

Teaching and Learning Methods and Practices in Science and Social Studies Lessons

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Abstract

This paper discusses the frequency of application of methods and practices in teaching Science and Social Studies. Considering the fact that this subject comprises heterogeneous content that draws upon the knowledge of many natural and social sciences, it is possible to apply an expansive range of methods and practices of teaching and learning during the teaching process. Empirical research which has been conducted has shown that the dominant teaching methods are dialogue, work with textbooks, teachers' lectures and demonstration of pictures and objects, while computer-aided learning, project method and working with professional papers are very rarely applied. Despite the characteristics and potential of the subject, methods/practices that encourage research and experiential learning are underrepresented in the classrooms. Some differences have also been detected in applying certain methods and practices, depending on whether they are used in teaching the subject content of Natural Sciences, Geography or History, and depending on the teachers' years of service.

Key words: *methods and practices of teaching; Science and Social Studies; subject content of Geography; subject content of History; subject content of Natural Sciences*

Introduction

Science and Social Studies is an integrative subject in Croatian education system in which students at the beginning of their education (1st to 4th grade) learn about things and phenomena in their immediate environment. The teaching of this subject comprises the interweaving of diverse subject content of the following subjects:

Natural Sciences, Geography, History, Sociology, Technical Culture, Economics and Culture, as well as the content of special educational areas (education for environment and sustainable development, education for democratic citizenship, transportation and health education). Basically, the aim of this course is to help students form a complete picture of the world that surrounds them, but also to prepare them for the systematic study of natural sciences, geography, history and other types of subject content at the secondary level of education. In most European countries, there is a related subject that is in some countries taught only during the first two years of primary school, while elsewhere it is taught throughout the whole primary education and primary school (Blaseio, 2006, according to Michalik & Murmann, 2007). In Germany and Austria it is known as *Science* [Sachunterricht], in the United States as *Social Studies/Science*, in Australia as *Studies of Society and Environment*, in Slovenia, our neighbouring country, as *Environmental Studies*, etc.

In teaching and learning extremely heterogeneous subject content of Science and Social Studies, it is possible to apply an expansive range of teaching methods and practices that are difficult to systematize. The choice of teaching methods depends largely on the specific educational content (Dolenec, 2000), as well as on the learning objectives (Götz, Lohrmann, Ganser & Haag, 2005) and other factors, such as individual abilities and interests of students. In the recent local and international methodological literature the teaching methods and practices have been given special attention, but when it comes to their understanding, defining and naming, a complete agreement has not been achieved yet. First of all, there are different terms in literature that make it difficult to communicate, so within teaching methods, authors also discuss the terms such as methods in the class, methods of teaching and learning, organizational types of the teaching and learning processes (Hempel & Lüpkes, 2011), large methodological forms (Meyer, 1996) and so on. Since teaching is a requirement for the learning process (Terhart, 1989) and since there has been a significant paradigm shift from teaching towards learning throughout the last decade, here we are talking about the methods and practices of teaching and learning.

The consequence of the vagueness of the terminology is that what one author considers to be the practice of teaching, some other author considers to be a method of teaching, while the third one considers it a form or strategy of teaching (Bežen, Jelavić, Kujundžić & Pletenac, 1991). Thus, the teaching methods sometimes include basic structures for longer time units (project method, case study...), while in other cases they imply the parts (elements) of the lesson (Wiechmann, 2010). Within teaching methods the same author indicates patterns of planning and acting related to forming longer sequences (at least to plan one lesson or a double lesson), meaning that every teaching method includes several teaching elements, such as the teacher's lecture or students' presentations, conversation circles or demonstrations. Jelavić (2000) equates teaching methods with educational strategies, emphasizing that each teaching method

(for example, research) uses different teaching practices in its own way - case studies, drawing, demonstration, writing, workshops, etc. In doing so, he criticizes traditional didactics in which the teaching methods are determined by external characteristics of a class (conversation, demonstration, oral presentation, drawing...). It can be concluded that teaching practice is a less-encompassing concept, an element of a teaching method (Bežen, 2008). In the earlier body of methodological literature related to the subject of teaching Science and Social Studies in Croatia (Bezić, 1998; De Zan, 2005), when determining the teaching methods, the most common approach was the traditional approach.

The *National Curriculum Framework* (2010) suggests selecting and applying those teaching forms and methods that will encourage the development of all areas of the student's personality, while at the same time enabling active, independent learning and application of knowledge in practice (Ministry of Science, Education and Sports, 2010). The traditional and emerging paradigms are discussed by Stoll and Fink (2000), who emphasize the application of different teaching and learning strategies aimed at engaging various types of intelligence.

The Objective and Hypotheses

The objective of the research was to assess the frequency of application of various methods and practices of teaching Science and Social Studies, particularly with respect to the content of teaching and teachers' years of service. Since students in classes of Science and Social Studies should be introduced to complexity, as well as numerous and interconnected factors which are present in the natural and social environment (Ministry of Science, Education and Sports, 2006), it is clear that it is an extremely complex subject which draws on the knowledge of many natural and social sciences. Taking into consideration the fact that Science and Social Studies as a subject covers mainly *natural sciences*, *geographical* and *historical* topics (including chronometry and introducing students to chronology), this paper attempts to analyze potential differences in applying methods and practices in teaching them.

According to the objective of the research, the following hypotheses have been formed:

H-1 In teaching Science and Social Studies, the dominant methods and practices are the traditional ones, inherent to lessons in which verbal aspects and lectures prevail.

H-2 In teaching Science and Social Studies there is a statistically significant difference in the frequency of applying certain methods and practices in teaching with regard to the content of teaching – subject content of Natural Sciences, Geography and History.

H-3 In teaching Science and Social Studies, there is a statistically significant difference in the frequency of application of certain methods and practices of teaching with regard to the teachers' years of service.

Research Methods

Sample

The research was conducted in December, 2013 in 18 primary schools in the continental counties in Croatia (Sisak-Moslavina, Karlovac, Brod-Posavina, Požega-Slavonia, Zagreb County and the City of Zagreb). The study included 176 teachers who teach from the first to fourth grade, of whom 171 (97.2%) were females and 5 (2.8%) males. Out of all respondents, 91 (51.7%) had more than 20 years of work experience.

Instrument

The research included forming and applying a Likert questionnaire (1-4 scale) that consisted of four parts. The first part collected general information about gender and age of the respondents, while the second, third and fourth parts contained the respondents' answers about the frequency of applying certain methods and practices when teaching topics and subject content of Natural Sciences, Geography and History. Given the vagueness of the existing terminology and attitudes of domestic and foreign authors in terms of understanding and appointing teaching methods and practices (Bežen et al., 1991; De Zan, 2005; Hage, Bischoff, Dichanz, Eubel, Oehlschläger & Schwittmann, 1985; Mattes, 2007; Terhart, 1989; Wiechmann, 2010), for the purposes of this research, there were 15 allocated teaching methods and/or practices and their application frequency was to be examined from the aspect of teaching Science and Social Studies. The respondents were offered the following methods/practices: *conversation, debate, teacher's lecture, student presentations, demonstrating phenomena in reality, demonstrating pictures and objects, demonstrating movies, working with a geographic map, using experiments, practical work done by students, working with textbooks, working with professional papers, project method, games and computer-aided learning.*

Data Processing

The data obtained by questionnaire was analysed using the statistical package SPSS (*Statistical Package for Social Sciences*). A descriptive statistics measure was the arithmetic mean. The normality of the distribution was tested with the Kolmogorov-Smirnov test which has shown that the results are not normally distributed. Therefore, nonparametric statistics, the Friedman test for dependent samples and the Mann-Whitney test for independent samples (rank sum test) were used to determine statistically significant differences. The level of statistical significance was set at $p < 0.05$.

Research Results

The frequency of methods and practices used in lessons stems from two groups of factors: the *actuating factors* which hinder the application of teaching methods and *stimulating factors* which simplify them (Bohl, 2000). Descriptive statistics was used in order to determine the frequency of applying methods/practices in teaching

the subject content of Science and Social Studies. According to the average rating (arithmetic mean), methods/practices for teaching the subject content of Natural Sciences, Geography and History were ranked from 1 to 15, with the rank 1 meaning a favourable situation (Table 1). On that basis, a synthetic rank was determined and this rank indicates that while teaching Science and Social Studies, teachers most frequently apply certain verbal teaching methods/practices: conversation, working with a textbook and teacher's lecture. Since the demonstration of pictures and objects is the following teaching method according to the frequency of application, it can be concluded that the prevalent methods and practices of teaching are still specific to lecture-demonstration teaching. Teachers on very rare occasions apply methods such as working with professional papers, project method and computer-aided learning. Although it contributes to a great extent to experiential learning and research, the project method, due to substantial time and energy that teachers need to put in it, extensive curriculum, poor material conditions (Bohl, 2000; Götz et al., 2005) and lack of competence, particularly among young teachers (Letina, 2013), is still underrepresented in our schools. Among the reasons for underrepresentation of computers in teaching, it should be mentioned that schools are poorly equipped with computers, teachers lack sufficient competence, and there is also a lack of e-books to supplement the textbooks.

If we define demonstration as a teaching method, then among the demonstration practices the highest average score was related to demonstration of pictures and objects, a relatively high average grade was given to demonstration of phenomena in reality, while demonstration of movies is rarely applied. Research results also confirmed a well-known fact that in lecture-demonstration teaching students rarely get an opportunity to present the content themselves, so the content is most frequently presented orally by teachers. Although the method of conversation is the most common method in teaching, teachers rarely apply debate/discussion as a type of conversation, which can indicate that other forms of conversation are dominant in classrooms (e.g. heuristic type of conversation). Therefore, it can be concluded that hypothesis H-1 has been proved.

It is possible, however, to observe some differences in ranks of teaching methods and practices that are applied in teaching topics and subject content of Natural Sciences, Geography and History. Thus, for example, working with a map is the second most common method/practice in teaching geographical topics, while the same method/practice is less frequently applied in teaching topics of History (rank 5) and even less frequently when teaching the topics related to natural sciences (rank 8). In teaching topics of History (and mostly Geography), where there is almost no possibility of experiment, the respective educational process has rank 15, while in teaching topics of natural sciences the method of conducting experiments has rank 10. Several other examples can be seen in Table 1.

Table 1

Ranking of methods and practices in teaching Science and Social Studies according to the frequency of their application in teaching the subject content of Natural Sciences, Geography and History.

| Method/practice | Mean | | | Ranks | | | Sum of ranks | Rank in total |
|------------------------------------|------|------|------|-------|----|----|--------------|---------------|
| | A | B | C | A | B | C | | |
| Conversation | 3.94 | 3.92 | 3.91 | 1 | 1 | 1 | 3 | 1 |
| Working with textbooks | 3.80 | 3.79 | 3.83 | 2 | 3 | 2 | 7 | 2 |
| Teacher's lecture | 3.68 | 3.75 | 3.81 | 4 | 4 | 3 | 11 | 3 |
| Demonstrating pictures and objects | 3.70 | 3.69 | 3.67 | 3 | 5 | 4 | 12 | 4 |
| Working with a geographic map | 3.22 | 3.79 | 3.29 | 8 | 2 | 5 | 15 | 5 |
| Demonstrating phenomena in reality | 3.31 | 3.32 | 2.96 | 5 | 6 | 9 | 20 | 6 |
| Practical work done by students | 3.31 | 3.17 | 3.12 | 6 | 7 | 8 | 21 | 7 |
| Games | 3.26 | 3.13 | 3.12 | 7 | 8 | 7 | 22 | 8 |
| Students' presentations | 3.09 | 3.08 | 3.15 | 9 | 9 | 6 | 24 | 9 |
| Working with experiments | 2.94 | 2.52 | 2.19 | 10 | 14 | 15 | 26 | 10 |
| Debate (discussion) | 2.80 | 2.86 | 2.85 | 12 | 10 | 10 | 32 | 11 |
| Demonstrating movies | 2.84 | 2.80 | 2.77 | 11 | 11 | 12 | 34 | 12 |
| Working with professional papers | 2.73 | 2.70 | 2.82 | 13 | 12 | 11 | 36 | 13 |
| Project method | 2.54 | 2.57 | 2.46 | 14 | 14 | 14 | 42 | 14 |
| Computer-aided learning | 2.50 | 2.51 | 2.54 | 15 | 15 | 13 | 43 | 15 |

A –topics and content of Natural Sciences

B –topics and content of Geography

C –topics and content of History (including chronometry and introducing students to chronology)

In order to determine whether there is a statistically significant difference in the frequency of application of methods/practices among teaching topics of Natural Sciences, Geography and History, the Friedman test was used for dependent samples, and the results are shown in Table 2. The conducted analysis shows that out of 15 methods/practices, in 8 of them there is a statistically significant difference. The methods/practices with a statistically significant difference are: teacher's lecture ($\chi^2=12.477$; $df=2$; $p=.002$), working with a geographic map ($\chi^2=76.056$; $df=2$; $p=.000$), demonstrating phenomena in reality ($\chi^2=37.309$; $df=2$; $p=.000$), practical work done by students ($\chi^2=10.786$; $df=2$; $p=.005$), games ($\chi^2=8.487$; $df=2$; $p=.014$), working with experiments ($\chi^2=97.717$; $df=2$; $p=.000$), working with professional papers ($\chi^2=7.296$; $df=2$; $p=.026$) and project method ($\chi^2=7.273$; $df=2$; $p=.026$). Since there was a statistically significant difference in 8 methods/practices, hypothesis H-2 has been partially confirmed.

The calculated average scores (means) in the previous table indicate that teachers, when it comes to topics of Natural Sciences and Geography, demonstrate phenomena in reality more frequently than while teaching topics of History and introducing

students to chronology. Practical work done by students and making experiments are also inherent in teaching topics of Natural Sciences, less in Geography, and the least in teaching topics of History. In addition, teachers apply games more often when they introduce topics of Natural Sciences.

Working with a map is a method/practice applied in teaching topics of Geography. Maps also have their application in teaching topics of History, while when it comes to topics of Natural Sciences, their potential for teaching is low. Geographic topics offer the best opportunities for carrying out projects, while subject content of History, according to teachers, is rarely taken as a starting point for designing projects.

When teaching topics of History and related topics, teachers frequently teach the material orally (teacher's lecture method) and apply the method of working with professional papers. Consequently, it seems that verbalism and lecture-oriented type of teaching is more characteristic of this content area of Science and Social Studies.

Table 2

Testing differences in the frequency of applying methods and practices in teaching Science and Social Studies with regard to its content (the Friedman test)

| Method/practice | Mean Rank | | | χ^2 | df | p |
|------------------------------------|-----------|------|------|----------|----|-------------|
| | A | B | C | | | |
| Conversation | 2.01 | 1.99 | 2.00 | .333 | 2 | .846 |
| Working with textbooks | 1.99 | 1.97 | 2.04 | 3.020 | 2 | .221 |
| Teacher's lecture | 1.91 | 2.02 | 2.08 | 12.477 | 2 | .002 |
| Demonstrating pictures and objects | 2.03 | 2.00 | 1.97 | 1.198 | 2 | .549 |
| Working with a geographic map | 1.78 | 2.37 | 1.85 | 76.056 | 2 | .000 |
| Demonstrating phenomena in reality | 2.15 | 2.12 | 1.73 | 37.309 | 2 | .000 |
| Practical work done by students | 2.13 | 1.96 | 1.91 | 10.786 | 2 | .005 |
| Games | 2.10 | 1.94 | 1.95 | 8.487 | 2 | .014 |
| Students' presentations | 1.94 | 2.00 | 2.06 | 3.437 | 2 | .179 |
| Working with experiments | 2.41 | 1.98 | 1.61 | 97.717 | 2 | .000 |
| Debate (discussion) | 1.97 | 2.01 | 2.02 | .528 | 2 | .768 |
| Demonstrating movies | 2.04 | 1.99 | 1.96 | 1.323 | 2 | .516 |
| Working with professional papers | 1.99 | 1.92 | 2.09 | 7.296 | 2 | .026 |
| Project method | 2.03 | 2.07 | 1.90 | 7.273 | 2 | .026 |
| Learning with a computer | 1.99 | 1.98 | 2.04 | 1.418 | 2 | .492 |

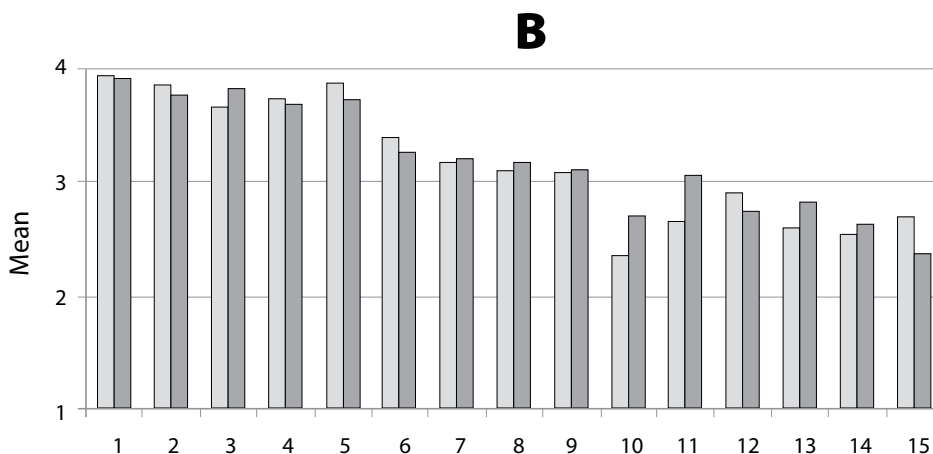
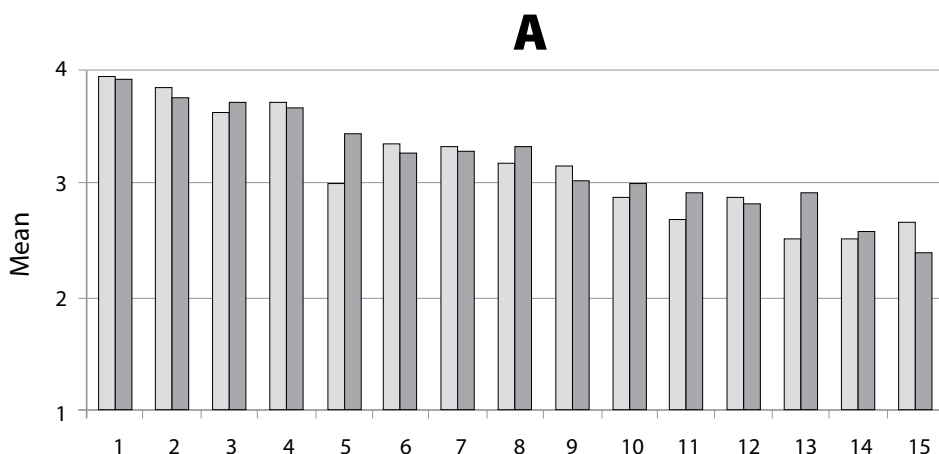
A –topics and content of Natural Sciences

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In order to determine whether there is a statistically significant difference in the frequency of applying methods/practices in teaching topics of Natural Sciences, Geography and History, with regard to the teachers' years of service, the Mann-

Whitney U test for two independent samples was used (respondents up to 20 years of service as opposed to respondents with more than 20 years of service). The conducted analysis has shown that out of 15 methods/practices of teaching topics and subject content of Natural Sciences, a statistically significant difference was found in only three of them, with regard to the teachers' years of service. Methods/practices in which there is a statistically significant difference are: working with a map ($U=2717.5$; $z=-3.231$; $p=.001$), debate/discussion ($U=2961.5$; $z=-2.219$; $p=.026$) and working with professional papers ($U=2550.0$; $z=-4.078$; $p=.000$). The calculated average scores (arithmetic means), shown in Graph 1, indicate that all three methods with a statistically significant difference are more frequently applied by the respondents with more than 20 years of service.



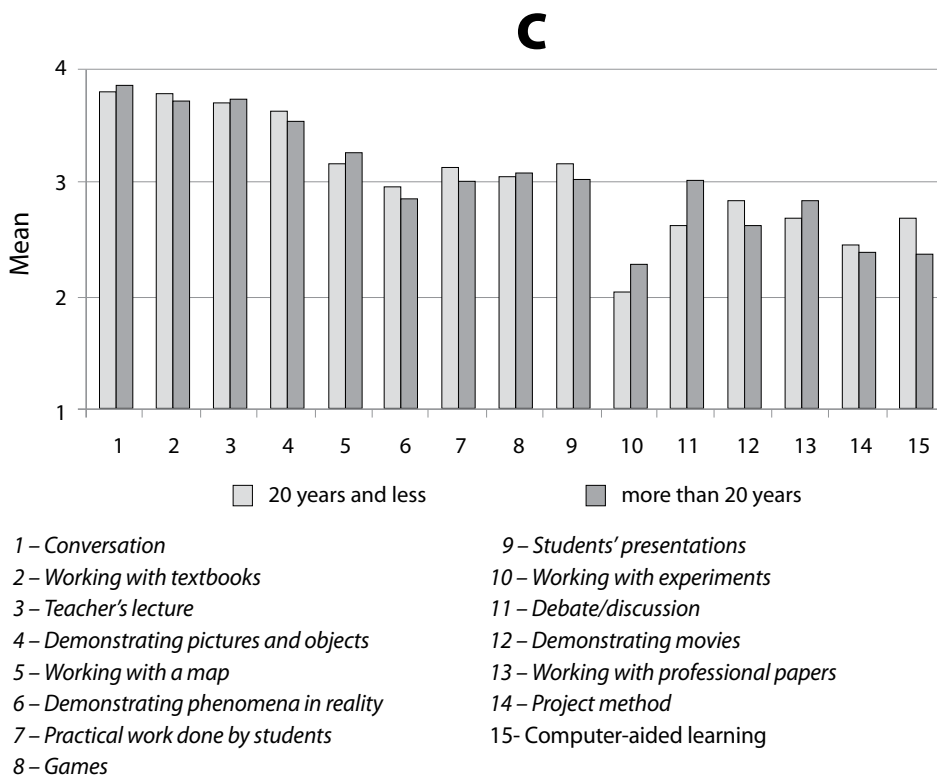


Figure 1. Frequency of application of methods/practices in teaching the subject content of Natural Sciences (A), Geography (B) and History (C) when teaching Science and Social Studies with regard to the respondents’ years of service.

When it comes to teaching the subject content of Geography in teaching Science and Social Studies, it has been found that there is a statistically significant difference with regard to years of service in six methods/practices which are: teacher’s lecture ($U=3057.0$; $z=-3.018$; $p=.044$), working with a geographic map ($U=3187.5$; $z=-2.469$; $p=.014$), working with experiments ($U=2696.0$; $z=-2.977$; $p=.003$), debate/discussion ($U=2521.5$; $z=-3.052$; $p=.002$), working with professional papers ($U=3093.5$; $z=-2.115$; $p=.034$) and computer-aided learning ($U=2895.0$; $z=-2.229$; $p=.026$). Younger respondents statistically significantly more applied working with a map and computer-aided learning, while the older ones statistically significantly more frequently applied other methods/practices in teaching.

Similarly to teaching topics of Natural Sciences, in teaching topics of History and related topics, a statistically significant difference with regard to the years of service was found in only three methods/practices. Those are: working with experiments ($U=2923.5$; $z=-2.313$; $p=.021$), debate/discussion ($U=2638.5$; $z=-3.176$; $p=.001$) and computer-aided learning ($U=2914.5$; $z=-2.166$; $p=.030$). Older respondents more frequently apply working with experiments and debate, while younger respondents more frequently apply computer-aided learning.

Since there has been a statistically significant difference in the frequency of applying methods/practices with regard to the respondents' years of service in a minority of cases, hypothesis H-3 can be only partially accepted.

Discussion and Conclusion

The aim of this study was to determine the frequency of methods and practices in teaching Science and Social Studies. As identified, the most frequent methods are conversation, working with textbooks, teacher's lecture and demonstrating pictures and objects. On the other hand, rarely applied methods are computer-aided learning, project method, working with professional papers, while only slightly more frequently used methods are demonstrating movies, debates and working with experiments. Teachers need to work on adopting an expansive range of teaching methods and practices that can be used in teaching, with special emphasis placed on methods that encourage experiential learning and research. Although the possibilities of teaching Science and Social Studies in that segment are significant, the research results have pointed to a still insufficient representation of methods and practices that have a greater didactic and pedagogical value.

The dominance of verbal methods and/or lectures and practices is not unique only to Croatian education system, as has been found in one of the recently conducted studies in Serbia (Maksimović & Stančić, 2012) that emphasized the supremacy of monologue and dialogue methods. Research on the frequency of teaching methods in Germany in the mid 80s of the previous century showed that most of the teaching time is spent on teacher-to-student conversation (lecture developed through questions), followed by teacher's lecture, demonstration and a fast game of questions and answers (Hage et al., 1985, according to Wiechmann, 2010). Giest's (1997) research, (according to Michalik & Murmann, 2007) also showed that the teacher dominates the lecture, and the conversation during teaching is characterized by answers to the questions asked by the teacher. Wiechmann (2010), however, at the end of 1990s, recorded certain qualitative developments in German schools, finding that conversation during the teaching process and teacher's lecture are not as dominant as before and that supervised activities performed by students and work in silence are getting more attention.

Some differences have been found in the frequency of application of certain teaching methods and practices, with regard to the subject content - whether of Natural Sciences, Geography or History. As it turned out, teaching the subject content of Natural Sciences is linked to certain "natural processes", such as observing or demonstrating phenomena in reality, practical work done by students and making experiments. In teaching geography-related topics, methods that can be found more often are working with a map, which is teaching practice characteristic of Geography, and team projects, while in teaching topics of History, the frequently used methods are working with professional papers and teacher's lecture.

Statistically significant differences in applying methods and practices in teaching, with regard to the teachers' years of service have been found only in a minority of cases. Teachers with more years of service make experiments, organize discussions or debates and use professional papers in the teaching process more frequently, as opposed to younger teachers, who are on the other hand more superior to the older colleagues when it comes to computer-aided learning. Although it could be assumed that younger teachers are more innovative, creative and generally inclined to apply contemporary approaches, if we exclude computer-aided learning, the research results have shown just the opposite. As for the methodological treatment of teachers, many years of teaching experience (that has certainly been accompanied by additional training) were proven to be an advantage over formal university education. This means that the competences teachers get in universities are not sufficient, but need to be expanded. Finally, our opinion is that research should be repeated in the next few years in order to identify potential qualitative changes in applying methods and practices that might take place in teaching Science and Social Studies.

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Metode i postupci poučavanja i učenja u nastavi Prirode i društva

Sažetak

U radu se raspravlja o učestalosti primjene metoda i postupaka poučavanja u nastavi Prirode i društva. S obzirom na to da je riječ o sadržajno heterogenom nastavnom predmetu koji se oslanja na spoznaje brojnih prirodnih i društvenih znanosti, u nastavi je moguće primijeniti širok repertoar metoda i postupaka poučavanja i učenja. Provedenim empirijskim istraživanjem utvrđeno je da u većem dijelu nastave dominiraju razgovor, rad s udžbenikom, učiteljevo predavanje i demonstracije slika i predmeta, a iznimno se rijetko primjenjuju rad s računalom, projektna metoda i rad sa stručnim tekstovima. Unatoč značajkama i mogućnostima nastavnog predmeta, u nastavi su nedovoljno zastupljene metode/postupci koji potiču istraživačko i iskustveno učenje. Utvrđene su i razlike u primjeni pojedinih metoda i postupaka ovisno o tome poučava li se njima prirodoslovni, geografski ili povijesni sadržaj, kao i s obzirom na radni staž ispitanika.

Ključne riječi: *geografski sadržaj; metode i postupci poučavanja; povijesni sadržaj; Priroda i društvo; prirodoslovni sadržaj.*