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Application of Innovative Models in Teaching Methods for Introduction to Nature and Society and Students' Success

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Abstract

This paper deals with the issue of shaping and applying innovative models in the teaching of *Teaching methods for introduction to nature and society* in the conditions existing in our schools. Most teachers need a modern methodical transformation of program contents for teaching nature and society. Therefore the theoretical part of the work is directed towards the consideration of innovative approaches in *Teaching methods for introduction to nature and society*, which asked for an indication of the theoretical basis for starting with the selected models, comparison of the traditional and the modern concept of teaching nature and society, pointing out the most important items and the underdeveloped competences of teachers and students for modern teaching practice, as well as the elaboration of those learning and teaching strategies that are underrepresented in today's teaching of nature and society, and which are necessary if we want to increase the level of students' success.

Keywords: Teaching methods; nature; innovative models; competences; teaching; students.

1. Introduction

Education theorists agree that all of the current school reforms have been largely restricted to external changes including reforms of the curricula, changing the length of schooling, changes in school organization, changes of instructional goals and objectives and the like. No reform of education has been more deeply involved in reforming education so far, and it is our duty now to put this in the foreground.

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Changing the curriculum is the foundation from which a new basis of the teaching process further grows out that move the role of teachers and students and remove forever all the modes in which the student is passivized. Reforms ... we all want them, but we are often not aware of what they bring along.

Teachers in pedagogical and didactic theory come across general guidelines for innovation of teaching, such as: instruction should not be conceived for memorizing facts and concepts, definitions and phenomena, but to respect individual differences among students, and to enable students to develop their knowledge independently etc. But such requirements induce no response if they are not seen and reshaped into precise and specific methodological guidelines aimed at the actual program content. The introduction of innovation will be facilitated by providing complete teaching materials that will help teachers to apply these innovations in practice more easily. The application of modern educational technologies does not involve only the modernization of schools with new and modern teaching aids, but it also gives clear instructions for delivering active forms and methods in the context of current curricula. The teacher must know how to combine modern methods, forms and methods of teaching, i.e. what the advantages and disadvantages of such models are and in which frameworks they can be successfully applied in our teaching practice.

In the attempt avoid generalized didactics and out of desire to leave strict methodology which can easily turn into routine and bare practice, the basic idea was to show the ways in which innovative models of teaching organization are formed in teaching the subject *Introduction to nature and society*, i.e. the effect they have on the students' success, or which dimensions the teacher has to take into account in order to meet the framework of the contemporary teaching of nature and society studies. Previous requirements constituted the basis for designing innovative models of learning in teaching *Introduction to nature and society* in the fourth grade. The aim is to demonstrate innovative models of learning from the initial idea to the final shape, with special emphasis on limiting circumstances during application, the conditions for their success, as well as their empirical confirmation by measuring the success of the student.

Intentional causes for writing this paper lie in the fact that in our teaching practice there are extremely rare empirical studies that aim to check the success of the application of contemporary models of learning and teaching in junior elementary school. Schools and education within the European Union offer their own proposals for modernizing of the teaching in our schools, but only as examples and ideas that need to be upgraded to suit the conditions of our teaching practice.

1.1. Theoretical aspect of the research problem

1.1.2. Difficulties in learning the curriculum of the subject Introduction to nature and society

Starting from teaching about the world around us, and in teaching about *Introduction to nature and society* in that teaching subject, the following problems can be noted:

- low representation of the number of weekly hours (generally two times smaller compared to other countries in the region and in Europe),
- anachronisms and discontinuities of the innovation program content,
- factography overwork and lack of adaptation to the abilities of students,

- methodological difficulties in the transformation of content,
- lack of continuous professional development for teachers,
- low material base for schools and low motivation of teachers;
- arbitrary and improvised interpretation of nature and its laws in school textbooks,
- anthropocentrism and terminological – conceptual inadequacy [1].

The teaching contents of the subjects *Introduction to nature and society* (contents about nature) are complex and very often they create difficulties to the teacher regarding adequate methodical transformation. Insufficient expertise, or lack of knowledge of the teaching content on the part of the teacher, results in teacher's decision to use the more traditional approach to the analysis of the teaching material, in which students passivization prevents deeper penetration into the explanation of complex natural phenomena or processes, as well as review or investigation on the part of the students.

Some experimental studies here provide a basis for the hypothesis that the current programs, as much as teaching methods and other factors, cause the poor performance of students.

1.2. Traditional concept of teaching Introduction to nature and society

Traditional teaching about Introduction to nature and society has its basis in the traditional theories of education, starting from Pestalozzi to Herbart, Dewey and Kerschensteiner. These ideas represent a unilaterally understood intellectualism because they observe education unilaterally. Therefore, traditional teaching of *Introduction to nature and society* advocates intellectualism on the one hand (accumulation of knowledge and facts, verbosity, excessive student load, the inability to apply what is learnt because of misunderstanding) and lowering of the educational level on the other side. Also, traditional teaching of *Introduction to nature and society* does not take into account equal respect and development of educational, correctional and functional tasks of teaching. Such teaching ignores the formation of attitudes and learning of positive human qualities, the formation of the scientific view of the world, and it pays the least attention to training students how to learn and how to think, so they are not prepared for continuing education.

The logic of the relationship between general and specific knowledge in the development of science is different from that in didactic settings, so the development of programs and the determination of the order of learning should start from the logic of the relationship between general and specific knowledge in the development of science from which the teaching content is taken. The given curriculum, which represents the traditional approach, is also called into question, because knowledge is no longer the goal of education. The modern approach to the curriculum promotes flexibility, adaptability, holistic approach, processes aimed at teachers and students, as well as their interactive-communicative relationship. So the basic elements of curriculum management are: content and scope of the curriculum, balance between different subjects, direction of curriculum, and integration of subjects and contents [2]. The curriculum development in the field in *Introduction to nature and society* should therefore be oriented towards the determination of the contents of terms, rules and laws that students should learn, then towards the resources by means of which they could understand and learn them, towards the abilities needed to be developed at the same time, attitudes and other educational components of personality that should be emphasized during classes, while the program contents

should be taken flexibly. This would imply that teachers do not blindly follow the contents of the textbooks and that they get rid of rigidities in planning and focus on the outcomes of teaching. It is extremely important to leave some room to students to influence the contents they learn and the way they learn. Through the program contents of teaching *Introduction to nature and society* the teacher leads students in the learning process, providing assistance and support.

Educational needs of students today are different. In this respect we can talk about changing the content of the concept of quality in education. The quality of education could be defined as a process of meeting the agreed standards. Among educational standards here, for us, the following are important: standards of quality of the teaching process, i.e. standards of educational content and teaching standards, as well as standards of quality effects, i.e. standards of educational achievement - knowledge, skills, abilities. To achieve the quality of the educational system it is necessary that it be defined, evaluated and monitored. Besides the defining of standards it is necessary to determine a set of indicators with which it will be possible to measure the degree of achievement of certain standards. School quality research has shown that the improved results of students' outcomes are directly related to school factors, namely that the results in performance are not dependent only on the ability and the characteristics of students, but also on the processes taking place within the class [3].

As Sidenko [4] says, in the teaching theory and practice today two pedagogies are shaped, two different conceptual paradigms of shaping the learning environment - the so-called pedagogy of knowledge and the pedagogy of skills, in the background of which are two schools – “school of memory” and “school development”. Analogous to the table given by Sidenko, we are showing comparative characteristics of traditional teaching of *Introduction to nature and society* oriented towards knowledge and innovative teaching of *Introduction to nature and society* oriented towards abilities:

1.3. Modern concept of teaching Introduction to nature and society

Modern teaching of *Introduction to nature and society* is based on the need to enable student through the program contents to be an active individual the society of knowledge. In the late nineties of the 20th century learning has become a priority area in the development of education policies of European countries, including ours. At the end of the year 2000 the European Commission has adopted a Memorandum on Lifelong Learning which stresses that lifelong education can no longer be just one aspect of education and training, but needs to become a leading educational principle aiming to develop a coherent education policy for Europe. Contemporary concepts of lifelong learning are based on the belief that everyone is able to learn, that everyone must develop motivation for learning and that individuals need to be encouraged to practice lifelong learning. Philosophy of lifelong learning implies a shift from education to learning. The realization of lifelong learning depends largely on the ability and motivation to take care of one’s own learning [5].

The modern concept of teaching *Introduction to nature and society* is based on the concept of teaching focused on action, i.e. on integrative learning. For such instruction it is necessary to understand the changing role of schools and education in the lives of children and young people. School should be seen as a comprehensive experience space, in which active treatment of the real things becomes a leading maxim of the organization of

teaching and learning. In such a way, a "bad" reality outside school with its limited opportunities for experience is being opposed by definite educational endeavor.

Table 1. Comparative characteristics of traditional and innovative developing teaching of *Introduction to nature and society*

Comparison parameters	**Traditional teaching of *Introduction to nature and society***	**Innovative developing teaching of *Introduction to nature and society***
Goal	Transfer of knowledge, skills and habits	Pupil's personality development
Motto	"Do as I do", "I am above you"	"Do not harm", "I am with you"
Basic characteristic	Teaching "memorizing"	Teaching developmental abilities
Character and style of mutual action	Subject – object, monologue, authoritarian	Subject – subject, poly-logical, democratic
Organization forms	Frontal, individual	Group work, pair work
Teaching methods	Informative, reproductive	Problem approach, reflexive
"Learning formula"	Knowledge – reproductive activity	activity – reproduction – knowledge, creation of the "success" situation
Learning styles	Learning by heart, reproduction, activity according to an algorithm	Explorative thinking activity
Basic teacher's functions	Information carrier, propagator of the subject-disciplinary knowledge, keeper of norms and traditions	Organizer of cooperation, consultant, manager, assistant
Pupil's status	Passivity, absence of interest	Activity, presence of motivation and interest
Guiding principle	"deflection" (under pressure)	"nurturing"

The modern concept of teaching *Introduction to nature and society* respects the foundations of the revolutionary model of learning [6].

- today everyone is both a teacher and a student,
- for most people learning is most effective when it is fun,
- if we ensure appropriate environment, most children will show a great amount of self-directed learning,
- good teachers today can make miracles by means of interactive electronic communications,
- people learn best when they want to learn, and not in some period of life determined in advance,
- when students are completely involved in learning even the difficult information can easily be learned and memorized,
- brain research shows that intelligence in the right environment can be improved,
- each of us has the learning style that is as individual as our fingerprints, so the school should recognize it,

- at each step it is necessary to use real world as your classroom, and in order to learn something you also need to do it.

In contemporary teaching of *Introduction to nature and society*, when it comes to the modern approach to the choice of teaching content we should take into account the achievements of structuralist scholars – J. Schwab, J. Bruner, Gagné, Ausubel, and our J. Djordjevic. According to the theory of structuralism in the selection and classification of educational content the methodological structure of disciplines should be taken into account and care taken of linking the contents. It certainly requires teacher's good knowledge of the structure of a specific discipline, and, as we are speaking about an interdisciplinary school subject Introduction to nature and society, the teacher should be well acquainted with the structure of the corpus of natural and social scientific disciplines: biology, physics, chemistry, geography, and sociology. If a teacher is able to meaningfully connect a number of elements, he/she understands the structure of the teaching subject.

Program contents of the subject *Introduction to nature and society* in contemporary teaching should not be treated only descriptively. It is necessary that the teacher insist on seeing the cause-effect relationships, on constructing lawful relationships between phenomena and on their analysis, which will result in operational thinking. Insisting on such a mode will lead to the formation of cognitive structures. If the content is not associated with the already gained knowledge, students will not understand the contents and will have to learn it by heart. Contents learned in such a manner do not last because it they do not fit into cognitive structures. Program activities in teaching Introduction to nature and society will not lead to the formation of educational and cognitive structures, if the complex natural and social phenomena and processes are learned in isolation and if they are learned by memorizing facts and concepts.

Another problem for teachers comes from the fact that in our country there is no taxonomy of teaching that would ensure standardization of goals and objectives classification. The goals and objectives in the curricula of *Introduction to nature and society* are very general and do not help teachers in the organization of teaching. Some experimental studies indicate that our current curriculum as well as the teaching methods and other factors are the causes of poor success. The curriculum of the subject *Introduction to nature and society* in recent years underwent substantial changes. In thematic terms, there was a reduction of the program with specific program contents having been much minimized (such as historic contents in the third and fourth grade of primary school) or removed (such as contents from astronomy and anatomy of the human body in the fourth grade of primary school). Apart from this, the curriculum of *Introduction to nature and society* is not so limiting for the teacher any more as it allows him/her broad autonomy in planning. The number of lessons planned for the realization of respective teaching topics, as well as individual teaching content is given as a frame, and so is the number of lessons. In the third and fourth grade this autonomy is even increased because the teacher is not given the framework number of lessons for the realization of the material within individual teaching themes. This autonomy of teachers in planning in practice is mostly seen as an additional difficulty and a problem and not as an advantage. The reason for this is the fact that programs, beside contents, do not have essential characteristics of the organization of the teaching process in which they are realized, i.e. there is no unity of content and method. Failing this, teachers often find a solution in planning by the textbooks, which can lead them into a trap. In this time of transition and reforms of teaching in which our country is still struggling in the field of education,

textbooks do not completely follow the reform process. Textbooks still do not represent collections of various problems that activate students in the process of learning concepts. In the textbooks for the subject Introduction to nature and society there are still not enough places that require the students' use of convergent or divergent thinking, formulating and asking questions, experimenting and inciting them to explore, prove and verify their conclusions and attitudes. Furthermore, textbook authors still pay very little attention to respecting individual difference among students. In most textbooks there are almost no additional, optional school or homework assignments that direct students to use additional reading, find additional information in encyclopedias and journals, independently perform an experiment, and do mini-projects and similar tasks. Beside this, authors of textbooks for *Introduction to nature and society* rarely make a connection between the content being learned with the previously processed content by directing students to previous chapters. All this is aggravated by the fact that teachers can choose among many books the one that best suits them. It is certain that the teaching content of the programs and textbooks is not the only factor in education, but with a rigid conception of these as the only sources of knowledge it can become an aggravating factor in the contemporary teaching of *Introduction to nature and society*.

Recent developmental psychology and psychology of learning believes that learning is an active process that emerges from the confrontation of the individual and his/her environment. The basic form of confrontation of man and the world is activity, action, and "work". This active facing with issues produces the basis for the development of thought and imagination. Learning must propagate and instigate this active character of learning, and thus shape learning conditions. In this way school learning will pass its mechanical step and lose the forced character, and knowledge will become an integrated part of the student's personality.

De Zan [7] argues that the modern teaching of *Introduction to nature and society* should be based on constructivist learning and teaching directed to research, on learning by discovering that is here understood as guiding towards research, and afterwards as independent students' research. Citing the research it can be ranked by weight and gradually it will be applied from the initial in *Introduction to nature and society* (of teaching the world around us). Guiding towards research can be ordered according to difficulty and should be gradually applied from the initial teaching of *Introduction to nature and society* (from teaching about the world around us).

2. Methodological frame of the research

The main problem of this research is how to make modern teaching of the subject *Introduction to nature* more efficient. This subject has interdisciplinary character and its basis lies in an even more complex subject. Most teachers find *Introduction to nature* difficult in all teaching activities, from planning and modeling to evaluation of the student. From the so far identified and comparative analyses from domestic and foreign activities for teaching *Introduction to nature* the following problems can be reported: program contents overloaded with facts and not adjusted to students' abilities, frequent improvisations of interpretation of nature and its laws, anthropocentrism, major difficulties in the methodical transformation of content, and low teacher motivation for applying novelties.

The teaching of the subject Introduction to *Introduction to nature and society* today must foster a "learning culture". Instead of memorizing facts and practicing encyclopedic knowledge and formalism students should

master rational learning techniques, and teachers should use techniques that activate students, motivates them for independent learning, creative work and application of knowledge in real everyday life. The center of a modern teacher's job is in teaching methods used with students. By applying innovative models of work a teacher should develop new competences, i.e. his/her work should acquire new quality.

The methodological transformation of the subject contents of *Introduction to nature* should be based in innovative learning models. The goal of this paper is to shape in detail the concrete – practical innovative models in teaching the subject of *Introduction to nature* that would include the following ways of learning and teaching:

- Problem learning (learning by solving problems and learning based on a problem)
- Learning by discovering
- Learning with computers
- Group work
- Pair work
- Method of guiding students' independent work
- Differentiated and individualized tasks.

For this research it is important to collect and systematize data about the condition in teaching *Introduction to nature and society* in our elementary schools. It is necessary to analyze the theoretical findings about respective manners of teaching. After that it is necessary to shape the existing respective ways of learning and organizing of students into original models of teaching *Introduction to nature* (creating methodological packages with adequate methodological material).

The subject of this research is theoretical and practical study of students' achievement by applying innovative models in teaching *Introduction to nature and society*. Students' achievements with the application of innovative models of teaching will be studied based on learned knowledge, habits and skills of students about *Introduction to nature and society* in junior elementary school.

2.1. Goals and tasks of the research

The goal of the research is to establish the effects on students' success that resulted from the application of the experimental program (innovative models of work in teaching nature).
A special goal of the research is aimed at shaping innovative models of work based on the experimental program in teaching *Introduction to nature* in the fourth grade of elementary school.

On the basis of the objectives it is necessary to realize the following research tasks:

1. To collect data on overall students' success and the success in *Introduction to nature and society*;
2. To perform an initial testing to see how much of the program contents of *Introduction to nature and society* in the experimental and control groups is learned;

3. To prepare teachers of experimental classes for teaching by means of applying innovative models of work.

2.2. Research hypotheses

Based on the theoretical approach to the problem, the goal and the task of this research the following starting hypotheses are formed:

***2.2.1. Basic hypothesis* (X0)** and alternative hypothesis (Xa) are as follows:

(Xo) It is assumed that the application of innovative teaching models for *Introduction to nature* will have no impact on increasing students' success, increasing the quantity and quality of knowledge, as well as on the increase of students' interest in the learning contents from the field of nature.

(Xa) It is assumed that the application of innovative teaching models for nature will facilitate students' success and increase students' interest in learning contents from the field of *Introduction to nature*.

2.2.2. Specific hypotheses:

(X1.0) Differences between the subjects of experimental and control groups with respect to the results achieved at the final test - subtest are not significant.

(X1.a) Differences between subjects of experimental and control groups with respect to the results achieved at the final test - subtest are significant because some respondents of the experimental group are better in solving some of the tasks.

(X1.b) It is assumed that the implementation of innovative models does not show progress of all students in the experimental group compared to the achievements of the initial test.

(X2.a). It is assumed that the implementation of these innovative models of teaching will show that all students in the experimental group progress when compared to the achievements of the initial test, so there are no weak students in this kind of teaching.

(X2.b) It is expected that the implementation of innovative models of teaching in the teaching of nature and society - self-observation, observation and reasoning will enable students to develop motivation for research work and the desire for new knowledge from nature.

2.3. Research types

The planned research is operational and developmental. The research is oriented towards modifying and improving the immediate educational practice in the third grade of elementary school.

The research focused on studying the teaching of *Introduction to nature* in the present, as well as in the future.

2.4. Research methods

a) Method of theoretical analysis - study of current theoretical knowledge of modern teaching, i.e. selected aspects of teaching and ways of adapting the content, forms and methods of educational work in teaching nature and society studies, abilities and interests of students.

b) Descriptive method - collecting data on students' academic achievement, students' attitudes toward innovative teaching of nature and society, studying of annual and monthly work plans of teachers, their written preparation for direct educational work, studying of curricula and textbooks for nature and society.

c) Causal method (experimental use) - discover the causal connections and relationships between innovative teaching, on the one hand, and the results of applying the model, on the other. The study used an experiment with parallel groups.

d) Comparative method - comparing the results of the initial and final measurements in the experimental and control groups, the calculation of the level of statistical significance of differences, comparing the results of initial and final test of knowledge in the experimental schools (establishing clear performance effects of experimental factors).

2.5. Initial test

The initial test of knowledge for this research was shaped as a list of objective type tasks, and the aim of this test was to establish the experimental and control groups' initial situations. This initial test included contents of "living" nature that students studied in the previous three grades. Good knowledge of this material is a prerequisite for understanding the contents that are part of the pedagogical experiment, belonging to the teaching topic Meeting with nature.

2.6. Final test

The final test of knowledge for this research was shaped as a list of objective type tasks and the aim of this test was to establish the experimental and control groups' final situations. The tasks of the final test included teaching contents of the teaching topic Meeting with nature taken from the syllabus of the subject *Nature and society* in the fourth grade (for 2009/10 school year).

2.7. Determination of the survey sample

The population in this study consists of the fourth grade elementary school students in the municipality of Probištip during school year 2009/10.

The general survey sample, which is deliberately selected, consists of two schools, four fourth grade classes in each school, or a total of eight classes, four of which were the control group (C group) and four the experimental group (Group E).

The experimental group consisted of students from two classes respectively in elementary schools "Braka Miladinovci": IV2 (28 students) - E1, and IV 3 (26 students) - E2, and from 2 classes in “Nikola Karev" in Probistip: IV 1 (27 students) - E3 and IV 2 (28 students) - E4.

The control group consisted of students from two classes in elementary schools "Braka Miladinovci": IV 1 (29 students) - K1, and IV4 (26 students) - K2, and students from two classes in elementary school “Nikola Karev" in Probistip: IV 3 (29 students) - K3, and IV 4 (28 students) - K4.

Such a sample was formed to reduce the role of negative factors to a minimum, especially those originating from the environment, i.e. school in which the research was conducted, although the research was conducted in schools that had similar material, spatial and other working conditions.

We point out that the fourth grade students were selected because in the previous school year (2010/11) significant changes were made in the third grade curriculum – the previous subject *Introduction to nature and society* was divided into two teaching subjects *Nature studies* and *Society studies* in accordance with the introduction of nine-year elementary education in R. Macedonia, which is a logical continuation of the subject from the third grade with the same title. All of this induced us to decide to perform this research in the fourth grade on subjects that suffered most changes - contents about the so-called living nature (plants-animals-humans), and to shape an experimental program for this research in which one teaching unit (Meeting with nature) will be tested, and the proposed way of realization will be confirmed in the innovative models and by measuring students’ achievement.

2.8. Data processing methods

In statistical analysis and collected data analysis at the stage of **descriptive statistics** measures of the average (central tendencies) and appropriate measures of variability (dispersion) were used: **arithmetic mean and standard deviation, median**. The normality distribution of the tests and subtests results by groups and sample as a whole was screened by means of the **Kolmogorov-Smirnov test.**

To test the hypotheses a **parametric statistical test** - **t-test** was used to determine statistically significant differences in the initial and final test and their subtests of their examinees in the control and experimental group; to determine the differences in the results of the final and initial test of the examinees in the experimental group; determining the differences in the final test results of the examinees in the experimental group and general school success.

The multivariate technique that is applied in structural studies of behavior - **canonical discriminant analysis** was used to determine the differences between the control and experimental groups in terms of results on the initial test, final test and school success.

Multiple differences were performed to determine prediction of the final knowledge test results, school success, and initial knowledge test and group affiliation.

Regression analysis was used to determine the relation between school success, success in subjects nature and society and previous knowledge of nature studies (as a predictor system) on one side, and student achievement in nature studies (as a criterion system), on the other side.

The data were processed by statistical software SPSS 8.5.

The teaching unit Meeting with nature is planned and programmed for this research according to the set general goals and tasks of the subject *Introduction to nature* for the third grade, but afterwards a detailed operationalization of goals and tasks was made **on three difficulty levels** by means of a more modern taxonomy of educational objectives – knowledge (awareness), understanding and application of knowledge.

3. Discussion

Therefore, for this research an experimental program was made for two teaching topics in the manner of detailed methodological operationalization. In the teaching of *Introduction to nature* phenomenological integrity prevails where the fundamental starting point is the integrity of phenomena in nature seeking to reflect in teaching. In the *Introduction to nature* curriculum particular emphasis is on the requirements for observation, monitoring of noting the phenomena in nature and in a corner of the living nature, planning and performing of practical work, identifying cause-effect relationship, working out the laws, as well as preparing simple models for the interpretation of phenomena and their effect in nature. “The human race is now at the crossroads and in the antagonism between the atavistic relationship to nature and the modern scientific understanding of nature’s importance for the existence of the phenomenon of life."[8]. In order to initiate students' interest in scientific research, it is also necessary to plan small “research papers" that students can perform independently and observe the application of science in daily life. Thus *technologically oriented integrity* will be accomplished. For understanding complex natural phenomena and processes in teaching *Introduction to nature* the teacher has to apply the *principles of general systems theory and cybernetics* that will enable students to observe the phenomenon or the process in terms of system operation, which means that you should know their structure and structure development, a way of maintaining balance and exchange, both material and information exchange.

The teaching topic **Flora and fauna** is one of the more complex issues in the fourth grade lessons of *Introduction to nature* due to its load of contents, with inadequate representation in the curriculum and, in addition, with a very unsystematically given learning materials in the literature (textbooks) in almost all current publishers. This is the conclusion of all the teachers with whom the researchers came into contact due to the nature of their work (more than a hundred fourth grade teachers are attending additional training at the Faculty of Pedagogy in Stip.

The problem is further expanded onto the contents about man that, from 2006/07 school year, have been studied in a much smaller scale than before. Specifically, students were previously (meaning until the above mentioned school year) studying these contents in 18 lessons, where they were acquainted with each of the man’s organ systems. Now it comes down to several lessons about the teaching topic **Man as part of nature**, which include: Man – social and conscious being, Sex differences in humans, Basics of healthy living. This material, as can be seen, in its essence imperatively deals with health education of students and the development of public health. The question is whether the health education of students can be established without basic information about the

anatomy and functioning of the human organism and the factors that positively or negatively affect it. Students of that age notice changes to their body daily, they want to discuss these and get answers, but a teacher with such a reduced number of lessons cannot satisfy their curiosity and dedicate himself/herself to these contents in a way students require. It was also an important benchmark for researchers to first find in the plan enough space for these lessons, and then to design a way to engage students with the help of preparatory homework, which will then allow them during lessons to have enough space to confront their views and to jointly, reach the right answers.

For these reasons, for the purposes of this study an experimental yearly curriculum was created that was applied in selected experimental and control classes, in order to avoid parasitic variables that would surely have occurred if the school took different curricula of teachers.

3.1. Balancing groups per overall success variable at the end of the first term

For the intended pedagogical experiment it was necessary to consider the overall success of the students of experimental and control groups at the end of the first term of third grade, because the experiment was done in spring, i.e. in the second term of the same grade.

Table 2: Overall students' success at the end of the first term of the school year of the fourth grade

School name	Class		No.	Excellent		Very good		Good		Satisfactory	
				No.	%	No.	%	No.	%	No.	%
"Braka Miladinovci"-Probistip	IV^2	E1	28	20	71.43	3	10.71	3	10.71	2	7.14
	IV^3	E2	26	19	73.1	4	15.4	2	7.7	1	3.8
"Nikola Karev"-Probistip	IV^1	E3	27	22	81.5	3	11.1	1	3.7	1	3.7
	IV^2	E4	28	21	75.0	3	10.8	2	7.1	2	7.1
Total E group			**109**	**82**	**75.2**	**13**	**11.9**		**7.4**	**6**	**5.5**
"Braka Miladinovci"-Probistip	IV^1	K1	29	21	72.4	5	17.3	2	6.9	1	3.4
	IV^4	K2	26	18	69.3	6	23.1	1	3.8	1	3.8
"Nikola Karev"-Probistip	IV^3	K3	29	22	75.9	5	17.3	1	3.4	1	3.4
"Nikola Karev"-Probistip	IV^4	K4	28	20	71.5	4	14.3	2	7.1	2	7.1
Total K group		**112**		**81**	**72.3**	**20**	**17.8**	**6**	**5.4**	**5**	**4.5**
Total K and E groups				**190**	**73.8**	**33**	**14.9**	**14**	**6.3**	**11**	**5.0**

The overall success at the end of the first half of the school year is expressed based on the number and the percentage of students with excellent, very good, good, satisfactory and unsatisfactory success, and on the mean grade of the classes for the experimental and control group, and for each class separately, and is given in Table 1.

Based on data from Table 1 it can be concluded that the experimental and control groups balanced according to the number of students with positive success (E – 75.2%, K-72.3%) and negative success (E - 5.5%, K – 4.5%).

Group E has a slight advantage in the number of students with excellent success (53.2%) compared to group K (59.0%). In the category of very good success the students are well balanced.

Table 3: Overall students' success at the end of the first term of the school year of the third grade for *Introduction to nature*

School name	Class		No.	Excellent		Very good		Good		Satisfactory		Total positive		Total negative	
				N	%	N	%	N	%	N	%	N	%	N	%
"Braka Miladinovci"-Probistip	IV 2	E1	28	13	46.4	8	28.6	2	7.1	5	17.9	28	100	0	0
	IV3	E2	26	16	61.5	5	19.3	3	11.5	2	7.7	26	100	0	0
"Nikola Karev"-Probistip	IV 1	E3	27	15	55.6	7	25.9	4	14.8	1	3.7	27	100	0	0
	IV 2	E4	28	14	50.0	6	21.4	5	17.9	3	10.7	28	100	0	0
Total E group			**109**	**58**	**53.2**	**26**	**23.9**	**14**	**12.8**	**11**	**10.1**	**109**	**100**	**0**	**0**
"Braka Miladinovci"-Probistip	IV 1	K1	29	17	58.6	5	17.2	2	6.9	3	10.4	27	93.1	2	6.9
	IV4	K2	26	15	57.7	6	23.1	2	7.7	2	7.7	25	96.2	1	3.8
"Nikola Karev"-Probistip	IV 3	K3	29	18	62.1	7	24.1	2	6.9	2	6.9	29	100	0	0
"Nikola Karev"-Probistip	IV 4	K4	28	16	57.1	8	28.6	3	10.7	1	3.6	28	100	0	0
Total K group			**112**	**66**	**59.0**	**26**	**23.2**	**9**	**8.0**	**8**	**7.1**	**89**	**97.3**	**3**	**2.7**
Total E and K groups			**221**	**124**	**56.1**	**52**	**23.5**	**23**	**10.4**		**8.6**	**218**	**98.6**	**3**	**1.4**

If we analyze the overall school success of classes the following will be observed: while E group as a whole leads in the number of students with excellent success, K3 control class has most excellent students (62.1%). The experimental class E4 has the least excellent students (61.5%). In the category of very good success the experimental class E2 has only 19.3% of such students, compared to E1 and E4, which have 50.00% of students with very good success. The experimental group has only one student with satisfactory success (1.22%), while the control group does not have any students with such success. From the stated above, we see that the classes are very diverse in structure, which in junior grade school is not uncommon.

Table 4: Students' success on the initial test (number of points and percentage by ranks on the test as a whole)

School name	Class		No.	Subtest 1		Subtest 2		Subtest 3		Total	
				Points	%	Points	%	Points	%	Points	%
"Braka Miladinovci"-Probistip	IV 2	E1	28	13	46.4	8	28.6	2	7.1	5	17.9
	IV 3	E2	26	16	61.5	5	19.3	3	11.5	2	7.7
"Nikola Karev"-Probistip	IV 1	E3	27	15	55.6	7	25.9	4	14.8	1	3.7
	IV 2	E4	28	14	50.0	6	21.4	5	17.9	3	10.7
Total E group			**109**	**58**	**53.2**	**26**	**23.9**	**14**	**12.8**	**11**	**10.1**
"Braka Miladinovci"-Probistip	IV 1	K1	29	17	58.6	5	17.2	2	6.9	3	10.4
	IV 4	K2	26	15	57.7	6	23.1	2	7.7	2	7.7
"Nikola Karev"-Probistip	IV 3	K3	29	18	62.1	7	24.1	2	6.9	2	6.9
"Nikola Karev"-Probistip	IV 4	K4	28	16	57.1	8	28.6	3	10.7	1	3.6
Total K group			**112**	**66**	**59.0**	**26**	**23.2**	**9**	**8.0**	**8**	**7.1**
Total E and K groups			**221**	**124**	**56.1**	**52**	**23.5**	**23**	**10.4**	**19**	**8.6**

Table: 5 Innovative models in the teaching of the subject Introduction to nature

MODEL	
TEACHING TOPIC	Flora and fauna
TEACHING UNIT	Division of the living world into kingdoms
CLASS TYPE	Presentation and review (2 classes)
CLASS GOALS	Systematization of the acquired knowledge of plants and animals and the introduction of new criteria for grouping of living organisms.
CLASS TASKS	
a) educational	Expanding the students' knowledge about living organisms. Learning the new way of dividing and grouping of living organisms into five kingdoms: monera, protista, fungi, plants and animals.
b) educationally	Development of students' team work and achievement of mutual cooperation.
c) functional	Enabling students to distinguish microorganisms, plants, animals, and fungi.
TEACHING METHODS	A) verbal – textual: the oral method (dialogue), the method of the written word

	(work on a text); B) illustrative - demonstrative: illustration with paintings and drawings, demonstrations of natural materials; C) method of managing pupils' independent work (long-term experiments)
TEACHING FORMS	Group, frontal.
TEACHING AIDS	Computer, LCD projector
TEACHING TOOLS	Teaching books, paintings, natural material, tweezers, magnifying glass
STUDENTS' ACTIVITIES	Research, mini-project, recording, evaluation, grouping, asking questions, reporting, asking questions
FORMS OF LEARNING	Participatively, cooperatively conceived.
CLASS ARTICULATION	1. Preparational task: **How does mold develop?** 2. Students' reports about the task done. 3. Group work. 4. Groups' reports.
METHODICAL GUIDELINES	Students should be given a preparatory research task 4-5 days before, with which a problem task is created in the introductory part of the class. • During class students work in heterogeneous groups of 4-5 students. Students are reminded that it is necessary to choose one student in the group who reads best and will read the material to the group. Then everyone should think about what he/she does not understand and ask questions about it in the group. After group discussion, they make a concept for their presentation to the other groups in the class. The group should elect a reporter. One of the members should draw a natural material, while another member should describe its appearance.

Preparational task: *How does mold develop?*

Material needed: a slice of bread, a plastic bag

Procedure: Put a slice of bread in a plastic bag. Leave the bag in a place outside the refrigerator. Every day, watch what happens to the bread. Write into your notebook: Homework, then the name of the task, and then make a table similar to this and there record what you observe.

The course of the lesson

INTRODUCTION

The lesson starts with a conversation with students:

- What creatures have you been familiar with so far? (Plants, animals, people.)
- What do you think, are there other living beings on this planet? (There probably are.)
- Have you heard of bacteria, viruses, fungi...? (Yes, we have.)
- Where do these living creatures belong? (Maybe they are animals.)
- Are fungi plants? (Yes, they are.)

- And if I tell you that fungi feed on ready food as animals, will you still argue that fungi are plants? (No.)
- Why? (Because plants produce food themselves.)
- Are then fungi animals? (Yes.)
- However, they are not. Your task is to learn during this class how living things are grouped in today's science and what their basic characteristics are.
- Does anyone want to ask a question about this?
- The students' questions should be written on the board. Some possible questions asked by students are:
- What are fungi?
- Where do bacteria and viruses belong?

All these questions for students are problem questions to which they will find answers on their own.

CENTRAL PART

Students work in groups of 4.Each group gets a similar instructional sheet. The difference is in the last task.

The instructional sheet

How are living things grouped in today's science?

In order to get answers to this question you must carefully analyze the paper sheet you got.

ANSWER: _____

Based on your preparatory task about mold, write to which kingdom mold belongs. Write it into the table!

Now try to answer the following questions:

What are fungi? _____

Are bacteria animals?	YES	NO
Can we see viruses with the naked eye?	YES	NO

4. Results

4.1. Difference between the subjects of experimental and control groups with respect to the results achieved at the final test - subtest I

Table 6. Subtest of awareness on the final test

Belonging to the experimental or control group	N	Mean	Std. Deviation	Std. Error Mean
Control group	112	5.86	1.79	.209
Experimental group	109	7.98	1.19	.138

The arithmetic mean of the control group on subtest I - awareness is 5.86 with a standard deviation of 1.795, while the arithmetic mean of the experimental group on subtest I – awareness is 7.98 with a standard deviation of 1.19. On average, the experimental group achieved better results for 1.79 points on subtest I - awareness, with little deviation of individual results from the mean.

Table 7. Testing result differences of E and K groups on subtest of awareness on the final test

	Levene's Test for Equality of Variances		t-test for Equality of Means					95%Confidence Interval of the Difference	
	F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	15.85	.000	-6.865	159	.000	-1.85	.248	-2.365	-1.396
Equal variances not assumed			-8.025	145.55	.000	-1.85	.237	-2.468	-1.385

With Levene's test it was obtained that F = 156.85 and p = 0.0, statistically significant, indicating that the variances of subpopulations in terms of the dependent variable, are inhomogeneous. We conclude that the applied t-test for unequal variances, t = -8.025, with significance p = 0.00, is statistically significant, indicating that there are differences between the groups. The experimental group averaged a higher score on the subtest of awareness for nearly two points compared to the control group. Limits 95% confidence interval for the arithmetic mean of difference does not include 0, which also indicates the existence of differences between groups.

Based on the presented results the hypothesis X1.0 is rejected and X1.a alternative hypothesis is accepted as follows: 'The differences between the subjects of experimental and control groups with respect to the results achieved at the final test - subtest I were significant because some respondents of the experimental group solve some of the tasks better.'

4.2 The difference between the subjects of experimental and control groups with respect to the results achieved at the final test - subtest II

Table 8. Testing differences found in E and K groups on subtest of understanding of the final test

	Levene"s Test for Equality of Variances	t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1.205	.279	-5.621	159	.000	-2.97	.612	-3.985	-2.015
Equal variances not assumed			-5.502	159.22	.000	-2.89	.623	-3.975	-2.023

With Levene's test it was obtained that F = 1.205 and p = 0.279 are not statistically significant, indicating that variances of subpopulations in terms of the dependent variable are homogeneous. The applied t-test for equal variance, t = -5.621 with a significance of p = 0.00 was **statistically significant**, indicating that there are differences between the groups. The experimental group averaged a higher score on the subtest of understanding for 3.11 points compared to the control group. The limits 95% confidence interval for the arithmetic mean of difference does not include 0, which also indicates the existence of differences between groups.

Based on the presented results the hypothesis X2.0 is rejected and X2.a alternative hypothesis is accepted as follows: 'The differences between the subjects of experimental and control groups with respect to the results achieved at the final test - subtest II, are significant because some respondents of the experimental groups solve some of the tasks better.'

Previous results also showed ***significant improvement of respondents in the experimental group participants regarding the application of knowledge*** in nature studies included in the research. Unlike them, the respondents of the control group showed no improvement in knowledge application, which states that the selected model of teaching in the control group does not prepare students sufficiently for the application of knowledge in the nature studies. In contrast, it is possible to conclude that the experimental program conditions the development of the ability to implement the knowledge of nature studies.

On the basis of previous results the null hypothesis X0 that says: 'It is assumed that the application of innovative teaching models of nature and society will have no impact on increasing students' achievement, raising the quantity and quality of knowledge, as well as increasing students' interest for learning the content from the area

of nature and society studies is rejected and the alternative hypothesis Xa that reads: "***It is assumed that the implementation of innovative models of teaching nature and society studies will enable increase in students' achievement, improvement of the quality and quantity of knowledge, as well as increase in students' interest in learning contents related to nature and society studies***" is accepted.

4.3 Individual student progress in achievements

If we considered all relevant factors important for school success, we would become faced with an inability to define failure, because each combination of all the relevant conditions matches some success. It is impossible to set standards of performance of individual students without taking into account the characteristics of the child and his/her student situation [9]. Psychologists believe that the causes of school failure can be grouped into three major sections: causes that originate from school, i.e. teaching and the factors associated with it, causes that come from the student's environments and causes that arise from the characteristics of students. For the purposes of this study the success students achieved at the final test was observed, and the knowledge showed by the students at initial testing was taken as a criterion for such a success. Here is a case of so-called simplified understanding of student success/failure, but for the purpose of research it is an optimal solution.

The term "weak student" here represents students who achieved less success in the final test of knowledge compared to the result of the initial test of knowledge. The first perception of this individual success/failure of each respondent the total score of respective respondents on the initial and final tests was taken as indicator, while in the second perception the indicator was the grade based on the number of points.

When we compare the number of points that each of the students from groups E and K achieved on the initial and final tests, the following results appear (Table 65):

75 students from group E (or 91.46%) achieved **improvement** compared to their previous knowledge of nature, it is a very important result when one bears in mind that only 28 students (or 32.56%) from group C progressed by the same indicator;

Only 5 students from group E (or 6.10%) regressed in relation to their prior knowledge, while the success of more than half of K group had this very tendency - 51 students (or 59.30%);

2 students from group E (or 2.44%) showed the same level of knowledge of "living" nature, as opposed to the K group in which the incidence of such students was slightly higher - 8.14%.

Table 9. Individual students' progress in the number of points on the final test in relation to the initial test

		Weaker success		**Same success**		**Better success**	
	No. of students	No.	%	No.	%	No.	%
E1	28	5	17,86	2	7,14	21	75
E2	26	3	11,54	1	3,85	22	84,62
E3	27	1	3,7	1	3,7	25	92,59

E4	28	1	3,57	0	0	27	96,43
E group	**109**	**10**	**9,17**	**4**	**3,67**	**95**	87,16
K1	29	20	68,97	1	3,45	8	27,59
K2	26	18	69,23	1	3,85	7	26,92
K3	29	18	62,07	6	20,69	5	17,24
K4	28	19	67,86	5	17,86	4	14,29
K group	**112**	**75**	**66,96**	**13**	**11,61**	**24**	21,43

Further analysis of individual results leads to the conclusion that in the E group the largest single improvement was +20 points (1 student), and the largest regression -4 points (1 student); in the K group the largest individual improvement was +10 points (1 student), while as many as four students showed significant regression of -10 points. The maximum possible number of points on both tests was 50.

When the grade achieved on the initial and final tests was taken as the indicator of student success, the situation is as follows (Table 66):

- a higher grade on the final test in E group was achieved by 56 students or 68.29%, while in the K group this number is much smaller - 11 students or 12.79%;
- students in E group achieved a lower grade on the final test, which is 2.44% compared to 30 students in K group or as much as 34.88%;
- 24 students from group E or 29.27% did not show better results if we look at results on the initial and final test, while this was a trend that existed for more than half of the students from group K - 45 students (52.32%);

Table 10. Individual students' progress in grades on the final test in relation to the initial test

		Weaker success		**Same**		**Better success**	
	No. of students	No.	%	No.	%	No.	%
E1	28	2	7,14	10	35,71	16	57,14
E2	26	2	7,69	9	34,62	15	57,69
E3	27	1	3,70	10	37,04	16	59,26
E4	28	1	3,57	10	35,71	17	60,71
E group	**109**	**6**	**5.5**	**39**	**35,78**	**64**	58,72
K1	29	9	31,03	13	44,83	7	24,14
K2	26	10	38,46	13	50	3	11,54
K3	29	8	27,59	16	55,17	5	17,24
K4	28	7	25	14	50	7	25
K group	**112**	**34**	**30,36**	**56**	**50**	**22**	19,64

The causes of failure of 6 students in group E who regressed according to the stated indicator obviously come from the students' environment and students' characteristics.

These results show a trend of a drastic reduction in the number of weak students in the experimental group after the realization of the experimental program, in contrast to the control group where an opposite trend appeared, i.e. increase in the number of weak students. The cause in this case can be sought in teaching of nature and society studies, i.e. the positive impact of experimental factors.

Thus, *the results obtained indicate that the application of innovative models show individual progress of the vast majority of students in the experimental group compared to the achievement on the initial test*.

However, we have to accept the set null hypothesis *(X5.0)* of research that says: "*It is assumed that the implementation of innovative models does not show progress of all students in the experimental group compared to the achievement on the initial test"* and to reject the alternative hypothesis, which states:

(X5.a): "It is assumed that the implementation of these innovative models of teaching will show that all the respondents from the experimental group progressed compared to the achievements on the initial test, and that in such teaching there are no weak students".

We cannot say with certainty that the downward trend in the number of weak students would continue if the experimental factor acted for a longer period, but we can conclude that the *results obtained indicate that the application of innovative learning models shows individual progress of the vast majority of students in the experimental group compared to the achievement of the initial test. So we can argue that the chosen models of teaching nature and society studies drastically reduce the number of weak students.* We tend to argue that teaching and schools in this case probably could not annul the negative impact of those factors that influence students' success from the environment or from within the personality characteristics of students.

5. Conclusion

The general conclusion of research is: adequate use of innovative models of teaching of Introduction to nature and society that are based on cooperative learning, learning through joint problem solving, learning through discovery, research directed learning, differentiated requirements for students, multiple communication in the classroom and direct contact with sources of knowledge (natural materials, educational software, internet, ...) leads to a significant increase in student achievement and thus contributes to enhancing the effectiveness of teaching *Introduction to nature and society studies*. The quality of students' knowledge is improving, because learning, understanding and application are emphasized, and students gain skills they need for further study of educational content from the area of Introduction to nature and society studies.

Traditional models of learning in the teaching of *Introduction to nature and society studies* operate only in the field of reproductive learning of facts and recognition of concepts and phenomena, and are poor triggers of students' thinking processes. Although teachers know the benefits and basic organizations of those forms of learning were the foundation of innovative models of teaching Introduction to nature and society included in this

study, some resistance to their use in teaching is still present. So here an attempt is made to eliminate the many ambiguities by directing teachers to manners of implementing the selected models. Continuous professional development of teachers for the implementation of innovative ways of learning in teaching *Introduction to nature and society* are a condition of a wider application of the proposed and similar models of work.

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