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**THE STUDENT TEAM
IN PROJECT-BASED LEARNING**

**ABSTRACT
of dissertation**

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The dissertation work was discussed at a meeting of the Department of Pedagogy and Management of Education at the Faculty of Education of Plovdiv University "Paisii Hilendarski" on 19.12.2023 and is scheduled for public defense before a scientific jury.

The dissertation is 246 pages long, including 205 pages of main text, 16 pages of bibliography (including 21 primary sources, 191 references of which 79 in Cyrillic and 112 in Latin and 11 internet resources) and 25 pages of appendices.

The structure of the dissertation includes: introduction, 3 chapters, conclusions, summary, sources, used literature and appendices. The thesis includes 28 tables, 76 figures and 3 diagrams.

The defense materials are available in the library of Plovdiv University "Paisii Hilendarski".

INTRODUCTION

The new realities, associated with new demands and the rapid pace of development in all spheres of social life, determine the need for timely and adequate change in one of the most conservative spheres of life – education.

The psycho-physiological development of primary school students is a prerequisite for their increasing autonomy and independence in decision-making, and school is the place where children who already possess basic language and social skills begin to put them into practice. It is crucial for the successful realization of both upbringing and educational goals that each child feels a significant part of the whole – a class or a team.

Project-based learning takes place in the context of teamwork during which students engage in interactions based on empathic communication with each other. The present study investigates whether the implementation of project-based learning among students leads to changes in certain social competencies and in group cohesiveness under teamwork conditions. The dissertation study is also relevant with the expectation of its practical applicability, as the potential of project-based learning to influence teamwork skills, empathy levels, and student class cohesiveness in the elementary stage of education have been poorly studied.

Teamwork requires participating students to be flexible in their behaviour, to overcome their egos, to develop self-discipline and to be responsible for their actions in order to achieve the common goal. Empathy, as part of social-emotional competences, is linked to social awareness and, through communication during project-based learning, to the ability to maintain positive relationships, the ability to accept the different point of view and different experiences of the other student without trying to change them, i.e. to see the situation through the eyes of your team partner. The application of project-based learning, in which students work in teams, is an appropriate practice that enables the monitoring of changes in the level of group cohesion.

Primary school age is an appropriate stage for the formation of social-emotional skills. They are among the determinant factors of how children do in school because of their relationship with the students' subjective well-being. The issue of the formation of social-emotional competencies is relevant and focuses on the involvement of students in teamwork, building a student community based on mutual cooperation and empathy.

The role of the teacher is becoming increasingly important in project-based learning, in which the student is at the centre of the educational process and the teacher acts as a consultant at different stages of the team activity to

unite and motivate students and to support the development of key competences.

The motive for conducting the present study is the currently developed educational programs, the emphasis of which is on alternative approaches to the implementation of the educational process. The focus of modern educational practices is on making learning less formal. Stimulating interaction between students, developing their teamwork skills, makes them more responsible and more cohesive in their efforts to acquire knowledge and skills, form competences and find common solutions.

The main research question in this dissertation is if the implementation of project-based learning with primary school students affect their teamwork skills, levels of empathy and class cohesion i.e. how do the components of the examined constructs interact and do the increased levels of the measured social competencies suggest higher levels of class cohesion.

The purpose of this dissertation research is to analyze and summarize the system of statements and empirically obtained results about the impact of project-based learning on the specifics of the student team in the initial stage of education.

Thus formulated, the aim of the dissertation research defines its object, subject and tasks.

The object of the dissertation research is the generalized discourse representing the constructs related to the research topic.

The subject of the dissertation research is the interpretation of the constructs teamwork skills, student team cohesion and project-based learning in theoretical and empirical terms.

Tasks of the dissertation research:

1. To present the understanding of project-based learning in historical and contemporary perspective.
2. To objectify project work in theoretical and practical discourse in the primary stage of education.
3. To plan and conduct an empirical study and use the results to offer recommendations for project-based work in the primary stage of education.

The dissertation is structured in two interrelated parts: a theoretical problem statement and an empirical study.

CHAPTER 1

A THEORETICAL FORMULATION OF THE PROBLEM OF THE STUDENT TEAM IN PROJECT-BASED LEARNING

I. Project-based learning – nature and specifics

1. Historical overview of the origin and development of project-based learning

Project-based learning is among the main pedagogical constructs in the dissertation research and this necessitates a brief historical overview of its origins, spreading and application. Some researchers of the project-based method share the view that its application in schooling is the result of the progressive educational movement that emerged in the United States in the late 19th century (Woodward, 1887; Kliebard, 1986; Krauth, 1985), while others argue that it originated and its application began in the late 16th century in architectural schools in Italy (Wilkinson, 1977; Weiss, 1982; Knoll, 1991; Schöller, 1993). Based on the sources studied and analyzed, the following periodization can be made related to the spreading of project-based learning in Europe and America, as well as its application in Bulgarian education:

- 1.1. 1590 – 1765: Project work begins in architectural schools in Europe.
- 1.2. 1765 – 1880: Establishment of the project as a method of teaching and its transfer to America.
- 1.3. 1880 – 1915: Application of the project method in work training and in the mass public schools.
- 1.4. 1915 – 1965: Redefinition of the project method and its transfer from America back to Europe.
- 1.5. 1965 – present: Third wave of spreading the project method.
- 1.6. The project method in Bulgarian education.

2. Place and application of the term project-based learning in school Pedagogy

The term project-based learning is subject to multiple interpretations. According to Dickinson it is a method of teaching (Dickinson, 2008), for Markham, Larmer, and Ravitz it is a systematic approach to teaching (Markham, Larmer, & Ravitz, 2003), Penchev defines it as a form of organizing learning (Penchev, 2003), according to Frank and Barzilai it is a type of educational tool (Frank & Barzilai, 2006), Kolesnikova and Gorchakova-Sibirskaya claim that it is a means of organizing students' independent work, (Kolesnikova, Gorchakova-Sibirskaya, 2005), and according to Delinesheva

it is a pedagogical technology, a form of organizing learning (Delinesheva, 2006).

For the purposes of this study, it is assumed that project-based learning is an autonomous learning system and a method for acquiring social competencies in the context of the overall education system, where didactic goals are achieved by solving an existing problem that has been studied and considered in detail, with the solution taking the form of a real, tangible practical outcome. The achievement of such a result is the consequence of cooperation and mutual support between the participants in the teamwork, of students' independent creative thinking combined with the skills to make interdisciplinary connections, to predict the results of the activities and to make an effective selection of solutions that will lead to an optimal result. The application of project-based learning in school pedagogy today involves a transformation in the main components of the traditional pedagogical process: the model of learning; the organization of learning; the roles played in the learning process by students and teachers; the learning environment.

3. Project-based learning – types and classifications

3.1. General characteristics of project-based learning

A model of project-based learning developed in 2014 by the Buck Institute (USA), with its 7 mandatory elements, called the “gold standard in project-based learning” (Boss, Larmer, 2018), is presented and analyzed. Its three main parts are analyzed: learning goals related to students' mastery of academic content and the development of skills and preparation for successful school and life experiences; core project elements: guiding problem or question, deep inquiry, authenticity, student voice and choice, critique and revision, reflection, public product; project-based learning practices in which students seek information to solve problems, build their own knowledge by helping to retain, transfer and use it in concrete life situations.

3.2. Types of project-based learning. Classification of types.

The classifications of the types of project-based learning vary widely, as scholars working on the topic identify its various attributes and indicators as leading.

An overview is made of the types of project-based learning according to K. Frey with a leading indicator being the participants in the project activities (Frey, 2002), D. Jack with emphasis on the range of tasks addressed during project implementation (Jaques, 2000), E. C. Polat dividing them into 6 types according to different attributes (Polat, 2005), V. D. Simonenko, who classifies them according to content, and A. Morgan (1983) proposes three generalized models of project work for educational purposes: project exercises, project

components, project orientation (Morgan, 1983). A brief analysis of collaborative learning (cooperative learning) (3.2.1.) and design thinking as an approach to project-based learning (3.2.2.) is made.

3.3. Stages for the implementation of project-based learning

This paragraph of the dissertation describes in detail the stages to be passed in order to achieve the objectives and implement the learning tasks in project-based education as it has to be planned, organized and conducted according to established standards. The main stages which project work undergoes are: planning, implementation, project presentation, and in each of the stages activities are carried out in a certain sequence.

3.4. The teacher's role in project-based learning

During project-based learning, depending on the age characteristics of the students and their experience in teamwork, the teacher has to perform different roles, keeping in mind the condition that the learning process is student-led and the teacher can only facilitate it but not control it. The ISTE standards related to facilitation are presented (ISTE Standards: For Educators). Facilitation and coaching are analyzed as activities that are appropriate for teachers using project-based learning in their teaching practice. The facilitator supports the work of the group by organizing and guiding it for maximum effectiveness, while the coach works to achieve real concrete goals through the development of students' personal skills. Teachers' decision whether to act as a facilitator or a coach is directly related to and determined by the goals, objectives and methods of teaching, as well as the specific needs of the students. Project-based learning puts the student at the centre of learning, stimulating him/her to be an active participant and discoverer of new knowledge and experiences. The teacher also has a new function – advisor and facilitator, creating an appropriate learning environment for the realization of students' creative ideas and teamwork.

3.5. The place of project-based learning in school policies and regulations in Bulgaria

Project-based learning, which enables each student to apply the theoretically acquired knowledge, transformed through his/her own vision of its practical application in the form of skills and competences for solving specific practical problems, corresponds fully with the requirements of the Pre-school and School Education Act. Personal fulfillment is achieved through active teamwork and among team members a consensus must be reached on the main priorities of the project activity. According to the Inclusive Education Regulation, the overall care relating to the support of individual needs can take place in the context of activities related to the acceptance of the student as a fully

participating member of a team, which is one of the characteristics of project-based learning.

The legal document that directly regulates the implementation of project-based learning in the primary stage of education is the Regulation on the amendment and supplementation of Regulation No. 4 of 2015 on the curriculum adopted in 2020 should which states that “young students in grades I – III should be engaged more fully with activities related to projects, creativity, teamwork by regulating 5 additional days for visits to cultural institutions, trips for educational purposes, green schools, creative events, etc., which may be scheduled between school days or after school hours.”.

3.6. Implementation of project-based learning in the primary stage of school education

In the pedagogical practice in the primary stage of education, project-based learning is related to the skills and initiative of the teacher as well as the age characteristics of children and their psycho-physiological capacities for both independent and team activities. Primary school age is significant in a child's development as this is the stage where the transition from visual-figurative to verbal-logical thinking takes place. In order for the students to be motivated and be active participants in their project activities, the problem being solved by the project must be personally and socially relevant to the students and be in their zone of proximal development. The realization of project activities in primary school education is related to the following features of teamwork: autonomy, optimal role distribution, communication, cooperation and synergy.

3.7. Good Practices for Project-Based Learning in Schools – Foreign and Bulgarian Experience

Project-based learning in Bulgarian schools is currently accepted and applied as a form of education that stimulates the development of skills and competences in students, which are necessary for their integration and help them succeed in the XXI century. The two-year epidemic situation in the country, conditioned by the spread of COVID-19, and the related need for distance learning, has presented teachers with the task of organizing learning in a new kind of environment, in which to achieve the goals and objectives of learning is directly related to the students' skills on how to learn effectively. Educational technologies now need to be transformed in order to be in sync with the changed paradigm of education, which puts the student with his personal, psychological and social individual qualities, needs and competences at the centre of the educational process.

The section presents several good practices from Europe and America related to the implementation of project-based learning, which does not fully represent their diversity.

1. Project work
2. Learning through collaboration (cooperative learning)
3. Learning through the Discovery Model
4. The design-thinking approach
5. School Design for Change programme of Design for change – “I can”
6. Educational model “The 3 compasses of the 21st century education”
7. Project-based distance learning in a virtual environment

Good pedagogical practices and experiences are part of the dissertation research, as they are a relevant format for building learning communities in which to contribute both to getting acquainted with innovations in the field of education and to enhancing the professional competences of educators.

II. The student team – essential characteristics

1. The group as an object of research

The group as a collection of people who are united and in close communication with each other has been the subject of much research that can be traced back in time. A brief review is made of some of the most popular and long established scientific concepts of J. K. Homans, R. Hare, J. K. McGrath, G. H. Freud, W. Wundt, E. Durkheim, F. Allport, J. Moreno, K. Levin and W. Schutz related to the group, the common feature in them all being that members of the group enter into interactions of various nature and duration in order to perform joint actions that lead to some satisfactory outcome.

An analysis and a comparative characteristics of the terms group and team is made **(1.1)**. Emphasis is placed on the interrelationships within the team and group behavior, as well as scientific research proving that there are not only interrelationships and cooperation among group members, as well as team members, but also interdependence, which is explained by the phenomena of “social facilitation”, “social inhibition”, etc. **(1.2)**.

The analyzed concepts of team formation focus on the processes of group dynamics, the stages of group formation from the position of the leader, the phases that are passed through in this formation, the formation of micro-groups, the reasons for the selection of the group leader and his replacement, the distribution of roles in teamwork among the participants in the team **(1.3)**.

2. The student team in the application of project-based learning. Team dimensions

The structure of the team is determined by the functions performed by its members and the nature of the personal relationships between them. The effectiveness of project-based learning is directly related to the degree of cohesiveness, the exchange of ideas, activities on common projects and cooperation with the teacher. During teamwork, students focus on both their general and individual qualities, they begin to self-reflect and self-evaluate, and become more self-critical in their evaluations. Every team is characterized by group dynamics, which deals with the patterns and tendencies of behavior that occur as individuals carry out their tasks and responsibilities during group work, and collaboration among teammates, which involves the integration and synthesis of each of the group member's ideas and experiences. Members must be personally accountable for their assigned tasks so that they can adequately contribute to the group goal. This dependence on other group members creates a sense of responsibility for each individual. The sense of individual responsibility within the group is a component of the structure of the fundamental knowledge of cooperation. **(2.1)** The school community, classes and class teams could not function if there was no empathy among their members. Expressions of empathy in school are related to skills that need to be formed and that find their direct use in teamwork. Expressions of empathy between individuals and in the group are the subject of many theories. For the purposes of this study, Social Appraisal Theory and Intergroup Emotions Theory are used **(2.2)**. Among the main constructs in the empirical study is group cohesion. This requires us to present the main ideas embedded in some of the most popular concepts of group cohesion: K. Levin, L. Festinger, A. Lott and B. Lott, T. Newcomb, J. Moreno, R. Merton, M. Deutsch, J. Laplanche and Jean-Pontalis, A. Petrowski, K. Bolan and R. Hoyle, Iv. Ivanov. The level of cohesion in the group fluctuates over time. It is not a gradually accumulating quality of the group and it is normal for the group to have moments of regression. Different team members feel differently about team belonging. Cohesion is expressed in the willingness to stay in the group, in the willingness to cooperate when solving common problems and to preserve the group. Cohesiveness is usually highly stimulating and desirable as a factor in group effectiveness **(2.3)**.

CHAPTER 2

AN EMPIRICAL STUDY

1. Design of the empirical study

1.1. Object and subject of the study

The object of the empirical study is the student team in the context of project-based learning.

The subject of the study is the existence of changes in some social-emotional skills of primary school students, as well as group cohesion of the class as a result of the implementation of project-based learning.

1.2. Aim and objectives of the empirical study

Aim: To investigate and explore the potential of project-based learning to influence students' teamwork skills and empathy levels, as well as student class cohesion.

Tasks:

1. To implement project-based learning with primary students during one academic year.
2. To define criteria for measuring students' teamwork skills.
3. To conduct an entry and exit survey with appropriately selected instruments at the beginning and end of the school year.
4. To record and analyze the results and make recommendations for the training practice on the basis of the formulated conclusions and summaries.

1.3. Hypotheses of the empirical study

Hypothesis 1. It is assumed that the implementation of project-based learning will increase the teamwork skills of primary students in the specified dimensions.

Hypothesis 2. It is presumed that students' levels of empathy and emotion recognition skills will be positively influenced by teamwork in the implementation of project-based learning.

Hypothesis 3. It is presumed that the factors of gender and demographic characteristics will have an impact on the teamwork skills of the students being tested.

Hypothesis 4. It is assumed that the implementation of project-based learning and student teamwork will be a real factor in changing class cohesion.

1.4. Participants of the empirical study

The empirical study was conducted with 702 students aged 7 – 11 years, in the primary stage of education in the following schools: Aleko Konstantinov Primary School and Stoyan Mihailovski Primary School in the town of Plovdiv,

Vasil Levski Primary School in the town of Krichim, Paisii Hilendarski Primary School in the town of Dupnitsa, Graf Ignatiev Primary School in the village of Graf Ignatievo and Hristo Botev Primary School in the village of Popovitsa.

2. Organization and methodology of the empirical research

2.1. Research toolkit

To conduct the empirical research, 3 instruments were used (2 standardized and one non-standardized/author's).

2.1.1. Non-standardized/author's questionnaire for teamwork skills (cooperation, activity, initiative, responsibility).

To measure changes in social competence, a non-standardized author's questionnaire was used, which was validated before the survey. The questionnaire was designed for children of primary school age and it aimed to identify changes in their social competence indicators – teamwork, which occurred after the implementation of project-based learning. The indicators of social competence – teamwork that are measured by the questionnaire are: cooperation, activity, initiative and responsibility.

2.1.2. A standardised test of empathy in children of primary school age ('Feelings and Thoughts'), with reported general levels of empathy and emotion recognition.

Measuring the changes in the general levels of empathy and emotion recognition in an empirical study is done by means of a standardized test for measuring empathy in primary school-aged children. It has been adapted and published in Bulgarian as the “Test for Measuring Empathy in Children of Primary School Age. Feelings and Thoughts” in *Fundamentals of Psychological Measurement – St. Stoyanova (2007)* with attached 6 photographs of faces with clearly distinguishable facial expressions of the six basic human emotions: happiness, surprise, fear, anger, sadness and disgust. (Jaldetti, Vassilev and Stamatov, 1994 based on Stoyanova, 2007).

2.1.3. Standardized sociometric procedure to determine the level of group cohesion of the class.

To detect changes in group cohesion, a sociometric survey is conducted, which is standardized. Its results are presented through sociograms and sociometric matrices, and a formula proposed by I. P. Ivanov (Ivanov, 2006) is used to calculate the coefficient of group cohesion. After processing and summarizing the obtained results, the changes in group cohesiveness are determined.

CHAPTER 3

ANALYSIS OF THE EMPIRICAL RESEARCH RESULTS

1. Statistical methods used to analyze the results

- Factor analysis to test construct validity – exploratory for the study before and confirmatory (confirmatory) for the study before and after implementing project-based learning;
- Reliability check using Cronbach's alpha method;

The results of the study were used for:

- Descriptive methods – frequency characteristics, measures of central tendency and measures of dispersion were calculated, diagrams and histograms of raw scale scores and individual subscales were made;
- Methods for testing the hypothesis of normality of the distribution of the scale and subscales – Kolmogorov-Smirnov for samples with a size greater than 200;
- Dispersion analysis of results before and after the implementation of project-based learning.

2. Analysis of the results of the questionnaire on teamwork before and after the implementation of project-based learning

2.1.1. Semantic structure of the questionnaire. Factor analysis

For the purposes of this study, 702 respondents were interviewed i.e. the prerequisites for factor analysis for testing the construct validity were met. Factor analysis of the items was conducted using the principal components method with varimax rotation. For the results obtained before the experiment, an exploratory and confirmatory factor analysis was conducted, and for the data after the experiment, a confirmatory factor analysis with subscales was conducted.

According to the exploratory analysis, two subscales are formed, which makes it possible, when using the questionnaire on teamwork for practical purposes, to combine the questions into two subscales: cooperation and responsibility and activity and initiative.

The confirmatory (validating) factor analysis confirms almost completely the exploratory factor analysis and the scale structure. It was carried out with the data after the experiment (2.1.1).

2.1.2.1. Psychometric characteristics of the questionnaire on teamwork

The reliability of the questionnaire on teamwork was established by means of Cronbach's alpha coefficient, which was calculated before and after the implementation of project-based learning among primary school students. The questionnaire contains 10 items. Before the implementation of project-based learning in terms of internal consistency of psychometric instruments in the present study, Cronbach's alpha in the questionnaire on all 10 items of the scale is 0.741, which means that the scale has very good reliability for practical purposes. (2.1.2.1) After applying project-based learning in terms of internal consistency of the psychometric instruments in the present study, the Cronbach's alpha of the questionnaire on all the 10 items of the scale is 0.802 which confirms its very good reliability for practical purposes. The analysis of the contribution of each item to the reliability of the scale, Cronbach's alpha when removing an item, shows that it is almost the same for the scale and if an item is removed, it is not necessary to remove another item because its reliability will not change much (2.2.1.1.).

The reliability analysis using Cronbach's alpha of the questionnaire on teamwork before the experiment was performed on four subscales: cooperation (2.1.2.2.1.), activity (2.1.2. 2.2.), initiative (2.1.2.2.3.) and responsibility (2.1.2.2.4.) and after the experiment on four subscales: cooperation (2.2.1.2.1.), activity (2.2.1.2.2.), initiative (2.2.1.2.3.) and responsibility (2.2.1.2.4.). The results show that all the items contribute almost equally to the reliability of the subscales, which means that there is no need to remove items.

Diagrams and histograms of the raw scale score and the individual subscales were made, and frequency characteristics, measures of central tendency, and measures of dispersion were calculated using descriptive statistical methods.

From the normality test performed on the distribution of raw scores on the teamwork scale and on the subscales of cooperation, activity, initiative, and responsibility using the Kolmogorov-Smirnov criterion, it appears that the distribution is not normal.

2.2.2. Dispersion analysis of the results by gender, demographic characteristics and age of students after the experiment

Dispersion analysis was used on the factors of gender, location, and grade/age to see if the scale scores are affected by them.

Gender factor

The effect of the independent factor gender on the dependent variable raw score on the teamwork scale was statistically significant ($p=0.034<0.05$).

Boys and girls showed similar mean scores on the teamwork scale after the experiment, but the difference is significant (**Table 1**).

Table 1. *Descriptive statistics. Scale score*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Boys	335	42.29	5.812	.318	41.67	42.92	16	50
Girls	367	43.17	5.120	.267	42.64	43.69	16	50
Total	702	42.75	5.475	.207	42.35	43.16	16	50

Location factor

The effect of the independent factor location on the dependent variable raw score on the teamwork scale is statistically significant ($p=0.000<0.05$). Participants from different locations show similar mean scores on the scale, yet differ significantly. An additional post-hoc analysis was conducted to compare the different groups by location. It appears that there is a significant difference between the scores of participants from Plovdiv and a village and between those from a small town and those from a village according to Tukey's method ($sig.=0.00$). The highest scores were obtained by those from a village, then those from Plovdiv and finally those from a small town.

2.2.5. Comparison of the results of the questionnaire on teamwork before and after the experiment

In order to compare the results obtained before and after the experiment, a hypothesis test was conducted to compare the means of related samples on each subscale and scale. The results of the statistical procedure can be seen in **Table 2**.

It turns out that the scores on the scale for teamwork have increased, but there is no statistically significant difference between the scores before and after the experiment ($sig. =0.272>0.05$).

On the subscale of cooperation, there does not appear to be a statistically significant difference between the results before and after the experiment ($sig. =0.882>0.05$, Table 2), as the results after the experiment did not change significantly.

On the activity subscale it appears that there is a statistically significant difference between the results before and after the experiment ($sig.=0.001<0.05$, Table 2) The results after the experiment are higher and this

means that the activity has increased after the experiment. The difference between the results before and after is experiment is small but significant.

Table 2. *Statistics for pairwise comparisons*

Scale		Mean value	Number	Standard deviation	Statistics	Significance (sig.)
Total test score	Before	42.45	702	5.059	-1.100	0.272
	After	42.75	702	5.475		
Cooperation	Before	16.86	702	2.572	.148	0.882
	After	16.84	702	2.781		
Activity	Before	8.43	702	1.340	-3.424	0.001
	After	8.65	702	1.289		
Initiative	Before	8.59	702	1.374	-2.190	0.029
	After	8.74	702	1.304		
Responsibility	Before	8.57	702	1.355	0.719	0.472
	After	8.52	702	1.440		

On the initiative subscale, there also appears to be a statistically significant difference between scores before and after the experiment (sig.=0.029<0.05, Table 2). The scores after the experiment are higher, i.e. after the experiment initiative has increased. The difference between the scores before and after is small but significant.

On the responsibility subscale, there appears to be no statistically significant difference between the scores before and after the experiment (sig.=0.472>0.05, Table 2). The results after the experiment did not change significantly.

Discussion

- The level of social competence of primary school students for teamwork after the implementation of project-based learning increased, although it was not statistically significant. Activity and initiative showed statistically significant growth, while cooperation and responsibility maintained their original levels.
- The choice of a teamwork partner for primary students is based on their emotional rather than pragmatic judgement.
- The different roles that students play and their participation in different teams leads to an increase in their self-esteem based on self-presentation, which is reflected in an increase in their overall activity level.

- Increased initiative, presumably, is associated with improved student skills in identifying significant ideas from minor ones and improved student skills in presenting their own ideas.
- Perhaps working systematically on projects makes students more competitive and creates the feeling that to reach an agreement with the other partner is not such an easy task. This can be described as “getting into reality” training.
- Through project-based teaching, students are able to resolve the typical mid-childhood internal conflicts between “because I want to” and “because I have to” in favour of “because I have to”. This decision is the result of the responsibility that students show towards their teammates and towards the overall outcome of the project activity.
- The demographic profile of the participants in the diagnostic procedure influences teamwork skills. Different sized localities show different rates of increase. This could be a reason to conduct further research in order to clarify the causes and address them.

3. Analysis of empathy test results for primary students before and after the implementation of project-based learning

For the purposes of the empirical study, a standardized test of empathy in children of primary school age (“Feelings and Thoughts”) (Stoyanova, 2007) is used, with reported general levels of empathy and emotion recognition.

The test reliability was established using the Cronbach's alpha coefficient, which was calculated before (3.1.1.1) and after the implementation of project-based learning (3.2.1.1) among primary students. The test contains 18 items and 6 photographs of faces with distinct emotions. The reliability of Cronbach's alpha on all 18 items of the scale is 0.676, which means that the scale has good reliability for practical purposes. The analysis of the contribution of each item to the reliability of the scale, Cronbach's alpha for item removal, shows that it is almost the same for the scale and it is not necessary to remove an item because its reliability will not change much.

Diagrams and histograms of the raw scale scores were made using descriptive statistical methods to calculate frequency characteristics, measures of central tendency, and measures of dispersion.

From the normality test performed on the distribution of the raw score of the empathy test using the Kolmogorov-Smirnov criterion (sig.=0.00<0.05, Stat.=0.097), it appears that it is not normal.

Figure 1. provides a diagram comparing the mean scores before (48.26) and after (50.06) for the total level of empathy. It turns out that there is a statistically significant difference between the results before and after the experiment (sig. =0.00<0.05, Table 3).

Table 3.

Scale		Mean value	Number	Stand. deviation	Statistics	Significance (sig.)
General empathy	Before	48.26	702	8.509	-4.100	0.000
	After	50.06	702	9.405		

The results after the experiment are higher as seen in Figure 1. This means that general empathy increased after the experiment. The difference between the results before and after the experiment is small but significant. **(3.3)**

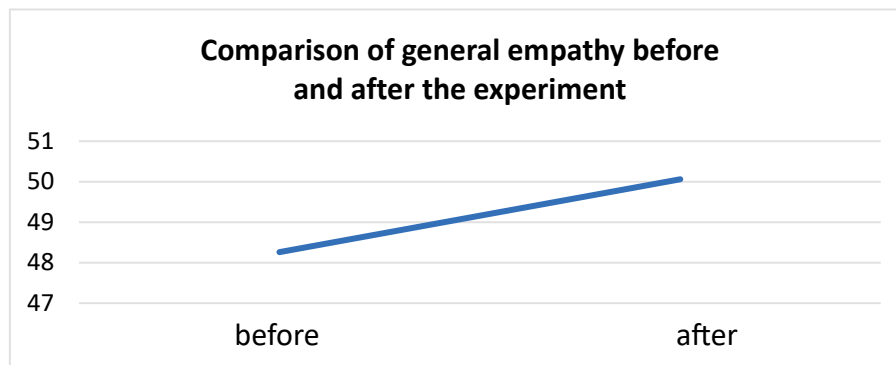


Figure 1. Comparison diagram of the mean values of the general empathy test

Discussion

- Participation in project activities has contributed to improving empathic communication and tolerance between partners in teamwork.
- There are positive changes in both students' personal self-assessment of their own significance and their capacity for self-control.
- Respondents' ability to self-regulate has increased i.e. students are able to control better their emotions, behaviour and attention in order to achieve better results both in terms of their education and in terms of the place they occupy in their social environment.
- When comparing the students' scores related to their emotion recognition skills, it is found that there is a difference in the direction of their increase.
- Teamwork in project-based learning helps students to regulate the expression of their emotions, to be empathetic in communicating with each other, and the opportunities to observe and evaluate the behavior and non-verbal expressions of basic human emotions of other team members during work also helps to increase their empathy.

4. Analysis of the results of a sociometric study of class cohesion before and after the implementation of project-based learning

For the purposes of the empirical study, a sample of 9 classes with second, third, and fourth grade students (195 students in total) studying in a large city, a small town, and a village was randomly selected. Sociometric methods were used to quantitatively measure and analyze the structure of immediate emotional interpersonal relationships within the team and to establish team cohesion.

Sociometric tables were prepared based on the choices and rejections recorded in the questionnaires that students completed. The visual spatial representation of the positions of individual students and the choices and rejections made or obtained by them is presented in target-type sociograms. On the basis of the sociometric data thus presented, the group cohesion coefficient can be calculated. It reflects the mutual sympathies among the students in the class related to the total number of participants in the study. To calculate the group cohesion coefficient, the formula proposed by I. P. Ivanov (Ivanov, 2006) is used.

$$C = \frac{\sum xy(+)}{n(n-1)}$$

C – group cohesion index
xy(+) – number of mutual positive choices in the group
n – the total number of individuals in the group

Table 4. presents a summary of the results obtained from the study on group cohesion of individual classes at the beginning of the school year before the implementation of teamwork in project-based learning and at the end of the school year after the implementation of teamwork in project-based learning (4.1.2).

Table 4. Group cohesion scores before and after implementation of project-based learning

Class	Location	Group cohesion index at the beginning of the study	Group cohesion index at the end of the study
2 nd grade	A big town	0,45	0,54
2 nd grade	A small town	0,11	0,31
2 nd grade	A village	0,54	0,63
3 rd grade	A big town	0,34	0,43
3 rd grade	A small town	0,58	0,58
3 rd grade	A village	0,53	0,67
4 th grade	A big town	0,45	0,54
4 th grade	A small town	0,52	0,52
4 th grade	A village	0,62	0,75

Discussion

- In all classes in both phases of the study, the distribution of students remains in four informal groups (leaders, accepted, marginals, and outsiders), but the participants in these groups are different because the students have changed the criteria by which they make their choices.
- The choice of leaders by primary students is not pragmatic but rather emotional. At the beginning of the study, leadership is associated with academic achievement, and at the end, students' organizational and presentational qualities, as well as their display of empathy during project activities, are leading.
- Some of the outsiders are named as such based on a very large number of negative choices. Defining them as undesirable partners is mainly related to their lack of demonstration of social teamwork skills. At the end of the diagnostic procedure, the disapproval of most of them is strongly reduced.
- There is a difference in the change in class cohesion in locations of different sizes. In one of the classes, the cohesiveness increased by more than twice, while in two of them it remained at the same levels.
- Collaborative activities during project-based learning change students' attitudes towards teamwork, enable them to get to know each other better, and this influences the degree of group cohesion.

5. Conclusions

5.1. Conclusions from the empirical study

1. The teamwork skills of the students who participated in the diagnostic procedure where project-based learning was applied have increased. On some indicators /activity and initiative/ the trend is clear, high levels of cooperation are maintained, and responsibility is associated with displays of critical thinking and increased competitiveness among students.

2. Participation in project work involves students participating in a different team and playing a different role, leading to an increase in student self-esteem based on self-presentation, which is reflected in an increase of the overall activity level.

3. Collaboration within teams remains at high levels, increasing as students get older. At the end of the diagnostic procedure, the choice of a partner for teamwork continued to be based on their emotional rather than pragmatic judgement.

4. At the end of the diagnostic procedure, the reported levels of the measured indicators – cooperation, activity, initiative and responsibility are high and students have high social competence to work in a team.

5. The diagnostic was conducted over the course of a school year and it is suggested that this is not a sufficient period to observe more significant positive changes in teamwork skills.

6. After the empirical study, there was a change in the level of teamwork skills by gender, with better rates among girls, and among students from different locations, and it can be stated that the factors of gender and demographic characteristics have an impact on the teamwork skills of the students studied.

7. After the implementation of project-based learning, the overall levels of empathy in the surveyed students increased, as the difference between the measured levels before and after the experiment was small but statistically significant. The data for a large city, a small town, and a village show that there are no statistically significant differences between students from different sized locations in terms of increasing their empathy. Age differences in the capacity for empathy are mainly seen in terms of insight into the experiences of others. Students aged 7, 8 and 9 are less able to recognize the rights of others to have a different opinion, whereas 10 – 11 year olds are more successful in putting themselves in someone else's shoes and making an effort not to hurt their feelings.

8. Recognition skills of non-verbal emotions are positively influenced by students' teamwork in the implementation of project-based learning, as they also recognize more complex emotions /surprise/.

9. The group cohesion of students after the implementation of project-based learning has increased and the data for a large town, a small town and a village show that there are differences between locations. In all classes in a large urban school, cohesion increased by the same percentage (27.3%). In the classes with students from a small town, the trend is for a more significant change in the younger students /in the second grade increased by more than 100%/, and in the third and fourth grades – the level of cohesion reported before the study was maintained. In classes in rural schools, cohesion has also increased without any pattern. The increase in team cohesion is influenced by the extent to which team partners know each other and the relationships that exist between them not only in the school community but also in the out-of-school community, and in smaller settlements, opportunities for communication and getting to know students both in and out of school are greater. It is likely that a full-day organisation would have a positive impact in this respect, increasing the time and way in which pupils interact with each other.

10. As a result of the implementation of project-based learning, students' criteria for identifying leaders, outsiders, and marginals have changed. The

summarised data from the sociometric survey shows that in all classes, regardless of the locality in which the school is located, leaders are either completely or partially replaced by others and this is not linked to their success in terms of mastering the curriculum content. The newly formed leaders have very good organizational skills, and the key factors in choosing a leader are other children's emotional judgment of their qualities, which changes as they grow older. At the later stage of primary school, the choice of leader is more conscious and is made on the basis of usefulness to teamwork, displays of empathy, cooperation and support for other team members. The number of marginals in classes from schools in all locations that participated in the study decreased compared to the beginning of the experiment, indicating that contact and communication during project-based learning enables students to find similar viewpoints and interests with other students they would not have contact with during academic classes. Most significant are the results observed in relation to outsiders. In schools in a large town, a small town and a village, respectively, the following is present: a change in the large town, a retention in the small town and the absence of an outsider in the village. There is a large number of negative choices made by one or two students in the class, which is due to their displays of egocentrism and their inability to exhibit and show empathy. All students designated as outsiders refuse to cooperate and often sabotage the common work or refuse to join in. At the end of the study, part of these students have kept their outsider position, but their disapproval has strongly decreased, and there are those who are no longer among the outsiders, new ones have emerged who refuse to comply with group norms or are unable to communicate effectively with others, but they enjoy much less disapproval than those originally identified.

11. A positive correlation is found between changed levels of teamwork and empathy and cohesiveness of student teams following the implementation of project-based learning.

5.2. Conclusions of the dissertation research

The analysis of the results of the dissertation research is the basis for the formulation of the following conclusions:

1. The understanding of project-based learning in historical and contemporary perspective is presented.

2. Project-based work in primary education is objectified in theoretical and practical discourse.

3. The effectiveness of the implementation of project-based learning depends on the teacher's good methodological preparation related to his/her ability to plan and conduct project activities according to the age psycho-physiological characteristics of the students and the goals he/she has set.

4. An empirical study was planned and conducted and the results were used to offer recommendations for working in a project-based environment in the primary stage of education.

5. The empirical study covering a period of one year of implementation of project-based learning among the surveyed primary school students showed the following results:

- The application of project-based learning increases the levels of social competence for teamwork and general empathy in primary students.
- The level of cohesiveness in student teams is higher and suggests that there is a positive correlation between increased levels of teamwork skills, empathy, and cohesiveness in student teams, which can be further explored.

The conclusions we have drawn lead us to assume that:

The aim of the dissertation research to analyze and summarize the system of statements and results obtained empirically about the impact of project-based learning on the specifics of the student team in the primary stage of education has been achieved.

The results of the overall theoretical-empirical study provide the basis for the following statements concerning the hypotheses put forward:

Hypothesis 1. “It is assumed that the implementation of project-based learning will increase the teamwork skills of primary school students in the specified dimensions” is partially proven, since the results of the diagnostic procedure indicate a positive change in only two of the four indicators.

Hypothesis 2. “It is assumed that empathy levels and emotion recognition skills will be positively influenced by students' teamwork when project-based learning is implemented” is proven because after implementing project-based learning, general empathy levels and emotion recognition skills have increased.

Hypothesis 3. “It is assumed that the factors of gender and demographic characteristics will have an impact on the teamwork skills of the surveyed students” is confirmed as there is a statistically significant difference between the gender of the students and the demographic characteristics of the location and the increase in teamwork skills before and after the implementation of project-based learning.

Hypothesis 4. “It is assumed that the implementation of project-based learning and student teamwork will be a real factor in changing class cohesiveness in primary education” is confirmed. The comparison of the results obtained after the implementation of project-based learning and student teamwork gives grounds to claim that they have an impact on increasing the cohe-

sion of student teams and there is a positive relationship between them. The hypothesis is proven.

The conducted theoretical and empirical studies and analyses provide a basis for proposing recommendations to work with the student team in a project-based environment in the primary stage of education.

5.3. Recommendations for work with the student team in a project-based environment in the primary stage of education

1. Methodologically, it is advisable for the teacher who implements project-based learning:

- ✓ To know the specifics of project-based learning related to its use with primary school students;
- ✓ To know the psycho-physiological characteristics of primary school students regarding their attitudes towards inclusion in different communities, also via teamwork;
- ✓ Apply it over several school years /it is recommended to start in the second term of first grade/ in order to be able to implement and monitor changes in students' teamwork skills, empathy among students and class cohesion;
- ✓ To plan in advance in his/her yearly teaching plan the lessons in which he/she will use the project method, it is good practice to have some of them linked to an event that is popular and about which there is a lot of information, in view of the fact that primary school students need more impressions and ideas due to their little life experience;
- ✓ When planning lessons, to clearly define the goal and objectives to be achieved through project-based learning on the specific topic;
- ✓ To plan the course of the lesson, planning the time needed for each of the stages of the activities in the student teams and to follow it strictly when the project-based learning takes place during classes.

2. Material and technical preparation includes:

- ✓ Planning and designing the environment in which the student teams will work, providing enough space for each team to discuss ideas and work so that they are relatively independent in their work from one another;
- ✓ Planning and supplying the necessary materials for teamwork in two areas:
 - team – the same stationery or other common materials to ensure the smooth running of the practical part of the project;

- personal – provided by the students, related to the specific topic and to the creative implementation of the project;
- ✓ Allowing enough time, but not too much time, for team members to obtain the necessary materials;
- ✓ Planning how the students will be allocated, and it is advisable to have at least one good teamwork organiser in each team;
- ✓ Preparation of verbal (presentation) and written instructions for individual student teams;
- ✓ Provision of additional sources of information (encyclopedias, reference books, access to information via digital devices with recommended links, etc.) and positioning in the environment in which the student teams will work (an information corner that is designated as such);
- ✓ Informing the parents of the students (through the traditional means of communication used by the teacher) about the topic and the date of the session and asking for their assistance (if needed).

3. While using project-based learning in the classroom is recommended:

- ✓ To discuss current events and problems in the students' lives that are of great interest to them and to which they want to find a solution in order to determine the topic of the lesson, with the teacher providing the direction for reflection, as well as the opportunity to listen to the suggestions of all students who wish to share ideas;
- ✓ To give specific, non-binding guidelines for research, gathering materials and ideas from students in student teams;
- ✓ To group students into teams for the specific project work, preferably with different team members each time;
- ✓ To encourage the generation and discussion of ideas to solve the problem in the team, respecting the opinion of all participants;
- ✓ To assist team members (if necessary) to define the rules that the team will follow;
- ✓ To encourage empathic communication during teamwork;
- ✓ To work on the formation of skills for adequate reading and understanding the instructions of the tasks to be performed and proper allocation of the time available to the team for their implementation;
- ✓ To draw the attention of team members to where additional resources on the topic are located and can be used;
- ✓ To work on the formation of presentational skills to adequately present the team's project to other teams, to students from other classes,

- to parents or to representatives of other communities who are relevant to the topic of the project;
- ✓ To form the skills to ask important and essential questions related to the projects presented by the teams and to transform the criticism (even if positive) into recommendations concerning improvements in the presentation or in the design of the presented project;
 - ✓ To work on the formation of skills at the level of the student team, related to the acceptance and implementation of relevant recommendations from other teams;
 - ✓ Sessions to end with reflection and self-reflection.

CONCLUSION

Contemporary educational trends require that learning in schools be distanced from notions linking it to the mechanical absorption of a certain amount of learning information and be seen as a tool to support students' cognitive development. This cannot be achieved through interpretations of the learning content alone, the learning environment also needs to change. It must correspond to real situations through which the student can form social experiences. Students must be given the opportunity to seek solutions to cognitive problems in situations as close as possible to real life, using a variety of ways of cooperative work. Project-based learning meets these needs.

The theoretical and empirical research conducted on the potential of project-based learning to enhance the teamwork skills of primary school students, provides a basis to claim that when using a teamwork form of learning, students experience changes in social competencies related to the judgment of the qualities possessed by their classmates, which is related to the outcome of the activity and the way they communicated with each other during this activity. During their common activity, students enter into different relationships with each other, have the opportunity for self-representation and self-affirmation in the community of their peers, adjust their self-control and self-assessment of their behaviour and thus their personal responsibility towards other participants in the process, cooperate with each other, become more tolerant and more responsible towards each other, and these are important prerequisites for increasing group cohesion. In general, the outcome of the collaborative activity improves, even though, despite being the same age, students have different personal development. Cooperation in teamwork implies that students who progress faster in the process of collaborative activity start helping those who lag behind. Advanced students work with students whose development is in the middle zone. In this way, the collaborative activity is modelling behaviour which is at a higher stage than individual learning.

In the traditional form of training, the emphasis is on competition, with each person taking responsibility for their own result, however, for teamwork to exist it is imperative that there is cooperation and empathy between group members. For some students, during project activities, they have to work in order to suppress their egocentric behaviour and attitude at the expense of the common goal and outcome of a particular activity.

Formed teams of different composition provide each student with the opportunity to get to know their classmates by performing activities, simultaneously entering into interpersonal relationships while learning. Children learn through observation, discussion, and synthesis. Opportunities for self-

learning are provided. Pupils develop certain skills to search for and find specific information, to discover a common idea, to discover interrelationships, to communicate tolerantly, to discuss effectively, to choose a solution correctly, etc. In project-based learning, interpersonal relationships are stimulated, which directly influence the cohesion of teams. The greater the cohesiveness, the more successfully knowledge is acquired and tasks are completed. Project activities provide opportunities and conditions for learning in unity of the intellectual, emotional and motivational side of communication and interaction activities.

The new educational requirements, based on the changes in modern society, can be accomplished by individuals with well-developed cognitive interests and needs, with a readiness for interaction, empathy, cooperation and teamwork.

CONTRIBUTIONS

1. A comprehensive study of the historical and contemporary scientific and applied theories related to the student team in project-based learning.
2. A diagnostic tool has been constructed and applied for children of primary school age in order to identify the levels of indicators of social competence for teamwork: cooperation, activity, initiative, and responsibility.
3. An original empirical study was conducted on the potential of project-based learning to influence teamwork skills and empathy levels of primary school students, as well as student class cohesion.
4. Recommendations are given on how to work with the student team in a project-based environment in the primary stage of education.

PUBLICATIONS LIST

1. Tareva, N. (2021). Origin and development of project-based learning – Conference reports from the tenth student scientific forum, vol. I. Plovdiv: Plovdiv University Press, ISSN 2738-8859.
2. Tareva, N. (2021). Project-based learning and its application in a virtual environment – collection “My pedagogical daily life – to keep smiling at school”, the village of Ribaritsa, Teteven municipality, ISBN 978-954-784-143-7.
3. Tareva, N. (2021). Project-based learning in primary education – current issues. Edu &Tech – Education and Technology. Vol.12, ISSUE 2, ISSN 1314-1791.
4. Tareva, N. (2021). Project-based distance learning in an electronic environment at the primary stage of education – a shared experience – “Doctoral research”. Plovdiv: Paisii Hilendarski University Press, ISSN 2367-7309.
5. Tareva, N. (2022). Influence of project-based learning on the formation of teamwork skills in primary school students. “Doctoral research”. Plovdiv: Paisii Hilendarski University Press, ISSN 2367-7309.

NOTE



A series of 25 horizontal dotted lines, evenly spaced, providing a template for handwritten notes.

