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Original research paper

EFFECTS OF PROJECT-BASED LEARNING ON ACADEMIC ACHIEVEMENT: A META-ANALYSIS*

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ABSTRACT

Project-based learning (PBL) is considered as an alternative to the traditional transmissive instructional approach. However, there is not a large number of meta-analytic studies that seek to synthesise findings of primary studies in order to assess overall effect of PBL on academic achievement, while in the national and regional research area such attempts are not present. This research had a goal of synthesising empirical findings about effects of PBL on academic achievement. Eighteen relevant studies (N = 2518) met the meta-analysis eligibility criteria. Statistical analysis under the assumption of random effects model points to a weak up to moderate effect of PBL on students' academic achievement (*Hedges' g* = .387 [*95% CI*: .027 | .747], Z = 2.109, p = .035). Results justify further research of the concept of PBL and discover the optimal implementation methods for this instructional approach.

Key words:
project-based learning (PBL), academic achievement, meta-analysis.

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INTRODUCTION

In critical speculations concerning the quality of instruction and learning process in schools, it is often pointed out that there is hardly a deviation from receptive (transmissive) instruction, which is based on traditional paradigm of transmitting educational content from teachers to students, mainly by means of frontally organised activities (Radulović i Mitrović, 2015). Thereby, various initiatives in order to transcend this state emerged, mostly directed towards changing the positions and roles of students and teachers, and creating different instruction models. Their goal is common – to engage students with different individual or group activities in order to develop critical thinking and skills needed for solving practical problems (Condliffe *et al.,* 2017). One of those models is *project-based learning (PBL)*[1], instruction model oriented towards the creation and development of students' knowledge and competence by working on research projects (Ristanović, 2019).

PBL belongs to a group of instruction models whose theoretical and methodological foundations are based on the constructivist and research-oriented approach towards learning and instruction. In that sense, work on research projects means that students build (construct) knowledge (Scardamalia & Bereiter, 2003) following methodology similar to that employed by professional scientists (Pedaste *et al.,* 2015). In addition to utilisation of scientific methodology, PBL is in accordance with the Piaget's metaphor of a *child as a scientist*, through which he refers to similarities between research activities of a scientist and the formation of scientific knowledge of children (Krnjajić, 2004). Students strive to research a problem identified in real-life situations and to devise an appropriate solution via authentic projects (Bender, 2020). Literature review suggests that different authors highlight more or less similar characteristics, specificities and stages of PBL organisation and realisation processes (for example: Darling-Hammond *et al.,* 2008; Grant, 2002). Based on the aforementioned authors' work, the following essential stages of PBL can be described: (1) establishing a driving question, (2) working on a project, (3) conducting a research, and (4) presenting the results. These authors also suggest that, during the realisation of one project cycle, special attention should be paid to the application of modern technologies and the development of students' autonomy and cooperation.

Driving question is a problem-type question or an assignment which students should answer by planning and conducting a proper group research. It is called a *driving* question because it plays a role of a starting foundation for organising project

[1] Alongside the term *project-based learning*, synonym terms can be found in literature concerning this subject, such as *project learning*, *project instruction model* and similar. Keeping in mind that in instruction and learning programmes for elementary and high schools, as well as other formal documents regarding education in Republic of Serbia, the term *project-based learning* is more common, the authors of this text have chosen to use it, too.

activities (Blumenfeld *et al.*, 1991) and drives students through the process of acquiring and understanding the key scientific concepts, but also supports the development of the skills necessary for life in the 21st century (Bender, 2020). Regarding the objection that a large number of instructional activities are not considered authentic, based on abstract concepts and unsuitable examples, and implicitly constrained by the school culture (Brown, Collins, & Duguid, 1989), driving questions also have a role of important mechanisms for introducing the authentic project assignments within instruction. Authenticity here means the assignment of various problem-type questions and tasks which are challenging, interesting and significant for students, because they deal with the real problems from close life environment. Namely, there are many ways to get to the solution, by choosing different project activities; a solution of a problem can be demonstrated, and there is a possibility of cooperation with others during the process of problem-solving (Blumenfeld, Marx, Patrick & Krajcik, 1998). When driving question is ultimately defined, the work on a project can begin.

Thorough *work on a project*, which encompasses research conceptualisation and planning of research procedures (Krajcik *et al.,* 1998), is the key activity after which this instruction model got its name, and which, according to some authors (Chen & Yang, 2019), differentiates it from other related models. Students need to decide what actions they will undertake in order to conduct the research and answer the driving question (Bender, 2020), and to thoroughly explain what kind of data needs to be collected, how they will do that, what equipment is necessary, what the duties of the project team members will be, how they will plan their time and the like (Ristanović, 2019).

Well conceptualised and written project is a necessary condition for the next step – *conducting a research*. Research encompasses data collection and represents activity by which students acquire knowledge significant for answering the driving question. This process is dualistic and encompasses models of library research (Polman, 1998) or initial research (Bender, 2020), and empirical research. Library research is a process of obtaining the basic information about the subject (Polman, 1998) during which students get familiarised with the subject's content by searching print or electronic sources. Afterwards, it is time for the empirical research, during which field observations of particular phenomena and processes take place (most often outside of the school), experiments are conducted and the like. Collected research data are analysed, essential findings for answering the driving question are highlighted, conclusions are formulated, and result presentation methods are defined.

Presenting the results that students have obtained while working on a project, makes another essential component of PBL (Blumenfeld *et al.,* 1991). Project results are often called artefacts, and the use of this term, primarily typical for archaeology, points out that the result must be a concrete, tangible product. Depending on the

character of a project and students' age and abilities, the range of the artefacts can vary from written works (various types of reports), combinations of verbal and visual methods for information presentation (for example, a poster or PowerPoint presentations or news articles), audio, visual, audio-visual and multimedia records (for example, sound recordings, videos or websites), space analogues (for example, dummy-products or models), all the way to artworks, plays and the like. Furthermore, an integral part of this activity is reflection, determining to what extent the driving question was answered, critical analysis of the presented artefacts and exchange of experiences gained during the work on a project.

When we talk about the application of modern technologies, it should be noted that the development of modern technologies in the late 20th and 21st century had an impact on digitalisation of various social spheres and lessened functionality of individuals with no possession of adequate digital competence. This situation, mainly the fact that young people grow up within digital, technological environment, inevitably reflects on the educational system too, in which the acquiring and development of digital competence is considered as an imperative. In accordance with that, in current approaches to the PBL theory and practice, significant attention is paid to the application of technologies capable of ensuring effective learning (Ristanović i Banđur, 2020). Globally available technological achievements, which students are familiar with, have multiple applications during the work on projects and enable quick retrieval of necessary information, solving of simulated problem situations, virtual visits to particular institutions and sites, real-time communication with distant students, teachers or experts, creation and presentation of various content and artefacts, and the like (Bender, 2020; Kolb, 2019; Krajcik & Czerniak, 2008). Although PBL supported by digital technologies and online environment has been present for almost two decades in developed countries, many of the aforementioned possibilities became necessary only after the onset of the COVID-19 virus pandemic and changed instruction circumstances caused by it. Application of multiple hybrid instruction models is encouraged, such as online PBL (OPBL; Thomas & MacGregor, 2005), PBL in flipped classroom (PBL-FC; Chua & Islam, 2021) or project-based blended learning (PBBL; Tong, Kinshuk & Xuefeng, 2020).

How to improve *students' autonomy* and encourage cooperation between various actors of the instruction process are only some 202of the central questions within educational research (Havelka, 2000; Ševkušić i Stanković, 2012). Regarding students' autonomy, it is interpreted within PBL as students' voice and choice (Bender, 2020) – a possibility to decide about various elements of project work; degree of students' autonomy is used by some authors as a criterion for the classification of projects (de Graaff & Kolmos, 2007). Autonomy mainly depends on students' experience and age, and its degree varies from students' limited participation in formulating the project's subject and driving question, or formation of groups, to a completely independent conceptualisation of an entire project. In PBL, in

comparison with traditional instruction, teachers' and students' roles are changed, so it is expected from teachers to provide help and support for students in creating a learning environment where knowledge will be built with utmost independence, or in cooperation with other students (Darling-Hammond *et al.,* 2008). Considering that PBL is founded on social-constructivist thesis that social, especially peer interaction has a very important role in learning process (Schunk, 2004), work on projects is usually performed in small groups (Chen & Yang, 2019). Students are encouraged to seek the solutions to the driving question together, which develops cooperative behaviour, critical thinking and communication skills (Krajcik & Czerniak, 2008).

Described stages and characteristics of PBL point to an existence of certain important differences compared to traditional instruction. In view of the fact that teachers in Serbia do not have enough practical experience in working with this model in the first place, it is expected that a series of delicate questions will emerge, but also a set of various problems during its implementation. As a matter of fact, PBL did not become popular in Serbia until recently, a state which is a result of an educational reform that promotes integrative approach to learning and instruction, oriented towards the competencies development and outcomes achievement. In the reformed curriculum for elementary schools, PBL is defined as unobligatory method of work which is meant to enhance the obtainment and the development of more functional knowledge and interdisciplinary competencies of students, and its application is set as a formal request (Programme of teaching and learning for the first grade of primary education, 2018). Also, starting from the school year 2018/19, grammar schools got new curriculum, which introduced 13 interdisciplinary elective subjects that shall be realised by means of PBL (Rulebook on instruction and learning plan and programme for grammar schools, 2020). As far as our country is concerned, in order to support the implementation of PBL in Serbia, trainings, handbooks and other auxiliary materials were developed. Based on the data of the Education Development Institute (ser. Zavod za unapređivanje obrazovanja i vaspitanja), in the period 2018–2020, around 55.000 participants underwent the aforementioned trainings (Đerić, Malinić & Đević, 2021). Quality of those trainings remains an open question for some future research. It is of essential importance for teachers to understand what PBL is, how to employ it, but also why and in which cases its application bears success (Condliffe *et al.,* 2017), and to be ensured that its efficacy is scientifically proven (Bender, 2020).

A considerable amount of individual empirical studies can be found, as well as a larger number of review articles, pointing out to a positive relationship between PBL and learning outcomes, which also identify the challenges students and teachers come across (Balemen & Özer Keskin, 2018; Bender, 2020; Bradley-Levine & Mosier, 2014; Chen & Yang, 2019; Condliffe *et al.,* 2017; Hasni *et al.,* 2016; Holm, 2011; Kokotsaki, Menzies & Wiggins, 2016; Legget & Harrington, 2021; Thomas, 2000). Results of various research can be summarised as follows.

1) Most research about PBL take into consideration an aspect of academic achievement. Studies on the relationship between PBL and academic achievement outnumber studies concerned with effects of PBL on some other learning outcomes (Condliffe *et al.,* 2017). According to those findings, students' academic achievement, higher-level cognitive skills, as well as students' capacity to apply knowledge in new situations is enhanced by PBL (Thomas, 2000). A positive effect on the development of cognitive skills and engagement for students with lower academic achievement was identified (Bender, 2020), as well as insufficient prior knowledge, and average or low verbal capabilities were identified for students that show lower level of interest in particular subjects (Bradley-Levine & Mosier, 2014). Students that come from classrooms where PBL is applied achieve higher results on knowledge tests in comparison with peers that are given traditionally conceptualised instruction (Holm, 2011), and that is especially revealed in the case of procedural knowledge (Ristanović, 2019). Regarding the permanence of knowledge, content learned during the work on projects is retained longer when compared to receptive learning (Bender, 2020);
2) PBL proves to be effective in mastering various subject disciplines such as science and technology, mathematics, but also history and economics (Bender, 2020; Krajcik & Czerniak, 2008);
3) This instruction model positively affects the development of critical thinking – students significantly improve critical thinking skills such as synthesis, evaluation, prediction and reflection (Bradley-Levine & Mosier 2014). Additionally, PBL methodology is considered useful regarding the development of emotional, psychomotor and research skills, it encourages students' self-esteem and learning motivation, initiative, responsibility and cooperation with other students through joint activities (Baran, Maskan & Yasar, 2018; Bender, 2020; Chen & Yang, 2019; Holm 2011; Ristanović, 2016; Ristanović, 2018).

In the 21st century, there is a rise in the significance of PBL regarding educational practice. However, that does not necessarily imply the empirically proven (positive) effect of PBL on academic achievement. The goal of this research is to assess if there is an overall and robust empirical finding which would support the existence of effects of PBL on academic achievement (in comparison with traditional instruction forms). Regarding that, general research hypothesis tested in this research is formulated as follows:

- H_G: There is an effect of PBL on academic achievement of students of various age and educational stage.

Among research articles that strive to synthesise findings of primary research dealing with effects of PBL on academic achievement (and also their association), one conducted by Chen & Yang (2019) is distinguishable, in which they found a

moderate up to a large positive effect of PBL on students' academic achievement, compared with traditional instruction ($d_+ = .71$). These authors compared effects of PBL with effects of traditional instruction forms on students' academic achievement. Chen & Yang (2019) found that association between PBL and academic achievement can be moderated by subject area, school location, hours of PBL instruction, and informational technology support, while moderating effects were not found regarding the size of PBL-instructed class and students' educational stage.

METHODOLOGY

Searching for primary sources and study eligibility criteria

Search for primary sources was conducted in December 2020, firstly in English, and then in Serbian (although there were no research articles in Serbian in the final database). Searching strategy encompassed systematic search for primary studies, primarily via academic search engine *Google Scholar* (as recommended by Chen & Yang, in order to avoid potential omitting of eligible studies by browsing individual research databases; Chen & Yang, 2019), which was accompanied by *Educational Resources and Information Centre (ERIC)* database search, as an auxiliary information source and the largest educational research database. It seemed that most research articles found in *ERIC* database were also found via *Google Scholar*. We used the following phrases for searching the Internet:

"project based learning" academic OR educational OR school achievement OR performance OR success

and, when searching in Serbian:

"projektna nastava" OR "projektno učenje" akademsko OR obrazovno OR školsko postignuće OR uspeh

This means the keywords (or key phrases) were: (1) *project based learning* [ser. *projektna nastava / projektno učenje*]; (2) *academic* or *educational* or *school* [ser. *akademsko / obrazovno / školsko*]; (3) *achievement* or *performance* or *success* [ser. *postignuće / uspeh*]. This search strategy was chosen because of relatively equal frequency of all aforementioned terms and their combinations in contemporary educational and psychological literature. Three consecutive *Google Scholar* or *ERIC* pages without relevant results were agreed upon to be a criterion for discontinuation of further searching.

This meta-analysis included peer-reviewed primary studies published in scientific journals (some of which are indexed on the SCImago list), which were

published between January 2000 and December 2020. We have established the following study eligibility criteria: (1) studies with student samples of all ages and educational stages were included, with no exceptions regarding students' gender, race and other demographic characteristics; (2) only studies comparing effects of PBL and traditional instruction on academic achievement via experimental or quasi-experimental research design were considered eligible; (3) meta-analysis included studies which contain accurate information regarding sample/group sizes, as well as adequate statistical parameters that can be converted if needed – *t*-statistics, *F*-statistics, χ^2-statistics, means and standard deviations, as well as a small number of other compatible effect size parameters; (4) grade point average (GPA) and its derivatives (parameters of academic achievement calculated on the basis of GPA), as well as success on achievement tests were considered eligible measures of academic achievement; Figure 1. shows how the number of studies has been reduced during the meta-analysis process.

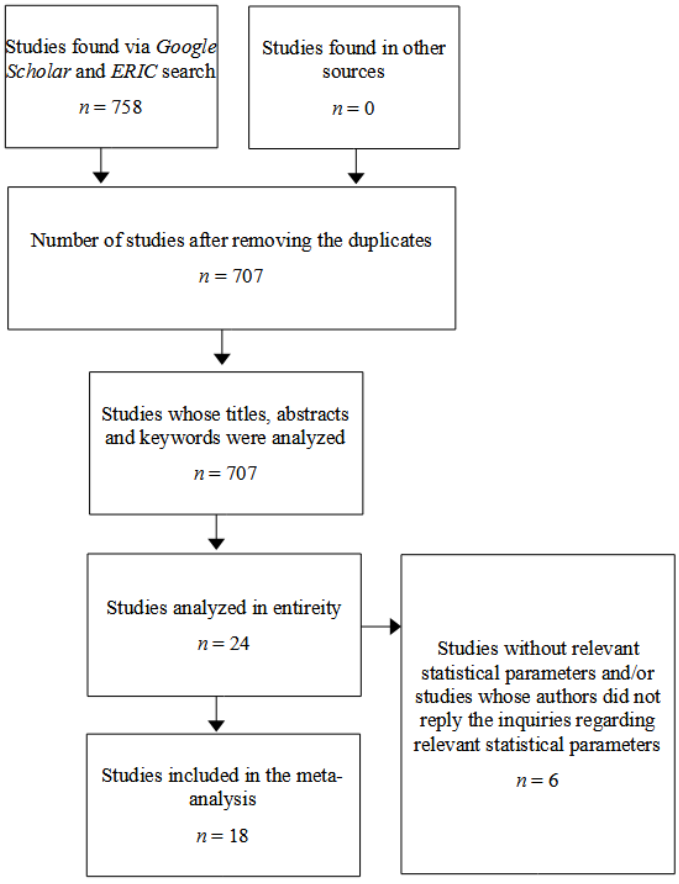

Figure 1: Study number reduction during the meta-analysis process

Regarding the GPA, official GPA records taken from various institutional databases, as well as participants' self-reports on GPA were taken into account. This meta-analysis did not include studies that employed various subjective measures of academic achievement, which are, incidentally, ever more present in educational research.

Firstly, the title, keywords and abstract of every study were analysed in detail. The papers that proved suitable on the basis of this preliminary analysis and that were available, were analysed in their entirety. If, based on the title, keywords and abstract, it was evident that a particular study was not eligible for this meta-analysis, that study was excluded from further consideration. If a study was fit for the meta-analysis based on this preliminary search, its full text was included into further analysis. When upon preliminary analysis it could not be decided if a particular study was eligible for the meta-analysis, a full text was analysed and the eligibility decision was made afterwards. Studies that could not be categorised as eligible, even after the full text analysis, were left for reconsideration after other studies had been analysed.

Unfortunately, as the final number of eligible studies was too small (n = 18), this meta-analysis examined overall effect of PBL on academic achievement, without consideration of moderating effects and relationships with various other variables (for example, socioeconomic status, group size, gender, technological saturation and many others), which undoubtedly deserves special attention and separate research, and which is a great limitation of this meta-analysis.

Also, it is important to notice that the starting point in this meta-analysis is random effects model assumption (Borenstein, Hedges, Higgins & Rothstein, 2019). The reason for that is, above all, that included effect sizes come from independent primary studies conducted by independent researchers, which certainly does support the functional equivalency of studies included in the meta-analysis. Participants in functionally different primary studies (with different sample populations, various methodological designs, that are conducted by different researchers and so on) were in different conditions, so the assumption about a fixed effect model (Borenstein *et al.,* 2019) in different studies would remain unsubstantiated. Furthermore, primary studies examining effects of PBL on academic achievement are, regarding the operationalisation of PBL and academic achievement, so heterogeneous that interpretation from the perspective of fixed effect model would not be an appropriate strategy. That extraordinary heterogeneity is one reason why out of so many considered primary studies only 18 were included in the final analysis. Thus, researchers came by a whole range of PBL and academic achievement interpretations, which makes a meta-analytic enterprise of this kind exceptionally demanding. In the end, the goal of this meta-analysis is the generalisation of findings to various populations, which also supports the adoption of random effects model. In the results section of this meta-analysis, we will present parameters regarding both the random effects and the

fixed effect model, so that readers converging towards the adoption of the fixed effect model (as done by Chen & Yang, 2019) can have proper data available.

Coding and data analysis

Coding and data analysis were conducted in LibreOffice Calc (v. 7) and Comprehensive Meta-Analysis (CMA v. 3; trial version was used). Sample size and relevant parameters from each study were inputted into the CMA matrix, after which the effect size for each study was calculated, as well as a meta-statistic with accompanying 95% confidence interval.

RESULTS AND DISCUSSION

The final database included 758 primary studies (of which 51 duplicates) out of which 18 eligible effect sizes were extracted (N = 2518), taking into account all the aforementioned criteria. Out of 18 studies included in the meta-analysis, 14 of them follow the independent groups research design, while 4 of them follow the dependent groups research design. Out of 18 analysed studies, in 11 (61%) studies a positive statistically significant effect of PBL on academic achievement was found, while 4 (22%) studies did not provide findings in support of statistically significant effect of PBL on academic achievement. Three (17%) studies found a negative statistically significant effect of PBL on academic achievement. Some additional information regarding 18 primary studies included in the meta-analysis are presented in Table 1.

Table 1: Information regarding studies included in the meta-analysis

ID No.	Study	Sample size	Hedges' g
1	Gratchev & Jeng (2018)	142	.738
2	Gratchev & Jeng, (2018)	112	–.009
3	Gratchev & Jeng, (2018)	128	–.778
4	Landron, Agreda Montoro & Colmenero Ruiz (2018)	41	2.203
5	Baş & Beyhab (2017)	50	3.021
6	Kizkapan & Bektas (2017)	38	.086
7	Rubenking & Dodd (2018)	129	.144
8	Baş (2011)	60	.831
9	Branch (2015)	600	.245
10	Cervantes, Hemmer & Kouzekanani (2015)	227	.377
11	Cervantes, Hemmer & Kouzekanani (2015)	234	.279
12	Karaçalli & Korur (2014)	143	1.138
13	Holmes & Hwang (2016)	60	–.590
14	Santyasa, Rapi & Sara (2020)	124	1.132
15	Filippatou & Kaldi (2010)	24	–1.751
16	Khaliq, Alam & Mushtaq (2015)	33	–3.114
17	Wekesa & Ongunya (2016)	360	.931
18	Çelik, Ertas & İlhan (2018)	13	2.138

Note. Studies with an ID No. of 1 through 14 follow the independent groups research design. Studies with an ID No. of 15 through 18 follow the dependent groups research design.

Relevant statistical parameters regarding the performed meta-analysis are presented in Table 2.

Table 2: Meta-analysis results – both models (n = 18)

Effect size and 95% confidence interval				Null hypothesis testing	
Model	Hedges' g	Lower limit	Upper limit	*Z*	*p*
Random effects	.387	.027	.747	2.109	.035
Fixed effect	.568	.493	.642	14.898	< .001

Regarding the heterogeneity parameter for studies included in this meta-analysis, the I^2-statistic was calculated (Cochrane, n.d.). I^2-statistic points to a heterogeneity degree and can have values from 0% to 100%. If $I^2 \leq 50\%$, studies can be considered homogenous and the fixed effect model is recommended. If $I^2 > 50\%$, there is a large heterogeneity of studies and the random effects model is recommended. In the case of this meta-analysis – $I^2 = 94.87\%$.

From the correlational point of view, we found a meta-analytic correlation between PBL and academic achievement of $r = .183$ ($Z = 1.874$, $p = .061$; $r^2 = .033$) for random effects model, and $r = .252$ ($Z = 15.449$, $p < .001$; $r^2 = .063$) for fixed effect model. In other words, PBL explains 3.3% of variance in students' academic achievement in the case of random effects model (borderline of statistical significance), and 6.3% of variance in the case of fixed effect model. This low percent of explained variance primarily points to a large number of factors with significant contribution to students' academic achievement, and application of PBL instruction model is just one small part in a complex process of education and learning. Also, high I^2-statistic value aligns with the impression about the great heterogeneity of studies that examine effects of PBL on academic achievement, which arises after a qualitative review of different studies. That is one more argument in support of random effects model adoption (although Borenstein et al. do not support making this important decision based solely on the parameter of this kind; Borenstein *et al.,* 2009).

Publication bias analysis

Publication bias refers to the potential impact of unpublished and missing studies, as well as studies with statistically insignificant findings on the results of meta-analysis. In this research, publication bias was examined via the classical Rosenthal method (Rosenthal, 1979). According to Rosenthal, publication bias will not affect the results if the fail-safe number is larger than the tolerance level, whereby the tolerance level is calculated as $5n + 10$, where n represents the number of effect sizes included in the meta-analysis. The fail-safe number in this meta-analysis is 533, and the tolerance

level is 100, so it can be concluded that publication bias does not affect the results of this meta-analysis.

CONCLUSION

Taking the aforementioned into account, and considering that *Hedges' g* is interpreted in a similar way as Cohen's *d* (Cohen, 1988), the results of the conducted meta-analysis point to a low up to moderate effect of PBL on students' academic achievement (g = .387, Z = 2.109, p = .035). Thus, a smaller effect was found when compared to the findings of Chen and Yang (2019; d_+ = .71), for example. Smaller effect obtained in this meta-analysis is most probably the consequence of smaller number of studies included in the final analysis. If various moderators were included, it would be possible to assess with a greater precision on what the effect size of PBL depends on, but, as said earlier, this study did not encompass the analysis of moderator variables because of the very small number of studies that were included in the final analysis. The impression about the moderate effect has also been gained after reviewing the results of primary research dealing with the effects of PBL on academic achievement. The aforementioned certainly justifies further research and implementation of PBL in everyday educational practice, but also suggests that studies examining effects of PBL on academic achievement should strive for a greater methodological rigor. This especially holds for national and regional level, where there is a lot of room for implementation of this educational method that proved to be highly beneficial, not only regarding academic achievement, but also attitudes and feelings towards learning process and knowledge acquisition. That is also another suggestion for researchers of PBL originating from the education in general – to pay the deserved attention to variables such as students' attitudes, emotions, interests, motivation. Further implementation of PBL would also enable more careful examination of its effects on academic achievement, which was shown to be positive in a large body of research.

A serious limitation of the conducted meta-analysis is the small number of studies included in the final analysis and, in view of that, the absence of potential moderator variable effects. Also, by using the search phrases described earlier, no studies in Serbian or from this region were found, which points to the need for studies dealing with effects of PBL on academic achievement. On the other side, the decision to interpret findings about effects of PBL on academic achievement from the random effects model perspective is something that separates this meta-analysis, because of earlier described reasons. However, this report also includes indicators related to the fixed effect model, so that readers who still see a greater justification for the application of this model have an insight into the relevant data.

Future researchers that embark to examine similar subject are encouraged to put every effort in order to make possible a moderator analysis of other variables that could have significant impact on the effectiveness of PBL, such as cultural context, group size, subject of PBL, technological saturation (application of modern technologies in PBL), students' socioeconomic status, and other. Finally, a recommendation would be the use of statistical software that specialises in meta-analytical procedures (for example, Comprehensive Meta-Analysis), which can greatly simplify and shorten the entire procedure.

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ВОЗДЕЙСТВИЕ ПРОГРАММИРОВАННОГО ОБУЧЕНИЯ НА АКАДЕМИЧЕСКИЕ ДОСТИЖЕНИЯ: МЕТААНАЛИЗ

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Аннотация. Программированное обучение рассматривается как альтернативное традиционному трансмиссивному подходу к процессу обучения. Тем не менее, существует небольшое число метааналитических исследований, направленных на обобщение результатов первичных исследований, с целью определить общий эффект программированного обучения на академические достижения, в то время как в национальных и региональных исследованиях таких усилий почти не было. Целью данного исследования является синтез эмпирических данных о воздействии программированного обучения на академические достижения. Восемнадцать релевантных исследований (N = 2518) соответствовали критериям включения в метаанализ. Статистический анализ, предполагая модель переменных эффектов, показывает присутствие слабого или умеренного воздействия программированного обучения на академическую успеваемость (достижения) учащихся (*Hedges'g* = 0,387 [*95%CI*: 0,027 | 0,747], *Z* = 2,109, *p* = 0,035). Результаты показывают необходимость и оправданность дальнейшего изучения концепции програмированного обучения, с целью найти оптимальные способы реализации данной формы обучения.
Ключевые слова: программированное обучение, академические достижения (успеваемость), метаанализ.