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ATTITUDES OF PRIMARY SCHOOL TEACHERS ABOUT THE IMPORTANCE, PLACE AND ROLE OF MODERN TECHNOLOGY AND MATHEMATICS IN STEAM EDUCATION

Abstract: The natural connection between mathematics, natural and technical sciences should be present and visible through very intense correlations between the respective school subjects. In many educational systems, the field of STEAM is recognized, which implies a holistic approach and integration of natural sciences (biology, chemistry, physics, physical geography), technical and engineering sciences (electrical engineering, mechanical engineering, construction, hardware and software engineering), art and mathematics. The aim of the paper is to examine the views of elementary school teachers (N = 160) about the importance, place and role of modern technology and mathematics in STEAM education. The study discussed the basic theoretical starting points, possibilities and challenges of applying modern technology and mathematics in integrative STEAM teaching. Also, teachers' attitudes were examined using the research survey technique, using as a research instrument an anonymous questionnaire created in the Google Forms web application as a five-point Likert-type scale. The research results confirm the positive attitudes of teachers about the importance of modern technology and mathematics in STEAM education. Also, the research results confirm that primary school teachers have positive attitudes toward and often apply modern technology and mathematics in STEAM classes for the preparation of materials, research activities and individualization of the teaching process. However, to a lesser extent, they attend professional development seminars focused on the application of modern technology in STEAM integrative teaching; there is a possibility to improve this important segment of education.

Keywords: STEAM education, integrative approach, teachers' attitudes, educational technology, mathematics, Serbia.

INTRODUCTION

The integrality of teaching means the realization of the requirement (principle) that all elements of the teaching process – content, psychology, cognition, sociology and organization – are functionally connected and form a harmonious

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whole (Vilotijević 2016). Teaching based on this approach can be very stimulating and motivating for students. Content that is interconnected contributes to knowledge that is complete, valuable and usable (Spremić 2007). Integrative teaching is teaching in which the boundaries between different subjects or disciplines are erased or partially imperceptible. This type of teaching makes meaningful connections between similar aspects of different disciplines. Disciplines mutually integrate, permeate and synthesize into a new whole that is larger and more significant than the simple sum of its constituent elements (individual subjects, disciplines) (Spremić 2007). The integrative approach primarily contributes to building a comprehensive picture of reality that students encounter in real life and helps to develop a divergent way of thinking and originality (Jovanovic, Kovcic 2017).

Vilotijević states that Gestalt theory (main representatives Wertheimer, Kafka and Keller) provided a good theoretical basis for integrative teaching. In this theory, the main point suggests that psychic processes cannot be broken down into small parts, since organization and integrity are the most important features of psychological processes, and they are lost through atomization (Vilotijević 2016). The effort to make the idea of integrative teaching a practical reality is present in many advanced pedagogical movements and directions during the 20th century. Ideas of integrative teaching can be found in the concept of active school from A. Ferriera, the project-method from J. Dewey, the idea of exemplary teaching, and the pedagogical-methodical ideas of Sreten M. Adžić. Cekić-Jovanović and Mihajlović observe that Adžić, through his examples from practical experience, encourages students to consider different perspectives, to connect facts, to think critically and creatively about ideas, to process and learn in different ways, to experience contents and to create their own original, individual works (Cekić-Jovanović, Mihajlović 2018). Most authors talk about three forms of teaching integration: full, partial and block. A complete form of integration means combining different teaching contents into a single course. Partial integration is when certain chapters that have similarities are selected from the teaching material, so they are processed together. In the block mode of integration, autonomous blocks are created that are independently programmed or parts of the joint program are separated for integrative processing. The levels of integration are intra-subject, inter-subject (use of inter-subject links) and inter-system integration (combining the contents of different subjects into a whole) (Drobnjak 2007).

STEAM is a teaching method that applies meaningful science, technology, engineering, art, and math content to solve real-world problems through hands-on learning activities and creative design (Bošković, Lalić, Milić 2020). It was created as a solution to the main shortcoming of STEM, which is the development of creative thinking and applied art in solving problems. The acronym STEM was created in the 1990s by the American National Science Foundation in order to better promote the integrative learning of science, technology, engineering and mathematics (Sanders 2009). There is a large number of studies that confirm the

advantages and didactic value of STEAM education (Gunčaga, Kopczynski 2019; Gutschank 2019; Đorđević, Kopas-Vukašinović, Mihajlović 2019; Stohlmann, Moore, Roehrig 2012).

Integrated STEAM education should be viewed as a space for students to apply their knowledge of disciplines to create products and/or solve problems that can be made or addressed using engineering principles (Brackley, Howell 2019). STEAM creates a safe environment for students to express and experience their ideas, which encourages them to think outside the box (Strutynska, Umryk 2019). A US News article reported that Andover High School is teaching geometry through art. Mathematics and art teachers used the game "scavenger hunt" in a local museum to make students understand that projective geometry is the same thing as perspective in art (Bošković, Lalić, Milić 2020).

Strategic documents and laws dealing with education in Serbia emphasize the importance of an integrative approach. The Law on Basic Education and Upbringing (*Official Gazette of RS*, No. 55/2013, 101/2017, 10/2019 and 27/2018 – State Law) defines the basic goals of basic education and upbringing, which foresees the development of key competencies for lifelong learning and cross-curricular competence in accordance with the development of modern science and technology, as well as the development of creative abilities, critical thinking, motivation to learn, ability to work in a team, and ability to take initiative and express one's opinion. The strategy for the development of education in Serbia until 2020 envisages the development of students' divergent thinking, creative abilities, creative potentials and the acquisition of higher-quality, practically applicable knowledge from various fields, and at the same time aspires towards cross-curricular planning and linking of teaching content. The application of innovative ways and methods of teaching represents a good basis for the introduction of the STEAM model into the formal framework of the educational system. The application of the STEAM model as a concrete action for the development of education is in accordance with the vision of the future state of the education system in Serbia. According to the Education Development Strategy in Serbia until 2020, primary education and upbringing is a good and stimulating environment in which students master quality knowledge and skills that can be interconnected and applied in further education and in everyday life (Education Development Strategy in Serbia 2020). The Rulebook on the teaching and learning plan for the first cycle of primary education recommends that integration, correlation and connection of the contents of different subjects should be carried out wherever possible in order to enable the complete development of the student's personality, the acquisition of quality knowledge, and the development of divergent and critical thinking (*Official Gazette* 2017, 2018, 2019a, 2019b, 2020). In the education of teachers, as key participants in the education system, special emphasis should be placed on strengthening their competencies for teaching and teaching methodology (K1) and competencies for teaching

and learning (K2) (Regulation on standards of competencies for the profession of teachers and their professional development, 2011).

The natural connection between mathematics, natural and technical sciences should be present and visible through very intense correlations between the respective school subjects. In many educational systems, the field of STEAM is recognized, which implies a holistic approach to the presentation of natural sciences (biology, chemistry, physics, physical geography), technical and engineering sciences (electrical engineering, mechanical engineering, construction, hardware and software engineering), art and mathematics. Establishing correlations of mathematics teaching with other STEAM disciplines can contribute to stronger student motivation and a deeper understanding of all areas that are integrated (Maass, Geiger, Ariza, Goos 2019). The advantages of integration are more than obvious. For example, a large number of problems in the field of computing cannot be solved without adequate mathematical knowledge. Conversely, the use of computers makes it easier to solve many mathematical problems and can contribute to a better understanding of certain mathematical concepts (primarily through the introduction of visualization and experimental methods in mathematics teaching) (Marić 2020).

Lipkovski claims that mathematics is essentially used in all natural and technical sciences. Ever since the age of Copernicus, Galileo and Newton, fundamental and new mathematical concepts have been created and developed on the one hand as a means for the progress of natural sciences, while on the other hand, every natural science intensively uses already existing mathematical methods in its development. The best example of this is the general theory of relativity, in which Einstein used the already existing theory of differential geometry. In the words of the German philosopher Kant, there can only be as much real science in any natural science as there is mathematics in it (Lipkowski 2020).

The correlation of mathematics and natural sciences in elementary school is best seen starting from the 7th grade with the teaching of physics, percentages and proportions in chemistry, although before 7th grade the mathematical concepts of scale and proportion also appear in physical geography (5th grade).

The example of Fibonacci rabbits (i.e. obtaining its sequence and the value of the golden section) reflects the correlation of mathematics and biology in the best possible way. It should certainly be mentioned that, in addition to the natural sciences, mathematics also occurs in other spheres, such as music, fine arts, and literature. When children learn rhythm and notes, they simultaneously learn division, fractions and proportions. Some studies have shown that people who know math are better at playing the piano (Nemirovsky 2013). Fine art relies heavily on symmetries, perspective, and projective geometry. Various literary works describe mathematical concepts in an even clearer form than their mathematical definition. The famous Goethe and his Faust describe the magic square through verses; Jules Verne in *From the Earth to the Moon* gives very precise definitions

of the parabola and the hyperbola. By learning mathematics, students acquire important skills needed for later computer and programming careers. On the one hand, mathematical education fosters the acquisition of concrete knowledge and develops a mathematical apparatus that has direct applications for solving practical tasks, and on the other hand, mathematical education contributes to the development of general cognitive abilities and the development of an appropriate approach to solving problems that is useful in all IT disciplines (Sevimli, Ünal 2022). Some of the concepts that are developed in the teaching of mathematics and are very important for the overall development of the student's personality, the acquisition of quality knowledge, and the development of divergent and critical thinking include: algorithmic procedures, mathematical logic, decomposition of problems into simpler problems, formal language, calculation and evaluation of values, computer graphics and geometry, and data analysis and processing (Marić 2020). Correlation of mathematics with programming and informatics enables most routine tasks to be automated, so it is possible to solve more complex problems. For example, with the use of a computer, it is possible to solve systems of linear equations with several dozen unknowns and equations, which can be used to build a fairly accurate model of a real-life problem. Problem-oriented teaching insists on the practical applicability of introduced concepts to solve concrete examples. For example, instead of the mechanics of calculating determinants by hand, it becomes much more important that the student can recognize that the determinant is a measure of area (i.e., volumes of the parallelepiped formed by its column vectors) and that the calculation of areas or volumes can then be reduced to the problem of calculating determinants. All of this poses a much greater challenge to students (and teachers) than in the case when only abstract tasks are solved, isolated from the general context of application and specifically prepared only in order to practice some concrete technique. This certainly means that weaker students will have difficulties in such activities. On the other hand, working in a team, peer teaching and the awareness that concrete problems are solved as part of formal education, the meaning of which students immediately understand, can lead to greater student motivation and thus to better results (Marić 2020).

RESEARCH METHODOLOGY

The aim of the research was to examine the views of elementary school teachers about the importance, place and role of modern technology and mathematics in STEAM education. In accordance with the set goal, research tasks were formulated.

– Examine whether and to what extent elementary school teachers apply integrative STEAM teaching;

– Examine whether and in what way elementary school teachers apply modern technology and mathematics in STEAM classes;

– Examine the views of elementary school teachers on the importance of modern technology and mathematics for STEAM education;

– Examine the views of elementary school teachers about the role of modern technology and mathematics in STEAM education;

– Investigate whether and to what extent primary school teachers attend professional development seminars focused on STEAM integrative teaching.

The descriptive method, the survey technique, was used in the research, and an anonymous questionnaire was created in the Google Forms web application as a research instrument.

The questionnaire consisted of three segments. The first part includes general information about the respondents (gender, level of professional education, years of work experience, place of school where they work, subject they teach), the second part of the questionnaire is a five-point Likert-type scale and includes 19 statements, and the third part of the questionnaire consists of 2 open-ended questions. The questionnaire was created by the authors of the paper based on previously studied literature. The value of the Cronbach alpha coefficient is 0.800 which indicates good reliability of the research instrument.

The sample of respondents is random, and the population that participated in the research are primary school teachers on the territory of Serbia. The electronic questionnaire was distributed via social networks and e-mail addresses that are in the database of Serbian teachers' associations. Analyzing the structure of the sample, our data showed that the most respondents work in city schools (99), then in rural schools (38) and the least in suburban schools (23). 119 subject teachers and 41 classroom teachers participated in the research, of whom 120 (75%) were women and 40 (25%) were men. Of the 160 respondents, there is an approximately equal number of those with 1–10 years of service (N = 45), 11–20 years (N = 46) and 21–30 years (N = 44) of service, while the smallest number is those with more than 30 years of service (N = 25).

When it comes to the data related to the subject area that the respondents teach, most of them (25%) teach social sciences (languages, history), all subjects 23.1%, mathematics 21.3%, natural sciences 15.6% (physics, chemistry, biology, geography), 7.5% of respondents teach technical (technique and technology, technical education, informatics) and 7.5% teach art and skills (music culture, art culture, physical education)

RESEARCH RESULTS

The first group of questions refers to the ability of teachers to implement STEAM teaching and the frequency of application of integrative teaching.

The largest share of respondents (57%) often functionally connect the contents of different subjects in teaching practice; 40% do it sometimes, and 3% of respondents rarely or never connect the contents of different subjects in teaching practice (M = 4.50, SD = 0.691). Also, most of the respondents (67%) claim that they connect situations from real life with the contents of science, technology, art and mathematics and use them in classes as examples for learning (M = 4.59, SD = 0.704). 57% of respondents partially agree and 19% of respondents completely agree that they often design and plan research activities that integrate the contents of different subjects (M = 3.74, SD = 1.043).

However, when it comes to the frequency of applying an integrative approach and connecting the content of different subjects according to the STEAM model, the largest number of respondents partially agree (54%) and 25% completely agree. As many as 21 respondents (13%) do not know whether they use an integrative approach in teaching practice and connect the contents of different subjects according to the STEAM model (M = 3.96, SD = 0.846).

Based on the obtained values of Levene's test of equality of variance and corresponding indicators of significance, we can conclude that there are statistically significant differences between classroom teachers and subject teachers when they respond to the items of the scale related to the ability of teachers to implement STEAM teaching and the frequency of application of integrative teaching, i.e. that classroom teachers are more qualified to implement STEAM teaching and apply integrative teaching more often than subject teachers (Tables 1 and 2). The results are in agreement with research from 2014 that showed that integration is easier to achieve in classroom teaching, because the material in classroom teaching is not as strictly differentiated as in subject teaching, which facilitates the application of this modern teaching model. "The implementation of integrative teaching in subject teaching, on the other hand, is hampered by excessive plans and programs. Integration is also made more difficult by the fact that it requires coordination between two or more teachers" (Adamov, Olić, Halaši 2014).

Table 1. Descriptive statistics

	Professional qualification	N	Mean	Std. Deviation	Std. Error Mean
Often in teaching practice, I functionally connect the contents of different subjects.	classroom teachers	41	4.68	0.471	0.074
	subject teachers	119	4.44	0.744	0.068
Very often I connect situations from real life with the contents of science, technology, art and mathematics.	classroom teachers	41	4.76	0.435	0.068
	subject teachers	119	4.53	0.768	0.070
In my teaching practice, I often use an integrative approach and connect the contents of different subjects based on the STEAM model.	classroom teachers	41	4 22	0.525	0.082
	subject teachers	119	3.87	0.916	0.084
I often design and plan research activities that integrate the contents of different subjects.	classroom teachers	41	4.05	0.773	0.121
	subject teachers	119	3.63	1.104	0.101
I often conduct research activities in classes that integrate the contents of different subjects.	classroom teachers	41	4.07	0.721	0.113
	subject teachers	119	3.47	1.241	0.114

Table 2. Independent Samples Test

		Levene's Test		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence	
									Lower	Upper
IT1	EVA	5.300	0.023	1.982	158	0.049	0.246	0.124	0.001	0.491
	EVNA			2.452	110.559	0.016	0.246	0.100	0.047	0.445
IT2	EVA	9.076	0.003	1.791	158	0.075	0.227	0.127	-0.023	0.477
	EVNA			2.317	123.793	0.022	0.227	0.098	0.033	0.420
IT3	EVA	6.406	0.012	2.286	158	0.024	0.346	0.151	0.047	0.644
	EVNA			2.944	122.366	0.004	0.346	0.117	0.113	0.578
IT4	EVA	11.605	0.001	2.244	158	0.026	0.419	0.187	0.050	0.787
	EVNA			2.657	99.309	0.009	0.419	0.158	0.106	0.731
IT5	EVA	32.447	0.000	2.940	158	0.004	0.603	0.205	0.198	1.007
	EVNA			3.766	120.714	0.000	0.603	0.160	0.286	0 919

EVA – Equal variances assumed; EVNA – Equal variances not assumed

In the continuation of the questionnaire, we examined whether and in what way elementary school teachers apply modern technology and mathematics in STEAM classes. A small number of respondents (about 5%) declared that they

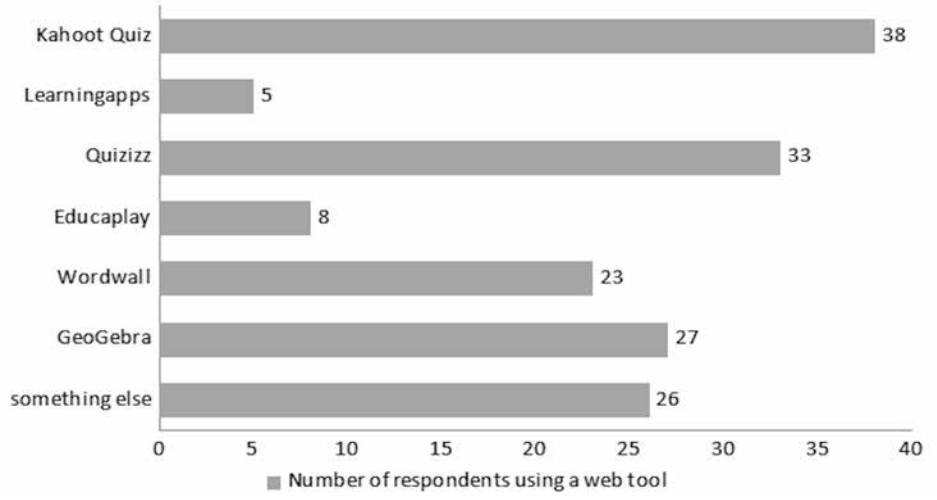
do not use modern technology to prepare the materials they use in integrative teaching classes. 150 respondents agree that they use modern technology during integrative teaching.

Table 3. Descriptive statistics

	N	Mean	Std. Deviation
I use modern technology to prepare the materials I use in STEAM classes.	160	4.33	0.716
During STEAM lessons, I often use modern technology.	160	4.29	0.756
During STEAM classes, I often use math content.	160	4.31	0.736
Valid N (listwise)	160		

Almost all teachers who use modern technology for preparing materials (95%) also use modern technology during integrative teaching (94%), which can be seen in the following graphic. Graphic 1 presents the web tools that teachers most often use during integrative teaching.

Graphic 1. The web tools that teachers most often use during integrative teaching.



Respondents who answered "something else" to the previous question had the opportunity to write down which web tool they use during integrative teaching. Among the answers the following appeared most often: *Google Questionnaire* (3 times), *Phet Colorado*, *Genialy*, *TinkerCad* once each, *MakeCode*, *Pintar Virtualab*, *Circuit Virtualab*, *e-classroom*, *Prezi*, *Jigsaw puzzle*, and *Settera*. Four respondents answered that they do not use any web tool.

Of the web tools, mathematicians most often use the *GeoGebra* tool (27); social science teachers most often use the tools that can be used to create quizzes, such as *Kahoot* (38) and *Quizizz* (33); language, arts and literature teachers most often use *Wordwall* (23), while other teachers use the offered web tools with equal frequency.

Of modern devices used during integrative classes in elementary school, smartphones are most often used (61.9%), followed by tablet computers (17.5%) and microbit computers (11.3%).

In most European countries, students and teachers use smartphones as powerful assistants. With high-speed Internet access, knowledge is at one's fingertips. Smartphones have a variety of technological capacities and laboratory applications that even the best-equipped European schools can only dream of. Using smartphones, we can determine geographic position (GPS coordinates), latitude, longitude, altitude, pressure, acceleration, angle of rotation, magnetic fields, and voltage. Also, smartphones contain high-resolution cameras with which we can record a process and manipulate it by speeding up or slowing down playback, enlarging the image, and the like. There are thousands of applications for using the data provided by smartphones, so their application in teaching is considered modern and necessary (Andrade, Richter, Gutschank 2014).

The next part of the results refers to the examination of teachers' views on the importance of modern technology and mathematics for STEAM education.

Regarding the statement that "software tools and applications contribute to the visualization of concepts", almost all respondents completely agree (52.5%) or partially agree (43.1%), which totals to 95.6% of the sample (M = 4.44, SD = 0.707). A large number of respondents fully agree (38%) or partially agree (52%) that modern educational technologies and differentiated mathematical contents contribute to the individualization of the teaching process (M = 4.23, SD = 0.801). The result obtained coincides with the result of research conducted in 2010 in Canada that found that educational software designed so that students can use it independently provides an opportunity for teachers to interact 'one-on-one' with those students who need help the most (Means 2010). 42% fully agree and 46% partially agree, which is 88% of respondents (M = 4.23, SD = 0.876), that modern educational technology includes a greater number of receptors in the learning process and thus contributes to a more complete and efficient understanding. Mathematical contents within STEAM classes develop logical thinking and functional knowledge (40% fully agree and 45% partially agree, which is 85% of respondents (M = 4.12, SD = 0.756)). 49% completely agree and 38% partially agree (M = 4.26, SD = 0.953) that students are more motivated to work during teaching activities that integrate the contents of different subjects with the application of modern technology and mathematics. The largest number of respondents (48%) do not agree at all and 28% of respondents partially disagree that the lesson in which the contents of different subjects are integrated is a wasted lesson, because it is im-

possible to assess the students' knowledge of individual subjects (M = 1.99, SD = 1.231). We can conclude that teachers have positive attitudes about the importance of modern technology for STEAM education.

Based on the obtained values of Levene's tests of equality of variance and corresponding indicators of significance, we can conclude that there are no statistically significant differences between classroom teachers and subject teachers, male and female respondents, teachers working in city, suburban and rural schools, and teachers with differing years of service when they respond to scale items related to the importance of modern technology for STEAM education.

The results of our research are in agreement with the results of previous research that has shown learning using modern technology is more effective than the average lecture, because the concentration of students is maintained at a high level. The aim of the research conducted by Mladenović in 2009 was to teach the same content in two different ways and to compare the achieved results after completing the test. The first group had 54 members and dealt with the material in a traditional way through lectures. The second group also had 54 members and processed the same teaching content through a multimedia course on their computer. The lecture lasted 3 hours in both cases. Of the 54 members who followed the traditional lectures, 31 were unable to reproduce even 20% of the material covered, 15 managed to reproduce 35%, and only 8 managed to reproduce more than 35% of the material covered. In the other group, out of 54 members who worked on the assigned material through multimedia courses, only 11 failed to reproduce at least 20% of the material covered, 6 managed to reproduce 35%, while as many as 37 members managed to reproduce more than 35% of the material covered (Mladenović 2009). In addition, the results coincide with the results of research on the possibilities of improving educational activities at universities by applying an integrative approach within multimedia programmed teaching. The majority of participants recognize multimedia programmed teaching and teaching based on content integration as ways to create practically applicable knowledge and understanding of material more easily. Also, these methods enable them to individualize teaching, i.e. to determine the pace of progress, the source of knowledge and learning according to their own interests (Cekić-Jovanović, Đorđević, Miletić 2018).

Based on the obtained results, we can conclude that primary school teachers have positive attitudes about the importance of modern technology and mathematical content for STEAM education, because modern technology and mathematics contribute to more complete and efficient understanding, visualization of concepts, individualization of the teaching process, student motivation for work and development of logical thinking. These results are similar to those obtained in research by Wei and Matt (2020). By further analyzing the results, we conclude that the largest number of respondents (57%) partially agree and 22% of respondents fully agree that they have acquired basic knowledge and skills for applying an integrative approach to working with students (M = 3.88, SD = 0.921). Also,

the majority of respondents (64%) believe that the application of an integrative STEAM approach requires teachers to have constant professional development (M = 4.55, SD = 0.716). However, the majority of respondents (45.6%) did not attend a single professional development seminar on the application of the STEAM model, which may be a consequence of the small number of seminars related to STEAM education in the catalog of professional development programs (http://zuov-katalog.rs/ index.php?action=page/catalog). On the other hand, during the COVID-19 pandemic, there was an expansion of webinars, so one can find various webinars related to STEAM education. In Serbia, such webinars were organized by the STEM Chamber and the Institute for Modern Education.

CONCLUSION

Based on the previously presented results, we can conclude that primary school teachers have seen the importance of connecting related content of different subjects for the overall development of students' personalities and the acquisition of quality knowledge. Also, they often apply integrative STEAM teaching.

It is widely believed that the primary driver of the economy and the creator of new jobs in the future will be innovations resulting from advances in science and engineering. Technology is already replacing workers in some workplaces. Mathematics should be known in order to do science, and science is needed to develop technology. Technology is needed for production – and for that we need engineers. Design should not be neglected either, because products should not only be functional but enjoyable to use too. Therefore, as a result, an increasing number of jobs are likely to require knowledge of STEAM. Establishing the integration of the content of different subjects based on the STEAM model can contribute to better quality learning, functional knowledge applicable in everyday life, development of creative thinking, application of art in solving problems and motivation for work. The research results confirm that elementary school teachers have positive attitudes towards and often apply modern technology and mathematics in STEAM classes for the preparation of materials, research activities and individualization of the teaching process.

One of the main tasks of education in the 21st century is to constantly renew and adapt the skills of lecturers in order to apply new technologies adequately and on a larger scale, because what they themselves do not know, they cannot continue to teach. This means that the scope of their work will increase, but the more dedicated they are to producing quality content and lessons, the better their teaching will be. The adaptation of educational units to new forms of learning must not be neglected either. Education must provide the foundations on which it can later be quickly upgraded, that is, it must learn how to self-upgrade and self-adapt to new technological requirements and to be able to deal with changes. The results of the

research show that elementary school teachers attend, to a lesser extent, professional development seminars oriented to the application of modern technology in STEAM integrative teaching; there is an opportunity to improve this important segment of education.

Therefore, we can conclude that the majority of elementary school teachers have seen the important role of modern educational technology and mathematics in STEAM education and have positive attitudes regarding that teaching model.

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ЗНАЧАЈ, МЕСТО И УЛОГА САВРЕМЕНЕ ТЕХНОЛОГИЈЕ И МАТЕМАТИКЕ У STEAM ОБРАЗОВАЊУ

Резиме: Природна повезаност између математике, природних и техничких наука треба да буде присутна и видљива кроз веома интензивне корелације између одговарајућих школских предмета. У многим образовним системима препозната је област STEAM која подразумева холистички приступ и интеграцију природних наука (биологије, хемије, физике, физичке географије), техничких и инжењерских наука (електротехнике, машинства, грађевине, хардверског и софтверског инжењерства), уметности и математике. Циљ рада је испитати ставове наставника у основној школи (N = 160) о значају, месту и улози савремене технологије и математике у STEAM образовању. У студији су размотрена основна теоријска полазишта, могућности и изазови примене савремене технологије и математике у интегративној STEAM настави. Такође, испитани су ставови наставника применом истраживачке технике анкетирања, а као инструмент истраживања креиран је анонимни упитник у веб-апликацији *Гугл Формс* као петостепена скала Ликертовог типа. Резултати истраживања потврђују позитивне ставове наставника о значају савремене технологије и математике у STEAM образовању. Такође, резултати истраживања потврђују да наставници основних школа имају позитивне ставове и често примењују савремену технологију и математику у STEAM настави и то за припрему материјала, истраживачке активности и индивидуализацију наставног процеса. Међутим, они у мањој мери похађају семинаре стручног усавршавања оријентисане на примену савремене технологије у STEAM интегративној настави и постоји могућност да се овај важан сегмент образовања унапреди.

Кључне речи: STEAM образовање, интегративни приступ, ставови наставника, образовна технологија, математика, Србија.