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THE ROLE OF THE STEM/STEAM/STREAM APPROACH IN THE PROFESSIONAL DEVELOPMENT OF TEACHERS WORKING IN PRESCHOOL TEACHER TRAINING COLLEGES

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Abstract: This paper aims to point out the importance of the STEM/STEAM/STREAM approach in the professional development and training of teachers in preschool teacher training colleges. Within the theoretical framework of the paper, the essential concepts related to the process of improvement of higher education teachers are discussed and the topicality of the problem of professional training is indicated. The methodological framework of the research is based on a research goal oriented to the examination of the opinions of teachers and associates of the Unit for Preschool and Nursery Teachers of the Academy of Applied Studies Šabac on the role of STEM/STEAM/STREAM approaches in the professional development of teachers. The general goal of the research is specified through two research tasks: 1) to examine how teachers perceive the impact of the STEM/STEAM/STREAM approach in their professional development process; and 2) to determine to what extent the research of examples of good practice and perspective in the field of STEAM through the establishment of partnerships with other institutions and organizations dealing with STEAM contributes to the improvement of knowledge and skills in the application of STEAM approaches in teaching. Using the descriptive method, by the Likert scale of judgments, the attitudes of teachers and associates of the Unit for Preschool and Nursery Teachers were examined and analyzed. The research results indicate that the system of professional development and training, which is based on important programs and legal document contributes to the improvement of the knowledge and skills of teachers in the application of the STEAM approach

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in teaching and the need for permanent training in different areas, to achieve a higher level of quality work with students.

Keywords: teachers, education, professional development, student, preschool teachers

INTRODUCTION

As a consequence of the emergence of complex social, technological, economic, and cultural challenges of modern society at the global level, there is a need for a significant change in the approach to learning and teaching at all levels of upbringing and education. The English term STEAM appears as an acronym, which refers to several academic disciplines: science, technology, engineering, arts, and mathematics. This term refers primarily to schools, that within the offered educational programs and modules, favor education as the key to the development of the scientific and technological sphere.

The importance of STEM and the investment of significant resources in the development of STEM competence is related to the needs of the labor market for experts in areas that are in expansion, which are related to the development of new technologies, such as currently robotics or artificial intelligence. A STEM education develops a range of transversal skills that are applicable in all fields, including critical thinking, problem-solving, innovation and creativity, scientific curiosity, collaboration, and teamwork, as well as communication and metacognitive skills.

Kelley and Knowles (2016) state that STEM has evolved into a meta-discipline and that it is an integrated approach that removes traditional barriers between subjects and focuses on applied processes of designing solutions to complex contextual problems using modern tools and technologies. In addition, the STEM approach in higher education encourages going beyond the framework of the traditional teaching paradigm and using student-centered teaching techniques, such as project teaching, problem teaching, collaborative learning, experiential learning, etc. This interdisciplinary approach contributes to the personal development of students during initial education and at the same time prepares them for continuous education, making them more employable, even if they do not decide on a career in the STEM field. Thinking about the ways in which national higher education systems can encourage students to develop the necessary skills will help them in their personal and professional development, which is important for a quality life.

Apart from the acronym STEM, the acronym STEAM appears more and more often, which in addition to the areas included in STEM also denotes "Arts," i.e. humanities, languages, dance, acting, music, visual arts, design, and new media. STEAM deals with the same concepts, but through the prism of the cre-

ative process and with the development of skills for the 21st century, it also develops the so-called 22nd-century skills that include connectivity, community, and culture.

The acronym STEM was introduced in 2001 by the American organization National Science Foundation (NSF), and it replaced the acronym SMET, which had been in use until then. Since research at that time showed that students in American schools had lower achievements in the STEM field compared to their peers from other parts of the world, various initiatives were launched to introduce STEM curricula in schools, so that students would acquire competencies in accordance with the needs of the labor market. On the other hand, the need for teacher education was also noted so that they could lead students on an interdisciplinary STEM journey. Those initiatives outlined the direction of STEM curriculum development, which spread from the United States of America to the world, following the needs and peculiarities of the educational systems of individual countries.

Thus, Wells (2019) emphasizes that the emergence of the STEM movement in its current form is the result of long-term attempts to integrate STEM content into the American K-12 education system, which includes education from kindergarten to high school, and to improve and adapt the system to social and the US economic context. Hence, in his opinion, we find the first initiatives for the popularization of STEM during the 1970s and 1980s; since then, there was continuity until the early 2000s, when systematic dealing with the topic began, and it has been developing ever since.

In the European Union, the interest in developing STEM skills can be seen through the European strategic framework for developing skills. The 2020 Communication from the Commission to the European Parliament, the Council, the European Social Committee, and the Committee of the Regions, entitled *Skills Agenda for Europe for Sustainable Competitiveness, Social Justice and Resilience* (EC, 2020), states the urgency of a paradigm shift in skills in the context of green and digital transitions.

Therefore, [Skills Agenda for Europe (EC, 2020)] sets goals for a five-year period, which are respectively aimed at increasing the number of adults involved in lifelong learning and raising the level of digital skills. To achieve these goals, 12 measures were determined, and measure number 7 refers to increasing the number of people with a diploma in the field of STEM and encouraging entrepreneurial and transversal skills. The description of the measure states that "[…] young people, especially women, are encouraged to be educated in the field of science, technology, engineering, and mathematics. Also, […] strengthen support for entrepreneurs and the acquisition of transversal skills such as collaboration and critical thinking" (EC, 2020).

From the above, it can be clearly concluded that the European Union recognized the importance of the STEM field, as well as the importance of encouraging the implementation of education to popularize the STEM field among young people. The progress report from 2021, which refers to the implementation of the aforementioned Program, states that, as one of the activities to encourage the participation of women in the STEM field, through the Erasmus+ program, partnerships on the design and implementation of higher education programs in the field of engineering and advanced of ICT based on the STEAM approach, as well as mentoring programs for female students, encourage them to choose STEM studies and a career in STEM occupations. On the other hand, there are numerous initiatives in practices, among which we highlight the STEM Alliance, an initiative coordinated by the European Schoolnet (a network of 33 European ministries in charge of education), which brings together participants from the economy and education to implement activities aimed at promoting STEM education and careers among young Europeans.

Figure 1. Transformation of a classroom into a small research center

Modern and high-quality teaching must enable students to take knowledge and skills that are applicable in the real world from the classroom, which can be achieved by transforming the classroom into a small research center, removing the barrier between the classroom and the workplace, teaching and real tasks, education, real life, and work environment. An efficient and modern classroom fosters a positive culture that enables students to solve problems, collaborate, create, test ideas, share knowledge, and encourage the use of technology.[1]

[1] https://sportedukalis.com/2023/07/01/stem-sistem-u-obrazovanju/

STEAM PROJECT TEACHING – TEACHING MODEL AND SUCCESS IN AN ONLINE ENVIRONMENT

In modern society, the educational system is rapidly changing, as many educational institutions have started to use the STEAM approach to learning, which does not focus only on additional teaching in the disciplines of science, technology, engineering, and mathematics, but applies a holistic approach to this teaching model, breaking artificial academic boundaries between scientific fields.

The integrated approach and STEAM connection in higher education is designed not only to improve student achievement but also to ensure more permanent retention of knowledge and ways of thinking that are needed for successful problem-solving and following modern innovations in all areas, especially in education.

The transition to online teaching and project-based learning with a STEAM approach has strengthened the STEAM project-based teaching model, in which students do not only learn content, which they would then apply in a project but the traditional approach to content learning is completely changed. In the STEAM project-based learning approach, students are first presented with a real problem and then tasked with learning the content necessary to answer questions that are the answers to the assigned project problem. During the process of testing, researching and developing solutions, students build problem-solving, project management, and collaboration skills, as well as leadership skills, necessary for success in the world outside the higher education institution, which is the basis of the educational system as a whole.

1. It helps students to apply knowledge from various STEAM disciplines in practice

The best success for online teaching is with project assignments that are based on real-world problems, providing an opportunity to make a clear connection between what is learned in the course of study and what is relevant outside the classroom. The authentic nature of STEAM project problems is that they require students to draw on knowledge and expertise in many areas, which gives them the chance to structure solutions in many different ways. Practically, with this approach, students are given the chance to feel that there was a right and a wrong direction, i.e. the right and wrong application of what they learned, by reaching the final outcome of the project.

2. It promotes deeper and more permanent knowledge

The goal of learning based on STEAM projects is to awaken the students' desire to come up with the correct solution, to find out what the correct answer is, and then to understand in more detail the purpose and goal of the project

and establish connections between the problems they face, and based on this, to think about what they already know and discover what they still need to learn in order to finish the project. This specific context helps them not only to identify and avoid misconceptions but to connect facts and information as they apply knowledge to solve, evaluate, and think about different project solutions.

3. Cultivates the inquiry and research skills necessary for the success of STEAM and project-based teaching

The open nature of the STEAM project approach, which does not seek a single correct answer but directly encourages both analytical and creative thinking, is necessary for introducing innovations and preparing students for the challenges of the modern world. If a teacher prepares a STEAM project that is focused on the development of research skills, he/she offers students learning questions that practically do not give correct answers, but lead to even more questions, deepening knowledge, but most importantly – to understanding the learning path, as well as what has been learned.

4. Learning based on the STEAM project approach fosters reflection and metacognition

As teachers have the challenge of presenting teaching material to students in a changed environment during online classes, it is necessary to teach them to learn to think and learn independently by applying the STEAM project model. Practically, in this way, students develop a sense of self-reflection for the adopted material and the successful implementation of the project. This would mean that the teacher has the task of teaching students about independence during educational activities, learning, and working on project tasks, through continuous questioning: What do we know? What do we need to know? What do we think will happen? What succeeded in the implementation of the project? What didn't work? What can we improve? How can we achieve a better outcome of STEAM project teaching?

The reflective nature of the STEAM project-based process helps students connect content and subject matter to the way they think and solve project challenges. The better they can find and use the learned knowledge, mastered skills, and abilities, the better they can understand not only the task that is set before them but also how to solve it.

The main advantages of applying the STEAM project approach in teaching include:

– mastering the material based on solving the problems needed for the realization of the project,
– encouraging the dynamic development of the student's personality through project-based, problem-based, and STEAM education,

- creation of a rich experience for students based on thinking about potential possibilities for the realization of the project,
- development of communication and social interaction skills, as well as teamwork,
- motivating students for scientific research work,
- encouraging students to independently create and come up with solutions,
- directing the student to apply educational technology and interdisciplinary approach with artistic expression in practice.

Research about STEAM and Education Institutions in Serbia

By reviewing the research of numerous foreign and domestic authors, it can be seen that the STEAM concept of education is recognized as suitable for the interdisciplinary connection of content from different spheres of science but also as a modern model of work organization that develops social skills, self-confidence, and motivation for learning, as being important factors for further progress of pupils and students.

Research results (Ingersoll & Merrill, 2012) point out that 18.2 percent of natural science teachers leave their teaching positions after the first year of working in education – 14.5 percent of mathematics teachers, and 12.3 percent of teachers of other STEM fields. A high percentage of teachers' lack of motivation to contribute to STEM fields through their own creative expression also led to a decrease in student interest in science subjects. Significant changes followed when the field of arts was added to the STEM educational concept, thus creating the acronym STEAM as a link between science, technology, engineering, art, and mathematics.

Some of the research findings (Jaipal-Yamani & Angeli, 2016) indicate that the use of educational robots encourages the development of STEAM skills, but also develops students' self-confidence and interest in the STEAM field in general. The authors Noh and Lee (2020) point out that the use of robots in educational work has a positive effect on the development of IT thinking skills, encourages the development of creativity and critical thinking, and develops problem-solving skills. In connection with the above, it can be concluded that the introduction of educational robots into teaching results in the effective inclusion of children in STEAM education activities and the encouragement of children to learn the basics of programming and develop IT thinking, i.e. the knowledge and skills they will need in the future.

Mora, et al. (2017) analyzed a literature review on gamification at the higher education level. The main focus of the review paper is on the review of

the framework for the development of gamification, taking into account the appropriateness of the age of students and the type of elements of gamification in higher education environments. The conclusion of the research showed the dominance of gamification elements in the business environment, while available tools for gamification were much less present in general activities such as education and healthcare. The authors state that most publications in higher education do not follow the formal design of the gamification process. Also, most of the paper focuses on the description of the experience, that is, on the so-called "ad hoc way" and thus does not contribute to the conduct of research by other researchers and teachers.

Recently, the idea of adding art to STEM programs has become popular, as a result of research into the positive effects of engaging in various types of art on children's development (Popović, 2017).

Contemporary trends in the STEM field emphasize teaching in which students make models, mini-robots, rockets, circuits, etc. and at the same time, they learn new content often by the method of insight and trial and error. To carry out such classes, modern STEM classrooms equipped with numerous equipment are needed, in which students have 3D printers, programmable robots, various measuring sensors, and electronic sets (e.g. LittleBits), (Glasnović et al., 2018).

Some previous research attempts in the STEM in Croatia have resulted in the findings that speak of the low interest of students in STEM professions, and the very poor and unfavorable educational structure of parents, which represents a threat to the achievement of many goals in the STEM area.

Also, the role of students' socioeconomic status in aspirations towards STEM professions is significant and in some parts of the educational system, there is a particularly low participation in extracurricular STEM activities. In addition, previous studies have shown that mathematics as a subject is among the least-liked subjects among students (Glasnović, et al., 2018).

Authors Nieto-Escamez and Roldan-Tapia explore experiences in the application of gamification at universities during the COVID-19 pandemic. The paper does not use the SLR methodology, and the authors narratively described 11 case studies on the application of gamification grouped by subjects or areas (chemistry, biology, medicine, computing, and economics). They analyzed the impact of gamification on increasing student motivation and the adoption of learning outcomes and found that it was positive, but also concluded that additional research is needed to confirm this, especially since there was no comparison with the adoption of learning outcomes in a traditional environment without gamification.

STEM has been a reality in the world for some time in the best educational institutions. However, there are also schools in Serbia where the highest qual-

ity and most modern world educational practices are nurtured, and students are truly prepared for life and work in the 21st century. In such schools, STEM education is an integral part of age-appropriate teaching.

Through the innovative concept of STEAM education, students of *Modern Elementary School and Gymnasium, International School, and ITHS secondary school for IT* acquire knowledge in science, technology, engineering, art, and mathematics in a creative way through project teaching, problem-solving approach, team work, and research spirit.

Also, in these schools, IT is an integral part of teaching from a young age, and regardless of age, students acquire important IT skills such as programming, design, and robotics, and with the use of educational technology, they master digital literacy, and *ITHS* students become qualified IT experts.

What particularly distinguishes the STE(A)M concept in these schools is the unique 4C principle: Creativity, Collaboration, Critical Thinking, and Communication. Thanks to them, students, instead of passively, acquire STEM knowledge actively, through real examples and multidisciplinary projects, working in research teams. Also, these principles belong to the so-called transversal skills and are indispensable for working in any field of the 21st century. In this way, the students of these schools not only acquire STEM knowledge but also prepare for professional life in the real world after schooling.

When talking about trends, it can be concluded that the effectiveness of the STEM approach depends on teachers who are trained and able to transfer knowledge in the right way. This is precisely why the *Modern Elementary School and Gymnasium, International School, and ITHS* place a lot of emphasis on the professional development of teachers so that they are always up to date with the latest knowledge and trends in education. In this way, they and their students are making progress.

What makes these schools stand out in this part of Europe is the fact that they connect STEM teaching with ecology in line with the latest world approaches and needs. We are talking about schools where students' environmental awareness is continuously developed – known as "green schools" – which organize numerous environmental actions. This is precisely why many STEM projects at the *Modern Elementary School and Gymnasium, International School, and ITHS* are designed to be directly related to environmental issues, which is why students acquire important knowledge but also learn how to use it positively and constructively to provide the benefits for the entire planet.

Serbia also has its exclusive representative for the promotion and implementation of STEM education. Namely, the Institute for Modern Education is the representative of the *Science on Stage Europe* network in Serbia. It is the largest network of STEM teachers in Europe with more than 100,000 representatives

from over 30 European countries, as well as Canada, Egypt, Kazakhstan, and Georgia. Through this network, teachers have at their disposal numerous resources for improvement, as well as various workshops where they work together with colleagues from all over the world on the implementation and improvement of STEM teaching. The Institute for Modern Education will also organize the first *Science on Stage* festival, where students from Serbia will have the opportunity to present their works from the STEM field and compete to go to the European *Science on Stage* festival.

In Serbia, there is also an interactive studio *Link STEAM Lab*, where students acquire knowledge in science, technology, engineering, art, and mathematics through practical examples, research work, and real projects. STEM education is one of the most important areas of today's education and it is extremely important to keep up with its trends if pupils and students were to be competitive at the world level in the 21st century.

Priorities in the Field of Higher Education

1. Promoting interconnected systems of higher education

The program will aim to strengthen strategic and structured cooperation between higher education institutions by:

a) supporting the development and testing of different types of cooperation models, including cooperation in virtual and combined formats and the use of various digital tools and online platforms;

b) promoting mobility through the application of automatic mutual recognition of qualifications and learning outcomes and incorporating mobility into curricula;

c) supporting higher education institutions to apply the Bologna principles including promoting core academic values and quality assurance standards and guidelines, as well as tools to improve mobility for all;

d) supporting higher education institutions in strong cooperation with representatives of EU member states, for piloting innovative cooperation and action; and

e) supporting the implementation of the Erasmus without papers initiative, the application of the European student identifier and the European student card.

2. Stimulating innovative learning and teaching practices, i.e. addressing social challenges and promoting innovation and entrepreneurship by supporting:

a) the development of learning outcomes and student-oriented curricula that better meet students' learning needs and reduce skill mismatches,

and the promotion of entrepreneurship while at the same time being relevant to the labor market and wider society, for example by inviting employees from companies and the business world or by developing curricula with industry, including small and medium-sized enterprises;

b) development, testing, and implementation of flexible learning paths and modular course design (part-time, online, or combined) and appropriate forms of assessment, including the development of online assessment;

c) the promotion of lifelong learning in higher education, including facilitating the initiation, validation, and recognition of short blocks of training leading to micro-credentials; and

d) the application of transdisciplinary approaches and innovative pedagogies such as flipped learning, international collaborative online learning, research-based learning and combined intensive programs, which support the acquisition of future-oriented transferable skills and entrepreneurship through a challenge-based approach.

Developing STEM/STEAM Methods in Higher Education

Developing STEM/STEAM methods in higher education, especially the participation of women in STEM fields: this priority supports the development and implementation of STEM programs in higher education, following the STEAM approach; promoting the participation of women in STEM fields of study, especially in engineering, ICT and advanced digital skills; developing guidance and mentoring programs for students, especially girls and women, to pursue STEM and ICT fields of study and careers; fostering gender-sensitive practices of education and training in STEM education; and eliminating gender stereotypes in STEM**.**

Rewarding Excellence in Learning, Teaching, and Skills Development

a) by developing and implementing strategies and a quality culture to reward and encourage excellence in teaching, including online teaching and student teaching, improving the learning, and teaching experience of students with reduced opportunities, student-centered learning and teaching in higher education, as well as support for flexible and attractive academic careers, teaching evaluation activities, research, entrepreneurship, management, and leadership;

b) training academic staff in new and innovative pedagogical approaches, including teaching in online or blended environments, transdisciplinary

approaches, new curriculum designs, delivery methods, and assessments that link education with research and innovation, where appropriate; and

c) developing new practices in teaching design, based on educational research and creativity.

Support for Digital and Green Opportunities in the Higher Education Sector through the support for:

a) digital transformation of higher education institutions (including interoperability) and digitalization of student mobility in accordance with the European Student Card initiative,

b) development of digital skills of students and employees, and

c) monitoring database graduate students.

In accordance with the green initiative, the program will support: a) institutional approaches, b) transdisciplinary approaches that have a clearly defined disciplinary background with lifelong learning, including support through micro-credentials, c) curriculum development in accordance with the necessary green skills, and d) supporting transnational partnerships between students, academic staff, universities, employers, the community and other stakeholders on climate challenges to create climate change leaders in higher education.

Building inclusive systems of higher education

The program will encourage inclusive approaches to mobility and cooperation activities, such as: a) supporting the education of refugee students and staff, and supporting institutions and staff from host countries to engage in this endeavor; b) increased access, participation, and completion rates for people with reduced opportunities including underrepresented groups, also through the development of voluntary quantitative targets; c) active support to incoming mobility participants during the process of finding accommodation, including cooperation with relevant stakeholders in providing appropriate and affordable accommodation; d) support for the mental health of students and academic staff; e) fostering gender balance in higher education institutions, in various fields of study and in management positions; and f) encouraging civic engagement by promoting informal learning and extracurricular activities and recognizing volunteer work and community work in students' academic results.

Support for innovation and entrepreneurial skills of students

The program will provide support for innovation and entrepreneurship in higher education, including for example a) support for the establishment and operation of living laboratories and incubators within higher education institutions, in close cooperation with the entrepreneurial sector and other relevant agents, in order to support innovative learning and teaching and help students entrepreneurs to develop their ideas into businesses, and b) supporting learning and teaching partnerships with commercial and non-commercial organizations in the private sector that support students' encounter with innovation and entrepreneurship.

RESEARCH METHODOLOGY

In the research, a scaling procedure was applied, within which the opinions of respondents were examined about the role of STEM/STEAM/STREAM approaches in working with students and the impact on the professional development of teachers. The goal of our research refers to the examination of the attitudes of teachers and associates of preschool teacher training colleges towards the possibilities of professional development and training by applying the STEAM concept of education. From the general goal thus conceived, we derived the following research tasks:

1. to examine the attitudes of teachers and associates of preschool teacher training colleges towards the contribution of the STEAM approach to professional qualification and advancement;
2. to examine the attitudes of teachers and associates of preschool teacher training colleges regarding the importance of the STEAM approach for developing interpersonal relationships;
3. to examine the attitudes of teachers and associates of preschool teacher training colleges regarding the importance of the STEAM approach for encouraging responsibility and creativity; and
4. to identify the proposals of teachers and associates of preschool teacher training colleges on what should be changed in teaching practice so that the STEAM approach is more prevalent.

By the STEM/STEAM/STREAM approach, we mean an integrated approach and STEM connection in higher education, which is designed not only to improve student achievement but also to ensure a more permanent retention of knowledge and ways of thinking that are needed for successful problem solving and following modern innovations in all areas, especially in education. We used descriptive analysis for data analysis.

The respondents' opinion on the role of the STEM/STEAM/STREAM approach in working with students and the impact on the professional development of teachers were examined through 24 statements where the respondents on a five-point Likert-type scale assessed the extent to which they agreed with them.

A suitable research sample was selected, which consisted of teachers and associates at the Unit for Preschool and Nursery Teachers of the Academy of Applied Studies Sabac (N=24). It is important to point out that the analysis and interpretation of the obtained results of this research can be viewed and related only to the given sample, but we believe that they represent a significant starting point for possible future research on the STEAM approach in higher education.

Table No. 1. Attitudes of teachers and associates about the STEAM approach on working with students and the impact on professional development

Areas of STEAM approach contribution	Attitudes	f
PROFESSIONAL QUALIFICATION AND ADVANCEMENT	STEAM is a philosophy, an approach in education that involves organizing teaching activities oriented toward learning outcomes.	5
	The emphasis of the STEAM approach is on developing certain competencies in students and teachers in order to cope with challenges, and life situations as easily and successfully as possible, and to be as successful as possible in future careers.	16
	Through science, students gain an understanding of the world around us, research and think critically, and easily find their way in an environment full of technological innovations.	6
	The effectiveness of the STEAM approach depends on teachers who are trained and able to transfer knowledge to students in the right way,	12
	The STEAM approach is important for the education of the future, as well as the present.	7
	Establishing partnerships with other institutions and organizations dealing with STEAM contributes to improving the knowledge and skills of teachers and associates in the application of the STEAM approach in higher education	11

Areas of STEAM approach contribution	Attitudes	f
DEVELOPMENT OF INTERPERSONAL RELATIONS	For the successful implementation of STEAM in higher education, cooperation between teachers at the Unit of Academy level is necessary.	19
	Through STEAM, teachers have the opportunity to collaborate more, plan lessons together, and exchange ideas with each other.	21
	The STEAM approach promotes and seeks cooperation among students, but also teachers.	18
	The STEAM approach actively involves all students, encouraging them to discuss, establish cause-and-effect relationships, connect materials, and perceive situations from multiple aspects, and all this in the context of everyday, problem situations that are real.	17
	STEAM is a dynamic, interactive, and very interesting and fun approach for students.	15
Areas of STEAM approach contribution	Attitudes	f
ENCOURAGEMENT OF RESPONSIBILITY AND CREATIVITY	STEAM encourages students to independently create and come up with solutions.	19
	Through STEAM, teachers motivate students for scientific research work.	14
	The STEAM approach contributes to the creation of a rich experience for students created by thinking about potential opportunities for project implementation.	20
	STEAM education directs students to apply educational technology and an interdisciplinary approach with artistic expression in practice.	17

Based on the expressed views of teachers and associates about the role of the STEM/STEAM/STREAM approach in working with students and the impact on professional development and advancement, that they support such work, we can conclude that their views confirm the expertise and readiness of teachers and associates for the transition to the STEAM concept of education that is recognized as suitable for interdisciplinary connection of content from different spheres of science. Also, teachers and associates recognize the STEAM approach as a modern model of work organization that develops social skills, self-confidence, and motivation to learn, as important factors for the further progress of students.

We also analyzed the obtained responses of teachers and associates about the mentioned areas of contribution of the STEAM approach: a) professional competence and advancement; b) developing interpersonal relationships; and c) encouraging responsibility and creativity (*Table 1*). The results based on the views of teachers and associates point to several important facts, which can serve in establishing conclusions and proposing possible measures to improve the work of teachers and associates in the STEAM approach in working with students.

RESEARCH SAMPLE

In the research process, a wider set of elements that make up the content of the opinions of teachers and associates of the Unit for Preschool and Nursery Teachers was measured with the aim of studying the structure and relationship of those elements.

For the sake of better visibility and concretization of the research results, we analyzed the collected responses and attitudes of teachers and associates in the following areas of contribution of the STEAM approach: a) professional training and advancement, b) developing interpersonal relationships, and c) encouraging responsibility and creativity. Also, we considered it important to present the views of teachers and associates and their proposals for changes in teaching practice so that the STEAM approach would be more prevalent in teaching practice with future preschool teachers. In this way, we classified the attitudes of students into four categories, when it comes to the STEAM approach, which they support in working with students.

The results refer to the opinions of teachers and associates about the importance of applying the STEM/STEAM/STREAM approach in professional development and professional training (*Table 1*).

When it comes to individual claims, teachers, and associates in general, express a positive attitude in relation to the claims. They mostly agree that:

- The STEAM approach prepares professionals who can transform society with innovation and sustainable solutions.
- For the successful implementation of STEAM in higher education, cooperation between teachers at the Unit level is necessary.
- Through STEAM, teachers and associates have the opportunity to collaborate more, plan lessons together, and exchange ideas with each other.
- STEAM is a philosophy, an approach in education that involves organizing teaching activities oriented towards learning outcomes.

CONCLUSIONS

An integrated approach and STEAM connection in higher education not only improves student achievement but also contributes to a more permanent retention of knowledge and ways of thinking that are needed for successful problem-solving and following modern innovations in all areas, especially in education. The results confirm the good professional competence of teachers; there are also results that indicate the need to improve the work of teachers in the STEM/STEAM/STREAM environment.

Based on the opinions of teachers and associates about the role of STEM/STEAM/STREAM approaches in working with students and the impact on professional development, the basic conclusions of this research are determined:

- The opinions of teachers and associates are divided in relation to their views on the impact of the STEAM approach on professional competence and advancement. The largest number of surveyed teachers and associates confirm that the emphasis of the STEAM approach is on developing certain competencies in students so that they can more easily and successfully cope with challenges and life situations, and be as successful as possible in their future careers.
- It is possible to concretize the stated views of teachers and associates about the STEAM approach through the areas of contribution of the STEAM approach in relation to professional training and advancement, developing interpersonal relationships, and encouraging responsibility and creativity.
- In a positive context, when teachers and associates support the STEAM approach in teaching, they point out that the STEAM approach is dynamic, interactive, and very interesting and fun for students.
- Certain attitudes of teachers and associates point to the need and possibilities of improving the STEAM approach in teaching, primarily in relation to: a) encouraging the development of STEAM skills, students' self-confidence and interest in the STEAM field in general b) a more flexible and adequate choice of digital platforms; and c) better assessment of students; competencies.

We present these results as possible measures for improving the work:

- It is important that teachers and associates who educate future preschool teachers continuously work on improving their competencies in the field of developing STEM/STEAM methods in higher education.
- Work systematically to improve and develop quality strategies and culture to reward and encourage excellence in teaching, including digital opportunities and building inclusive higher education systems.

- An important aspect of improving the work of teachers and associates refers to the planning and organization of students' activities (the organization of their professional and integrated practice), for the purpose of practical training for their future profession.
- The system of professional development and training which is based on important programs and legal documents, contributes to the improvement of the knowledge and skills of teachers in the application of the STEAM approach in teaching.
- The need for permanent training in various fields, in order to achieve a higher level of quality of work with students.

We believe, based on the results presented in this paper, that in future research it would be important to compare students' attitudes about the contribution of the STEAM approach and the work of teachers with students' success in exams and the exam passing rate in the system of vocational education at the basic and master level. We thereby indicate the importance of this paper – on the one hand, for the improvement of pedagogical practice, and on the other hand, in relation to possible new research issues.

Based on the above-presented conclusions, a general conclusion can be drawn: teachers and associates have positive attitudes regarding the possibility of professional development by applying the STEAM approach in vocational schools for the education of preschool teachers. They are aware of the effects achieved by the STEAM approach and the implementation of the STEAM concept of education, but in order to apply this way of working with students, it is necessary to provide them with different working conditions and additional education.

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