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Annual Report on Published Articles in Mathematics Education in the Republic of Srpska During 2015

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Anstract In this report we provide an incomplete list of published articles within 'Research of Mathematics Education' domain by authors from the Republic of Srpska (one of the entities of Bosnia and Hercegobina) during 2015.

Key words and phrases: *research in mathematics education, the Republic of Srpska (An Entity of B&H)*

In Bosnia and Herzegovina (and therefore in the Republic of Srpska), and in our close area, there is not a medium through which one can make access to the published texts in the domain of 'Research in Mathematics Education' by authors from this area. Our intention for this article is offering to local and international academic community information about the scientific and profesional products into the mentained domain. We will realize this intention by electronic magazine 'Bijeljina methodical journal', which edited by teachers of the Bijeljina Faculty of Education.

Unfinished list of published papers

[ME-RS: 15-22] **Siniša Bubonja**: *Teaching proficiency* [**С. Бубоња:** *Умијеће подучавања*] (In Cyrillic, In Serbian),
MAT-KOL (Banja Luka), ISSN 0354-6969, ISSN 1986-5228
XXI (1) (2015): 33-40

Abstract. The work is based on a chapter of the book called "Mathematical discovery" by George Polya (1887-1985), quite unknown to our reading society and also one of the greatest methodologist and pedagogue. Main point of this work is to present ideas and views of this author to readers and it is about mathematics. Also, it can help us teaching as a guide line for further improvement of teachers. In this work I will consider teaching as a skill and not a science. I will give his aims and principles. On the very end, I will give a short review of the author's hints that were created at collegiums of methodology. That were lead by him, as a result of thinking about work that a teacher does every day, in his position, known as "ten commandments for teachers".

[ME-RS: 15-21] Siniša Crvenković, Mirela Mrđa and **Daniel A. Romano**: *As students of the teaching program to realize the triangle*? [С.Црвенковић, М.Мрђа и **Д. А. Романо**: *Како студенти учитељског програма схватају тространик / троугао*?] (In Cyrillic, In Serbian),
IMO – Istraživanje matematičkog obrazovanja, ISSN (p) 2303-4890, ISSN 1986–518X ,
Vol. **VII** (2015), 12: 9-16.

Abstract. For a success in learning Geometry the understanding of geometrical concepts is essential. Gave a lot of research on elementary pre-service teachers have difficulties in understanding geometry concepts. The aim of this paper is to present a research on how pre-service elementary school teachers understand elementary Geometry notion of triangle and its properties.

[ME-RS: 15-20] Siniša Crvenković, Mirela Mrđa, **Daniel A. Romano,** Marina Zubac : *Analyzing mathematical tasks using MATH taxonomy* [S.Crvenković, M.Mrđa, **D.A. Romano***,* M.Zubac*, Analiziranje matematičkih zadataka korištenjem MATH taksonomije*], (In Latinic, In Serbian), **IMO – Istraživanje matematičkog obrazovanja**, ISSN (p) 2303-4890, ISSN 1986–518X , Vol. **VII** (2015), 13: 1-12.

Abstract. In this article an analyse of a mathematical task model using by MATH taxonomy is presented.

[ME-RS: 15-19] Siniša Crvenković and **Daniel A. Romano**: *Early Algebra and Early Algebra Thinking*, [С. Црвенковић и **Д. А. Романо**: *Рана алгебра и раноалгебарско мишљење*] (In Cirilyc, In Serbian),
U: Aleksandra Mihajlović, (ur.) **Metodički aspekti nastave matematike III**. Treća međunarodna konferencija MATM 2014, (pp. 27-47), Fakultet pedagoških nauka, Jagodina 2015,
ISBN 978-86-7604-141-1.

Abstract. In this text we have intention to give our contribution to conceptualize domains Early Algebra and Early Algebraic thinking making connections of these notions with theorethical constructs 'Mathematics knowledge of concepts and processes'. These terms – Early Algebra and Early algebraic thinking - (and notions covered by these terms) are described based on our own research and readings from the body of literature focused on Early Algebra and Early Algebraic reasoning. In this article we offer some reasons to be motive to academic societies of researchers of mathematics education, mathematicians and teachers in our area to focuse on Early Algebraic approach of elementary school Arthimetics.

[ME-RS: 15-18] **Jelena Gajić**, Mirela Mrđa and **Daniel A. Romano**: *An analysis of students' mental structures in solving the task of the limit of function* [**Ј.Гајић**, М. Мрђа и **Д. А. Романо**: *Једна анализа студентских менталних структура при рјешавању задатака о граничној вриједности функције*] (In Cirilyc, In Serbian);
MAT-KOL (Banja Luka), ISSN 0354-6969 (p), ISSN 1986-5228 (o),
XXI (4) (2015): 221-235

Abstract. This report contains an analysis of unacceptable and missed responses of students of Mechanical Engineering Faculty at Banja Luka Univeristy to a question about the limit of functions. The procedure of calculation of the limits in the proposed task other than the application of the so-called. 'logarithmic procedure' should be applied and Lopitalov theorem. Based on the collected data and derived conclusions, relying on *APOS* theory and the *SOLO* taxonomy, we estimate that the concept of limit values and processes that concept (but not procedurally using this concept) for the majority of the student population eligible tested with considerable difficulty. Offered is a reconstruction of student mental images that can induce in their minds in an effort to offer acceptable answers to a given task using categorical terms *RBC + C* theory of abstraction. It seems that it can form a hypothesis (whose justification would, of course, be meticulously examined) that many students of this college have built urgently needed conceptual and procedural knowledge in their cognitive level on the border of threads and processes function due to inadequate performance of the consolidated knowledge of the properties of field real numbers.

[ME-RS: 15-17] **Slaviša Jenjić and Želimir Dragić**: *Mathematical workshops in the function of popularization of mathematics class teaching*, [**С.Јењић, Ж. Драгић**: *Математичка радионица у функцији популаризације разредне наставе математике*] (In Cirilyc, In Serbian),

U: Aleksandra Mihajlović, (ur.) **Metodički aspekti nastave matematike III**. Treća međunarodna konferencija MATM 2014, (pp. 143–157), Fakultet pedagoških nauka, Jagodina 2015, ISBN 978-86-7604-141-1.

Abstract. Mathematics class teaching plays the key role in understanding of mathematics and in subsequent higher-grade learning of mathematics too. There is a small number of the students there who understand mathematics and show interest for it, and, at the same time, there is a large number of those who think of mathematics as a bugaboo, and who show or exhibit certain oversights in its learning at the beginner's level. The things are not as bad as some people claim, still, as the other people state, the things are also not at the satisfactory level. In any case, the things can be better. It is necessary to create new approaches, i.e. to create new trends in teaching of mathematics with lower age pupils of primary schools. This paper summarizes mathematics workshops in class teaching of mathematics, their theoretical background and application of their practical realizations. It endeavors to show that it is possible to make mathematics classes more popular by using mathematics workshops, and that mathematical contents can be learned and overcome in an acceptable and interesting way. What is being emphasized is the importance of workshops in the development of mathematical thinking, cooperativeness and creativity of pupils in their work, and, eventually, the teacher's preparation of workshops.

[ME-RS: 15-16] **Snježana Jovičić**: *Efraim Fishbein Theory on figural concepts* [**Сњежана Јовичић:** *Теорија Ефраима Фишбеина о фигуралним концептима,*] (In Latinic, In Serbian)
BMČ – Bijeljinski metodički časopis, ISSN 2303-5366,
Vol. **2** (2015), 2: 15-21

Abstract. For the formation of geometric concepts in geometry have a significant role of geometric figures. Geometrical figures have two basic functions: conceptual and figural. There are three categories of mental entities related to geometric figures: definition, image and figural concept. Efraim Fishbein introduces the concept of "figural concept ". The term is explained by means of an isosceles triangle.

[ME-RS: 15-15] **Snježana Jovičić**: *Geometric contents in teaching mathematics in lower grades of elementary school*, [**С. Јовичић:** *Геометријски садржаји у настави математике нижих разреда основне школе,*] (In Cirilyc, In Serbian)
IMO – Istraživanje matematičkog obrazovanja, ISSN (p) 2303-4890, ISSN 1986–518X ,
Vol. **VII** (2015), 13: 21-28

Abstract. Geometry as part of mathematics has always been little attention has been given to the school, whether due to incompetence of teachers, lack of interest of students or for some other reason, teaching geometry is largely ignored. In order to examine the current curriculum and determine the approach geometry contents created this work. It presents an analysis of the geometric content in the teaching of mathematics in the second, third, fourth and fifth grade in the Republic of Srpska. The aim of this work is, inter alia, consideration of initial geometric thinking and reasoning in children on basic geometric concepts in primary school as well as their mutual relations.

[ME-RS: 15-14] **Snježana Jovičić**: *Duval's cognitive model of geometric thinking* [**Snježana Jovičić**: *Duvalov kognitivni model geometrijskog mišljenja*] (In Latinic, In Serbian)
BMČ – Bijeljinski metodički časopis, ISSN 2303-5366,
Vol. **2** (2015), 2: 7-13

Abstract. To understand the difficulties that many students have with the understanding of mathematics, we must determine the cognitive functioning of different mathematical processes. Presentation and visualization are the basis of understanding in mathematics. The purpose sniff paper is to give a little fuller description Duval's cognitive model of geometric thinking, relying on Piaget's theory of cognitive development. We emphasize that the semiotic representation of the most important in any mathematical activities, including the activities in the field of geometric thinking. There are three groups of semiotic representation: material, descriptive and verbal representations. Duval highlights four types of cognitive understanding: perceptual, sequentially, voice and operational understanding. In the framework of geometrical reasoning, there are three kinds of cognitive processes: visualization, construction and reasoning.

[ME-RS: 15-13] **Snježana Jovičić**: *Katherine Houdement and Alaina Kuzniak's geometrical paradigmes* [**S.Jovičić**: *Geometrijske paradigme Katherine Houndement i Alaina Kuzniaka*] (In Latinic, In Serbian) **IMO- Istraživanje matematičkog obrazovanja**, ISSN (p) 2303-4890, ISSN 1986–518X, Вол. **VII** (2015), 12: 17-23

Abstract. The need to understand the geometry of the modern world is desirable precisely because mathematics teaching should first teachers and students and to provide quality knowledge in the field of geometry. It is shown that students who are studying for teachers solve one task in geometry. Three different paradigms are presented, which are formulated by Houdement K. and A. Kuzniak: They are divided into elementary geometry, namely: Natural geometry (Geometry I), Natural axiomatic geometry (Geometry II) and Formalistic axiomatic geometry (Geometry III). Listed paradigms are compared and confronted with the Van Hiele's approach geometry.

[ME-RS: 15-12] **Jelena Kurtuma** and **Daniel A. Romano**, *Some social implication on mathematics education in the Republic of Srpska (B&H),* (In English) **IMVI Open Mathematical Education Notes**, ISSN (p) 2303-4882, ISSN (o) 1840-4383, **5**(1)(2015): 46-54

Abstract. Our intention in this paper is to open a discussion with different people, who have influence on principle-philosophical attitudes on mathematics teacher education policy, about social and political aspects of mathematics education in the Republic of Srpska (an entity of Bosnia and Herzegovina) school systems.

[ME-RS: 15-11] **Милијана Миловановић**, **Даниел А. Романо***: Дескриптивна анализа Истраживања математичког образовања у Републици Српској (Б&Х) у периоду 2011-2015,* **IMO – Istraživanje matematičkog obrazovanja**, ISSN (p) 2303-4890, ISSN 1986–518X , Vol. **VII** (2015), 12: 25-36.

Abstract. This text offers a descriptive analysis of trends in Research of Mathematics Education in the Republic of Srpska (an entity of Bosnia and Herzegovina) between 2011 and 2015. The study is a review of 86 articles published in Mathematics Education domain by 131 authors from the Republic. Also, it is presented (unfinished list) of published articles.

[ME-RS: 15-10] Jovana Miljić, Siniša Crvenković and **Daniel A. Romano**: *Research compatibility opinions of students and teachers in mathematics*, [Ј.Миљић, С. Црвенковић и **Д.А. Романо:** *Истраживање компатибилности мишљења ученика и наставника о настави математике*] (In Cirilyc, In Serbian), **IMO – Istraživanje matematičkog obrazovanja**, ISSN (p) 2303-4890, ISSN 1986–518X , Vol. **VII** (2015), 13: 29-59.

Abstract: The research we conducted showed that the teaching of mathematics in our schools, yet traditional, it is the teacher in the classroom dominant and that in order to improve instruction and increase student achievement must be trained in modern teaching approach in which the student will be the holder of the learning process . The students were of the opinion that their teachers are qualified, to motivate for work, his Directing to them and that they are fair to them. Also, students believe that the teaching has to be more diverse and better organized. If teachers respect the opinions of students, then developing in them the inner motivation to engage in the learning process. Given the highly expressed willingness of teachers to support students during testing of knowledge is very important that the students establish normal communication.

[ME-RS: 15-9] **Danijela Mitrovic**: *Mathematics and language* [**Д.Митровић:** *Математика и језик*] (In Cirilyc, In Serbian),

BMČ – Bijeljinski metodički časopis, ISSN 2303-5366,
Vol. **2** (2015), 2: 21-26

Abstract. In this article a connection between mathematics and language is presented.

[ME-RS: 15-8] **Danijela Mitrovic**: *Mathematics and language, II;* [**Д.Митровић,** *Математика и језик, II*] (In Cirilyc, In Serbian),
IMO – Istraživanje matematičkog obrazovanja, ISSN (p) 2303-4890, ISSN 1986–518X ,
Vol. **VII** (2015), 13: 12-19

Abstract: Mathematics is a universal language and mathematics makes it possible to present a problem and solve by using symbols, numbers and operations. Language mathematics is not always formal and understanding of certain definitions, theorems testimony is necessary informal understanding natural language. The aim is to show the connection between spoken language and mathematical language. The paper presents homophones, as well as examples of ambiguity say the same shape, but with different meanings. Mathematics has the attributes of the language, but for its understanding necessary knowledge of the spoken language. Addressing a large number of problems and situations that people encounter in everyday life and professional context demands a certain level of knowledge of mathematics, as well as the language of mathematics.

[ME-RS: 15-7] **Danijela Mitrovic**: *Mathematics and language, III;* [**Данијела Митровић,** *Математика и језик, III*] (In Cirilyc, In Serbian),
BMČ – Bijeljinski metodički časopis, ISSN 2303-5366,
Vol. **2** (2015), 2: 36-44

Abstract: In order to understand the math is not enough just to learn formulas, definitions, theorems, but need to understand the language of mathematics and learned ways besides solutions to the problems it is necessary to know how to communicate with other mathematicians. The level of understanding of mathematics includes better knowledge compared to previous levels, when a student really learned to appreciate and understand the content and is able to logically explain, material exposes logically and with understanding. This means that the student isable not only to recognize and reproduce the learned, but it is done and thought- processing knowledge - to understand and explain facts, concepts, rules, definitions, to sort out the important from the unimportant, connects facts and conclusions. A student who has learned the material at this level can verbally stated mission to "translate" the mathematical language or sign language, and vice versa, with more abstract - mathematical language can be translated into less abstract, more concrete, plain language.

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[ME-RS: 15-6] Mirela Mrđa, **Daniel A. Romano** and Marina Zubac: *An analysis of student's mental structures when incorrectly calculating the limit of function*, (In English)
IMVI Open Mathematical Education Notes, ISSN (p) 2303-4882, ISSN (o) 1840-4383,
5(2) (2015): 101-113

Abstract. In this paper, the authors attempt to make the analysis of unacceptable and missed student responses when calculating a limit of functions. Based on the collected data and derived conclusions, relying on *APOS* theory and the *SOLO* taxonomy, we estimate that the concept of limit values and processes with that concept (but not procedurally using this concept) for the majority of the student population is acceptable with considerable difficulty. A reconstruction is offered of student‟s mental images using categorical terms *RBC* + *C* theory of abstraction and Sfard‟s theoretical model for the learning of mathematical concepts.

[ME-RS: 15-5] **Ljubiša Preradović, Sandra Kosić-Jeremić:** *Student achievement in the university entrance examination and the effects of preparation classes – a case study of civil engineering students*, (In English)
Tehnički vjesnik, ISSN 1330-3651 (p), ISSN 1848-6339 (o),

Vol.22, No.3 Lipanj 2015, **22**(3) (2015): 785-791

Abstract. This paper is a review of the mathematics test taken by undergraduate candidates in the university entrance examination for enrollment in the geodesy undergraduate course offered at the Faculty of Architecture, Civil Engineering and Geodesy, University of Banja Luka, Bosnia and Herzegovina, in the academic year 2012/13, and it analyses the relevance and impact of preparation classes on candidate achievement. It contains an analysis of the candidates' mistakes according to problem, achievement discrepancy according to problem, as well as differences between the candidates relative to the secondary school completed and secondary school grade point average. The findings of the analysis are presented using descriptive statistics and relevant statistical tests of the SPSS statistical analysis software package. The correlation of achievement in the entrance examination with attendance in the preparation courserevealsa strong statistical significance in regard to candidate achievement in the mathematics test (p = 0.024).

[ME-RS: 15-4] **Daniel A. Romano**: *Recognizing the conceptual, processual and procedural knowledge on set-theoretical notion of relation through RBC + C theory of abstraction*, [**Д.А. Романо**: *Препознавање концептуалног, процесног и процедуралног знања о скуповно-теоријској релацији посредством RBC + C теорије апстракције*] (In Cirilyc, In Serbian);
BMČ – Bijeljinski metodički časopis, ISSN 2303-5366,
Vol. **2** (2015), 2: 1-6

Abstract. In this paper, by analyzing the test results of students of two technical faculties of the University of Banja Luka trying to establish conceptual, processual and procedural knowledge by means of constructing the mathematics-theoretical concept of relations relying on components *RBC + C* theory of abstraction.

[ME-RS: 15-3] **Daniel A. Romano**: *What's Happening in the Mathematical Sciences and Research of Mathematics Education in the Republic of Srpska (An entity of B&H)* (In English),
MAT-KOL (Banja Luka), ISSN 0354-6969 (p), ISSN 1986-5228 (o),
XXI (3) (2015): 149-157

Abstract. This report about research in mathematics and Mathematics Education in the Republic of Srpska is a resource for the international academic society. In this paper we expose the capacity for research in mathematics and Mathematics Education and scientific competence of researches in the Republic of Srpska during 2012-2014, as an example.

[ME-RS: 15-2] **Daniel A. Romano:** *Comparative evaluation of the significance of mathematical tasks in the testing of candidates for admission to college*, [**Д.А.Романо**: *Компаративна процјена сигнификантности математичких задатака при тестирању кандидата за упис на факултет*] (In Cirillyc, In Serbian);
Učenje i nastava, ISSN 2466-2801,
I (4) (2015): 723-740

Abstract. In this paper, we give our reflections on the comparative assessment of the quality of math problems in the testing of candidates who applied for admission to the Faculty of Mechanical Engineering in Banja Luka in the period 2012-2015. Models used estimate significance of mathematical tasks are standard assessment such as *Bloom's, SOLO*, *AT* and *MATH* taxonomies. In addition, we also used a numerical model analogous to Huntly model.

[ME-RS: 15-1] **Daniel A. Romano:** *One study of student structures of formulas with logical implication and its contraposition*, [**Д.А.Романо**: *Једно истраживање о студентским конструкцијама формула са логичком импликацијом и њеном контрапозицијом*] (In Cirillyc, In Serbian);
Zbirnik radova učiteljskog fakulteta u Prizrenu - Leposavić, ISSN 1452-9343,
9(2015): 217-224

Abstract. In this paper we present the results of student testing two technical colleges in Banja Luka on understanding and applying the logical implications and its contraposition in a real situation. This particularly research support our belief that the population tested students although they does not have enough knowledge about these logical concepts. However, have the potential to expose possession of conceptual and procedural knowledge in connection with those logic tools.
