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Advantages of Applying the Method of Self-aware Polyform Heuristics in Mathematics Teaching

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ABSTRACT

Traditional didactics, as well as traditional pedagogy, dealing with goals, general methods and methodologies and general classifications, are no longer able to respond to the current needs of modern teaching, in the form of resolving current issues of how to act in all individual educational cases. Precisely such a state of pedagogy and didactics induces the need to observe in a new way the methodology of teaching mathematics, which in the modern constellation of educational processes and relations has acquired a new meaning and significance. This is simply because it is able to answer this important question on how to realize some methodological issues, not in general as in traditional pedagogy and its disciplines but completely specifically, harmonized with the goals and contents of each individual task, in the realization of teaching. With this research we show that the innovated George Polya (Polya, 1966) heuristic method, i.e. its synthesis with the method of Confucian self-knowledge, more precisely the interactive method of self-knowledge polyform heuristics, greatly enriches the teaching of mathematics and contributes to its dynamization and acquisition.

Keywords: mathematics teaching, discovery learning, interactive teaching, method of self-cognitive polyform heuristics (principle of polyformity)

INTRODUCTION

Modern teaching of mathematics seeks to eliminate the mechanical memorization of a large quantum of knowledge, and also seeks to avoid the formal development of students' mental abilities. It is normal that such teaching implies the development of students' abilities, but not on worthless mathematical material, but on contents that are of good quality in terms of education and upbringing.

By learning through discovery, the content that students need to adopt is not presented in a ready-made form, but must be discovered. In the first step, this form of learning differs from receptive learning, because it starts from something new, unknown, which will intrigue the student to discover. To achieve this, the student must reorganize and transform the data, integrate them with the adopted data, and then transform that integrated combination in such a way as to reach the desired goal or discover meaningful connections that he lacked. When these phases are over, the discovered content is adopted as in receptive learning, the student incorporates the discovered content into his cognitive structure. The role of the teacher

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is to enable students to have such productive thought actions, to unobtrusively guide and develop them in them, as well as to make his personal overall action logical and consistent.

Thus, the specificity of this form of learning is that the student is directly involved in learning by discovering new content for himselg, which is accompanied by personal experiences of pleasure, satisfaction, self-affirmation, while receptive learning is the acquisition of knowledge and building a personal attitude towards new content. In contrast to this teaching, interactive teaching and learning, which are based on the didactic principles of permanence and diversity, are more focused on the child's personality as a whole person. For the most part, students go through the teaching process on their own, through group work, discussing the learning material and the given topic. The curriculum does not exist as complete, predetermined, but as an orientation with enough space for creativity from teachers and students. It starts from the interests of students, the contents are related to their experience, and the child's motivation is internal.

Modern learning of mathematics, by the method of self-knowledge polyform heuristics - is based on the didactic principles of permanence and diversity to which geometric polyformisms are added, i.e. it is based on the didactic principle of polyformity. The essence of this important didactic principle is reflected in the permanent insistence on an integral understanding of various approaches to understanding and comprehending the studied teaching phenomena. Its exploitation in practice requires from teachers excellent knowledge and skill of applying the most diverse professional-didactic-methodological possibilities, and induces intensive thinking activity in students expressed by quality self-examination and higher motivation.

The efficiency of the principle of polyformity is based on the evident psychological fact that changes and diversity in work refresh teaching, and monotony mainly induces a weakening of interest and the appearance of passivity and boredom (Markovic, 2010). The basis of the principle of polyformity consists in the double or multiple application of the law of negation to the same phenomena, i.e. initial problems or known theories. However, polyformity is not only a scientific and philosophical principle, but also a teaching principle (Nikolić, 2016). Therefore, in the teaching of mathematics, the principle of polyformity should have a universal role, which would be presented by enriching the teaching with various contents, means, procedures and methods (Marković, 2012).

1. RESEARCH METHODOLOGY

For the purposes of our research, we have accepted the definition of the learning method by discovery of Radomir Radovanović, who defines it as "directed self-educational (individual) student work in teaching based on specially programmed material and interactive communication between teachers and students.", his articulation of learning through this method and stemming from the results of his research.

1.1. Research problem

The problem is to determine whether learning through discovery can influence the increase of knowledge and the development of productive thinking of students in the teaching of mathematics.

1.2. Research subject

The object of research is to determine the effects and impact of learning through discovery on the quality of knowledge and productive thinking abilities of students in mathematics teaching.

1.3. Research aim

The aim of the research is to experimentally determine the extent to which the application of modern mathematics learning by methods of self-knowledge polyform heuristics with the help of computers (for example the implementation of the teaching topic Linear functions in the 8th grade of primary school and the use of Desmos Graphing Calcula (online program)) increases the educational effects of the teaching process, contributes to the permanence of knowledge and increases the motivation of students. According to this definition, students' achievements will be measured through the permanence of knowledge and through motivation to learn. The aim is also to look at the attitudes of mathematics teachers regarding the application of

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modern mathematics teaching by methods of self-knowledge polyform heuristics with the help of computers in the teaching of mathematics in primary school.

1.4. Research tasks:

- Explain the program of using Desmos Graphing Calcula (online program) - for the realization of the teaching topic Linear functions as well as the very concept of functions.
- Compose objective tests of knowledge, initial and final tests that will contain tasks from three cognitive levels (knowledge of facts, understanding of concepts and analysis and reasoning, i.e. application of knowledge). Since we previously mentioned motivation as one of the indicators of achievement, we would construct a questionnaire to examine the motivation of students to learn mathematics. The questionnaire could be applied to both groups after the experiment.
- To equalize the experimental (E) and control (K) group of students at the beginning of pedagogical research on the basis of: general success and success of students in mathematics at the end of the first semester of 8th grade and the results of the initial test.
- To determine whether there is a statistically significant difference in the achievement of students of the experimental and control groups on the final test, immediately after the realization of the research experiment.

2. RESEARCH HYPOTHESES

At the beginning of the research, it was assumed that the application of the method of self-knowledge polyform heuristics as the dominant method within the basic settings of interactive teaching with the help of computers during the realization of mathematics content in the experimental group will interest students and encourage them to learn independently and solve tasks, to independently and permanently monitor the success of their work, which will result in an increase in the educational effects in the teaching of mathematics.

We expect that the application of the method of self-knowledge polyform heuristics as the dominant method within the basic settings of interactive teaching with the help of computers will contribute to the permanence of knowledge and increase motivation for further learning. In the control group, students will work according to traditional methods with pre-prepared written materials of teachers for each class.

2.1. Main hypothesis: The use of teaching aids afforded by the most modern information and communication technology, and on that basis the direct or obvious experience of students, significantly contributes to a higher level of achievement than any traditional teaching aids used to mediate knowledge and stimulate certain activities in the learning process.

2.2. Special hypotheses:

- H1 The application of multimedia video presentations in the teaching of mathematics significantly contributes to a higher level of achievement in terms of student motivation in relation to traditionally set teaching.
- H2 The application of the appropriate online program Desmos in the teaching of mathematics significantly contributes to a higher level of achievement in terms of the quality of knowledge, skills and attitudes of students in relation to traditionally set teaching.
- H3 In the system of modern primary school teaching for planning and organization of educational activities by applying certain means as a source of knowledge supported by the most modern information and communication technology.

3. SAMPLE RESEARCH, METHODS AND INSTRUMENTS

3.1. The population and the research sample are represented by the students of the 8th grade attending primary schools from the area of Vojvodina in the 2018/2019 school years: primary school "Dositej Obradović" from Irig, primary school "Milica Stojadinović Srpkinja" from Vrdnik, primary school "Milan Petrović" from Begeč and elementary school "Vuk Karadžić" from Novi Sad. Our sample belongs to the category of intentional samples (two classes of 8th grade in the experimental group and two classes of 8th grade in the control group) of 120 students, of which 60 students of the control group and 60 students of the experimental group.

The equalization of groups will be done according to the principle of pairs, and considering the following criteria: general success of students in the previous semester, success in the subject mathematics, success in the initial testing and biological gender. The SPSS 14.0 software package will be used for statistical processing of data obtained on knowledge tests (initial test, final test) and surveys. The Microsoft Exell software package will be used for statistical data processing (creation of tables and graphs)

The research will analyze statistical parameters: arithmetic mean (AS), standard deviation (SD) and standard error (SE). To check the existence of the difference between the arithmetic means of the comparison results, the group is t - test (t) with the significance threshold p = 0.05, as well as the correlation coefficient (r). The magnitude (intensity) of the effect of the independent variable on the dependent one was obtained by calculating the eta correlation (h).

Immediately before the classes of initial and final testing of knowledge, all teachers received tests to determine the effects of work in the experimental and control group. After the results of this research, each student received his test for insight, as feedback on the success of his work, and the teacher tested the results of the whole class. An agreed meeting was held with all teachers at which the research results were presented. The teachers of the experimental group expressed their opinion based on their personal experience of applying learning through discovery and the method of self-knowledge polyform heuristics.

There were both experimental and control groups in each school.

Table 1

Structure of the student sample regarding to overall success in the first half of the year

Overall success	Experimental group	Control group	T o t a l:
Excellent	24 (40%)	21 (35%)	45 (37%)
Very good	10 (17%)	14 (23%)	24 (20%)
Good	15 (25%)	19 (32%)	34 (28%)
Sufficient	9 (15%)	5 (8%)	14 (12%)
Unsatisfactory	2 (3%)	1 (2%)	3 (3%)
T o t a l:	60 (100%)	60 (100%)	120 (100%)

Table 2

Structure of the student sample regarding the mathematics grade at the end of the first semester

Overall success	Experimental group	Control group	T o t a l:
Excellent (5)	22 (37%)	20 (33%)	42 (35%)
Very good (4)	12 (20%)	15 (25%)	27 (23%)
Good (3)	11 (18%)	12 (20%)	23 (19%)
Sufficient (2)	12 (20%)	10 (17%)	22(18%)
Unsatisfactory (1)	3 (5%)	3 (5%)	6 (5%)
T o t a l:	60 (100%)	60 (100%)	120 (100%)

From the tables, we can observe the approximate uniformity in terms of success in teaching mathematics.

3.2. Research methods:

- Theoretical analysis method;
- Descriptive method;
- Experimental method – didactic experiment with parallel groups and
- Methods of pedagogical statistics

During the application of certain research methods, it will be necessary to use certain research techniques in order to realize the goal and tasks of the research as successfully as possible, and to apply the research instruments as efficiently and rationally as possible. Testing, surveying and scaling techniques will be applied in this research.

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3.3. The instruments that will be constructed and applied in the research are:

- Initial test - a test to determine the previous knowledge and skills of students in groups E and K in mathematics, before the introduction of the experimental.
- Final test - test of knowledge and skills of students in E and K groups in mathematics after the introduction of the experimental factor.
- Scale of attitudes for students of the experimental group on the application of interactive teaching with the help of computers during the implementation of the teaching topic Linear functions.
- Scale of attitudes for primary school mathematics teachers on the application of learning using the method of self-knowledge polyform heuristics with the help of computers in mathematics teaching.

The initial testing will be performed immediately before the start of the experiment, the experimental variables. The final testing will be performed seven days after the action of the experimental factors.

After setting the hypotheses, the variables of the experimental research will be defined: independent, dependent and control variables. Independent variables are two models of teaching: interactive teaching - learning by the method of self-knowledge polyform heuristics with the help of a computer (online program for functions) and traditional teaching. The dependent variable is the permanence of the acquired knowledge and the motivation for further learning of mathematics. The control variables are: school success (general success and success of students in mathematics at the end of the first semester of the 8th grade) and student success achieved on the knowledge test.

The procedures applied in the research are work on pedagogical documentation and testing. Insight into the pedagogical documentation was achieved through the classbooks of all departments in the research. The data collected from the classbook refer to students: name of school, class, department, list of students (name and surname of students), gender of students, success at the end of the first semester and grades in mathematics. Subjects of both the experimental and control groups were tested twice - the initial test before the introduction of the experimental factor and the final test after the introduction of the experimental factor.

4. RESULTS AND DISCUSSION

After it was proven that the groups were uniform, and before the experimental factor was introduced, initial measurements were performed in all classes of the 8th grade. Students received a test of knowledge in mathematics. The test was applied as a measuring instrument for determining the initial state before the introduction of the experimental factor. The initial measurement was realized in 2019.

The initial test included 10 tasks for checking the knowledge of general mathematical knowledge, general school material. We have prepared tasks of the objective type for examining the knowledge of students in mathematics in order to determine the achieved level of acquisition of mathematical knowledge in the 7th grade and from the beginning of the school year in the 8th grade.

Table 3
Tabular overview of the results after the initial test, for the students of both groups is the following

Initial test	**Control group**	**Experimental group**
Boys in the group	**28**	**27**
Girls in the group	**32**	**33**
Points (0 – 0.5)	12	11
Points 0.5 - 1	6	7
Points 1 – 1.5	6	8
Points 1.5 - 2	3	3
Points 2 – 2.5	6	4
Points 2.5 - 3	6	8

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Points 3 – 3.5	3	1
Points 3.5 - 4	1	1
Points 4 – 4.5	1	0
Points 4.5 – 5	2	1
Points 5 – 5.5	3	4
Points 5.5 - 6	3	3
Points 6 – 6.5	0	1
Points 6.5 - 7	0	1
Points 7 – 7.5	0	0
Points 7.5 - 8	3	4
Points 8 – 8.5	1	0
Points 8.5 - 9	3	0
Points 9 – 9.5	0	1
Points 9.5 - 10	0	0
Points 10	1	2
TOTAL	**60**	**60**

In order to prove that the groups are independent, i.e. that the students have the same mathematical knowledge with high probability, we do a t - test on these two groups of results and show that the obtained t - value is significantly smaller than the table, and the null hypothesis is valid. The test itself takes place in several stages:
1 - setting the hypothesis and listing the numerical test results (table above);
2 - noticing the number of results for each of the groups (therefore, 60 for each group);
3 - calculation of the arithmetic mean of each group;
4 - calculating the sum of the squares of each result, for each of the two groups;
5 - calculation of squares of arithmetic means for both groups;
6 - calculation of variance of the difference between the two means;
7 - calculation of standard deviation;
8 - calculation of t - values and comparison with tabular values, in relation to the given significance threshold.

In this case we set, for example, the following zero hypothesis: "average results in both groups of initial testing do not differ". Further on, we perform the test in the following way:

Table 4
The average results in both groups of initial testing do not differ

INITIAL TEST	**Control group**	**Experimental group**
Sum of all results, Sx	179,9	184,3
Number of students, n	60	60
Arithmetic mean, $\bar{x}$	2,998	3,071
Sum of squares, Sx^2	930,18	1018,26
Square of sum, $(Sx)^2$	32364,01	33966,49
$\frac{1}{n}\times(Sx)^2$	539,400	566,108
Sd^2 $(Sd^2 = Sx^2 - \frac{(Sx)^2}{n})$	390,599	452,152

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$s^2 \quad (s^2 = \frac{Sd^2}{n-1})$	(s_1^2) 6,620	(s_2^2) 7,663
$s_d^2 = \frac{s_1^2}{n} + \frac{s_2^2}{n}$	0,23805	
$s_d = \sqrt{s_d^2}$	0,487	
$t = \left\lvert \frac{\overline{x_1} - \overline{x_2}}{s_d} \right\rvert$	0,15	

On the basis of the obtained t - value, by comparing it with the tabular value with the significance threshold p = 0.05 and with 120 - 2 = 118 degrees of freedom (2n - 2), which in the table is 1.98, we conclude that with 95% certainty we can accept our hypothesis and, therefore, be convinced that our control and experimental groups are truly independent and show the true picture of the situation in the student population according to the criterion of general mathematical knowledge. We applied the final tests of knowledge in mathematics after the implementation of the experimental program in February 2019. The knowledge testing is performed using a test of knowledge in mathematics like on the initial testing.

The final test contains 10 tasks of objective type. With these tasks, the level of students' ability to independently use the Linear function was examined, for the experimental group through the method of self- knowledge polyform heuristics and learning through discovery, as well as the computer online program Desmos, and in the classical way for the control group respectively.

Table 5
Results of the final test in the control and experimental group

	Control group	**Experimental group**
Boys in the group	**28**	**27**
Girls in the group	**32**	**33**
Points 0	0	0
Points 0,5	0	0
Points 1	2	1
Points 1,5	1	1
Points 2	5	4
Points 2,5	2	1
Points 3	5	4
Points 3,5	3	0
Points 4	7	4
Points 4,5	3	2
Points 5	2	1
Points 5,5	5	4
Points 6	1	2
Points 6,5	0	2
Points 7	4	5
Points 7,5	3	3
Points 8	1	3
Points 8,5	1	2
Points 9	2	3

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Points 9,5	2	3
Points 10	11	15
T O T A L	**60**	**60**

Conducting a t – test on the results

We can now set the initial or so-called null hypothesis to "the average test results in the control and experimental groups of students do not differ."

The t – test aims to show us, over a numerical value, whether or not, with a probability of 95% (because the given significance threshold is p = 0.05) our null hypothesis is correct, i.e. whether the results in the control and experimental group **really do differ.**

Table 6

Differences in the control and experimental group

FINAL TEST	Control group	Experimental group
Sum of all results, Sx	343	407
Number of students, n	60	60
Arithmetic mean, $\bar{x}$	5,716	6,783
Sum of squares, Sx^2	2472	3232,5
Square of sums, $(Sx)^2$	117649	165649
$\frac{1}{n}\times(Sx)^2$	1960,816	2760,816
$Sd^2 \quad (Sd^2 = Sx^2 - \frac{(Sx)^2}{n})$	511,184	471,684
$s^2 \quad (s^2 = \frac{Sd^2}{n-1})$	(s_1^2) 8,664	(s_2^2) 7,995
$s_d^2 = \frac{s_1^2}{n} + \frac{s_2^2}{n}$	0,2776	
$s_d = \sqrt{s_d^2}$	0,5268	
$t = \left\lvert \frac{\bar{x}_1 - \bar{x}_2}{s_d} \right\rvert$	2.025	

As the critical t - value at significance p = 0.05 and with 120 - 2 = 118 degrees of freedom (2n - 2) is equal to 1.98, we conclude that with 95% certainty we can say that the second (experimental) group of students did better in the final test from the control group. However, for the significance threshold p = 0.01, the critical value is 2.62, which means that we cannot say that the implemented way of learning through polyform heuristics, in 99% of cases, gives better results than the classical, frontal one. Additional features that we can determine are variances and, therefore, standard deviations and standard errors for both groups (we use the Bessel correction of variance).

Next, we determine:

Table 7

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Fisher's coefficient of influence of the initial test on the results of the final test (i.e. the influence of the independent variable on the dependent one).

	Control group	**Experimental group**
Mathematical expectation, **E(X)**	5,716	6,783
Sample variance, V = $\left(\frac{1}{59}\sum_{i=1}^{60} x_i^2\right) - \frac{60}{59}\bar{x}^2$	8,6718	7,9992
Standard deviation, SD	2,9447	2,8282
Standard error, SE	0,3801	0,3651

To calculate the correlation, to illustrate, we present a tabular procedure:

Table 8
The influence of the initial control group test on the final result of this group.

	Products of the pair initial x final	**Sum of the squares of the number of points - initial**	**Sum of the squares of the number of points - final**
Control group	0 0 12 3 30 12 15 3 7 6 15 3 0 0 0 3 1 6 0 11	930,18	2472

The correlation coefficient is equal in this case to **r = - 0,9878.**

Table 9
Influence of the initial test of an experimental group on the final result of that group.

	Products of the pair initial x final	**Sum of the squares of the number of points - initial**	**Sum of the squares of the number of points - final**
Experimental group	0 0	1018,26	3232,5

8
3
16
8
4
0
0
2
4
12
2
2
0
12
0
0
3
0
30

The correlation coefficient is equal in this case to **r = - 0,8692.**

Thus, the coefficient in the second case is smaller, and the new learning method really relies less on students' mathematical prior knowledge, and more on cognitive abilities. If we perform an additional t - test on the obtained correlations (so-called testing of the hypothesis for the correlation coefficient - linearity), we will get that for the control group the coefficient is closer to linear than for the other, experimental one, which is expected.

We have proved that, in addition to the classic way of teaching, educators will be able to use various methods that place emphasis on student activity and cooperation of all participants in the educational process. These are, among other things, interactive methods, working in small groups, various forms of learning through discovery and problem solving, application of experiments, reviewing experiments, searching for answers to questions that students ask themselves, using TVs, computers, learning painting techniques, playing musical instruments etc. So, the teacher organizes this type of learning where the child will be in a situation to think, ask, research, will be encouraged to find a solution. By solving tasks, one cannot only acquire mathematical education and mathematical culture, especially if it is about "prepared" school tasks, in which there is no need for thought activities, but also apply directly the mastered theoretical contents.

In order for mathematics to be interesting, as we have shown in our work, problem solving should be based on discovering theoretical relations and practical problems. In teaching and learning, we should not apply only one methodological approach, because each has its advantages and limitations. What we have managed to notice is that successful teachers use more methods in their work with students, they bring novelties to their work, they are very creative, ready for any cooperation and even criticism, while bad teachers work every day according to the same scheme. They are not willing to introduce novelties into their work, to deepen their knowledge and insights.

Which method will be applied depends on several factors: the type of material, previous knowledge of students, the composition of the class. The methodological forms and methodological details that the teacher plans and applies during teaching are based on the timely pulsation of didactic principles, which is manifested in their simultaneous polyform-cohesive action, i.e. integral dialectical unity (Nikolić, Hilčenko 2021).

Our pedagogical practice should definitely be changed, although it is based on receptive learning, in accordance with the results of empirical research. Learning from the book is losing its primacy over new media. Computers have become an integral part of everyday life, and they have taken an exceptional place in the process of education. This powerful means of communication opens new possibilities in the field of learning, and it is underused so far. As we applied the computer in teaching and a new method of self-knowledge polyformity, we concluded that the computer is a teaching medium whose function is learning to search for information, not learning information by heart, it's learning how to learn, how to solve problems, and it enables the realization of research methods and discoveries. By using computers in teaching mathematics, students not only acquire mathematical knowledge, but also learn to use a computer. They are enabled to be active participants in the teaching process, which makes teaching more interesting, which achieves a higher level of knowledge acquisition, develops logical and mathematical thinking, systematicity, accuracy and precision in work, and also forms the basis for intellectual and creative development.

What we have proven with this research is the advantage of application and efficiency of the principle of polyformity, which is based on the evident psychological fact that changes and diversity in work refresh teaching, and monotony mainly induces weakening of interest and the appearance of passivity and boredom. Therefore, in the teaching of mathematics, the principle of polyformity should have a universal role, which would be reflected in the enrichment of teaching with various contents, means, procedures and methods. The complete methodology of mathematics seen in the light of the principle of polyformity is based on the fact that, and this can be taken as a didactic axiom, pictorial interpretations of teachers, given in the form of multiple obviousnesses, give another dimension to teaching mathematics. Therefore, the didactic principle of obviousness appears here as a polyformism of trivial representations of the same phenomenon.

5. CONCLUSION

Through the research, we concluded that the modern teaching process strives for methods and teaching forms that will encourage students to actively participate in the teaching process. Teaching methods must be interactive and enable two-way communication that will aim to develop intuitive thinking in students and encourage them to independently solve problem situations and come to knowledge.

Computers, although underused in the teaching process, are slowly finding their place. The possibilities of their application in the presentation of teaching contents are recognized. Teachers are not sufficiently acquainted with computer software of mathematical content, as well as with the possibilities they offer in the process of teaching, but there is a will to approach organized education, in order to use the possibilities provided by computers for the realization of interactive teaching processes in which students would acquire knowledge through self-knowledge heuristics.

Learning through the method of self-knowledge heuristics according to modern didactics is extremely important, because learning is an individual act, and this way of learning enables each student to self-realize and achieve personal maximum, while the acquired knowledge has a lasting character (Nikolić, 2016). Interactive teaching enriched with innovative methods realized with the use of computers and the method of self-knowledge polyform heuristics, enables students to acquire knowledge at their own pace, staying on the teaching content for as long as necessary to fully adopt it.

This paper deals only with some of the interactive teaching methods that can be realized with the use of computers, but the range of possibilities offered is far wider. With the help of computers and the use of mathematical computer software or online programs, teachers can create a variety of presentations that can be used to perform experiments in order to adopt a teaching topic, as interactive material or to learn by solving problems. There are a large number of sites with mathematical content, which can be used in the process of preparing classes, so in teaching itself.

Such modern interactive methods of self-knowledge polyform heuristics, incorporated in the teaching of mathematics with the use of computers, motivate students to engage more, which increases their intellectual power. Motivation is enhanced by a sense of satisfaction due to active participation in the process of learning. Drawing is the first step towards abstraction (important contents are summarized, and less important ones are neglected) (Sharigin, 2004).

Based on this methodological research, we conclude that such presentations are in a direct functional connection with the breaking of formalism in mathematics teaching, because these interpretations significantly influence students to easily form mental images of abstract mathematical concepts, which "gives birth to aha experiences", i.e. a one moment flash of complete clarity. Learning through the method of self-knowledge polyform heuristics has greater effects in terms of acquiring content, and especially process, i.e. applicable knowledge in terms of modern taxonomies of knowledge,

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because the student makes his own efforts to organize newly acquired information, in his own information system, and find the full range of information he needs, thus increasing his ability to organize and organize data, deductive, analytical-synthetic procedures and their applications in various problem and even life situations (Markovic, 2010).

According to many researchers, modern teaching, which is a combination of principled and methodical "knitting" with the help of computers, and which is not known or recognized by traditionalist teaching, contains new qualities of diverse teaching, increases student activity in teaching and acquiring knowledge, affects their greater motivation, curiosity, initiative, creativity and applicability of acquired knowledge in everyday life, which are the basic goals of modern mathematics teaching (Nikolić, 2021). The self-knowledge heuristic method is exactly the method that is necessary for modern teaching and which will be "discovered" and affirmed by the school of the 21st century. We are convinced that it will finally carry the epithet of universality through practical revelations and resurrections.

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