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THE INFLUENCE OF THE PROJECT METHOD ON THE ACHIEVEMENT OF YOUNG LEARNERS IN THE FIELD SCIENCE AND SOCIAL STUDIES

Summary: The paper deals with the influence of project work on the achievement of young learners in the area of science and social studies. The presented results are part of a wider study, in which they were interpreted from a different angle. The goal of the wider study was to determine to what extent a higher level of knowledge acquisition in the field of science and social science can be achieved through didactic instructions within the project method. The topic of this paper is theoretical and empirical exploration of the project method efficiency on the learning achievements of young learners. From the presented research objective the research problem was posed in the form of a question: Does the project method influence the level of the learners' knowledge acquisition? In accordance with the theoretical basis and the research goal a hypothesis was defined. It refers to the assumption that the experimental group learners will show a higher level of knowledge acquisition in comparison to the control group learners. In the study participated 120 fourth grade learners. The content sample which was taught through the project method for the subject science and social studies covered the teaching topic *A look back – the past*. The obtained results showed that learners who worked through the project method achieved a higher level of knowledge acquisition on the final test, in comparison to the learners who covered the content in the usual way. In other words, the results support the assumption that the application of the project method influenced the increase of the knowledge quality of learners on all levels – reproduction, understanding and application of knowledge.

Key words: project method, science and social studies field, quality of knowledge.

Introduction

Recently much attention has been given to the need to change the contemporary schools with the goal of eliminating or at least decreasing its weaknesses, such as the inability to follow the developmental flow and needs of contemporary society. Among the weaknesses which dominate our educational system, one may note the stiff organization of educational work with its verbal teaching in which the teacher has the monopoly position and has the role of knowledge mediator. It is not surprising that learners are overburdened with educational content and are not directly involved in the learning process, which results in lower motivation for learning and learning efficiency. Furthermore, this influences on their negative

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attitude towards school and disables their intellectual development (Novak, 1990: 5). However, the question is posed, how is it possible that in spite of numerous attempts we have not been able to implement a new school system different from the one that Comenius envisioned. Maybe the answer lies in the undoubted quality of certain elements of traditional teaching, which should not be changed but just modified and harmonized with contemporary concepts, or the answer should be sought in the learners' needs, since the dominant method suits them to a certain extent.

One of the possible solutions to the current problems is reflected in affirming learning methods which can activate the learners and create space for their creativity, development of thought, problem solving, encouragement of various abilities and personality as a whole. A teaching method which can influence the substitution of knowledge transmission from teacher to learner with active, participative, cooperative learning and learning in which a child is an active and constructive participant (Ivić et al., 2001), is the project method. The project method, as an imminent part of integrative learning, encourages the development not only of knowledge and skill, but also emotional, moral and aesthetic sensibility in a child. During work on a project the holistic principle is followed and successive permeation of integrated content is achieved without strict subject atomization and division. It is a fact that during the implementation of a project learners spontaneously acquire certain content and master cognitive and social skills. The didactic-methodological apparatus in project activities presupposes dispersive application of workshop cooperative work, interactive strategies which encourage creative eristic conversations, methods and didactic tools which enable children to gain skills using various intelligences and symbolic systems.

The project method is recognized in literature as an innovative approach to learning, which through its strategies influences the learners' success in acquisition of knowledge needed in the XXI century (Blumenfeld et al., 1991; Barron & Darling-Hammond, 2008, Bell, 2010, D'Orio, 2012, according to Cervantes, 2013). Furthermore, the project method enables a new approach, because learners have an opportunity to ask questions which awaken their curiosity, i.e. through research and posing questions the learners create the framework for the project. The increasing need for education to focus on creating creative individuals is another reason why the usage of the project method is recommended worldwide. The latest studies show that the project method follows social changes and that it is directed towards the development of planning, research and team work activities (Thomas, 2000).

Terminological explanation and concept defining in the project method

In the beginning the word project in didactics represented an activity conducted by the learners which was based on selection and planning and which is conducted in situations similar to real life (American teachers have been using this term since 1900) (Žlebniĳ, 1962: 194). However, the term project officially enters the educational system before the First World War, and is introduced by William Heard Kilpatrick, who was inspired by the ideas of John Dewey, as a new learning method which he named the project method or project teaching (as some call it, Žlebniĳ, 1962). W.H. Kilpatrick in his paper *The Project Method: The Use of the Purposeful Act in the Educative Process* from 1918 started a discussion on the term "project" for which he says "it is knocking at the door of educational terminology and is waiting to be let in" (Kilpatrick, 1918)³. His main goal was to introduce discovery learning into the classroom, i.e. the method of learning through experience. He represented views according to which

³See: <http://people.umass.edu/~rwellman/Philosophy/Kilpatrick.pdf> (01. 11. 2017).

thinking is a means of readaptation, and ideas instruments in adaptation (Gudjons, 1994). Such a relationship can be connected to the approach to programs which are today more and more support, and refers to the approach directed towards relationships, i.e. didactics directed towards relationships. Here relationships present the core of the program, and key dimensions recognize questions of quality, frequency, power, proactive action, collaboration of welfare, learning and co-construction of meaning (Pavlović Breneselović & Krnjaja, 2014). In didactics directed towards relationships the child is considered as a social actor, the agent of social learning and development, and childhood is considered to be a sociocultural context. This approach is based on theoretical constructs of sociocultural theory of development and learning, childhood sociology, postmodernism and post-structuralism (Pavlović Breneselović & Krnjaja, 2014).

As descriptors for this concept one can also find: method, strategy or form of teaching, project plan and even problem teaching (Šimleša, 1969: 204, according to Matijević, 2008). It is difficult to determine what is more correct or what should be given priority (the clarification of this shall be attempted in the following text).

It is important to look back on the concepts of project teaching and the project method. As it has been mentioned earlier, in the literature project teaching and project method can be encountered as synonyms in literature, which is debatable. If we take into consideration that teaching is a more complex concept than a method. In this way it is not acceptable for these two phrases to be viewed as synonymous. Furthermore, teaching is institutional and non-institutional organized creative effort in learning prescribed content and acquiring knowledge, skills and habits. Therefore, it cannot be considered the same as a method which “represents a determined sequence of controlled action” (Gojkov, 1995: 57), because teaching is more complex than methods. Project teaching can be characterized as a system or a model oriented towards the development of the learners knowledge and skills through work on discovery projects (Ristanović, 2015). On the other hand, the project method exists as help and an addition to the organization of the teaching work which is implemented in the standard conception of teaching, with an increased connection between subjects with content that can be naturally connected.

There are many different definitions of the same concept, but if we sublimate all of the definitions, what they have in common is that the same concept of learning is put in the forefront. The concept in which learners are independent, where they are encouraged to actively learn through thinking and reaching conclusions, problem solving, and where the accent is on the development of the ability to notice, describe, on written, verbal and graphical expression, practical work completion, differentiating between the important and unimportant etc. Generally it could be said that it is a “constructive activity with a goal” (Đorđević, 2010: 101) or “an activity which poses problems to the mind and on which it completely focuses so as to solve the problem until the end in a normal situation” (Classe, 1972, according to Đorđević, 2010: 101).

Learning through projects does not seem particularly revolutionary and there exist other trends in education, however the point is that the project method is a flexible method for the implementation of a teaching plan and program through which many other projects and ways of learning such as learning through play can be achieved (Heick, 2013).

Methodological framework

The object of this research is the theoretical and empirical study of the effectiveness of the project method on the learning outcomes of young learners. From the proposed object of the research the problem has been defined in the form of a question: does the project method influence the learners' knowledge acquisition? With the research goal to determine to what extent it is possible to achieve a higher level of the learners' knowledge acquisition in the area of science and social studies through a set of didactic instructions within the project method, and in comparison to the typical way of teaching. The general hypothesis is that learners from the experimental group will show a higher level of acquired knowledge on the final test, in comparison to learners from the control group. Through the experimental method we strived to determine to what extent the project method influences the increase of fourth grade learner achievements. An experiment with parallel groups was applied, with an experimental group (three classes) and control group (three classes) of fourth grade elementary school children. An adequate sample is in question.

For the needs of this research tests were constructed (initial and final) which contained questions across three levels of knowledge, which incorporated questions of reproduction, questions of understanding and questions of application.

The validity of the tests has been conducted through a logical validation of the tests, where harmonization with the Teaching plan and program for the subject science and social studies for the third and fourth grade of elementary school has been verified. Questions on the test have been harmonized with general standards of achievement – educational standards for the end of the first cycle of mandatory education (Zavod za unapređivanje obrazovanja i vaspitanja, 2011), and in accordance with the general demands on the basic, intermediate and advanced levels. Three levels of question difficulty were used as guidelines in the validation of the tests – level of reproduction, level of understanding and level of application. As has already been mentioned the levels represent dimensions of cognitive processes.

The *reliability* of the tests of the learners' knowledge has been tested with the Split-half method (splitting the test into two halves). The following results have been reached: initial test = 0.757, final test = 0.950.

The *objectivity* of the knowledge tests has been conducted through an internal formula which teachers use in their work. The most precise task which is used for showing the harmonization of test graders has been conducted through calculation the mean value of the correlation coefficient of the grader group (four graders participated – author of the paper and three teachers of the experimental group). Spireman's correlation coefficient has been calculated for every possible pair of graders, and afterwards its mean. All noted correlations are high, since their value was above 0.9. The starting value for the Initial knowledge test was $p = .914$; the Final knowledge test value was $p = .914$. The reached results indicate that a very high correlation between the graders existed, which confirms the objectivity of both tests.

Research sample. Six classes of fourth year elementary school children from Vrsac participated in the study. The starting sample consisted of 150 learners from two schools, four classes (two experimental classes [IV₁ and IV₂] and two control classes) from the elementary school "Jovan Sterija Popović" and two classes (one experimental [IV_v] and one control class [IV_b]) from the elementary school "Vuk Karadžić". For the needs of this experiment the sample has

been reduced to 120 subjects. Twenty subjects have been excluded from the study because they have not completed at least one of the creativity tests. The sample in question is adequate.

This age group of learners has been selected for the following reasons:

- the assumption that their logical operations have stabilized and that they would be able to participate in the experiment program without greater difficulties;
- learners of this age should have already become to a high degree enabled to independently learn;
- this age is adequate for mastering efficient learning techniques which learners could apply in other areas of study.

Variables. In accordance with the posed goals, tasks and hypothesis of the study the following variables have been determined: the independent variable is the project method which has been applied in science and social studies classes in the fourth year of elementary school and which has been shaped according to the experimental program.

The project method involved the following ways of teaching and learning: individual and group research tasks, learning through discovery, learning through problem solving, learning through computers, cooperative forms of learning – group work, as well as didactic instructions which are incorporated into the project method, such as: research and try out, modify, change, combine etc. Therefore, an independent variable is in question, a variable which has a role of the experimental factor in this study.

Dependent variable in this study are the expected effects which occur under the influence of the experimental factor – the project method: learners' knowledge level.

Control variable in this study was the parents' educational level, so that the influence of the experimental factor on the dependent variable could be controlled more reliably.

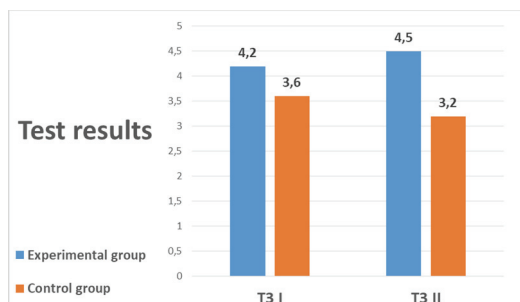
Research results and interpretation

The following text will present the results which refer to the differences between the experimental and control⁴ groups on the initial and final knowledge tests.

The covariance analysis was used for the study of differences between the experimental and control groups' achievement on the knowledge tests.

On the following graph (Graph 1 – *The achievement of the control and experimental groups on the initial and final knowledge tests*) results which refer to the achievement of the control and experimental group on the initial and final knowledge tests have been shown. It must be stated that the groups were not matched in this criteria. This variable was statistically controlled in the analysis of the effect conducted in this program on the achievement on the Final knowledge test. This means that the Initial knowledge test had been included in this analysis as a co-variable and was thus held constant.

⁴ In the following text the experimental group will be referred to with the letter E, and the control group with the letter C;



Graph 1 – The achievement of the control and experimental groups on the initial and final knowledge tests

On the basis of the reached results it was concluded that there existed a small difference in the initial results between the experimental and control groups ($E= 4.2$; $C=3.6$), while a more significant difference was noticed on the final knowledge test results ($E= 4.5$; $C= 3.2$), as well as an achievement decrease of the control group. The reason for such results in the control group can be explained with the fact that very abstract content for learners of this age can be understood and acquired with great difficulty without adequate didactic-methodic instruction. On the other hand, the success of the E group can be brought into connection with the synergy of factors, among which are didactic instructions within the framework of the project method (planning and preparation, organizing, implementing and researching). When the learner is in the situation to independently discover, master the basic methods and techniques which lead to the final goal, the knowledge, skill and ability quality is assured (Lord, 1998; De Zan, 1994). Studies have shown that the best results have been achieved by learners who reached the results through discovery (De Zan, 2005).

One such study is the meta-analysis of all of the studies which referred to the research of the discovery method influence on the achievement in the field of natural sciences and which were conducted between 1984 and 2002 – it was conducted by Minner and colleagues (2010). This study has been taken into consideration because the discovery and project methods have many common activities (monitoring; asking questions; examining books and other sources of information; research planning; using tools for gathering, analysis and interpretation of data; proposing answers, explanations, predictions and presenting results). They concluded that in 61% of 138 studies there was a positive effect of some level of the discovery method on the increase of achievement and duration of knowledge.

In the following text results which show the differences in the achievement of E and C groups on parts of the tests will be presented. Again the covariance analysis was used because here also the educational level of the parents had to be controlled since the groups were not homogenous in this respect.

At this level the questions were formulated so that the dominant verbs (categorized on the basis of the Anderson and Krathwohl's taxonomy for the dimension of reproduction, where the first dimension was used which refers to cognitive processes) were: recognize, define, identify, mark etc. Experimental group learners, within the experimental program, worked on tasks which demanded from them to indicate answers, multiple choice questions, to name the answer (e.g. Who was the first Serbian king?) etc.

Table 1. Differences between the control and experimental groups on the initial knowledge test results in the section which measured reproduction

| Variable | SS | df | MS | F | p |
|-----------|-------|----|-------|-------|------|
| group | 2.052 | 1 | 2.052 | 1.183 | .279 |
| SEfather | 3.686 | 2 | 1.843 | 1.062 | .349 |
| SE mother | 4.299 | 2 | 2.150 | 1.239 | .294 |

Data in Table 1 indicates that there is no significant difference between the achievement of the control and experimental groups on the part of the initial knowledge test which deals with reproduction. This tells us that the groups were quite even on the Initial knowledge test in the section which measures reproduction and that a statistically significant difference did not exist between the two groups on the first i.e. initial measuring.

In the table below we can see the difference between the control and experimental groups in their achievement on the final knowledge test regarding reproduction.

Table 2. The difference between the control and experimental groups in the results on the final knowledge test in the section which measures reproduction

| Variable | SS | df | MS | F | p | B |
|-----------|---------|----|---------|--------|-------------|--------------|
| group | 432.379 | 1 | 432.379 | 58.394 | .000 | 4.010 |
| SEfather | 37.976 | 2 | 18.988 | 2.564 | .081 | -2.736 |
| SE mother | 15.806 | 2 | 7.903 | 1.067 | .347 | -1.700 |

Therefore regarding the first level of questions – level of reproduction and recollection, on the basis of the results (Table 3) ($p=0.000$ on the level of significance of 0.05) it is noted that the experimental group achieved significantly better results.

It could be said that such results were expected, since in the theoretical part of the study, the advantages of the project method were noted through theoretical analysis.

This is supported by numerous studies which dealt with similar questions. One of these is a three year study which was conducted by Boaler in 1996. Namely, in mathematics classes she studied the differences between the work forms which are used within the project method and traditional teaching in which the teacher and frontal teaching dominate. The results that she gathered indicated that the experimental group achieved significantly better results, with three times as many maximum points (Boaler, 2002).

The following table shows the differences between the control and experimental groups in the achievement on the initial knowledge test regarding the level of understanding (knowledge).

Table 3. The differences between the control and experimental groups on the initial knowledge test results in the section which measures understanding (knowledge)

| Variable | SS | df | MS | F | p | B |
|-----------|-------|----|-------|-------|-------------|---------------|
| group | 5.349 | 1 | 5.349 | 6.462 | .012 | .446 |
| SE father | 5.584 | 2 | 2.792 | 3.373 | .038 | -1.001 |
| SE mother | .430 | 2 | .215 | .260 | .772 | -.294 |

The reached results indicate that on the questions which focused on understanding, there existed a significant difference between the control and experimental groups. Learners from the experimental group achieved better results on questions on this level of categorization, as defined on the basis of Anderson and Krathwohl's taxonomy, which shows the result $p=0.012$ on the level of significance 0.05. Furthermore, a significant effect of the fathers educational level has been noted ($p=0.038$). In other words, the results showed that learners whose fathers has completed only elementary school achieved lower results in this part of the test.

When the second part of the test is in question (Table 4), which refers to questions of understanding, the situation is similar to the previous part of the test ($p=0.000$ on the significance level of 0.05). The results indicate that there exists a significant difference between the control and experimental groups in achievement on the final knowledge test in the section measuring understanding (knowledge), i.e. here also we have a significant effect of the group. Hence, the experimental group achieved significantly better results in comparison to the control group, under the influence of the experimental program.

Table 4. The difference between the control and experimental groups on the results of the final knowledge test in the section which measures understanding

| Variable | SS | df | MS | F | p | B |
|-----------|---------|----|---------|--------|-------------|--------------|
| group | 265.495 | 1 | 265.495 | 31.829 | .000 | 3.142 |
| SE father | 44.967 | 2 | 22.484 | 2.695 | .072 | -2.981 |
| SE mother | 11.339 | 2 | 5.669 | .680 | .509 | -1.508 |

The results obtained coincide with results reached by Gultekin (2005, according to Holm, 2011) in his research the goal of which was to study the influence of the project method on learning achievements of learners in the social sciences. The sample consisted of fifth grade elementary school learners. The results indicated that learners who studied according to the experimental program showed higher academic knowledge than their peers which did not study through project work. Furthermore, they showed higher results in the development of logical thinking (Holm, 2011).

In the following table results which show the difference between the experimental and control group on the Initial knowledge test which measures the application of knowledge are shown.

Table 5. The differences between the control and experimental group on the results of the initial knowledge test on the section which measured the application of knowledge

| Variable | SS | df | MS | F | p | B |
|-----------|-------|----|-------|-------|-------------|---------------|
| group | 1.818 | 1 | 1.818 | 2.515 | .116 | .260 |
| SE father | .402 | 2 | .201 | .278 | .758 | -.132 |
| SE mother | 7.709 | 2 | 3.854 | 5.332 | .006 | -1.299 |

The results indicate that there is no significant difference between the control group and experimental group in the achievement on the initial knowledge test in the section regarding the application of knowledge.

The third part of the Final knowledge test referred to knowledge application. During the experimental program the learners worked on tasks in which they needed to independently or as a group research, classify and make reports on the basis of gathered material.

Through the data analysis and reached results we can conclude that the experimental program gave statistically significant results on the third part of the Final knowledge test as it had done on the first two parts of the test, which can be seen in the following table.

Table 6. The differences between the control and experimental group in the results on the final knowledge test in the section of knowledge application

| Variable | SS | df | MS | F | p | B |
|-----------|---------|----|---------|--------|-------------|---------------|
| group | 247.670 | 1 | 247.670 | 58.154 | .000 | 3.035 |
| SE father | 37.802 | 2 | 18.901 | 4.438 | .014 | -2.737 |
| SE mother | 2.221 | 2 | 1.110 | .261 | .771 | -.653 |

On the basis of the obtained results it can be concluded that there exists a statistically significant difference between the experimental and control group ($p=0.000$ on a significance scale of 0.05). The results indicate that the tasks which the learners in the experimental group had to complete contributed this (e.g. Imagine that you lived during the rule of Đurđe Branković. What would your life look like?). Additionally, we started from the assumption that the project method is the most complex form of practical logical and intensive knowledge acquisition, from problem wholes in an area of knowledge, presenting and transferring the usage and preparation of concrete knowledge (Đorđević, 2007).

Golubovic-Ilic (2013) also dealt with the application of research work (as a component of the project method) in the discovery process in the science and social studies classes. The goal of the research was to determine the effects of the application of research work on the coverage of content in the subject science and social studies. The subjects of the study were third grade elementary school learners. The results of the study indicated that significant differences existed regarding the quality of knowledge between the learners who learned the subject science and social studies through independent research work and those who learned in the standard way. The author also studied the duration of knowledge. The results indicated that the knowledge gained through research work lasted longer (Golubović-Ilić, 2013). Such results indicate that knowledge which the learners gain through independent work (research, problem solving, discovery etc.) is of higher quality and lasts longer in comparison to when knowledge is given in a finished form.

Conclusion

If our goal is to increase the learners' motivation, the quality and duration of knowledge and to develop independent learners than the project method can help us achieve it. Experience has shown that knowledge gained through discovery lasts the longest.

The project method is based on the research approach which is based on the constructivist educational paradigm in the foundation of which lies independent activity of the individual. Only the content which is acquired through the investment of mental effort, through control and construction of new knowledge, becomes an integral part of the learners' active-operational knowledge (Golubović-Ilić, 2013: 204). The results of this research support the aforementioned assumption since the experimental group learners, i.e. the learners who worked on a project, showed a higher level of acquired knowledge on the final test, in comparison to learners who were taught in the standard way. In other words, the results indicate on the confirmation of the possibility that the application of the project method influenced the increase of the knowledge quality of learners on all levels – reproduction, understanding and application.

After the analysis of our study, as well as the review of studies from other authors, it can be concluded that the project method can and should have a more significant role in educational work. Furthermore, the application of this form of work in teaching contributes to a higher activation of learners, and aware activity and mind activation in classes is applied more widely, the learners abilities of remembering, noticing, comparison of concepts and processes enables the learners' for independent learning (Golubović-Ilić, 2013). This does not mean that it should be above all other teaching methods which are used in classrooms today, but that it should be given the opportunity to give its contribution.

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Danica Veselinov was born in 1978 in Pancevo, where she finished elementary school and grammar school “Uros Predic”. In 2010 she completed her bachelor studies at the Teacher Training Faculty, Belgrade University, where she became a Master of Arts in the area of didactics. From 2011 she has been working at the Preschool Teacher Training College “Mihailo Palov” as a teacher for practical training. In the same year she has enrolled in the PhD studies at the Teacher Training Faculty, Nis University, in the area of methodology. To the present she has published many papers connected to didactic-methodological issues and preschool education.