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APPLICATION OF EXPERIMENT IN THE REALIZATION OF GEOGRAPHICAL CONTENTS IN THE FIRST CYCLE OF COMPULSORY EDUCATION FROM A TEACHER'S PERSPECTIVE

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Abstract: School experiments enable students to gain knowledge through direct practical activities. The aim of the research study was to obtain information on the scope of application of models, experiments and research, as methodical solutions, when processing geographical content in the teaching of social, environmental and scientific education. An empirical study was conducted to analyze the experiences of 117 teachers, in the first cycle of compulsory education in the Republic of Serbia, about the application of this work method.

The results of the research indicate that teachers occasionally realize geographical content, in the teaching of social, environmental and scientific education, through experiments, even though the resources needed for their implementation are accessible to all students. Experiments can be applied to explain the essence of physical geographical phenomena and processes, however, their use in teaching involves the training of teachers to use them, which, unfortunately, was mostly cited by teachers as a reason for occasional application. Greater attention should be given to training future teachers to apply the experiments in order to use this method more often when working with students, where they would work as a team, be active, creative, think critically, identify and explain phenomena and processes and relate to examples from everyday life.

Key words: experiment, geographical contents, teaching Social, Environmental and Scientific Education, research.

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INTRODUCTION

In the first cycle of primary education in Serbia, geographical contents are realized in teaching compulsory subjects The World Around Us and Social, Environmental and Scientific Education. The question that is frequently asked is how to bring closer geographical phenomena and processes that are abstract to the pupils of younger school age? What is wind and how to determine its speed, why do day and night alternate, as well as many other questions to which pupils find answers in traditional explanations given in textbooks through learning concepts that need to be remembered, or by means of modern technology, using 3D models and animations (Koehler et al., 2013; Džigurski – Ivkov et al., 2009) which provide wide range of possible explanations of geographical concepts, however, their application in teaching considers teacher training for its use and technically equipped schools, which are, unfortunately, very common deficiencies. That is why, school experiments, that are relatively neglected part of teaching geography in our schools, can be applied for the explanation of physical – geographical phenomena and processes (De Zan, 2005; Cvjetićanin et al., 2010). While realizing geographical contents in the teaching of social, environmental and scientific education through experiments and research work, there is no need for any special nor expensive equipment (most frequently used items for school experiments are: balloon, plasticine, funnel, plastic bottle, paper, etc.), but what is necessary is teacher's knowledge (which is gained through schooling and professional development) for the application of this methodical solution.

School experiments enable the acquisition of pupils' knowledge through direct practical activities, and are often used in teaching physics (Dojčilović and Ivković, 2008) and chemistry, whilst in teaching geography are not. The most frequent are visits to science festivals, school meteorological observations, demonstrations in working with a compass (Tadić, 2011), and the least common are experiments in the true sense of the word (Andrews and Knighton 2008; Buza and Bigaci, 2009; Vanderlinden and Suzuki, 2009; Mate et al. ., 2008; Pikulik, 2017; Rabiza, 1988; Robson, 2006; Tota, 2014). "Starting from the first grade of primary school, as part of the teaching of social, environmental and scientific education, pupils should, step by step, be introduced to the scientific method. It is a teacher's task to gradually get pupils to think like scientists. They should have such an approach (the thinking process) not only within school and learning, but also to adopt it as a way of solving problems in everyday life: spot the problem - formulate questions - set hypothesis (es) - collect additional data and information - test the hypothesis - discuss the results - draw a conclusion and predict the

development of the phenomenon (Džinović and Tadić, 2020: 20)." Geographical concepts through school experiments are not abstract, easily forgotten, but pupils learn and work in a team, are active, creative, think critically, notice and explain phenomena and processes, and then connect them with examples from everyday life (Vilotijević and Vilotijević, 2010; Živković et al., 2015). Pupils need to understand why it is necessary to learn geography and that it is the basis of many phenomena and processes that they encounter every day. Geographical knowledge would help them to get to know the nature and discover the laws that rule it (Fundamentals of Natural Sciences - School Set, 2007; Matanović, 2006).

RESEARCH METHODOLOGY

The aim of the research was to obtain information about the scope of application of experiments and research study, as methodical solutions, when processing geographical contents in the teaching of social, environmental and scientific education.

Research tasks were related to determining teachers' opinion on how often, in the teaching of social, environmental and scientific education, geographical contents are realized through experiments and research work; then, whether the curricula of subjects The World Around Us and Social, Environmental and Scientific Education, sufficiently provide instructions for the realization of geographical contents through experiments and research work; from which publishers, teachers use textbooks for the subjects The World Around Us and Social, Environmental and Scientific Education, whether the textbooks include geographical contents that are suitable for the realization through experiments and research work and whether the teachers have acquired sufficient knowledge through schooling and professional development about the application of experiments and research work in the processing of geographical contents.

It is assumed that geographical contents are not often realized through experiments and research work, and that their application in teaching, according to teachers' opinion, means training for its use, which was, unfortunately, mostly stated as a reason for its occasional use.

A descriptive method was applied as a general method, which type was a descriptive survey that provided insight into the scope of application of models, experiments and research work, as methodical solutions, when processing geographical contents in the teaching of social, environmental and scientific education. Since it was considered to examine the causal – consequential connection between the examined phenomena, it is also a causal survey.

Of the nonparametric methods, a correlation using the Spearman coefficient and the χ^2 test were used to determine whether there were statistically significant differences between the variables. The correlation between the variables, cross-tabulation (contingency coefficient – C) was used as well (Todorović, 1998). When the statistical tests for the analysis of differences (χ^2 test) and relations (contingency coefficient) showed that there was a statistically significant difference, that is, connection between the variables, the direction of those relations was determined. The research results are presented in tables and graphs. The data were statistically processed in the SPSS 21.0 program.

The research sample consisted of 117 teachers. Based on the survey questionnaire, data were obtained on the gender of teachers: male 16.2 % (f = 19) and female 83.8 % (f = 98), as well as on educational background: 19,7 % (f = 23) tertiary education, 61,5 % (f = 72) higher education, 18,8 % (f = 22) master's degree, magister degree or PhD. Such high percentage of 80.3% (f = 94) teachers with higher education and master's degree is a consequence of the teachers', with a degree from the Pedagogical Academy, additional education at the Faculty of Teacher Education. In order to determine the relevance of work experience for the answers they had given, we classified teachers according to their experience in teaching profession into four categories: a) 0 - 9 years = 16.2% (f = 19); b) 10 - 19 years = 14.5% (f = 17); c) 20 - 29 years = 56.4% (f = 66); d) 30 and more years = 12.8% (f = 15). Considering the type of settlement in which the school where teachers work is located, the data show that 35.0% (f = 41) of teachers work in cities, while 65.0% (f = 76) work in schools in other settlements.

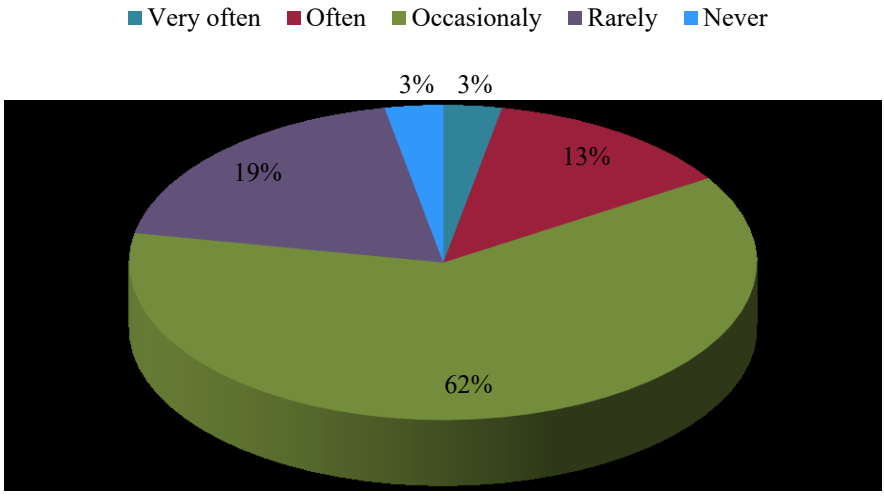
For the purposes of this research, a questionnaire was constructed as a special instrument for empirical research that serves to assess the situation related to the scope of application of geographical contents in the teaching of social, environmental and scientific education through experiments and research work, so that possible improvements could be implemented in teaching.

RESEARCH RESULTS AND DISCUSSION

In the research part of the paper, we wanted to determine *how often geographical contents are realized through experiments and research in the teaching of social, environmental and scientific education.*

Graph 1 shows that 62.4% (f = 73) of teachers occasionally, in the teaching of social, environmental and scientific education, realize geographical contents through experiments and research work, 15.4% (f = 18) of teachers

very often and often, while 22.2 % (f = 26) of teachers rarely or never realize geographical contents with this work method. The chi-square shows that the difference in the frequency of responses is statistically significant ($\chi 2 = 142.1$; df = 4; p = 0.00), based on which we can say that most teachers occasionally use experiments and research in the realization of geographical contents.



Graph 1. How often are geographical contents realized through experiments and research work in teaching Social, Environmental and Scientific Education?

Based on the contingency coefficient calculated from the classification shown in Table 1, whose value is 0.39, at the level of statistical significance of 0.00, the results show that there is a connection between teachers' educational background and the frequency of using experiments and research in the implementation of geographical contents, which means that the teachers with a tertiary education more often use experiments and research work in the realization of geographical contents than the teachers with higher education.

Table 1. Connection between educational background and teachers' evaluation of how often geographical contents are realized through experiments and research work in the teaching of social, environmental and scientific education

		How often is geography-related content taught through experiments and research work in social, environmental and scientific education?					
		Very often	Often	Occasionally	Rarely	Never	Total
Educational background	Tertiary education	1	8	14	0	0	23
	Higher Education	1	7	45	17	2	72
	Master's degree, Magistrate and PhD	1	0	14	5	2	22
	Total	3	15	73	22	4	117

Based on the contingency coefficient calculated from the classification shown in Table 2, whose value is 0.54, at the level of statistical significance of 0.00, the results show that there is a connection between work experience in the teaching profession and the frequency of using experiments and research in the implementation of geographical contents, which means that the teachers with work experience from 20 - 29 years more often use experiments and research in the realization of geographical contents than the teachers with experience from 0-19 years.

Table 2. Connection between work experience and teachers' evaluation of how often geographical contents are realized through experiments and research work in the teaching of social, environmental and scientific education

		How often are geographical contents realized through experiments and research in the teaching of social, environmental and scientific education?					
		Very often	Often	Occasionally	Rarely	Never	Total
Work experience	0 – 9 years	0	0	10	6	3	19
	10 – 19 years	0	1	11	4	1	17
	20 – 29 years	0	11	46	9	0	66
	30 and more	3	3	6	3	0	15
	Total	3	15	73	22	4	117

There is no connection between the genders, as well as between the type of settlement in which schools where teachers work are located and opinions of teachers on the use of experiments and research work in the realization of geographical contents.

One of the tasks was to determine *why teachers rarely or never use experiments and research work in the realization of geographical contents in the teaching of social, environmental and scientific education*. Respondents were asked an open-ended question, however, the answers were similar and could be classified into one category (f = 26):

- Geographical contents are not realized through experiments and research work due to the lack of teaching aids in schools, all teachers say, that is, 100% of them.

Teachers who rarely or never use experiments and research work in the realization of geographical contents in the teaching of social, environmental and scientific education, do not state any reason that indicates lack of teachers' motivation or any other reason than the above.

We wanted to determine through empirical research *whether the curricula of the subjects The World Around Us and Social, Environmental and Scientific Education, give instructions for the realization of geographical contents through experiments and research work to a sufficient extent.*

The chi-square indicates that the difference in the frequency of responses is statistically significant ($\chi 2 = 73.21$; df = 4; p = 0.00), where 43.6% of teachers (f = 51) think that the programs largely give instructions for realization of geographical contents through experiments and research, only 5.1% of them (f = 6) think that they fully give instructions, while 31.6% (f = 37) cannot decide whether the programs give sufficient instructions or not. One fifth, i.e. 19.6% (f = 23), think that the programs do not give or do not give enough instructions for the realization of geographical content through experiments and research work.

The correlation between the educational background and the teachers' evaluation whether the curricula of the subjects The World Around Us and Social, Environmental and Scientific Education, give instructions to a sufficient extent for the realization of geographical contents through experiments and research (Table 3) is significant (C = 0.25), at the level of statistical significance p = 0.01, which means that the teachers with higher education more often state that programs give instructions to a greater extent than the teachers with tertiary education.

Table 3. Correlation of educational background and teachers' evaluation of whether the curricula sufficiently give instructions for the realization of geographical contents through experiments and research

		Educational background
Teachers' evaluation of whether the curricula of the subjects The World Around Us and Social, Environmental and Scientific Education, give instructions to a sufficient extent for the realization of geographical contents through experiments and research work	correlation coefficient	0,25
	p	0,01

Textbooks for the subjects The World Around Us and Social, Environmental and Scientific Education are consisted of contents from Natural Sciences and Social Sciences and the Humanities among which are the geographical contents that we are considering in this analysis. We asked *which publishers do teachers use textbooks from, for the subjects The World Around Us and Social, Environmental and Scientific Education.* Table 4 shows the classification of textbooks use by publishers.

The chi-square test showed that there is a statistically significant difference in terms of the frequency of use of textbooks from the stated publishers ($\chi 2 = 104.79$; df = 5; p = 0.00), which means that the textbooks of Klett, Creative Center and Logos are used more often than others.

Table 4. Textbooks (classification by publishers)

Textbooks for the subjects The World Around Us and Social, Environmental and Scientific Education used by teachers:	Frequency	Percentage
➢ Logos	43	36,8
➢ Creative Center	18	15,4
➢ Klett	46	39,3
➢ Other	10	8,5
➢ Total	117	100

From the above mentioned, the task arose to determine *whether the textbooks contain geographical contents that are suitable for realization through experiments and research.*

The chi-square indicates that the difference in the frequency of responses is statistically significant ($\chi 2 = 107.06$; df = 4; p = 0.00), where 53.0% of

teachers (f = 62) think that textbooks largely contain geographical contents which are suitable for realization through experiments and research work, only 6.0% (f = 7) of them consider to contain them in full, while 29.9% (f = 35) cannot decide whether the textbooks contain enough geographical content or not. 11.1% (f = 13) of teachers think that textbooks do not contain at all or contain to a small extent geographical contents that are suitable for realization through experiments and research work.

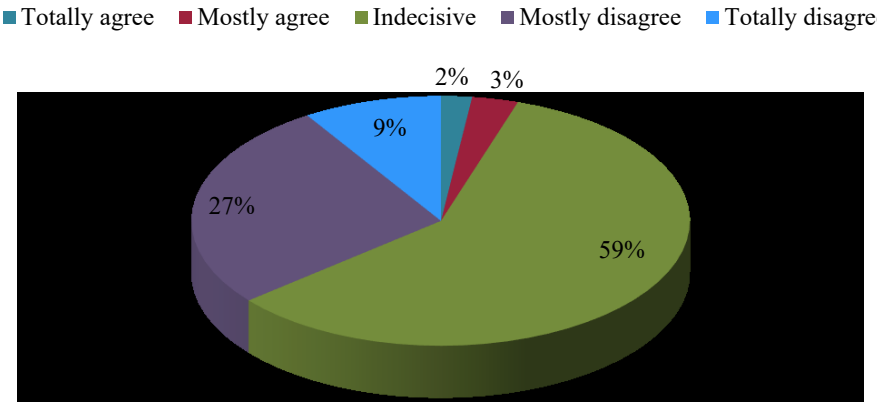
Based on the contingency coefficient calculated from the classification shown in Table 5, whose value is 0.77, at the level of statistical significance of p = 0.00, it can be said that there is a connection between teachers' evaluation of to what extent do the programs in the teaching of social, environmental and scientific education give sufficient instructions for work and evaluation of to what extent textbooks contain geographical contents that are suitable for implementation through experiments and research work. To a large extent, for 33.33% (f = 39) of teachers, programs in the teaching of social, environmental and scientific education, sufficiently provide instructions for experiments and research work, and textbooks contain geographical contents that are suitable for realization through experiments and research work, while 18.80% (f =) of teachers are indecisive.

Table 5. Connection between teachers' evaluation of to what extent do the programs in the teaching of social, environmental and scientific education give sufficient instructions for work and evaluation of to what extent textbooks contain geographical contents that are suitable for implementation through experiments and research work

		Textbooks contain geographical contents that are suitable for realization through experiments and research work					
		Yes, completely	Yes, to a large extent	I'm indecisive	Yes, to a small extent	Not at all	Total
Teachers' evaluation of to what extent do the programs in the teaching of social, environmental and scientific education give sufficient instructions for experiments and research work	Yes, completely	2	4	0	0	0	6
	Yes, to a large extent	5	39	7	0	0	51
	I'm indecisive	0	10	22	5	0	37
	Yes, to a small extent	0	9	6	6	0	21
	Not at all	0	0	0	0	2	2
	Total	7	62	35	11	2	117

In the research part of the paper, we wanted to determine *whether teachers acquired sufficient knowledge about the application of experiments and research work in the processing of geographical contents during schooling and professional development.*

Graph 2 shows that 5.1% (f = 6) of teachers are of the opinion that during schooling and professional development they acquired sufficient knowledge about the application of experiments and research work in the implementation of geographical content, 59.0% (f = 69) are indecisive and 35.9% (f = 42) disagree (mostly or totally). The chi-square shows that the difference in the frequency of responses is statistically significant ($\chi 2 = 133.56$; df = 4; p = 0.00), based on which we can say that most teachers are indecisive or think that they did not acquire sufficient knowledge about the application of experiments and research work in the processing of geographical contents during schooling and professional development.



Graph 2. Have the teachers acquired sufficient knowledge about the application of experiments and research work in the realization of geographical contents?

Based on the contingency coefficient (C = 0.62; p = 0.00) (the classification is shown in Table 6), we can say that there is a positive connection between teachers' evaluation of how often, in the teaching of social, environmental and scientific education, geographical contents are realized by means of experiments and research work and their evaluation of whether they have acquired sufficient knowledge about the application of experiments and research work in processing geographical contents during their schooling and professional development.

Teachers, 70 of them who occasionally, in the teaching of social, environmental and scientific education, realize geographical contents through experiments and research work, more often state that they are indecisive (f = 54) and mostly do not agree (f = 16) in evaluation of whether they have acquired sufficient knowledge during their schooling and professional development about the application of experiments and research work in processing geographical contents, than the teachers who often use this methodical solution (f = 10), while stating that they are indecisive about whether they have acquired sufficient knowledge during their schooling and professional development about the application of experiments and research work in processing geographical contents.

Table 6. Connection between teachers' evaluation of how often, in the teaching of social, environmental and scientific education, geographical contents are realized through experiments and research work and their evaluation of whether they have acquired sufficient knowledge about the application of experiments and research work in processing geographical contents during schooling and professional development

		During schooling and professional development I have acquired sufficient knowledge about the application of experiments and research work in processing geographical contents					
		Totally agree	Mostly agree	Indecisive	Mostly disagree	Totally disagree	Total
How often are geographical contents realized through experiments and research work in the teaching of social, environmental and scientific education?	Very often	0	1	2	0	0	3
	Often	1	3	10	1	0	15
	Occasionally	1	0	54	16	2	73
	Rarely	0	0	2	13	7	22
	Never	0	0	1	1	2	4
	Total	2	4	69	31	11	117

CONCLUSION

In achieving the aim of the research, to gain relevant knowledge about the scope of application of experiments and research work in the implementation of geographical contents in the teaching of social, environmental and scientific education, the first task was to determine how often they are used,

where most teachers declared occasional use. Teachers who rarely or never use experiments and research work were asked to give reasons for it. All of them stated that the reason is the lack of teaching aids in schools (they do not mention any other reasons) and beside the fact that no special funds are needed for the realization of experiments (Farndon et al., 2000): (most common items used for school experiments are: sand, plasticine, balloon, plastic cups and bottles, paint for cakes, etc.), but what is necessary is teacher's knowledge for the application of this methodical solution.

Based on the contingency coefficient, it was calculated that there is a connection between teachers' evaluation of to what extent programs in the teaching of social, environmental and scientific education, sufficiently provide instructions for experiments and research work and evaluation of to what extent textbooks contain geographical content suitable for their implementation. For one third of teachers, the programs also provide sufficient instructions and textbooks contain geographical contents that are suitable for realization through experiments and research work.

In the research part of the paper, we wanted to determine whether teachers have acquired sufficient knowledge about the application of experiments and research work in the processing of geographical contents during schooling and professional development, whereby most teachers were hesitant or thinking that they did not acquire sufficient knowledge during schooling and professional development. The analysis of the data leads us to the conclusion, whereby the general hypothesis of the research was confirmed, that geographical contents are not realized by means of experiments and research work often, emphasizing that during schooling and professional development they did not acquire enough knowledge for their application.

Based on the research, we can conclude that it is necessary to shed light on this segment in the methodical education of teachers during their studies at teachers' and pedagogical faculties, and then through professional development programs for teachers who already work in practice, to improve geographical knowledge.

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