

MATHEMATICAL SOCIETY OF SERBIA



BOOK OF ABSTRACTS

Scientific Conference

“Research in Mathematics Education”

Belgrade, May 10-11, 2019.

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Dear Participants,

It is our great pleasure to welcome you in Belgrade. This scientific meeting is organized in an attempt to raise interest for and help the development of research in mathematics education. We hope that the meeting will offer you a chance not only to hear about other research and learn about some interesting findings but to get some new ideas for your own research. We also hope that it will help the development of the community of researchers in our region which is not sufficiently present in the broader community of mathematics educators.

The Mathematical Society of Serbia is proud of getting chance in this endeavor.

We wish you a very pleasant stay in Belgrade hoping that you will return soon.

Sincerely,

Conference Board

PROGRAMME AT A GLANCE

Place Hotel M, Belgrade, Serbia

Date May, 10-11, 2019

Friday, May 10	Saturday, May 11
9:30 - 10:00 Registration	9:30-11:00 Workshop
10:00 - 10:15 Welcome and Opening	Dr Patrick Barmby "Research on monitoring and evaluation of knowledge in mathematics teaching - from quantitative to qualitative research methods"
10:15 - 11:00 Invited speaker Dr Jarmila Novotna, Professor at Charles University, Czech Republic "Bridging two worlds – cooperation between academics and teacher-researchers"	
11:00 – 11:45 Invited speaker Dr Snežana Lawrence, senior lecturer at Middlesex University, United Kingdom "Motivation in the learning of mathematics: mathematics education and the founding principle of history"	

FRIDAY, MAY 10	SATURDAY, MAY 11
11:45 – 12:15 Coffee Break	11:00-11:30 Coffee Break
12:15 - 13:00 Invited speaker Dr Patrick Barmby, Head of Research at <i>No more Marking</i> , United Kingdom “Using a variety of methods for mathematics education research”	11:30 – 14:00 Museum Visit
13:00-13:45 Discussion with plenary speakers	
14:00-15:00 Conference Lunch	14:00-15:00 Conference Lunch
15:00 – 16:30 Reports Session 1	15:00 – 16:30 Reports Session 3
16:30-17:00 Coffee Break	16:30-17:00 Coffee Break
17:00-18:30 Reports Session 2	17:00- 18:30 Reports Session 4
	18:30-19:00 Closing session

REPORTS SESSION 1	
Friday May 10 15:00– 16:30	<p>Dragana Stanojević, Branislav Randjelović and Aleksandra Rosić Educational standards in mathematics for the end of secondary education - Analysis of students achievements</p> <p>Alenka Lipovec and Jasmina Ferme Lower elementary grades student teachers reflecting self - performed mathematical lesson</p> <p>Nebojša Ikodinović, Jasmina Milinković and Marek Svetlik Problem posing based on outcomes</p> <p>Vojislav Andrić and Vladimir Mičić Poet Desanka Maksimović's high school graduation exam</p>

REPORTS SESSION 2	
Friday May 10 17:00– 18:30	<p>Aleksandar Milenković and Sladjana Dimitrijević Advantages and disadvantages of heuristic teaching in relation to traditional teaching - the case of the parallelogram surface</p> <p>Radomir Lončarević A different approach in solving linear diophante equations. An experimental study on using multiple strategies to solve linear diophantine equations</p> <p>Mika Rakonjac and Jasmina Milinković Problem solving strategy - a criterion for the assessment of conceptual understanding</p> <p>Milena Marić and Vojislav Andrić About one case of research on mathematical knowledge of students</p>

REPORTS SESSION 3	
<p>Saturday May 11 15:00– 16:30</p>	<p>Sladjana Dimitrijević, Branislav Popović, and Marija Stanić Influence of the type of formulation of mathematical tasks on students' success in solving it</p> <p>Aneta Gacovska Barandovska Research approach in math teaching - arguments for and against</p> <p>Radojko Damjanović, Dragić Banković and Branislav Popović Predictors of the intention of using manipulative</p> <p>Marija Radojčić University students' opinions about secondary school subjects and their attitudes toward mathematics</p>

REPORTS SESSION 4	
<p>Saturday May 11 17:00– 18:30</p>	<p>Nives Baranović Students knowledge about quadrilaterals</p> <p>Radoslav Božić The Application of Modern Technology in Teaching and Learning Stereometry</p> <p>Milica Nikolić, Sonja Orlić and Ljubica Oparnica Influence of mathematics textbooks on student achievements assessed by SPUR</p>

INVITED SPEAKERS

Invited speaker

Bridging two worlds – cooperation between academics and teacher-researchers

Jarmila Novotna

Department of Mathematics and Mathematics Education, Charles University, Prague, Czech Republic

Teacher-research represents a broad and current topic not only in the field of mathematics education. The term refers to a variety of situations in which teachers are involved in research, either conducting research in which they focus on their own teaching or cooperating in a collaborative research with academics from all types of institutions and/or other teacher-researchers. In any case, teachers' participation in any research project influences all participants' approaches to both school practice and theory of mathematics education.

In the plenary lecture, examples of successful teacher-research and fruitful collaboration among teachers and academics will be presented. G. Brousseau's characterization of the difference of the teacher acting as a teacher and as a researcher will be used. Generally, teachers researching their own practice reflect and improve the practice in their natural environment. Their ambition is to comprehend the situation in which they are the main participant. Action is linked with reflection.

The aim of cooperation between academics and teacher-researchers in communities of practice is to gain knowledge related to a specific research question. Through the process of sharing information and experiences with other members of the group, members learn from each other and have an opportunity to develop personally and professionally. Examples of cooperation of academics and teacher-researchers will serve as the basis for the analysis of factors contributing to success of such research events. Our objective is to present the differences between the roles of teacher-researchers and academics and the impact of such cooperation on both teachers and academics.

Prof. RNDr. Jarmila Novotná, CSc
*is the professor at the Faculty of
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Prague. She has HDR (habilitation
à diriger des recherches) at
l'Université Bordeaux 2 Segalen,
France. She is chercheur titulaire
at CeDS – Université Bordeaux
Segalen.*



Her main fields of interest are didactical conditions of transformation of students' models of activities when grasping knowledge and skills, pre- and in-service training of mathematics teachers for their profession and transfer of research results into practice.

She is an active member of Czech and international research community (e. g. she was a member of the International Committee of The International Group for the Psychology of Mathematics Education (PME) and European Society for Research in Mathematics Education (ERME); she has been a member or chair of IPCs of several important international scientific events; she was the member of IPC of ICMI Study 15 – The Professional Education and Development of Teachers of Mathematics and ICMI Study 23 – Primary Mathematics Study on Whole Numbers; she was a member of ICME 10 Survey Team – The professional development of mathematics teachers; she has been a member of editorial boards of several international journals; she is the member of informal communitie Learners' Perspective Study and Lexicon).

She is the member of several Councils of PhD Studies in didactics of mathematics in the Czech Republic and abroad and she is the supervisor of PhD students.

Invited speaker

Motivation in the learning of mathematics: Mathematics education and the founding principle of history

Snežana Lawrence

Department of Design Engineering & Mathematics, Faculty of Science
and Technology, Middlesex University, London, United Kingdom

Mathematics is most often, according to a UK national study conducted earlier in this century, described by British teenagers as ‘irrelevant’ and ‘boring’. Even withstanding that this may have improved since 2004 (despite some evidence to the contrary) this talk will focus on exploring what the possible meanings of such statements may entail. It will also propose that, in order to construct a personal engagement and motivation for the learning of mathematics, learners need to develop skills for creating internal dialogues about mathematics.

These dialogues, in order to be effective, should be rich in examples of different images and visions of mathematics as well as interpretations of what ‘doing’ mathematics may entail.



Dr Snežana Lawrence works as a senior lecturer at Aviation Programmes, Department of Design Engineering & Mathematics, Faculty of Science and Technology at Middlesex University, London, the United Kingdom.

She is interested in the creativity, identity, and engagement in the learning of mathematics, and is a mathematical historian. She is involved in the national and international initiatives to promote the use of the history of mathematics in mathematics education. Snezana is on the Council of the Institute of Mathematics and Its Applications, is an editorial board member of Mathematics Today (Institute of Mathematics and Its Applications) and is the Associate Editor of the BJHM (British Journal for the History of Mathematics), published by Taylor & Francis). She is the Education Council member of the same society.

*Twitter @mathshistory, @snezanalawrence
www.mathsisgoodforyou.com*

Invited speaker

Using a variety of methods for mathematics education research

Patrick Barmby

No more Marking, United Kingdom

In this talk, I will discuss different methods I have used in my research into mathematics education. My particular research interests have included children's understanding of mathematics and the role of visual representations, assessment in mathematics education and professional development of mathematics teachers. Reflecting these interests, I will discuss three research methods that I have found particularly useful in these areas of interest. I will try and provide a balance of both quantitative and qualitative approaches, and in fact discuss methods that are useful in both types of approaches.

Firstly, I will discuss research that I carried out in England using eye-tracking methods to examine primary children's understanding of visual representations of multiplication (Bolden, Barmby, Raine & Gardner, 2015). Although I will discuss some quantitative results resulting from the research, I will mainly focus on the use of eye-tracking as a qualitative video tool to find out how children examine mathematical representations and what we can infer about their understanding from the resulting videos.

Secondly, I will discuss research work I am currently involved in using a comparative judgement to assessing pupils' understanding in mathematics. Ian Jones and colleagues (Jones & Inglis, 2015) have shown that comparative judgement can be used to assess more 'nebulous' constructs in mathematics education research such as 'understanding'. I will discuss what comparative judgement is and how I use it to assess children's understanding, and also what qualitative results can be obtained in terms of progression in children's understanding in particular areas of mathematics education.

Finally, I will discuss the work of one of my PhD students, Brantina Chirinda (Chirinda & Barmby, 2017), and her use of Design-Based Research (DBR) methodology to develop a professional development intervention for secondary mathematics teachers in an informal settlement in Johannesburg, South Africa. I will particularly emphasize how DBR develops practical interventions and theoretical perspectives which take into account and apply to particular contexts – in fact the recognition of context being an important part of this research.

Bolden, D., Barmby, P., Raine, S., & Gardner, M. (2015). How young children view mathematical representations: a study using eye-tracking technology. *Educational Research*, 57(1), 59-79.

Chirinda, B., & Barmby, P. (2017). The development of a professional development intervention for mathematical problem-solving pedagogy in a localized context. *Pythagoras*, 38(1), 1-11.

Jones, I., & Inglis, M. (2015). The problem of assessing problem solving: Can comparative judgement help? *Educational Studies in Mathematics*, 89(3), 337-355.

Invited speaker

***Dr Patrick Barmby** is the **Head of Research** for No More Marking and joined the organization in July 2017. Prior to moving to No More Marking, Patrick was working in South Africa as a Senior Lecturer in mathematics education at the University of the Witwatersrand, Johannesburg.*



He also worked for 13 years at Durham University in the UK, and in both institutions, he worked closely with trainee teachers and also carried out research mainly in primary mathematics.

His research interests include the notion of understanding in mathematics, the use of visual representations in teaching mathematics and the use of eye tracking technology in mathematics education research.

In the past, he has also published on developing attitude towards science measures and on the teaching of problem solving. Patrick also taught for two years in a rural secondary school in Kenya.

REPORTS
Sessions 1 – 4

Educational standards in mathematics for the end of
secondary education -
Analysis of students achievements

Dragana Stanojević, Branislav Randjelović
and Aleksandra Rosić

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Standards for general secondary education are based on competencies that will enable students to successfully respond to different life challenges in various life situations (educational, social, cultural, interpersonal, practical, etc.). Three levels of achievement are defined for each competency - basic, intermediate and advanced. Three levels are cumulative and embedded one in another so that students at the advanced level fulfill requirements from other levels.

Methodology for the development of educational standards for the end of secondary education. In this paper we present the results of the empirical examination of students' achievements in Mathematics.

Keywords: Educational standards, student achievements, general secondary education, mathematical competences

Lower elementary grades student teachers reflecting self-performed mathematical lesson

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Teachers can focus on general pedagogical aspects, such as motivation, discipline and teamwork, or on subject specific (in our case mathematical) pedagogical aspects, including mathematical misconceptions, learning trajectory in mathematics and mathematical representations. Professional knowledge needed for teaching mathematics has been perceived as specific in the case of primary school teachers. Teacher trainees (N = 104) reflected on the mathematics lessons they performed at the beginning and at the end of their training periods. Our database consists of the trainees' reflections on teaching scenarios. At the end of the teacher training programmes, a significantly larger number of participants shifted their focus from general pedagogical aspects to the mathematics-related aspects of their teaching performance. Nevertheless, less than a half of the participants in the 4th year of training mentioned mathematics specific aspects in their reflection. Despite progress in observed elements, however, we still have some concern regarding the overall situation of teaching mathematics at primary level.

Keywords: Class teacher, general pedagogy, mathematics specific pedagogy, reflection

Problem posing based on outcomes

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Newly reformed Serbian curriculum defines outcomes as a basis for planning instructions. The paper focusses on tasks designed to assess accomplishment of an outcome. Based on theory of representations we designed sets of four matching representational contexts of tasks corresponding for particular outcomes (symbolic, verbal using math language, realistic, and pictorial) with total of 24 tasks. A sample of 153 fourteen years old pupils (8th grade elementary school) was taken from 6 schools in Serbia. The main goal of the study was to investigate whether representational context of tasks (symbolic, math verbal, realistic verbal or iconic) results in different achievement. The analysis of the student's work reveals to what extent the representation of the problem by which we evaluate student achievement of outcomes alters the results. The findings implicate some important considerations for task designers and math instructions.

Keywords: Outcome, problem posing, representation, assessment.

Poet Desanka Maksimović's high school graduation exam

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Hundred years between 1919 and 2019 is by all standards a long period during which effort has been made to develop and improve mathematics education in Serbia. The paper investigates the resulting changes in terms of students' knowledge. The final exam in Mathematics for the year 1919, when Serbian great poetess Desanka Maksimović graduated, has been used in the empirical study. A sample of 508 high school graduation students (aged 18-19) participated in the study. The paper presents results of the analysis in details. Comparison with the achievements of the generation 1919 is used as a reliable basis for a number of commentaries and, in our opinion, several valuable conclusions.

Keywords: Reasoning, formal knowledge, „anti-normal“ distribution, retention of knowledge.

Advantages and disadvantages of heuristic teaching in relation to traditional teaching - the case of the parallelogram surface

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In this paper, the authors compare the results of two distinct teaching methods - teaching with the heuristic and elements of problem solving approach and traditional teaching of mathematics in elementary school, in particular on determining the area of the parallelogram. One group of students (the experimental group) had to come up with an appropriate rule for determining the area of the parallelogram through heuristic approach, with the help of manipulatives such as tangram and paper models. In the second group (the control group) the same teacher dealt with this mathematical contents in the usual, traditional way, teacher-centered classroom climate. The research was conducted in 2017 in the elementary school "Stanislav Sremčević" in Kragujevac, Serbia with the sample of 59 students of the sixth grade. After classes, students were tested to examine possible differences in their understanding, theoretical and practical knowledge, depending on the teaching method. Students from the experimental group also expressed their impressions through the questionnaire about the classes, in terms of their attitudes and their self-efficacy.

Keywords: Heuristic approach, problem solving, teacher-centered classroom, parallelogram area.

A different approach in solving linear Diophantine equations. An experimental study on using multiple strategies to solve linear Diophantine equations

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The most common methods for solving the linear Diophantine equations (LDE) of form $ax + by = c$ ($a, b, c \in \mathbb{Z}$) that students learn in advanced classes in primary schools are Euclid algorithm, Euler method and solving by guessing or inspection. This paper introduces an alternative method in solving LDE of form $ax + by = c$ ($a, b, c \in \mathbb{Z}$). The LDE is solved using the properties of Farey sequence and in this paper the algorithm for solving LDE is given. In the second part of the paper an experimental study is described and the answer on the following question is given. *Can using multiple strategies lead to greater gain in solving LDE, or does it lead to confusion?* The experimental study was conducted on 124 seventh-grade students, who had been divided in four groups. Each group of students were acquainted with different numbers of methods for solving linear Diophantine equations. Post-test results show an interesting difference in solving LDE from group to group. Also, in this paper we present the main reasons for using the specific method to solve LDE from students' point of view. One year later we conducted measurement in retained knowledge and procedural flexibility and here we present our findings.

Keywords: Research methods, learning processes, retained knowledge, procedural exibility, linear Diophantineequations, Farey sequence.

Problem solving strategy - a criterion for the assessment of conceptual understanding

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Contemporary conceptualization of mathematical competences and mathematical thinking underline importance of knowledge of multiple representations. The aim of this research is to examine the impact of the introduction of different representations of mathematical concepts in teaching on the development of conceptual understanding and problem solving competences. In the course of the research, a pedagogical experiment with parallel groups was conducted on a sample of 130 fourth-grade students, age 11, within the framework of the themes Set N and Geometry. The effectiveness of the introduction of the experimental factor was evaluated by: 1) a qualitative analysis of student responses (descriptors: procedural understanding, conceptual understanding), which gives insight into conceptual understanding, whereby the criterion for assessing the concepts understanding is not the knowledge of the term or the expression of their meanings in their own words but identifying the essential properties of the concept through problem-solving processes, which involve comparing and establishing links between different conceptions of the term; 2) statistical analysis of quantitative data based on pupil responses in the final test. We concluded that the implementation of different representations of concepts in teaching effectively supports the development of conceptual understanding and success in problem solving.

Keywords: Representations, conceptual understanding, procedural understanding, mathematical problems.

About one case of research on mathematical knowledge of students

Milena Marići and Vojislav Andrić

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Valjevo grammar school each autumn explores the mathematical pre-knowledge of newly-arrived first grade students. The research is carried out on the basis of an initial test equal to all tested students. The objectives of such research are multiple, and the results of the research are of great importance primarily for the students (due to further training) and their subject teachers (due to taking corrective steps), but also the class elders, for parents (for more information) and the school as a whole due to the creation of objective conditions for improving students' success). The paper presents detailed research results with comparative data, appropriate comments and some of the possible conclusions.

Keywords: Mathematical prerequisite knowledge, initial assessment, corrective steps.

Influence of the type of formulation of mathematical tasks on students' success in solving it

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The needs of modern society require that problem solving, problem posing, and real-world mathematics must be an integral part of the compulsory mathematics education. Thus students should be trained to perform the transition from one formulation of mathematical task to another. Therefore, the problem of transition between different representations of the same problem is the topic of numerous studies. It has been already noticed that all types of transitions are not equally included in school practice and that some transitions between the representations are more difficult than others (e.g., verbal → symbolic and graph → symbolic belong to difficult transitions). The main goal of our analysis was to determine whether there are differences in the degree of impact of different formulations on success in solving the problems of different levels of complexity. Namely, we analyzed the success in solving one quite simple mathematical task and two more complex problems, while all three of them are given in three different representations (symbolic, graph, verbal). This is closely related with the question of instrumental and relational understanding of school mathematical contents by students. We analyzed data collected from 584 students studying the eighth class (14.5 - 15.5 years, the final class of the Serbian compulsory education) from 8 cities (the sample represents approximately 0.8% of the state population of students in this class). Participants anonymously filled questionnaires which consist of some basic information (gender, average mark in mathematics during the current school year), three mathematical tasks, two questions about their opinions on the given tasks.

Keywords: Formulation of mathematical task, problem representation, instrumental and relational understanding.

Research approach in math teaching - arguments for and against

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The Macedonian educational system is under continuous revision and changes to the syllabuses and methods of teaching. In the last decade, almost every aspect of teaching mathematics and science has been changed, some more than once. These last curriculum changes are made according to the Cambridge International Examinations Center. The learning materials have been translated and partially adapted, using the original centre materials. The paper gives a critical overview on the methods of teaching, topics covered by the curriculum and knowledge assessment and students results, before and after the changes. Different opinions appeared among teachers, for and against the „new ways” of teaching mathematics. Some of the arguments for and against will be presented, problems and questions will be stressed out and challenges and possible solutions will be offered. Since the quality of the math textbooks used in primary school has been pointed out as the biggest problem at the present situation, the paper also contains a discussion on the role of textbooks against the role of the teacher in the classroom.

Keywords: Individual students work, research approach, problem assignments, experiment, quality of knowledge and critical thinking.

Predictors of the intention of using manipulative

Radojko Damjanović, Dragić Banković
and Branislav Popović

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The use of manipulatives is a kind of intervention in a process of supporting and developing of mathematical thinking. Their use is a precondition for efficiency and improving the quality of mathematics teaching. It is necessary that the intention of using manipulatives is completely appropriate and clarified to the teacher as to a subject who intervenes with this powerful tool which changes the circumstances in the learning environment. At the same time, manipulatives increase student participation level in the process of learning mathematics, strengthens their role as an actor of the educational process. The results of the research indicate that it is possible, based on the perception of familiarity, capabilities and a range of other parameters, to determine the circumstances and design recommendations for improving teacher competencies for the use of manipulatives. One of the results of the research is also the formula which, on the basis of the input of certain parameters, indicates the prediction of intentions to use manipulatives by a particular teacher.

Keywords: Manipulatives, the use of manipulatives, prediction, participation, developing mathematical thinking, teaching and learning mathematics.

University students' opinions about secondary school subjects and their attitudes toward mathematics

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Aim of this study is to investigate students' opinions about the most interesting and the hardest secondary school subject. In fact, purpose is to reveal is the students' opinion influenced by teacher, subject content, students' self-assessment or some other factor. Special attention will be paid on subject of mathematics and subjects related to sciences. In this research, students' attitudes toward mathematics in categories such as value mathematics and self-assessment mathematics will be given. Also, in this study relation between students' attitudes toward mathematics and their opinions about secondary school subjects will be discussed. In this study 857 students from University of Novi Sad were involved who belong to four different areas such as: economy, technical sciences, medicine and law. Results of this study will also reveal is there any significant difference in students' attitudes and opinions by students' gender, faculty or secondary school.

Keywords: Students' attitudes and opinions, the hardest subject, the most interesting subject, mathematics.

Students' knowledge about quadrilaterals

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Students obtaining a teaching degree in primary education should themselves acquire a certain level of knowledge of mathematics and develop their own mathematical competencies, in order to ensure appropriate learning environment for development of primary school students' mathematical knowledge and competencies. Various educational research reveal that many university students encounter difficulties with tasks involving geometrical concepts, often misunderstanding the concepts, especially the relationships among the various quadrilaterals. Special attention is devoted to understanding the hierarchical classification of quadrilaterals. The research presented in this paper was conducted with third year undergraduate students of Primary Education at the University of Split Faculty of Humanities and Social Sciences. The aim of the research was to establish the scope of primary education students' knowledge of quadrilaterals, the manner in which they establish relationships among quadrilaterals as well as to investigate students' misconceptions of these relationships. Obtained results are comparable to results of other researchers and confirm difficulties in identifying quadrilaterals in non-standard positions or of non-standard shapes, in addition to unexpectedly poor knowledge of quadrilaterals' properties and inability to establish inclusion relationships, especially in the case of trapezium.

Keywords: Geometry thinking, hierarchical classification, inclusion definition, primary education, quadrilaterals.

An application of modern technology in teaching and learning stereometry

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The paper analyses the possibilities of applying a three-dimensional view of geometric objects within the dynamic software *GeoGebra*, during the teaching and learning stereometry. The research included students in the final (eighth) grade of elementary school. The *GeoGebra* software was applied in introducing students in the formation and the elements of a right circular cylinder. The method of collaborative learning was applied. The students worked in small groups and they had the possibility to independently create dynamic worksheets, by using *GeoGebra* software, which they used for observing a three-dimensional view of solid figures (cylinder and prism), analyzing and comparing their elementary properties. After finishing group work, the students presented their results, after which they had the opportunity to discuss their observations. The results of students' work were analyzed. Guidelines for further research as well as for the implementation of the described approach in teaching are given.

Keywords: Cylinder; dynamic software; stereometry; three-dimensional view.

Influence of mathematics textbooks on student achievements assessed by SPUR

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Textbook is a basic school book in Serbia and as such is one of the key aspects of the quality of teaching mathematics. Teachers use tasks from math textbooks for exercises at mathematical classes and also for creating tests for evaluation. When evaluate mathematical knowledge we need to take into account more dimension: skills, properties, use, representation (SPUR). It is a multi-dimensional approach devised by Thompson and Kaur. In this study we investigated influence of mathematics textbooks used at mathematical classes on the level of understanding equations and inequalities (measured in the SPUR sense). The sample contains 102 pupils of the 4th grade of primary school and their teachers (N=6) from the territory of the School Administration Sombor. The instrument consists of a test for students and a questionnaire for teachers. Results shows that there exists statistically significant difference in mathematical achievements between groups using different textbooks. It indicates that it is important which textbook is used in math classes. There is a strong correlation between mathematical achievement on SPUR test and grade in mathematics which suggests that assessment in primary schools in School Administration Sombor is in accordance with mathematical knowledge. There is no influence of the working experience of teachers and gender of students to mathematical achievement on SPUR test.

Keywords: Assessment in mathematics, SPUR, mathematics textbooks, mathematics