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**ABSTRACT OF
DISSERTATION PAPER**

on the subject

**“The motivation of bilingual students in mathematics and information
technology education grades 8-12”.**

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Introduction

One of the forms of knowledge is learning. It is a complex, multifaceted and multi-layered activity through which students get to know the world, new and interesting subjects, under the guidance and the huge role of the teacher. Throughout their studies, students pass through various and numerous stages of their development and knowledge.

The older they get, the more their knowledge expands - they become more precise, more complete, more thoughtful. In this way, they form in themselves habits, practical thinking and cognitive activities. The more practical their education is, the better they prepare for life, and the better they consider the goals and ways to achieve them.

In teaching students, the teacher is the leader, but he can also learn a lot from his students. It is especially important and interesting when the students are bilingual, since a lot can be learned from them about a different culture, values and traditions that are essential for their development and learning. The differences between scientific knowledge and the education of bilingual students are described in many different scientific works and articles.

Since there is a difference between learning and scientific knowledge, the main indicators are the goals, the subject, the means of achievement and the results obtained in one case and in the other. The purpose of scientific knowledge is to discover new facts that have not been known before. In teaching, the goal is for the students to learn the facts that have already been discovered and are known to science, but to the students is something completely new matter.

The Bulgarian language is quite difficult to master even in its conversational form, especially when at home the bilingual students speak in their mother tongue. When children have difficulty speaking Bulgarian, it will be even more difficult for them to master the literary official language, despite all the extra hours they are provided at school. In reality, these children speak Bulgarian only and only at school with the teachers.

When they have more classmates from the same ethnic group, they again communicate in their mother tongue, which further complicates and delays mastering the Bulgarian language. All

bilingual students have specific conditions, but still in the schools in our country this is not taken into account for the education and upbringing of bilingual students.

Since these students have a small linguistic stock of words in their vocabulary, this does not allow them to absorb the minimum knowledge, skills, experience and preparation. In order to achieve the educational minimum, it is necessary to use additional forms, programs and projects through which these students can master the Bulgarian language to the extent that they reach at least the educational minimum of knowledge.

The development seeks answers to the following more important questions:

- Why do bilingual students find it more difficult to learn and understand math and IT tasks?
- Are bilingual students from lower secondary school willing to achieve positive results in mathematics and IT?
- What is the attitude of the parents in relation to the training and education of their children?
- What is the role of teachers in achieving success for bilingual students?

The present work is organized in search of answers to questions exciting more and more not only education or other scientific field, but these are questions that excite the whole world. This is because there is a lot of emigration around the world and accordingly a way of unification and liberality is being sought.

The PURPOSE of the study is: to build a foundation for motivation to learn mathematics and IT in bilingual students, it is necessary to develop models, methods, techniques and technologies. All this to find out if it will work and give results. All these methods should be put into practice and the students should understand and understand that this will be useful to them after school.

TASKS:

1. Clarification of the reasons for the low motivation for learning of bilingual students.
2. Analysis of the environment in which students live - bilinguals - traditions, goals, priorities.

3. Experimenting with different methods and techniques to increase the motivation for learning of bilingual students.
4. Study of any literature working in the field of integration of bilingual students.
5. Survey of students' opinion about the technologies and methods that teachers use for motivation to learn mathematics and IT.
6. Studying the opinion and attitude of parents in relation to the education and training of their children.
7. Organization and implementation of a pedagogical experiment to establish the need for learning motivation of bilingual students.
8. Performing a qualitative analysis based on the data from the conducted experiment.

The following are the basis of the study

HYPOTHESES:

1. It is assumed that students who have already gained self-confidence in their knowledge will be able to work on a strategy for self-regulated learning. Conversely, students who have not yet gained self-confidence in their knowledge will not be able to work on a self-regulated learning strategy.

The methods used in the study are:

1. Analysis of psychological, pedagogical and methodical literature on the researched problem.
2. Survey and discussion with teachers, parents and students.
3. Pedagogical monitoring.
4. Solving entrance, intermediate and exit tests to see the development of bilingual students.
5. Processing and analysis of the received survey data.

In this dissertation, a model of teaching bilingual children is proposed, related to the application of ICT and active methods, in the teaching of mathematics and information technology.

The practical part of the dissertation concludes that the proposed methods and specific subject didactic technologies can be useful in compiling and improving curricula, textbooks, teaching aids, methodological recommendations, conducting specialized optional

subjects or electives in secondary school. The object of the study is the teaching of mathematics and IT at the high school stage of secondary school.

In the First chapter, a historical review of the development of bilingualism and its theoretical interpretations from the point of view of philosophy, psychology and pedagogy is made. Attention is paid to modern approaches to the success of bilingual students.

Chapter Two examines the structure, organization and strategies of motivation and scientific knowledge. Examples of specific technologies applicable to the implementation of e-learning are given. Exemplary didactic technologies and methodical guidelines are indicated, which can participate in building the learning motivation of bilingual students in grades 8-12. Special attention is paid to the active and modern methods of motivation for the education of bilingual students from the high school stage.

The third chapter presents the results of tests, surveys among teachers, parents and students from Bulgaria, aimed at the attitudes and motivational needs of bilingual high school students and their tendency to use and share individual resources and methodical lessons on the Internet.

In the Conclusion, the main conclusions are synthesized and the contributions of the dissertation are listed.

In the Acknowledgments, university and international projects are indicated, with the help of which a large part of the research in this dissertation was carried out.

First chapter: Essence of bilingulism

§1. What is bilingualism

Bilingualism generally means learning two languages for communication.

The definition of bilingualism and its meaning have been discussed by a number of researchers (Pavlenko, 2006; Grosjean 1982; Heinz, 2001). "Until now, there is no widespread and universally valid definition of bilingualism and how it can be measured." (Bhatia & Ritchie, 2016). "In some cases, it is used to refer to the use of two languages, and in others, it is used to refer to several languages simultaneously." (Fielding, 2015) The term bilingualism is synonymous with multilingualism, multilingualism,

or polylingualism and is preferred for use. "The bilingual person usually has an equal degree and depth of proficiency in both languages and is able to use them effectively on each occasion.

The bilingualist is able to keep the two linguistic systems separate so that he can switch from one to the other with ease" (Daskalova, 2003). "Absolute balance and equal written and oral proficiency in both languages is impossible and unattainable. One can be perfectly proficient in the spoken aspect of one language and perfectly proficient in the written aspect of the other language" (Romaine, 1995) "Bilinguals are rarely proficient at the same level" (Grosjean, 1982) "Languages need not be spoken and used at a very high level" (Bhatia, 2006; Grosjean, 1982; Romaine, 1995). "Functional bilinguals - the languages they know must be used regularly.

This is considered a middle option for determining the quantity and quality of languages used" (Grosjean, 1982).

Proficiency in speaking, writing, understanding, and reading the respective language should be established. "A person may be bilingual if he can speak and write in one language but understand and read less" (Beardsmore, 1982). The definitions of bilingualism which are basic are the following:

1. Acquiring both languages simultaneously "When a child is raised from birth with two languages or when a second language is introduced before the age of three" (Paradis, Genesee, Crago, 2011). "From the beginning, although bilingual children may in some cases speak slightly later than monolinguals, they develop both languages simultaneously and consciously separate and distinguish them" (Meisel 2008; Daskalova, 2003). "This does not imply that they have equal competence in both languages" (Ramirez-Esparza, Garcia-Sierra, 2014).

2. Acquires both languages sequentially Nowadays, many families move to live abroad and this leads to "sequential acquisition takes place due to the family's emigration to another country or if the child attends a school that is taught entirely in a foreign language" (Genesee, Paradis, Crago, 2004; Ramirez-Esparza, Garcia-Sierra, 2014). Vereshchegin (Vereshchegin, 2014) distinguishes three main types of bilingualism:

a) individual bilingualism, inherent in one or a few people

- b) group bilingualism, is in people united by interests
- c) mass bilingualism, inherent in a whole community or a majority.

In Bulgaria there are still no conditions and attitudes created for the mastery of the Bulgarian language by the children of minority groups, who inhabit compactly whole villages or neighborhoods. Such children must be integrated.

§2. Bilingualism in secondary school

Since nowadays it is more and more necessary to communicate in a multicultural classroom, many questions of different nature arise.

- What is it like to communicate in a multicultural classroom?
- How do you communicate in a multicultural environment?
- How do we express ourselves in a multicultural environment in a way that does not offend anyone?
- What peculiarities do students encounter in communicating in a multicultural environment?
- What difficulties do teachers face when working in a multicultural environment?
- How to include bilingual students in school?
- How to integrate bilingual students in a multicultural learning environment?

When the teachers along with the parents have the same goal - that the student should get the necessary education, upbringing, knowledge, habits and develop towards his better future, then the combined efforts will lead to a positive result.

- The need for education helps a person to communicate better, to have a better command of the written official language, to speak better, to develop better and to be fulfilled.
- Communication between people is a complex process. In communicating we need to think carefully about what we say, how we say it, why we say it. We simply want to communicate information, learn information, or hurt the person across the room. It is all a long and complex process of information exchange.
- The exchange of information in the classroom is between students or between teacher and student.

When information is exchanged between students it is in spoken English and covers different areas that are not always for educational purposes. And although the communication is in spoken Bulgarian, it is beneficial for bilingual students to practice and improve their Bulgarian.

When exchanges are between teacher and students they are in literary Bulgarian and most often cover the subject in question, and are always for educational purposes. Here are a few examples:

- Involving students in extra-curricular activities;
- Organizing consultations;
- Asking questions and requiring answers;
- Individual approach to each student;
- Assigning individual homework;
- Assigning individual tasks and projects for improvement in the respective subject and others.

Methodological, practical and applied aspects of mathematics and IT education in multicultural environments:

- Learning to express themselves correctly in literary Bulgarian;
- Learning to write in literary Bulgarian;
- Inclusion in a multicultural school environment;
- Active participation of bilingual students in the educational process;
- Individual work with pupils to make them feel significant;
- Innovative approaches to maths and IT work;
- Practical tasks;
- Integration into school and society;
- Difficult language barriers lead to failure and easy drop-out.

§3. Difficulties and peculiarities in the acquisition of Bulgarian language and its application in mathematics and IT classes by bilingual students

One of the main problems in modern education in Bulgarian schools is related to reading comprehension. Many students do not understand what they read. The reasons are of different nature: the presence of many foreign words in the texts (mostly Englishisms); the texts offered are not adapted to the educational level of the pupils; they do not know how to read texts, they do not know the Bulgarian

language well. The acquisition of the official Bulgarian language is also difficult for bilingual pupils due to the risky family environment, as a large percentage of them are illiterate or semi-literate. "There are eight types of students who struggle and fail in mathematics:

- Risky family environment .
- Primal thinking and responding.
- Lack of positive attitude towards learning.
- Poor manners.
- Lack of study habits.
- Negative out-of-school influences.
- Knowledge gaps.
- Deficiencies of pedagogical influences" (Koleva, Chalakova, 2020)

This study aims to present the results of a research on tests and questionnaires conducted with bilingual students from different ethnic group in a comparative perspective. The aim is to identify the problems bilingual students have in understanding tasks and solving them. To propose methodological ideas to improve motivation and stimulation for learning in mathematics and information technology.

Teachers working in Bulgarian schools with bilingual children need to exchange experiences and up-to-date methodological guidelines to stimulate and motivate students' attention in the learning process.

For example, in the topic "Volume of a pyramid", tenth grade, with bilingual children, it is a challenge for the teacher to show how through infilling one can find out how many times the volume of a pyramid is smaller than that of a prism. Games and competitions in mathematics stimulate students to positive emotions. They are accepted with positive feelings and contribute to motivating the student towards deeper knowledge. Games start with easier problems and gradually progress to more difficult ones.

The teacher looks for ways and forms of effective learning, tailored to the vocabulary of Bulgarian words for bilingual students. Working with bilingual children is a difficult challenge that the Bulgarian teacher faces.

The majority of parents of bilingual students have low educational status or no education and their values and

understandings are quite different. For them the education of their children is not a priority and therefore the teacher is faced with the difficult task of approaching very delicately in numerous conversations with the parents and explaining to them the importance and significance of the children having the necessary education, to express themselves correctly, to be able to read and write and to understand.

Teaching should be reinforced with visual materials because it is much easier to remember this way. When the majority of students do not have a rich vocabulary of Bulgarian words, an individual teaching approach is needed, according to the individual needs of bilingual students.

At school age relationships of responsibility, mutual help, tolerance, cooperation, teamwork are built. And these children do not have the necessary habits, knowledge and skills to build these relationships. In the development of these relationships, teachers occupy a key place and are the undisputed authority, sometimes even in spite of the opinion of some parents.

Last but not least, communication will only be effective when the teacher-student-parent relationship is based on trust, cordiality, toelart, cooperation, consideration, listening and mutual support.

§4. Why it is important to work for the success of bilingual students

Firstly, the environment, traditions, goals, needs of specific bilingual students should be studied through surveys, discussions, talks, dialogue with the students themselves and their parents. All these studies are thoroughly analyzed and on this basis the educational program that is most suitable for these children is determined.

The main task of the mathematics teacher is to organize the learning process so that the learning material is easily accessible and understandable, in order to obtain more durable and in-depth knowledge and problem-solving skills and better results at the end of the school year and at the National External Evaluation.

In order to achieve better results in mathematics learning for bilinguals, motivation and discipline for class work play a particularly important role.

Why a concerted effort should be made towards this goal.

- To have more motivated students to get better jobs and better lives.
- To perceive the subject "mathematics" as an opportunity for fulfillment in life - builders, drivers, cashiers, all professions where mathematics is a necessity.
- To perceive the subject "Information Technology" not as a pastime but as a necessity, because everywhere computer literacy is required for better paying jobs.

All of this goes to show that developing numeracy cannot remain a commitment of maths teachers alone, it is important to make it a priority for every student, parent/carer, the community and to be able to see how this knowledge will help them in real life situations.

Second chapter: Motivating bilingual students in mathematics and information technology education grades 8 – 12.

§1. Motivation - nature and strategies to increase it in bilingual students. Scientific knowledge

Motivation is an internal process, that feeling that does not leave us alone and reminds us where we want to be and we look for ways to achieve. Motivation is important in addition to getting bilingual students to participate in the learning process, how much to learn, what to learn, how the information is presented to them. It is very important for teachers to keep students motivated, and in fact this is the most difficult task to do. This is done in many ways that depend on the specific situation and the students. It is extremely important that students are given motivating feedback - encouraged to complete a specific task set to them, explained when they have made a mistake so that they understand correctly and try to correct themselves. Their mistakes should not be left and neglected and they should think that if they failed once, then they will never succeed.

In order to understand the nature of cognition as a process of obtaining true knowledge about objects, it is necessary to begin first of all with its three basic categories - the object of cognition, the cognizing subject (individual or collective), and the cognitive image.

The object of knowledge is the surrounding objectively existing reality and human society with its two sides - material and spiritual.

The subject of cognition is man as a whole, together with all the means of cognition created by him. Moreover, one can speak of an

individual subject when cognition is carried out by an individual person or of a collective subject when it concerns a group of people.

"Types of cognition are empirical (sensory and rational moments) and theoretical - forms of their existence.

From the fact that the "sensuous" and the "rational" are not degrees, but sides, moments of the overall cognitive process, it follows that the methods of scientific cognition cannot be separated into purely sensuous and purely rational methods. In each of them both sensuality and rationality are present, with their respective primacy. This conclusion of the structural scheme of cognition is graphically reflected by the rectangle of "methods" so that at both ends it enters the rectangles of the sensuous and the rational with their inherent forms of cognition" (Ivanov, 2004).

The forms of sensory cognition are the following:

- Concept
- Understanding
- Idea.

Reproduction in human through words, conversation or in written form is called sensory image. The forms of rational cognition are the following:

- Idea
- Consideration
- Conclusion

§ 2. Methodological guidelines for teaching bilingual students

Teaching bilingual children is a social and continuous process, involving overcoming specific difficulties. A teacher to be good must have his own personality, style, manner, approach and method of teaching.

In school, the students' interest is very difficult to awaken and difficult to retain, These are the two main tasks of the teacher. If he achieves them, then he has done a large percentage of his work, because it is not only important to awaken the interest, but also to manage to retain it. Most of the students are not interested in the subject of mathematics and it is very difficult to awaken there. The thinking activity in the students is triggered by the different methods and approaches by which the teacher works with the students. The best way to do this is when several sayings of a problem are shown.

Another way is to set a practical problem and ask students to solve it in different ways and then discuss.

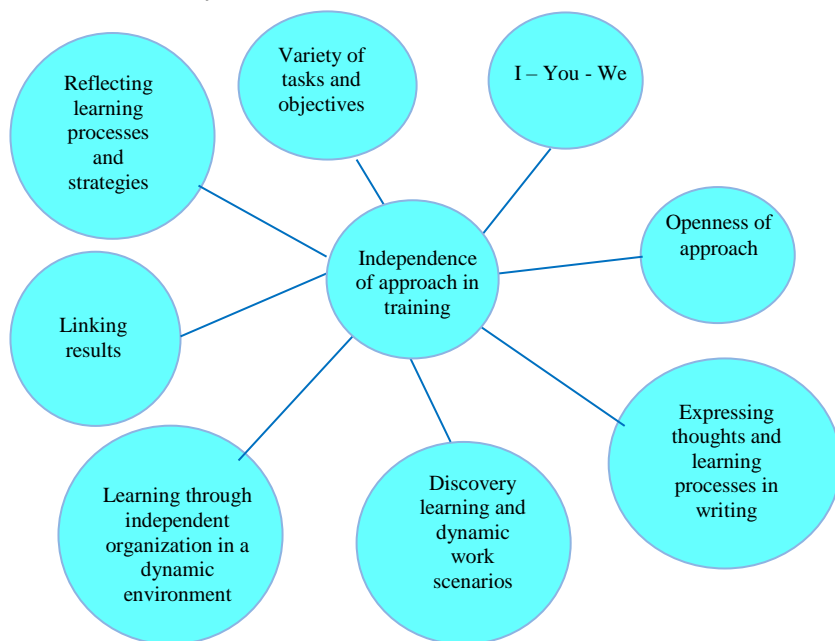


Fig. 1 Pedagogical situations for the formation of motivation and activity

All this provocation of thinking to solve a certain problem develops logical thought and flexibility.

In the 9th grade, when studying the section "Functions", different types of functions are considered:

- *Proportionality* with a coefficient greater than and less than 0, respectively.
- *Linear function* and right proportionality. Practical examples of a linear function such as in sports - running, swimming in a straight line - are given after it has been plotted.
- *Inverse Proportionality*. Here the explanations are linked to practical examples. One that can be used is if a family has to pick a certain amount of mushrooms to make enough money,

then the more family members work the faster they will finish the job.

- *Square Function.* Examples suitable for this type of function, as it is more complex, are in soccer, volleyball, archery, hammock, and others (Fig. 2, author's own). In this way students understand where in reality this function is used.



Fig.2 Quadratic function

After looking at the different types of functions, a cross-curricular link was made with IT and geography. The different functions can be represented in a few practical examples:

- a type of diagram that can be used to understand the change in temperature by hour in a city;
- the change in speed of a car moving from point A to point B.

By pointing to real-life examples, students get motivated much more quickly and start to participate more actively in maths and IT lessons, understanding and realising that maths lessons will benefit them at some point after they leave school.

Another section of mathematics in Year 9 is Similar Triangles, which is suitable for motivating students in mathematics and IT classes. It looks at different types of angles and triangles (Table 2, author's based on Archimedes ed.).

Again, attention is paid to practical examples by considering similar objects to have the same shapes but different dimensions. After seeing them, they come to the conclusion on their own that such shapes are similar, not identical. For better visualization and understanding, examples such as T-shirts, jeans, butterflies, roses,

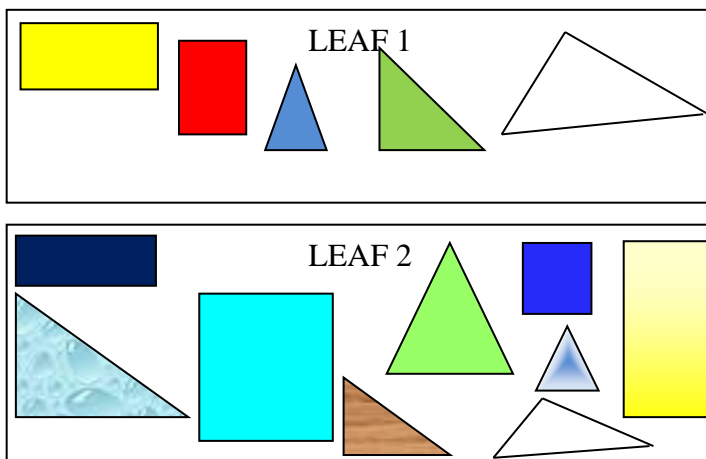
different size notebooks, roofs of houses, etc. can be used (Fig. 4, author's own).



Fig. 3 Similar figures

The next step is to establish the difference between identical and similar figures. With the Mozabook platform, a didactic game can be prepared in advance that shows different shapes and students have to say which ones are similar and which ones are the same. The students should fill in the similar shapes with the same colour and the similar shapes with a pattern of the same colour and by forcing them to see for themselves if they have mastered the new concept (Table 1, author's own). If an interactive display/board is used, the task becomes much more fun and stimulates active participation of the students.

Table 1



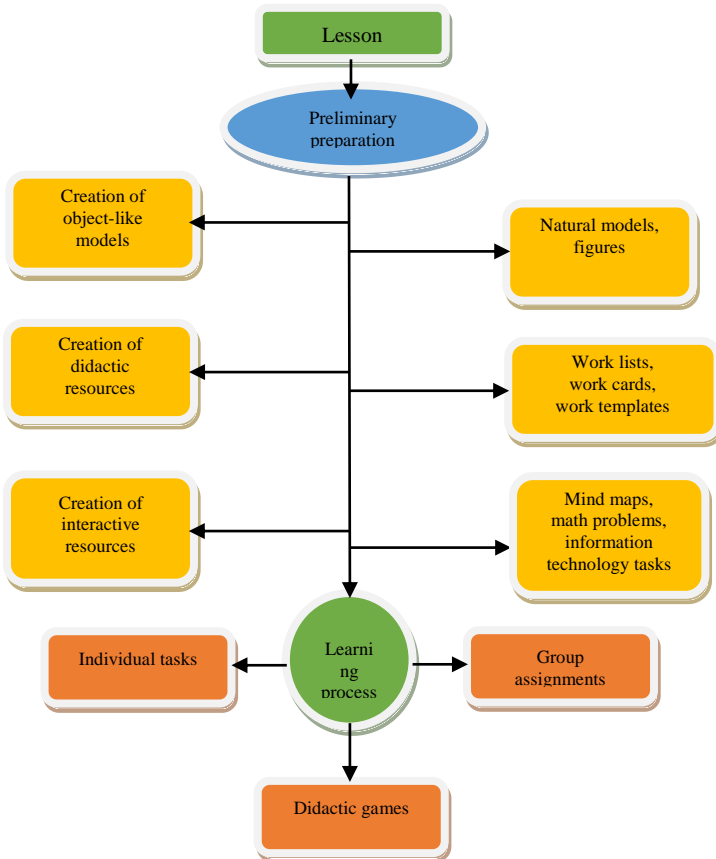


Fig. 3 Attendance learning model

Games and competitions in mathematics stimulate students to positive emotions. They are accepted with positive feelings and contribute to the student's motivation towards deeper knowledge. The teaching aims to form and build mathematical culture, knowledge, skills, positive attitude to learning in the long term in bilingual students.

The learning process should contribute to and result in the following skills in students:

- understand the learning content and apply what they have learned to specific situations
- be able to analyze specific situations
- be positive about technology
- be able to use technology in personal and professional contexts.

§3. Provoking the interest of bilingual students in mathematics and IT classes

"A student is not a vessel to be filled, but a torch to be lit" Plutarch

Everyone has his own thoughts, impressions, priorities and goals. But no one is able to react the same way to every impression and goal. Each person sets their priorities and naturally gives each goal the time and attention it needs. If all this is summed up in one word it is interest. Each person has interests in different areas. But interests are not constant, they change according to the different situations a person faces. The teacher plays a particularly important role in awakening interest in the subject of mathematics. He must always be ready to prepare with new methods and more real-life examples, where he can show the pupils that this particular section and these particular problems will be useful to them in everyday life. He can present the material as an individual or group role play, in the form of a presentation without or with their participation. Challenge their thinking by posing certain life situations related to mathematics and which are relevant to their life and living.

§4. Active learning methods, of bilingual students in distance learning in electronic environment (DLEE).

For several years, it has been necessary to rethink the learning process in all educational levels and, in particular, the integration of new technologies in the educational process.

Technology nowadays is developing at an extremely fast pace. Electronic diaries, work platforms and electronic resources have been introduced in schools, which on the one hand facilitate the work of the teacher and on the other bring variety to the lessons. Some of these platforms are Google Classroom, Shkolo, Microsoft Teams, admin+, etc.

Since the majority of teachers in Bulgaria are not very familiar with how to work with electronic platforms and resources, and even less with how to create them, it is extremely necessary to conduct the necessary training by qualified persons to train pedagogical specialists to work in electronic environments and electronic resources. Because at some point you get the awkward situation that the pedagogical specialist with a lot of experience and knowledge turns out to be unable to cope with e-learning, but the students can. To avoid such a situation, training of pedagogical specialists is necessary.

The use of IT in school as a way of teaching or setting tasks, increase the effect of learning. Some of the advantages are as follows:

- Learning material is easily absorbed and understood.
- Lessons become more enjoyable and interesting. This way students are more focused and active in class.
- Students understand that this way they can get the information they need more easily.
- Pupils understand that they will need to use IT for better development and when finding a job.

Some characteristics of using IT are:

- Fluidity;
- Parallelism;
- Reciprocity;
- Nonsynchronicity;
- Versatility;
- Income-generating;
- Innovative;
- Versatility.

Based on the author's pedagogical experience related to the education of bilingual students in the DLEE, triggered by the COVID-19 pandemic, a model (Fig. 6, author's own) transforming the curriculum content is proposed.

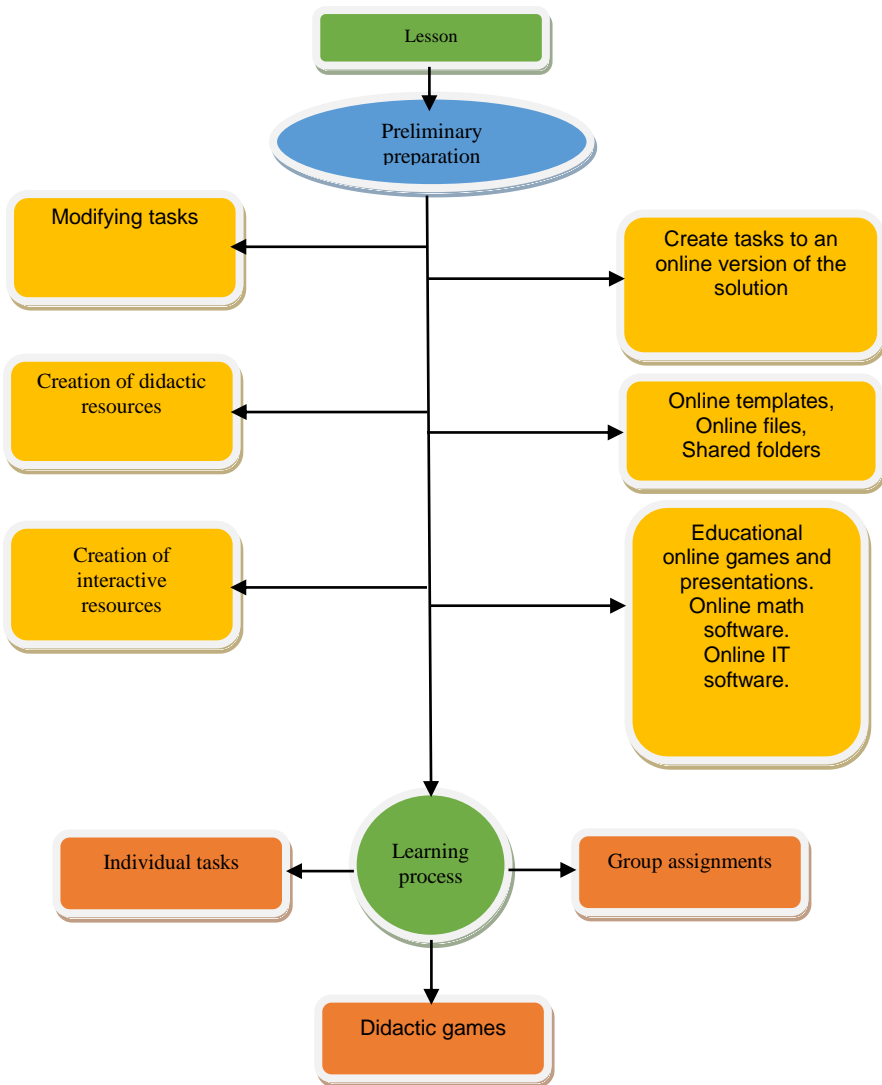


Fig. 4 Training model in online form

E-learning

The importance of e-learning is related to the use of computers and electronic platforms and resources as a means of communication between teacher and student and as a teaching tool. Learning is divided into three types, depending on the time at which teachers and students communicate with each other.

- Synchronous learning
- Asynchronous learning
- Blended learning

"E-learning is suitable for training adults who are unable to attend classes on a fixed schedule and in an area remote from their place of residence, as they are limited by their working hours and the factor of residence is of particular importance to them" (Pavlova, Kharizanov, 2019).

Third chapter: Pedagogical research

§1. Organization of the pedagogical experiment

The main task set by this research is not to obtain some unknown information about a phenomenon or process, but to construct a model of the object with the obtained data.

In this sense, it is understood that in this dissertation a pedagogical research is conducted, namely:

- Experimental ideas to be tested;
- Observation, evaluation and explanation of facts;
- Surveys among teachers, students and parents, aiming to find out how much they experience difficulty in the learning process and what innovative means are used;
- Group and individual discussions and talks with teachers, students and parents;
- Different approaches in different groups to find out what is appropriate and produces results;
- Analysis of pedagogical literature;

§2. Formation of the target group

The formation of the target group took place at the beginning of the eighth grade, when direct communication and observation of the students was still limited. The work in the target group is aimed at developing and expanding existing and potential

abilities. The diagnosis of aptitude and motivation is a complex process that often goes beyond the competence of the teacher.

A preliminary study of the students' attitudes, interests and desire to learn was carried out with the assistance of the class teachers and mathematics teachers.

Nowadays, the testing of students occurs through "tests". "If we regard tests as a scientific method of measurement, their beginnings must be sought only in more recent times." (Byzhkov, 1999)

According to the surveys, discussions, observations and individual conversations among teachers, their professional difficulties are due to several factors:

- They do not understand and speak the official language - Bulgarian;
- Education is not the priority of parents first and students second;
- Limited vocabulary;
- They do not know how to express themselves;
- They do not know how to behave in class;
- They lack the necessary discipline, which is very important for knowledge and results, because students are sure that they will not have poor results in the end in spite of everything.

§3. Qualitative Analysis of Educational Research

The aims and objectives of quantitative analysis, also called empirical, experimental, with the testing of hypotheses, and the identification of certain states and contradictions in the field of education and educational science.

At the beginning of the experiment, three groups were formed, of which two control groups and one experimental group:

- 1) From 32 students (grade 8 A) – control group A;
- 2) from 28 students (grade 8 B) – experimental group B;
- 3) from 25 students (grade 8 C) – control group C.

In several author's graphs can be traced the results of entry levels, intermediate levels and annual result in mathematics and information technology of control and experimental groups, for the period of study. These results are based on the author's mathematics tests and IT publishing tests.

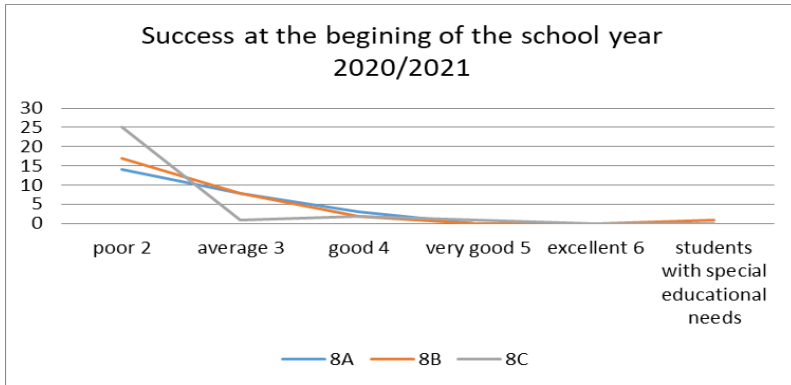


Fig.5 Success at the beginning of the year in mathematics grade 8

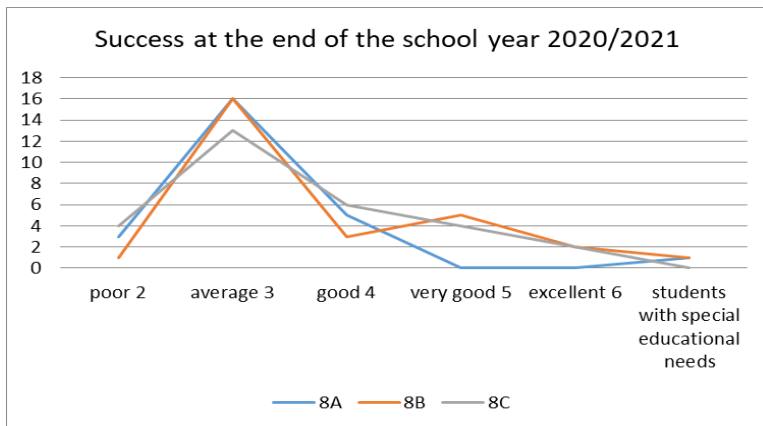


Fig. 6 Success in the end of the year in mathematics grade 8

From the graphs it can be observed that the poor performance is 99% in control and experimental groups, at the beginning of the school year, which is due to low motivation, change of school environment, family environment and difficult understanding of parents and students of the need for education. As they have quite different understanding and traditions. At the end of the year it is clearly seen that the poor results have significantly decreased and increased, not by much but there is some result in the control groups.

While in the experimental group the scores have increased significantly.

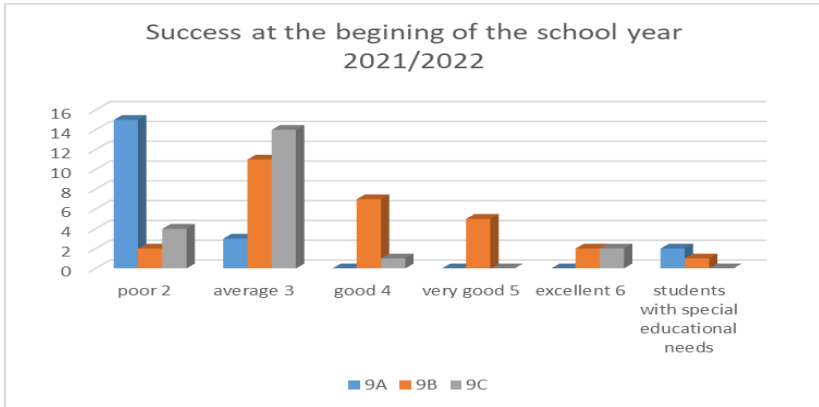


Fig.7 Success at the beginning of the year in mathematics grade 9

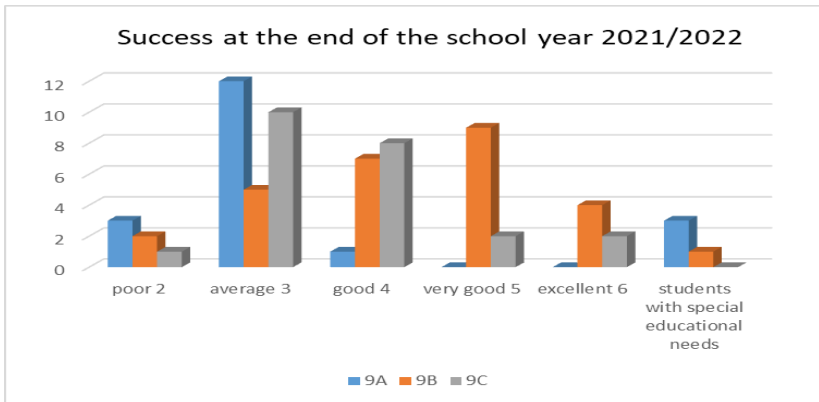


Fig. 8 Success in the end of the year in mathematics grade 9

In this academic year, the graphs show that the low scores in control group 9A remained unchanged, and decreased significantly at the end. Attainment has risen, not by much but still some positive outcome has been achieved. In control group 9B the poor results are not as many as they were the previous year, and by the end of the school year the percentage drops significantly. In the experimental group 9B the poor results persisted both at the beginning of the

school year , and at the end. But what makes an impression here, the results are generally rising, the motivation of students to achieve good results and realization is increasing.

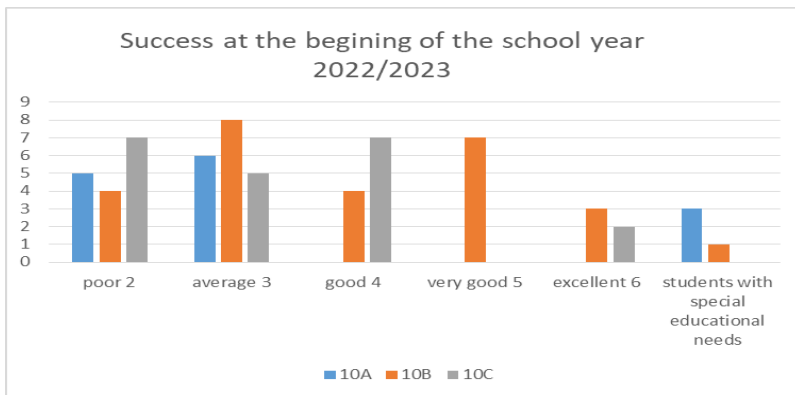


Fig. 9 Success at the beginning of the year in mathematics grade 10

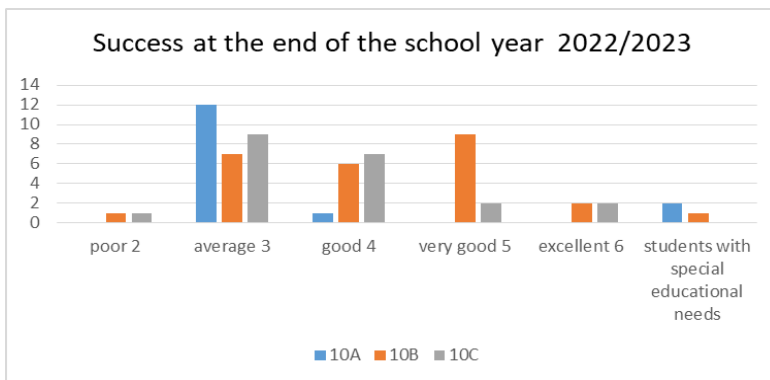


Fig. 10 Success in the end of the year in mathematics grade 10

In this academic year, the graphs show that underperformance in control group 10A remained unchanged and there were no underperformers at the end. Attainment has risen, significantly and a positive outcome has been achieved. In control group 10B, the low achievers are not many, but by the end of the

school year the percentage drops significantly. In experimental group 10B, all scores rise significantly over the school year period. Students' motivation to achieve good results and realization increased.

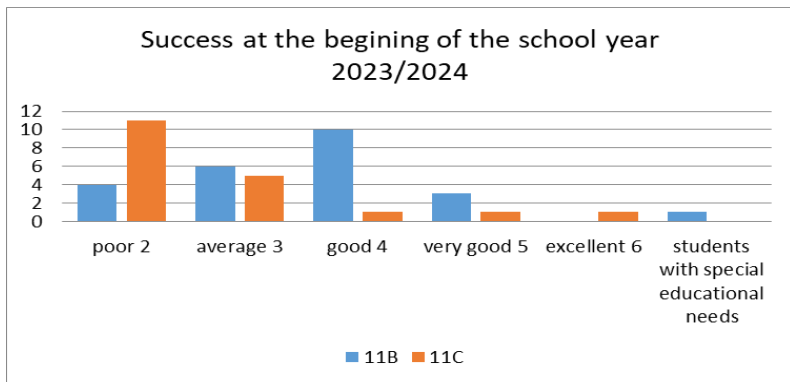


Fig. 11 Success at the beginning of the year in mathematics grade 11

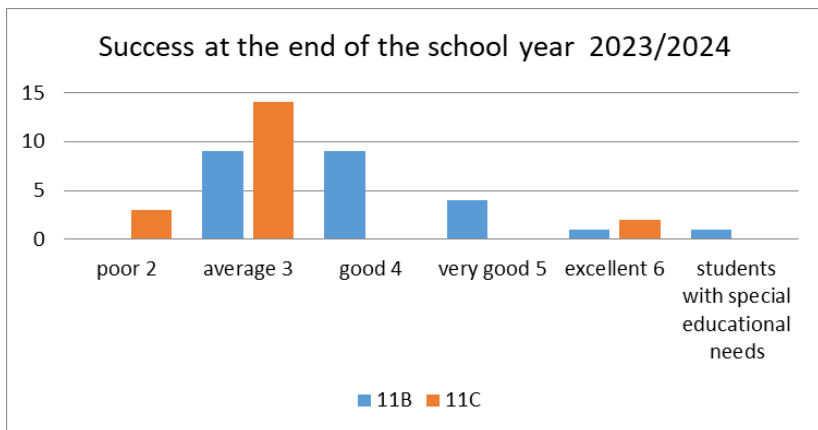


Fig. 12 Success in the end of the year in mathematics grade 11

During this school year, the graphs show that the poor results in control group 11B, the poor results are not many, but by the end of the school year the percentage drops significantly. In the

experimental group 11B, all scores increased significantly during the school year period. The students' motivation to achieve good results and get a better result for the high school diploma is increased.

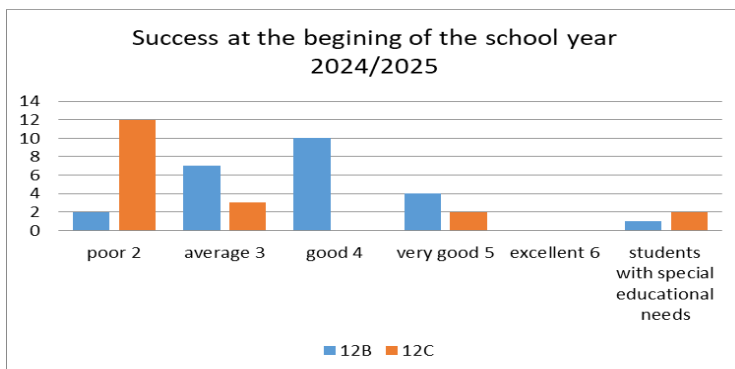


Fig. 13 Success at the beginning of the year in mathematics grade 12

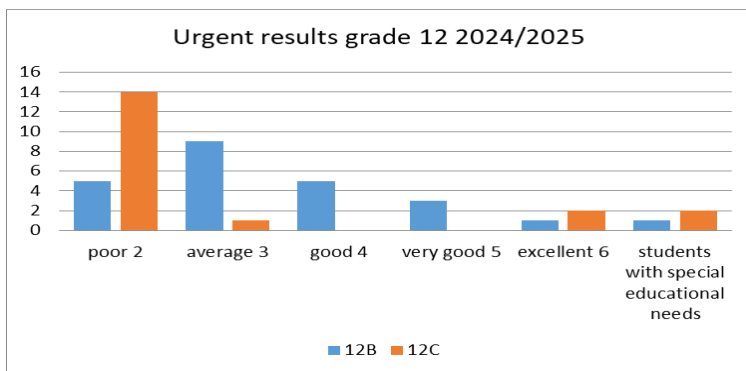


Fig. 14 Success at the end of the term in mathematics grade 12

Here the graphs show that the poor results in the control group 12B are not many and by the end of the first term the percentage does not change. In the experimental group 12B, all results remain unchanged from the entry level and term results, which is due to the fact that they do not have an exam in mathematics

and direct their strength and energy to the subjects in which they will have exams.

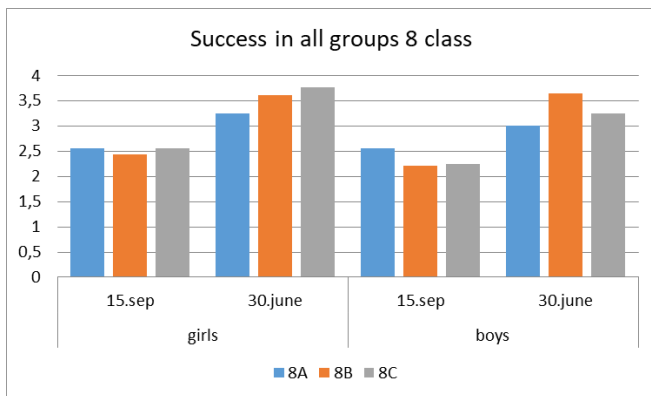


Fig. 15 Tracking success between girls and boys in mathematics in grade 8

What conclusion can we draw from the graphs that compare success between girls and boys during the school year. In all three groups worked with, it is clearly seen that the success of girls is increasing significantly compared to the success of boys.

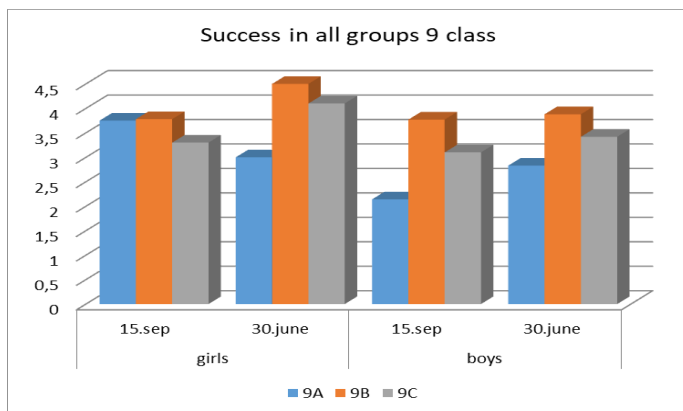


Fig. 16 Tracking success between girls and boys in mathematics in grade 9

The conclusion we can draw from the graphs that compare success between girls and boys during the school year. At the beginning of the school year, success is almost the same for girls and boys. In all three groups worked with it is clearly seen that the success of girls increases significantly, during the year compared to the success of boys.

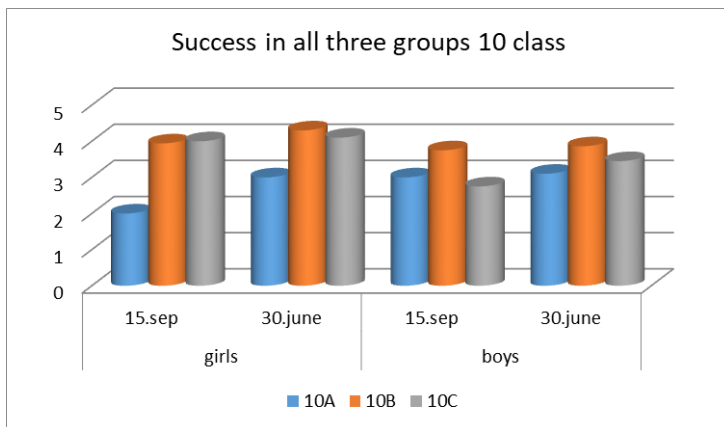


Fig. 17 Tracking success between girls and boys in mathematics in grade 10

At the beginning of the school year, success is almost the same for girls and boys. In all three groups worked with it is clearly visible that in this school year the success of girls and boys is increasing almost in the same way. During this school year they were about to complete their NCE and the first stage of their secondary education and this may have had a positive effect on their motivation. Especially to control group 10A, as their goals are to get a driving license with which they can find a job more easily. The next few graphs by the authors present the success in IT at the beginning and end of the school year, comparing each group.

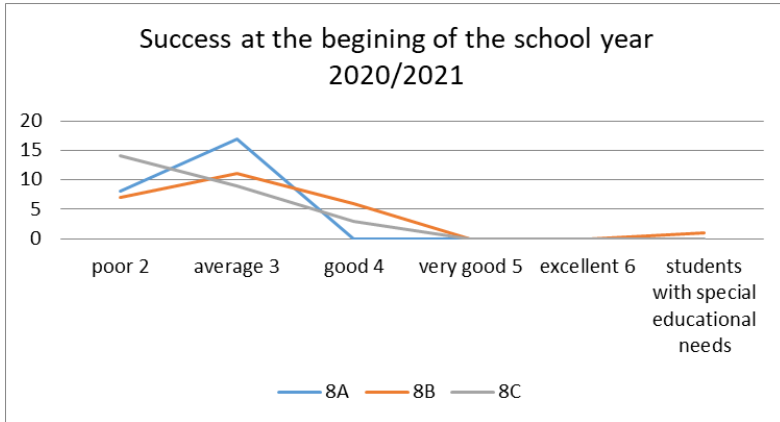


Fig. 18 Success at the beginning of the year in IT in grade 8

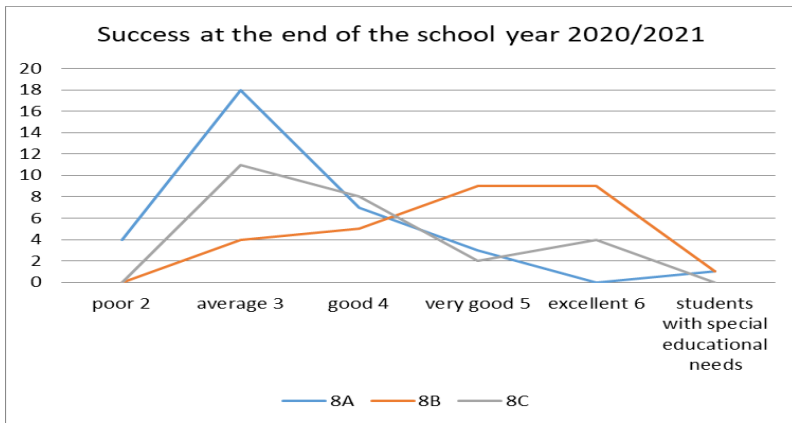


Fig. 19 Success in the end of the year in IT in grade 8

From the graphs it can be stated that the poor results are the most in the control groups, at the beginning of the school year, which is due as we said above to the low motivation, the change of the school environment, the family environment and the difficult understanding by parents and students of the need for education. At the end of the year it is clearly seen that the poor results have significantly decreased and increased, not by much but there is some result in the control groups. While in the experimental group the scores have increased significantly.

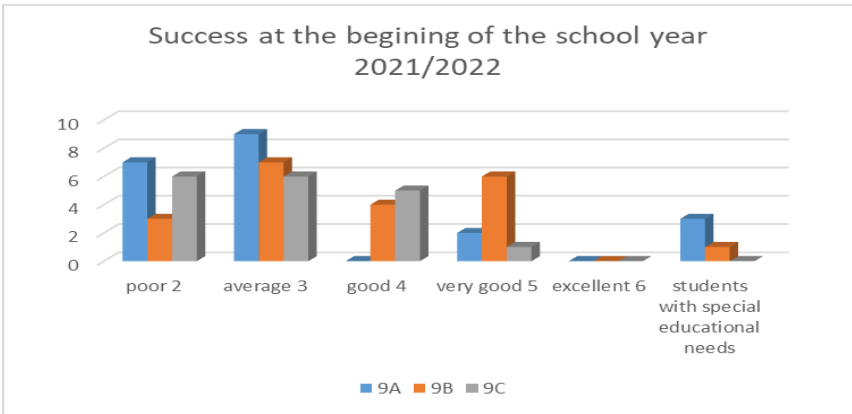


Fig. 20 Success at the beginning of the year in IT in grade 9

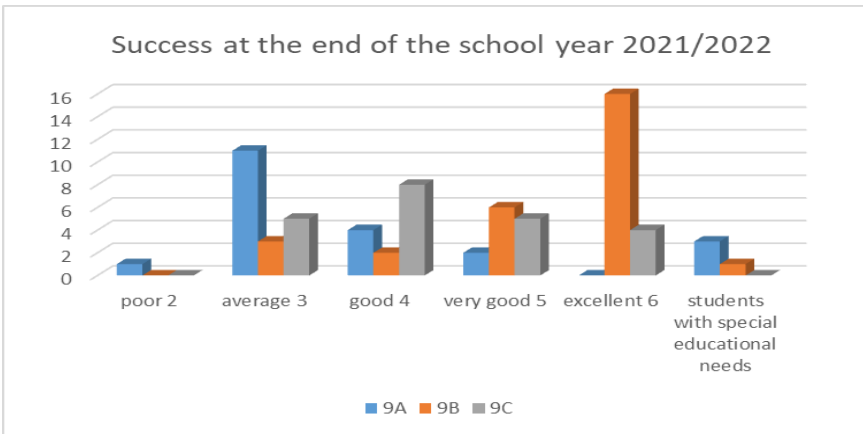


Fig. 21 Success in the end of the year in IT in grade 9

In this academic year, the graphs show that the low scores in the control groups remained the same as the previous year, and decreased significantly at the end. Attainment is up, not by much but still some positive result has been achieved. In the experimental group 9B, the scores increase significantly and the success is much higher. It is noteworthy that the results generally increase, the students' motivation to achieve good results increases.

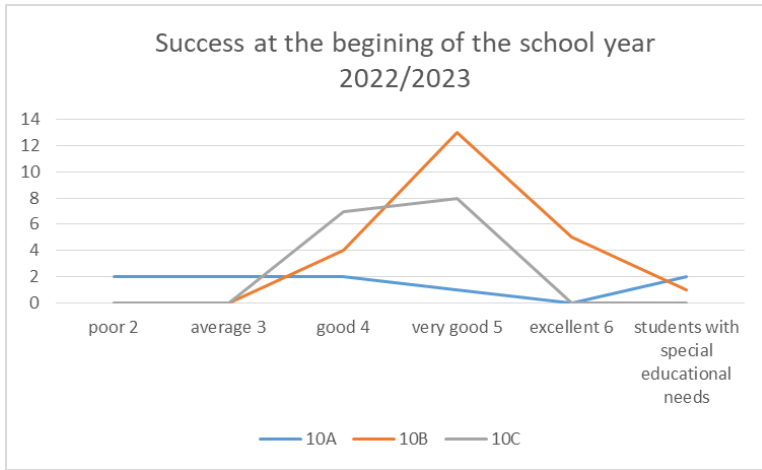


Fig. 22 Success at the beginning of the year in IT in grade 10

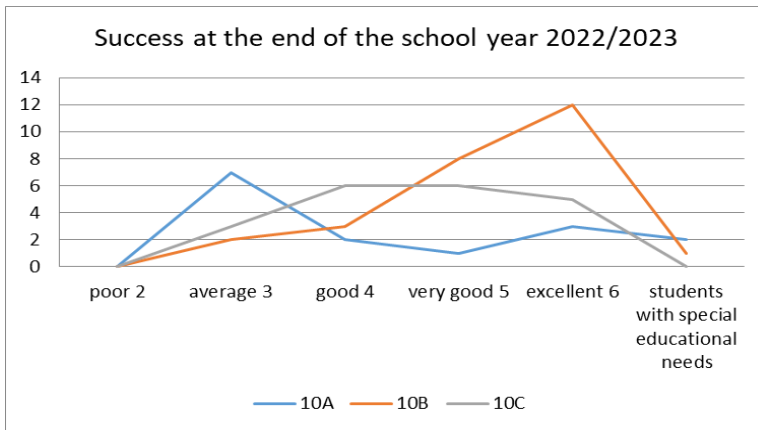


Fig. 23 Success in the end of the year in IT in grade 10

In this academic year, the graphs show that only the control group 10A remains unchanged and there are no weak results at the end. Attainment is up, significantly and a positive outcome has been achieved which is not high but progress is being made. In control group 10C and experimental group 10B, the results are at an average level, but at the end of the year success is increased. Especially in the experimental group the success is more than good.

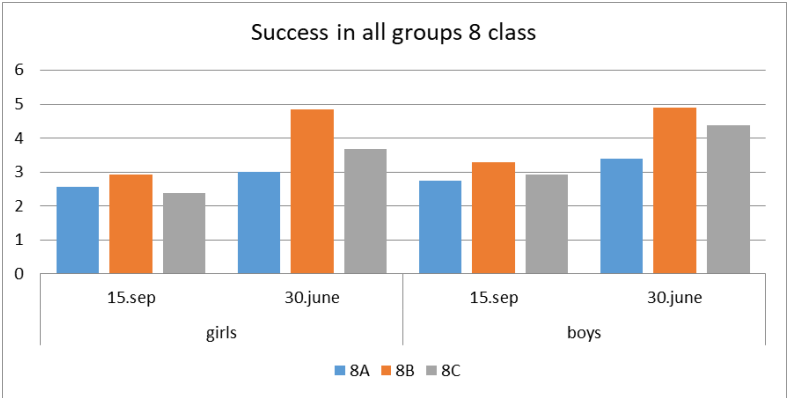


Fig. 24 Tracking success between girls and boys in IT in grade 8

In contrast to the success in IT maths, a very different graph is observed. Girls' success is much lower than boys' at the beginning of the school year. At the end of the year, however, success is the same for boys and girls. The conclusion we can draw is that they have more motivation to learn IT.

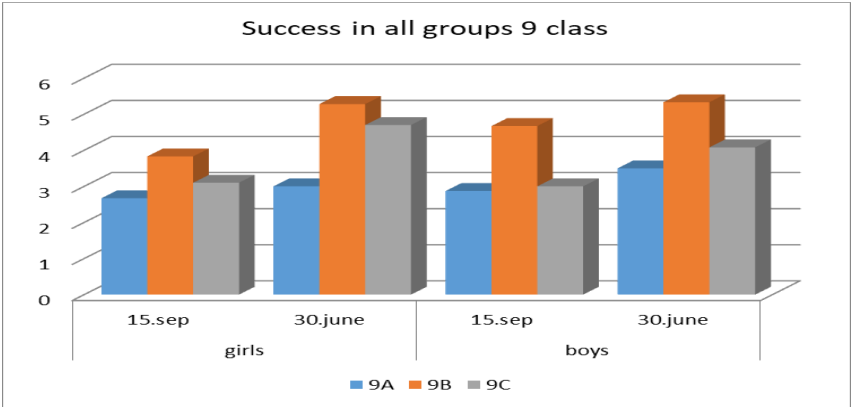


Fig. 25 Tracking success between girls and boys in IT in grade 9

The conclusion we can draw from the graphs that compare success between girls and boys during the school year. At the beginning of the school year, success is almost the same for girls and

boys. In all three groups worked with, it is clear to see that the success of girls and boys increases significantly.

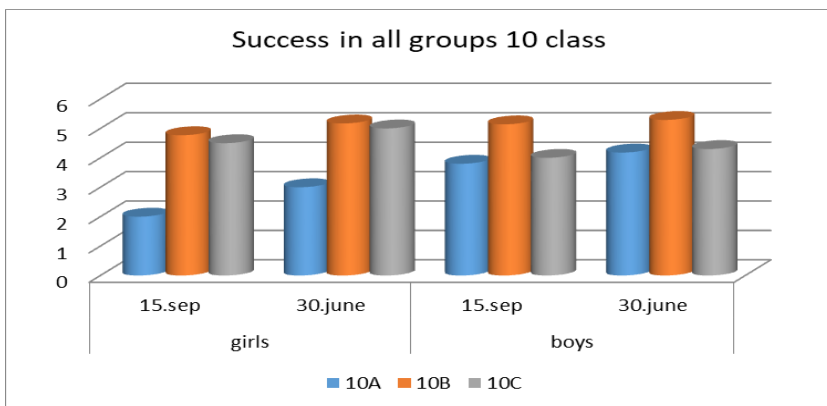


Fig. 26 Tracking success between girls and boys in IT in grade 10

The conclusion we can draw from the graphs that compare success between girls and boys during the school year. At the beginning of the school year, success is almost the same for girls and boys. In all three groups that we work with, we can clearly see that in this school year the success of girls and boys is increasing almost in the same way.

Conclusion

In today's world it means, as students had no incentive and motivation to learn and get good education, which in future influences, to get better prospects in life. This also leads to low motivation in life - they are not willing to learn even after years.. They also do not have motivation to work harder to get more. They settle for little, because the environment they live in thinks that way and it is very difficult for a child to resist all that reasoning instilled for years, throughout the child's life. But still there is a small minority of those parents with low literacy who want the best for their children. They try to remove them from their generally accepted environment, which costs them a lot of work, rejection from one side of their environment and on the other side - from the environment in which they want their children to fall. But still there are no impossible things.

The main contributions in the dissertation are.

Scientific:

1. Surveys and observations of bilingual parents have been conducted, aimed at their attitudes to helping their children.
2. Teacher surveys have been conducted to explore teachers' experiences and readiness to work with bilingual students.
3. A model for teaching bilingual students was developed.

Scientifically applied:

1. The authors have developed didactic materials applicable to the teaching of mathematics and information technology to bilingual students.

Ideas for future research:

1. Motivation of bilingual students in mathematics and information technology education 5-7 grade.
2. The development of bilingual students, in mathematics and information technology education.
3. Bilingual students studying in a specialized class Software Science 8-12 grade - a stepping stone for a better future.

List of publications and citations on the dissertation:

1. Publications in journals and other periodicals

Publication 1. Harizanov, Kr., Stefanova – Milanova, Silvena., “Scientific knowledge - categories, types and its application in the teaching of mathematics and information technology”, MATTEX 2022, CONFERENCE PROCEEDINGS, v. 1, pp. 117 – 123.

Publication 2. Stefanova – Milanova, Silvena., “Some methodological guidelines in the training of bilingual children”, Annual of Konstantin Preslavsky University of Shumen, vol. XXIII C, 2022, pp. 41 – 48, <https://doi.org/10.46687/AHRE1060P>

Publication 3. Milanova, S., Why it is important to work for the success of bilingual students – Annual of Konstantin Preslavsky University of Shumen vol. XXIV C, 2023, pp. 65 – 75, <https://doi.org/10.46687/TXGD3708>

2. Publications from conferences in Bulgaria

Publication 4. Миланова, С., Как се отрази обучението в ОРЕС на децата билингви в обучението по математика, информатика и ИТ СМБ, Боровец, 10-14 април, 2023 – http://www.math.bas.bg/smb/2023_PK/tom_2023/pdf/192-197.pdf

Publication 5. Milanova, S., The Motivation of Bilingual Students in Mathematics and Information Technology Education pp. 192-197, сп. „Педагогика“, книжка 2s/2024, година ХСVI, pp.105-114, <https://doi.org/10.53656/ped2024-2s.08>

REFERENCES

Bhatia, T. & Ritchie, W. (2016) Multilingual Language Mixing and Creativity. *Languages*. 1. 6.10.3390/languages1010006

Beardsmore Baetens, H. (1982) *Bilingualism: Basic Principles*, Multilingual matters, California University: Tieto.

Fielding, R. (2015) *Bilingual Identity: Being and Becoming Bilingual in Multilingualism in Australian suburbs*. Springer, p. 25.

Grosjean, F. (1982) *Life with Two Languages: An Introduction to Bilingualism*. Cambridge, Mass: Harvard University Press.

Heinz, B. (2001) 'Fish in the river'. Experiences of bilingual bicultural speaks. // *Multilingua* 20 (1), pp. 85–108.

Meisel, J. (2008) The bilingual child. – In: Bhatia T., Ritchie, W. *Handbook of bilingualism*: John Wiley & Sons, pp.90–130.

Paradis, J., Genesee F., Crago, M. (2011) *Dual language development and disorders: A handbook on bilingualism and second language learning*, 2nd Edn, Baltimore, MD: Brookes.

Pavlenko, A. (ed.) (2006) *Bilingual minds: Emotional experience, expression, and representation*. Clevedon, Buffalo, Toronto : Multilingual matters Ltd.

Ramirez-Esparza, N. Garcia-Sierra, A. (2014) Y. Hong (Eds.), *Oxford library of psychology. The Oxford handbook of multicultural identity*. Oxford University Press, pp. 35–56.

Romaine, S. 1995 *Bilingualism* (2nd ed.) Oxford: Blackwell.

Бижков, Г., Педагогическа диагностика. С. "Университетско издателство, Св. Климент Охридски", 1999

Верещегин, Е. М. Психологическая и методическа характеристика двуязычия (билингвизма). М. – Берлин: Директ-Медиа, 2014, с.14, 17

Даскалова, Ф. (2003) Психоллингвистика. София: Даниела Убенова (*Daskalova, F. Psiholingvistika, Sofia: Daniela Ubenova*).

Иванов,И.,Взаимоотношения между научното познание и познанието в процеса на обучението по математика//Сборник научни трудове посветен на 100-годишнината от рождението на Джон Атанасов, Том I, УИ „Епископ Константин Преславски“,Шумен,2004,с.151-155.

Колева Ст., Чалъкова К.,Интерактивни уроци MOZABOOK и обучението по математика при билингви, 2020

Павлова,Н., Харизанов,Кр.,Технологии за описание на урок в обучението по математика, информатика и информационни технологии,Второ преработено и допълнено издание,УИ„Епископ Константин Преславски“, Шумен, 2019, 264 с.