction. According to other research (Davidova & Zavadska, 2019), the STEAM approach in the music curriculum allows the integration of music education with natural sciences and humanities and it enriches students' experience based on three pedagogical principles – personalization, participation, and productivity. Numerous studies confirm that children become more adept at communicating with peers through musical activities, such as playing musical instruments, creating music, and musical games, (Pitt, 2020) and they become more confident since speech is not the only medium of communication (Denac, 2022). Moreover, the positive impact of music on the intellectual, social, and personal development of children and adolescents has been confirmed in many studies that also highlight that musical activities influence language development, literacy, creativity, fine motor skills, coordination, attention, self-confidence, emotional sensitivity, and social skills (Hallam, 2010; Aguilera & Ortiz-Revilla 2021).

STEAM (Science, Technology, Engineering, Arts, and Mathematics) aims to foster creativity, critical thinking, collaboration, and problem-solving skills by bridging the gap between traditionally segregated subjects (White, 2014). In STEAM education, students are encouraged to explore increasingly complex, real-world problems and challenges holistically, drawing upon the principles from each area to develop innovative solutions (Sanders, 2009). One of the key strengths of the STEAM approach is its ability to cultivate technical proficiency and creative expression. Also, by incorporating arts (music), STEAM acknowledges the importance of imagination and aesthetics/emotional intelligence in problem-solving (Aguilera & Ortiz-Revilla, 2021). Such integration enriches the learning experience; more importantly, it facilitates the development of communication and critical thinking (Wahyuningsih et al., 2020; Belbase et al., 2021) and prepares students for the complexities of the modern world that requires interdisciplinary collaboration and adaptability (Morales et al., 2021).

Cekić-Jovanović and Gajić (2022) prove the positive attitudes about the STEAM education and the importance of integrating modern technology and

mathematics. Their findings confirm that primary school teachers have positive attitudes toward the STEAM approach, confess willingness to prepare the materials for the STEAM research activities, and claim that they apply it often in teaching Digital Technologies and Mathematics. However, they point out that professional development training sessions and seminars dealing with integrative teaching and STEAM are much needed. On the other hand, most students consider that they have the competencies to cooperate with their colleagues to organize integrative activities (Milić, Mladenović, & Spasić, 2020). These competencies can be crucial for improving and modernizing university teaching.

The results of the research conducted among students of the Faculty of Mathematics and Natural Sciences and the Faculty of Engineering and Technology (Elabuga Institute of Kazan Federal University) showed that the problem of teacher education in general education institutions is a challenge of the modern world and is now relevant more than ever. The findings demonstrate that only 18% of students are familiar with existing global/state STEAM education programs; only 15% believe they are prepared to implement STEAM activities, and only 10% are confident in their readiness to lead project activities (Anisimova, Sabirova & Shatunova, 2020). These data indicate several issues, inter alia, teachers' readiness to implement new educational programs and preparing future teachers to execute practice-oriented educational activities for forming design and research competencies.

The utilization of the STEAM approach in university teacher education and, subsequently, the implementation in kindergartens and elementary schools through our students, depends on various factors. First, it includes curriculum design, possibilities for interdisciplinary linking of different fields, teacher education and training, resource availability, and student developmental levels (Carrier at al., 2011). The STEAM approach aims to integrate multiple areas to promote holistic learning experiences (Belbase et al., 2021). Because of all the above, future teachers need to be familiar with this approach during their university education.

All these researches and results of theoretical and empirical research, which we have looked into, showed that there are advantages and several disadvantages of the implementation of the STEAM approach. The analysis (Margot& Kettler, 2019) of empirical articles published between 2000 and 2016 indicate that while teachers value STEM education, they reported barriers such as pedagogical challenges, curriculum challenges, structural challenges, concerns about students, concerns about assessments, and lack of teacher support.

For that reason, the authors of this paper wanted to investigate the attitudes of final-year students of the Faculty of Education in Jagodina towards the implementation of the STEAM approach in university teaching, the importance

of collaboration of professors in STEAM activities/projects, and their attitudes about the advantages and disadvantages about the implementation of the STEAM approach in university teaching.

## RESEARCH METHODOLOGY

The research objective is to examine students' attitudes on implementing the STEAM approach to university teaching. In accordance with the objective, the following research tasks have been formulated: determine students' views on the advantages and disadvantages of the STEAM approach to university teaching; determine students' views on the possibilities of applying the STEAM approach in university teaching; determine students' views on the professor's initiative to methodically model STEAM activities in classes through music and ecology.

A descriptive method and techniques of surveying and scaling were applied. The research instrument was a questionnaire with a five-point Likert-type evaluation scale, designed by the paper's authors.

The questionnaire consists of three parts: the first part examined students' attitudes on the advantages and disadvantages of the STEAM approach to university teaching; the second part examined students' attitudes on the possibilities of applying the STEAM approach to university teaching; and the third part examined students' attitudes on the professor's initiative to model STEAM activities in university classes through music and ecology methodically. The questionnaire consisted of both closed- and open-ended questions.

The research sample consisted of 89 third- and fourth-year students of the Faculty of Education, University of Kragujevac in Jagodina. Students attending academic studies on programs Class Teacher Education and Preschool Teacher Education were surveyed. The students were surveyed after the STEAM class/workshop in the field of natural sciences and music education.

The survey was conducted *in vivo* in March 2024. The acquired data were processed using the SPSS program.

## RESULTS AND DISCUSSION

Considering the subject of the research, our starting point was the research task to determine the students' attitudes on whether there is potential for the implementation of STEAM activities at the faculty, as well as the advantages and disadvantages of this approach. The findings show that the STEAM approach in university teaching contributes to the fulfillment of several advantages that are in line with the needs and requirements of modern education and the future

jobs of class teachers and preschool teachers. Students from both programs agree to the greatest extent, that there are numerous advantages. It is encouraging that the majority of students believe that a large material investment in teaching materials is not necessary to implement STEAM in teaching. Also, they believe that it is possible to apply this approach in university teaching and that it is necessary to apply STEAM more. Findings show that students have stronger sense of community and a broadened worldview and problem-solving when faced to the challenges of real life situations, and with real colleagues (*Table 1*).

*Table 1. Students' attitudes*

| I part ITEMS | Class Teacher Education | | Preschool Teacher Education | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| The STEAM approach contributes to students acquiring more functional and quality knowledge | 4.48 | 0.653 | 4.54 | 0.582 |
| The STEAM approach allows students to connect science and music | 4.6 | 0.645 | 4.85 | 0.368 |
| The biggest advantage of implementing the STEAM approach is divergent thinking and encouraging creativity among students | 4.4 | 1.000 | 4.54 | 0.647 |
| The STEAM approach enables the holistic development of each student as an individual | 4.16 | 0.987 | 4.04 | 0.774 |
| The STEAM approach enables students to realize exploratory music activities in nature or through outdoor learning | 4.48 | 0.770 | 4.58 | 0.504 |
| The STEAM approach combines time for processing similar contents of several different areas/subjects | 4.44 | 0.712 | 4.85 | 0.368 |
| II part ITEMS | Class Teacher Education | | Preschool Teacher Education | |
| | Mean | SD | Mean | SD |
| The STEAM approach can be successfully applied in university teaching | 4.36 | 0.860 | 4.62 | 0.496 |
| It is necessary to apply more STEAM approach to university teaching | 4.48 | 0.770 | 4.69 | 0.471 |
| Certain contents of the course Natural Sciences and Methodology of Music Education are suitable for the implementation of the STEAM approach | 4.12 | 0.833 | 4.50 | 0.707 |

| | | | | |
|---|---|---|---|---|
| Certain contents of natural science, and contents in music teaching like listening or performing music, provide the most opportunities for integration | 3.92 | 1.038 | 4.23 | 0.710 |
| For the successful implementation of the STEAM, large material investments are necessary for the acquisition of teaching materials | 2.36 | 1.114 | 3.08 | 1.383 |
| There are no suitable contents in university teaching that can be successfully connected through the STEAM approach | 2.08 | 1.115 | 2.46 | 1.392 |
| Future Teachers/educators are not sufficiently trained in the STEAM approach | 2.76 | 1.234 | 3.23 | 1.451 |

The STEAM approach in university teaching enables the acquisition of practical knowledge and logical conclusions, which, through creative thinking and including music, can be achieved in natural sciences (Milić & Mladenović, 2022). Although students believe that it is possible to connect the contents of different subjects, most of them were hesitant when asked for a specific example, in this case listening to music with specific topics covered by natural sciences. It is possible that they do not have enough experience, even though they are students of the final year, or they did not see the possibility for this kind of content linking. Anyway, their answers to the open-ended questions showed that the STEAM approach opens up new possibilities and ideas for the implementation of teaching. Some of the students' responses showed their enthusiasm for professors' collaboration in integrating two different areas, and confirm that learning through music and with music encourages creativity and increases their practical experiences:

> *Connecting music/art and science is very encouraging.*
> *It is easier to absorb some facts and it is more fun. But, it cannot be applied all the time and not everything can be processed in this way.*
> *I realize that there is a connection between certain contents of different subjects that I had not studied before.*
> *I did not believe that subjects such as science and music could be connected.*
> *This approach helps me understand the lessons more easily and have a better interaction with my students.*
> *STEAM activities and workshops are very interesting.*

Findings show that there are many possibilities for how university teachers and future teachers can apply the STEAM approach. Therefore, we can agree that the university practice represents an appropriate and applicable environment for the implementation of STEM activities. To ensure successful implementation teachers should work together, do collaborative planning, be

an effective team, plan lessons, identify learning objectives, and align instructional strategies. These results confirmed the findings of other studies, e.g. Malinović-Jovanović & Ristić (2017), who highlighted the need to demonstrate various possibilities of integrating teaching materials of different areas and subjects through specific examples, explore them from different angles, and present the appropriate instructions for their design.

The results indicate that students consider STEAM activities to be entertaining, highly motivating, more perceptible, more remarkable, and specific and that they provide active participation of all participants:

> *We learn interactively.*
> *I would like to contribute to the development and progress of my students in different ways.*
> *I would teach like the professors who gave us practical solutions for connecting different areas and showed good cooperation.*
> *I would like to encourage children.*

Other research on the attitudes of future teachers show similar trends – students are more motivated to present different subjects to their future students in this way (Berlin & White, 2010; Erdogan & Ciftci, 2017; Kocakaya & Ensari, 2018). Our research findings show that there are opportunities for integrated teaching, by interrelating and unifying the subjects frequently taught in separate academic subjects in the curriculum. We discovered that interdisciplinary learning breaks down the barriers between different areas, allowing students to see connections and overlaps between separate academic subjects. By connecting and combining similar, suitable content from different areas, university teachers gain time for learning. The STEAM approach must encourage a holistic understanding of complex real-world problems, preparing students for the interdisciplinary challenges they will face in their professions.

Results suggest that students' understanding of the roles in the STEAM should be increased for them to teach more content. Hence, the STEAM professional development can be perceived as an effective initial way to change practice, citing the importance of collaboration and team teaching integrated directly into the learning process.

Also, implications from this study offer other university teachers significant and valuable considerations towards to successful implementation of STEAM teaching.

## CONCLUSION

The research conducted among final year students at the Faculty of Education in Jagodina showed that students have positive attitudes towards the application of the STEAM approach in university teaching. Students believe that the STEAM approach in university teaching has more advantages than disadvantages. In addition, students have positive attitudes about the professor's initiative to methodically model STEAM activities in class, especially through music and natural sciences/ecology.

Nevertheless, there is a need to improve knowledge about the STEAM approach. It is necessary to enable more training and attendance at seminars, workshops, and professional development projects focused on STEAM teaching and the application of modern technology in STEAM, because good cooperation and integrative teaching are important segments, not only of university education but also of education in kindergartens and schools, for which our students are preparing.

This further implies the need to modernize university teaching by encouraging and increasing the motivation, education, and training, creating interest in further enriching the acquired levels of knowledge and competencies and creating specific, professional competencies for the application of innovative approaches.

There is a need to further direct student competencies through university teaching, and this is the reason why the application of innovative approaches, such as STEAM, is necessary.

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