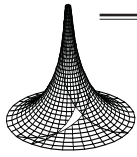

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Teaching
Mathematics and
Computer Science

Report of Meeting
Researches in Didactics of Mathematics and Computer Sciences
January 26 – 28, 2018 Hajdúszoboszló, Hungary

The meeting Researches in Didactics of Mathematics and Computer Sciences was held in Hajdúszoboszló, Hungary from the 26th to the 28th of January, 2018. It was organized by the Doctoral School of Mathematical and Computational Sciences of University of Debrecen.

The 61 participants – including 47 lectures and 17 PhD students – came from 8 countries, 21 cities and represented 37 institutions of higher and secondary education.

After the warm welcome of László Csernoch, vice rector for academic affairs of University of Debrecen the conference was opened by professor Gyula Maksa, leader of the Didactic Program of the Doctoral School of Mathematics and Computer Sciences of University of Debrecen. He welcomed the participants and emphasized the importance of the fact that the conference was held this year at a new location, in Hajdúszoboszló, in Hungary.

The annual conference this year was held for the tenth time. It was dedicated to András Ambrus and Károly Lajkó on the occasion of their 75th birthday. They both played a decisive role in the development of the mathematics didactic research community in Hungary since 1999 and are still significant members of it. The subjects presented in the lectures and posters of the conference were of great variety. Beyond the use of alternative methods in teaching mathematics, as well as surveys on students thinking there were several lectures on digital technology using in mathematics and computer science education.

The conference venue, Hajdúszoboszló is a small city near to Debrecen famous for its thermal baths. A very memorable event was the bathing in the Termal Spa of Hotel Aurum.

In his closing speech, professor Zsolt Páles, leader of the Doctoral School of Mathematical and Computational Sciences of University of Debrecen appreciated the high quality of the lectures, with special regard to the works of the invited lecturers and PhD students. He also gave his thanks to all the lecturers, the chairs of sessions, and also to the main organizers Eszter Kónya, whose work essentially contributed to the success of the conference.

Subsequently, we provide the abstracts of the lectures in alphabetical order of the authors' names.

List of abstracts of lectures

András Ambrus: *Some basic questions of mathematical problem solving teaching*

The talk analysis four basic questions. 1. Analyzing the human memory system from the point of view of mathematical problem solving, the role of working memory and long-term memory. 2. The place of the problem solving in the learning model of J. Hattie: surface learning, deep learning, transfer. Input and output variables: skill–knowledge; will–dispositions of the mind: emotional strength, cognitive abilities, strategic awareness, social sophistication; thrill–the role of motivation. There are two phases - acquiring and consolidation - in surface and deep learning. 3. The analogy between experts chess playing and mathematical problem solving. 4. The use of worked examples in teaching mathematical problem solving.

Gabriella Ambrus: *Problem solving teaching – in the focus the "backwards method"*

For teachers is especially important to have structured, on their experience based knowledge in mathematical problem solving. According to some research results, - in some extent - the problem solving can be taught, and a possible way for this is the teaching of problem solving strategies using different methods. The "backwards" method or strategy means to work starting from the goal situation – by analysing this – towards the starting conditions (statement), and this can lead in some cases even to surprising simple way of solution. Among teacher students, with the help of surveys and different types of exercises – within the

Content Pedagogy Research Program of the Hungarian Academy – I investigate the questions, how they are able to use this method and which is their knowledge about it.

Eszter Árokszállási: *There are many possibilities for error. How can I help my students?*

In solving the problems of combinatorics it is very easy to make mistakes in the secondary school for students. In fact even the most experienced teachers are easy to make mistake. You can quickly say "You do not even know this?" That can feel bad for both students and teachers alike. From 2012-16 I conducted research in classroom conditions at Paksi Vak Bottyán Secondary School. I do not even tell myself that he/she has no talent for him/her. Rather instead I asked questions about "What are the reasons for doing?" and "How can I help my students?" In my presentation, I'm talking about some of the mistakes that depend from the internal structure of problem data, and the others from external presentations. Again others depend on the individual or common features of our working and long-term memory. I also show how we have helped to eliminate mistakes and to develop combinatorial thinking.

Tünde Baranyai: *To choose, but from what? Examination of new mathematics textbooks in use in Hungarian primary schools in Romania*

In Romania, a new curriculum for the elementary school has been introduced since 2013, making it necessary to develop new textbooks as well. In the 2017-2018 school year, only the first and second grade textbooks were produced. The presented research examines whether the mathematics textbooks in use in Hungarian primary schools in Romania meet those requirements. We used documentation, contents analysis and surveys as research methods.

Beatrix Bacova, Jan Gunčaga: *Information and Communication Technologies in the Preparation of Future Teachers of Mathematics*

Present-day teachers need to develop and complement their education constantly if they want to understand an educational process and also their pupils and students. The use of information communication technologies, which have their indispensable place in the educational and training process, is crucially important. Therefore an informational base enabling students to apply acquired knowledge and skills in practice should be created. Our university teachers and students use the MATLAB computer program in the teaching/learning process.

László Budai, Sára Fruzsina Berényi: *Dual training students' mathematical and informatics competence*

On Budapest Business School we teach second academic year deal dual training students. These listeners certain informatics and mathematical courses it is made on a manner just like that, than the listeners with a traditional training with one difference: the dual listeners taking a part in a training make trainee work at different firms beside the visit of the courses. Our present research is aimed at it primarily, that what kind of knowledge necessary to use for the listeners the row of their trainee work, what kind of informatics, and mathematical background is requested nowadays in the competitive sector and is presented furthermore, how this knowledge is attached on a what kind of manner/they may be attached to the obligatory informatics, mathematical courses. We outline our related results, our experiences to this in our lecture.

Hana Burian: *Teaching analysis in high school*

Mathematical analysis has been taught in Hungary for over 100 years. Despite this, students still find it one of the hardest parts of the high school mathematics syllabus. One possible reason for this is that a lot of logical quantifiers can be found in most definitions and theses, and understanding these poses a huge challenge to students in my experience. In order to validate this idea, I conducted preliminary surveys in high schools both in Budapest and in the countryside. After summarizing and evaluating the results, I constructed another test which was completed in the autumn of 2017 by first year university students pursuing a degree to become Mathematics teachers. My presentation will include details of the development of the test, my experiences during the surveying, and also of the preliminary results of the test.

Éva Adamkó Csernusné: *Comparative analysis of the performance and motivation of Hungarian and foreign mechanical engineer students*

Comparative analysis of the performance and motivation of Hungarian and foreign mechanical engineers through a basic informatics course Mechanical engineer students in the first semester should complete the class named Engineering Informatics 1. This class consists of theoretical and practical parts, and gives introduction in the basics of the spread sheet and database management. In the first semester of the year 2017/18 large amount of student registered to this class, so the available data is representative. I created a survey about the previous

informatics studies in high school or in primary school. In my lecture I draw conclusion about the results of both student groups, based on the above mentioned previous knowledge and examine the differences and similarities between them.

Edith Debrenti: *Problem solving for teacher training students*

General problem-solving skills are of central importance in mathematics achievement. The present paper presents an experiment involving first and second grade teacher training students, who have been asked to solve certain mathematical problems. The basic idea of the intervention was developing students knowledge about word problem solving strategies with an emphasis on the role of problem solving into four steps and visual representations in mathematical modelling. The program lasts for 14 units (pre-test, 12 lessons, post-test), which is about 14 weeks duration, (at a rate of one lesson/week) and is dedicated to problem-type tasks. The aim was to investigate whether problem solving is more efficient when using the traditional curriculum, traditional problems or when using problem-type tasks. We hypothesized that using problem-type tasks might prove helpful in solving the problems.

Kornélia Éva Dékány: *My first experience of applying co-operative techniques in university mathematics educations*

During this semester (Autumn 2017) at the Faculty of Mechanical Engineering of the Szent István University, I tried to elaborate the curriculum of Basics of Mathematics and Mathematics I. of the BSc students using co-operative techniques. In this presentation I give some examples of these and summarize my first experiences.

Gerhard Glass: *Benefits of teaching mathematics with advanced scientific calculator - workshop using Casio FX-991EX*

Demonstrating how using a Casio FX-991EX advanced scientific calculator can improve teaching math: more math- less calculation, more reality - less triteness, more motivation- less frustration. Based on examples, participants will have the opportunity to learn how to best use the calculators in class: from simple problems ("how to solve equations") to difficult tasks for different sectors of math ("analysis, linear algebra, probability, complex numbers"). All worksheets (including the solutions) are given to the participants after the workshop (pdf).

Enikő Jakab: *Where do I go in research? Analysis of cuboid and cube.*

In my comparative research about the effectiveness of mathematical learning-teaching process I deal with the examination of such geometrical conceptions, as

the square, the oblong, the cube and the cuboid. These conceptions are present everywhere in our life and also in the life of children. The cuboid and the cube often occur in every- day life. Despite of it children often name the square to cube, the cube to square and the cuboid to oblong. In order to these conceptions being realized correctly, we plan an improving curriculum among the fifth forms pupils with the usage of ICTs which depends upon the results of a previous teaching in an ordinary educational environment. During the experiment we would like to examine the effect of consciously used ICTs on the development of examined conceptions.

Péter Juhász: *Pósa method in high school education*

In September 2017, we started teaching grade 9 students using the Pósa method, in 3 experimental groups, within the framework of the Content Pedagogy Research Program of the Hungarian Academy of Sciences. We focused on developing independent thinking skills. We aim to study how to ensure sufficient time for the students to conceive the solutions for the problems. We have two main expectations. First, students are to feel pleasant during the lessons, we would like them to think on mathematical problems with joy and empowered. Second, we aim that students acquire working knowledge, that their thinking skills develop, not only their capacity for coping with certain routine tasks. The presentation offers some insight into the details of the experiments, and we also share our experience from the the first 3 months.

Sándor Kántor: *Extra mathematics for prospective computer engineers*

The title refers to the area studying special aspects of teaching-learning of high school students who will use informatics not just as users, but later, during their university studies and at their workplace, as a profession, so a special training is useful for them. This part of the teaching-learning process concentrates on a preliminary introduction of the difficult material occurring in later studies. Therefore, from a didactic point of view, we treat it, on one hand as premath, on the other hand similarly as practicing problems for competitions. Accordingly, such teaching is done in study groups or in special classes. I will sketch the material of four topics: algebraic structures, set theory, mathematical logic, recursions (in informatics algorithms).

Sándorné Kántor: *Mathematical doctoral school of the mathematical seminar of the University of Debrecen at the beginning of the 20th century (1927-1940)*

In this lecture we present 16 mathematical dissertations, the life and later carrier of their authors (15 persons). These dissertations were written under the

direction of Professor Dávid between 1927 and 1940. That time he was the leader of the Mathematical Seminar of the University of Debrecen. The themes of the dissertations were connected with his scientific work, such as history of mathematics (two Bolyais), or research work in mathematical analysis (arithmetic-geometric mean). The dissertations were published individually as a book. Later they were collected in a colligation under the name Dissertationes Davidianae Debrecen 1927-1940. We have to mention this colligation does not contain the dissertation of Ferenc Kárteszi (1933). We found it between the dissertations of Doctors of Philosophy in the Library of the University of Debrecen.

Ildikó Kézér: *Some further results about the composition of arithmetic functions*

We investigate some further problems related to the commutativity of the composition of arithmetic functions. We study the equation $f(g(n)) = g(f(n))$ from various new aspects, where f and g are well known arithmetic functions: $d(n)$, $\phi(n)$, $\sigma(n)$, $\omega(n)$ és $\Omega(n)$. We still need just the basic facts about the above functions, and use only elementary methods in the proofs, so most of these proofs are accessible and understandable for students. We show how pupils might approach these questions, using mathematical software (GeoGebra for instance), as well. We present some problems, their solutions, which can easily be understood, but the proofs are sometimes tricky, and in fact one of them relies on a deep theorem far beyond the reach of the students. We give also some partial and conditional results, ask new questions, and formulate some conjectures. This topic can be discussed well in secondary school, mainly within the framework of group study sessions: exploring the world of these kinds of problems can be challenging, adventurous, and useful, as well.

Márton Kiss: *The role of schemes in selecting task-solving methods*

Searching for the methodology of learning and teaching mathematics, we asked students in some grammar schools to solve a test including four tasks. We supposed that the majority of students who do well in a final paper have serious problems with solving a simple task from a previous topic. Furthermore, most students were considered to prefer applying task-solving methods which were recently integrated in their memory rather than easier ones. The topic of the test written by the students was geometry, more precisely the connection between the sides and the angles of a triangle. Our survey aimed at assessing the existing schemes of students, as well as comparing the results of the final papers written a few months earlier and of the tests created by us in the same topic. In addition,

different methods applied by grammar school students and university students studying Mathematics were confronted.

Rita Kiss-György: *Teaching and developing space concept and spatial representation in the light of fine arts. The plan and prelude of my PhD research*

Secondary school students are having growing trouble with the spatial representation, that is the 2 dimension-mapping and drawing of spatial objects. First, I am aiming at revealing how the effects of everyday life and education influence the space vision and the maturity of spatial representation as well as their deficiency. Resent research is based on an evaluation of a test series. I am representing the test sheet used for the survey with tasks connected to space vision, and a questionnaire aimed at gaining information of studies in Mathematics and Arts. I am also representing a free-hand drawing task, which is able to examine the spatial representation and handicraft of students. I will demonstrate some problems and present the actual state of the elaboration of the tests.

Anna Klingné Takács: *Prove that .... (?)*

Traditionally, our students study Calculus in the first semester. We think it is important for undergraduate students of economic science to understand the important definitions and theorems. We ask these on the exams. Our experience that we get appreciable works for the theoretical questions less continually. Is that needed to ask the not mathematics from academic specialisation listeners for the theory? The opinions are differently. In my presentation I will speak about this also from my side and also the listeners side.

Judit Kollár: *Investigating the efficiency of catching-up courses in higher education*

In recent years, one of my research goals has been to find out what factors are causing understanding difficulties during the teaching of mathematics in higher education. What kind of mathematical misunderstandings prevent students in their progress? Therefore, according to these factors, how we should shape and modify the curriculum of the catching-up courses so that we can pass on the necessary knowledge in the most effective way over a semester. We analysed the results of the exams after determining student difficulties and providing them targeted catching-up courses. We examined how to eliminate the usual mistakes, how applicable knowledge we had provided, and which were the student layers where catching-up courses could be considered effective. This research was supported by the European Union and the State of Hungary, co-financed by the European

Social Fund in the framework of TÁMOP 4.2.4. A/2-11-1-2012-0001 National Excellence Program

Lilla Korenová: *Let's discover the symmetry!*

In the talk we present some didactical suggestions concerning the topic of symmetry using digital technology and manipulative activities. The presented problems are investigated in the dimensions of cognitive processes, understanding, application and assessment. In our research we applied the constructivist teaching - learning method and used qualitative research methodology.

Beatrix Kovács: *Problem-solving with Information and Communications Technology tools. A case study*

In the basic national curriculum, both problem-solving thinking and the improvement of digital competence appear as fundamental goals. In my presentation, I am analyzing how the use of technology helps problem-solving thinking in mathematics in certain phases of the problem-solving process suggested by Pólya, the analysis being within the framework of a movement problem presented to the group under my examination. According to my hypothesis, the use of the spread sheet software helps the student to reach conjectures, and to recognize new connections which would be more difficult or even impossible for them to recognize during traditional–pen-and-paper–problem-solving. The results of the group I examined reflect that the basic principles suggested by Pólya can still be motivating today in the improvement of problem-solving thinking enhanced with information and communications technology tools.

Zoltán Kovács, Eszter Kónya: *Let's discover the solution: look for a pattern!*

In our lecture, we examine the specificity of problem-solving thinking from the primary school to university level in groups with different abilities. We have analyzed student responses to a problem that could represent realistic problems for each age group in different wording. The mathematical model of the problem examined can be given as a series, in several ways. Thus, the result of our research primarily reflects the modeling and rule recognition capabilities of learners, and how the deductive closure can lead to discovery.

Csilla Kvaszingerné Prantner: *The importance of accessibility related to teaching and learning websites*

Accessibility support and equal access to information related to the educational websites is paramount, as pupils obtain their information mainly from the

Internet, learn on there and fulfill their electronic administrative errands. The obstacle-free accessibility of educational web pages is crucial aspects because there are plenty of commuting students who are learning on their journey. The correspondent students usually study besides working, and a significant proportion of adults engage in atypical learning, meaning out of school, enterprise, individual or other web training. Members of the above mentioned groups rely primarily on web pages during their study, as they can access the required learning information from the Internet. Furthermore most people with disabilities are forced to learn only through the Internet. In my lecture I speak about the accessibility issues of educational webpages and presenting a self-developed example.

Orsolya Lócska: *Mathematicians in the media with the eyes of students aged 14-18*

The film, as one of the most popular media, features new and exciting mathematicians and scholars who can influence the image emerged about mathematics in everyday life. In my lecture I examine characters of a specific film. On the one hand I compare the appearing mathematicians and scholars with the stereotyped scholar image, which has been described for many studies. I explore also the opinion of a student group about the characters, concerning sympathy to them.

Nicolina Malara: *Research in Didactic of Algebra and Indications about Our Studies in this Field*

We describe the evolution of the studies in didactic of algebra in the framework of the research in mathematics education, highlighting the reasons which have brought about a deep change of its teaching and also the birth of early algebra. We present our studies in this field sketching our ArAl project in early algebra that merges classroom innovations of linguistic, metacognitive and socio-constructive type and programs for teachers' development. In particular we focus on a set of linguistic constructs we have conceived, that have shown themselves to be useful for giving teachers and students new attitudes and pre-algebraic ways of seeing arithmetic. Then we present our methodology of work with teachers to help them to refine/convert their professionalism and we discuss some results arising from this work.

Zoltán Matos: *Using the history of mathematics in the secondary mathematics teaching*

In recent years, mathematics history as a possible motivational tool has become more and more pronounced in successive teaching program. But how can it become a tool for building a motivational base without becoming subject-matter

of instruction? When we begin studying the history of our subject, we can see that, in addition to the life of mathematicians mentioned in the program of course, there are many methods of problem solving, proofs, or algorithms in which mathematics can be part of the current maturity requirement. For example, in 1579, Bombelli approached the 13 square root with an infinite continued fraction. This can be used to enhance the teaching of algebraic fractions in the 9th grade by having an estimate, a condition, an increase of two sums to squares, an equation sort, factorization, and the calculation of value of continued fraction. This is part of the grammar school subject-matter. In addition, we can start initiate concepts of error term or of convergent series.

Sándor Nagydobai Kiss, Zoltán Kovács: *Problem variation for the Varignon-theorem*

Studying our workbooks, it can be stated that our students have little or no role in the problem posing domain, and it is presumably the classroom practice as well. However, problem-building could play an important role in inquiry based mathematics teaching, improving the problem-solving abilities and the attitudes towards mathematics. In the lecture we will show that the well-known Varignon-theorem holds a rich variety of problem variations.

Anita Misetáné Burján: *Chess and Mathematics at school*

In the school of the 21st century it is becoming increasingly important that children not only make the daily material of a subject their own, but also improve their way of thinking in the given field as well. The creation of useable knowledge is not only a prioritized task in the field of Mathematics, the studying of which could also be a learning experience for the children of the global and digital age, but this is a huge challenge also for the teachers. The usage of gamification (making into play) in education creates excellent opportunities. Judit Polgár, multiple Olympic champion chess player, did a lot for the introduction of the game of chess in kindergarten, school and worked to popularize chess in a wider range, she mentions chess as the "super weapon" of the digital age. Chess and mathematics can help each other in multiple points in educational and professional work. Learning by playing highly increases the motivation of the child, thus acquiring new skills is easier. In my presentation I would like to share, through didactical research and real life examples, how chess can help develop the Mathematical way of thinking in a primary school-aged child.

Rita Nagyné Kondor: *Engineering Students' Spatial Ability – International Students in Hungarian Higher Education*

Many studies have shown that there are correlations between various measures of spatial skills and performance in particular Science, Technology, Engineering and Mathematics (STEM). Spatial visualization ability is a prerequisite for success in engineering education. This report investigated spatial visualization skills (recognition of the cohesive parts of three-dimensional figures, mental cutting with a plane) of international engineering students in Hungarian higher education.

Ildikó Pomuczné Nagy: *Analysis of exercises written for a course to improve mathematical problem solving skills of teaching students*

For decades now, I have been teaching physics and mathematics and I came to the conclusion that the success of the students is closely linked to how much emphasis has been put on the development of their mathematical problem solving skills. Using my experience as college tutor I have designed a course that is aimed at improving the mathematical problem solving skills of my teaching students. My presentation is aimed at showing a particular example of one of these seminars. This will include exercises with answers, the analysis of methodology used in solving the exercises and the feedback from students to finish up. An analysis of the methodology employed by all students, those that answered correctly and also those that have not will be performed. With my work I would like to point out that to the success of teaching students as future mathematics teachers and their overall positive attitude towards mathematics is derived from the emphasis put on the development of their mathematical problem solving skills.

Dóra Sebők-Sípos: *Use of Mathematics in BSc Theses in Engineering Training*

The efficiency of engineering mathematics teaching can be measured in different ways. The common tests and exams can show the knowledge of students in mathematical context soon after studying the topic but do not say much about the ability to use mathematics to solve professional problems. Analyzing the way our students use mathematical methods in professional tests and theses can show more reliable picture about the success in learning engineering mathematics. Application of mathematical tools in engineering BSc theses was investigated and the results are presented in the talk. Though the tools used in theses necessarily depend on the topic, the mathematical knowledge of students and their relation to mathematics can be characterized by studying the way they apply the theory and calculation methods.

Ewa Swoboda: *Do primary education students are able to make generalizations?*

Generalization is one of the basic mathematical activities. Mason (1996) claims that generalization is the heartbeat of mathematics. In the teaching of mathematics the students have to be brought to gain a double awareness: (1) of seeing the particular in the general, (2) of seeing the general through the particular. Still too often generalization is considered as the process which is available to students at higher educational levels only. Additionally, in the Polish mathematics curriculum for primary education, there is no reference to higher mathematical goals such as generalization, formulating rules or perceiving relationships. Perhaps this is also the reason why the results in these targets are far from the expectations of teachers of initial classes. Teachers believe that a child from a primary education level cannot work himself, and that far-reaching help by adults is needed. The preferred form of "help" is the direct teaching of fixed, step-by-step procedures for solving various types of math problems. To make children's life easier during math classes, they suggest "shortcuts" by teaching techniques, while not expecting deep and individual approach to mathematical problems. Therefore, the question can appear: Are primary education students able to make generalizations? There is no doubt that the answer to this question should be positive. In everyday life, all small children spontaneously make generalizations based on observations – accumulated experience – and make up the corresponding rules. Learning depends on perceiving relationships, and children are capable of such observations and inferences. During my speech I will present some examples of children's spontaneous actions leading to seeing the general through the particular. It is necessary to prepare teachers for situations where the student goes beyond the narrow goals that the teacher intends to pursue. The elementary principle: teach and asses for understanding must be interpreted very broadly.

Csaba Szabó, Janka Szeibert, Csilla Zámbó: *Testing the testing effect for pre-service math teachers*

We present an experiment on the effect of the testing learning for first year math students.

Gyöngyi Szanyi: *In the footsteps of the heuristic strategies – experiences of the analysis of the textbooks and the related teaching manuals*

One of the traditions of Hungarian mathematics teaching is the problem-based approach to mathematics. To evoke Tamás Varga's activity we have planned a textbook research and organized with regards to the textbook series, which was

made to the 1978 curriculum. We have investigated what is the proportion of the tasks for different competence groups in the textbook according to the teacher's reference book: whether its solution requires reproductive, integrative or creative skills. We have classified the integrative and creative tasks in a way that if any of the heuristic strategies appear in it, or if they are suitable for acquirement. In our presentation we make mention of the partial result of our textbook research, namely about the 5th-6th form textbooks. We are also going to talk about the experience and the result that were carried out with the help of the teacher's reference book analysis.

Janka Szeibert, Csaba Szabó, Csilla Zámbó: *Efficiency of test-enhanced learning in teaching elementary geometry*

Test-enhanced learning is a method that uses active recall of the information during the learning process. It has been proved to be efficient learning texts or words. There is no publication on test-enhanced learning in mathematics, where memorizing is not enough, understanding (eg. definitions and concepts) is also essential. The topic of our talk is innovative: an experiment on the efficiency of test-enhanced learning used for teaching geometry in a secondary school for grade 9 pupils.

János Szűcs: *The usability of LEGO in mathematics education (case-study)*

The usability of LEGO in mathematics education (case-study) The LEGO materials for education can be spread in Hungary in the consequence of the agreement between the government and the LEGO Manufacturing Ltd. in 2016. Two classes of Szent István Sport Primary and Secondary School in Jászberény engaged in trying out the LEGO sets in math lessons. In addition the students could use the tools in a summer camp. The theme will be shown in more aspects, and the experience connected with the topic will be presented.

Viktor Takács: *Business Informatics for Economics Students*

In the October 2012 issue of Harvard Business Review Data Scientist was mentioned as the sexiest job of the 21st century [Davenport, 2012]. The article also forecasted that the shortage of data scientists is becoming a serious constraint in some sectors. After some years, when we look at what competences are required by the literature for a data scientist we can see that a data scientist has a very strong mathematical, economical and algorithmic skills, but it is not limited to certain mathematical/statistical/economical topics or computational techniques (computer programming, or database management). Besides all this, they need also a problem-sensitive approach and problem-solving thinking to be able to

reveal the information inherent in the data. In our presentation we show how can be improved this approach for first year economics students.

Katalin Takácsné Bubnó: *Developing algorithmic thinking with mathematical didactic aid*

From 2013 to 2016 we presented an analogy-based method on teaching novice computer programming. The method was based on Pólya's problem solving model. We worked with this method in four consecutive school years in secondary school classes with different orientations and ages. Now we show the steps and the final conclusions of the development of our method. Furthermore we present the statistical data and data analysis of students final tests to point out and confirm the very close relationship between building the schemes of mathematical problem solving and the schemes of algorithmization. We will show how the results of mathematical didactics and mathematical psychology–and a well-chosen mathematical tool–can help develop algorithmic thinking.

Margit Tarcsi: *How Long does it Take to Get to School? The Study of Measuring Time and the Knowledge of the Level of Timing Units*

In this study we examined how the children are able to solve the timing problems. We have investigated the knowledge level of scientific and everyday concepts in the fourth grade. There is a lot more difficulty in dealing with teaching timing than in other measurements. The changes between the timing units are not decimals or even constant. Students find it difficult to read the time from the watch. By completing a test sheet we get a comprehensive picture of the level of knowledge of fourth grade children in this topic.

Andrea Tick: *The evaluation of the computer usage and learning habits of the Z generation*

The analysis and evaluation of the computer usage of the today's active university student society, the Z generation is justified by the fact, that higher education is continuously shifting its education programmes to some form of e-learning to a larger and larger extent, either as entirely self-standing e-learning courses or in the framework of blended learning. In parallel, it can be noticed that nowadays young adults gain information from the net instead of gaining knowledge or reading from specialized books, lexicons and literature. Therefore, it is of high significance to analyze the computer-, internet - and online e-learning - usage of this stratum of the youth, to explore and to familiarize with their information gaining and learning processes. Beyond the previous scope this research touches on the related questions of IT security and cultural affinity as well. The survey

conducted with approx. 600 students studying various majors at different universities strives to explore with the help of mathematical and statistical methods the relationships of the computer usage and learning habits of today's university students.

Andrea Tick, László Budai: *Introducing the subject "Informatics and the world" at the Faculty of Management and Business of Budapest Business School, experiences and student results*

The modernization of the training and outcome requirements in higher education as well as the urge of the application of modern technologies triggered the elaboration and introduction of novel knowledge delivery and gaining methods. As a result, new curricula were introduced at the Faculty of International Management and Business of BBS, whose content was also changed and modernized. Consequently, a new subject "Informatics and the world" was worked out, whose goal is to give a global view on the world of Informatics, to offer up-to-date digital literacy training to meet the challenges of the ICT in the 21st century, to deliver, expand and systematize IT technology knowledge. Our presentation outlines the eventual challenges (parallel teaching of IT skills), its content, analyses the student's results and finally some experience and feedback from the students and the teachers.

Ferenc Várady: *Innovative features of the Casio fx-991 (D)EX scientific calculator, or to what extent do we allow computing to mathematics teaching?*

Nowadays modern computing applications offer a wide range of opportunities to illustrate the curriculum in teaching, to assist in the learning and teaching process, and to test. However, the use of equipment is not uniform in practice. There are some states in Germany, where the CAS calculator is expected. In many places, however, using that type of calculator is explicitly prohibited. In my presentation I would like to present a calculator that does not provide any graphical application or CAS. Yet, it is innovative because the performed operations can be converted to QR code. This code can be read by using the calculator's own application and the results can be uploaded to a virtual classroom. Without a mobile phone, however, it remains like a common scientific calculator.

Margareta Végh: *Playful Mathematics*

Playing and games have an important role in our everyday life. They possess numerous distinctive characteristics that differentiate them from other activities and grant their place in our daily routine. Nowadays learning through playing has become a quite fashionable method and experts have come to divide them into

three categories: 1. Games Based Learning: we can say that we learn something through games. 2. Gamification: these are learning situations in which a game is primarily used as a means of motivation. For example in certain learning phases children are offered reward points and so they become motivated to make a competition, learning for gathering the most reward points. The majority of video games belong to this category. The pupil learns for the sake of the game. 3. Games structured learning: Here the teacher creates a playing situation that is attractive for the pupils. The experience of playing itself is what forwards the process of learning. This is called learning by playing.

Erika Veres: *Talent management in Transcarpathia based on the results of the 4th International Hungarian Mathematics Competition*

The 4th International Hungarian Mathematics Competition held in Transcarpathia, Beregszász between April 28 and May 1, 2017, was organized by the Hungarian Carpathian Hungarian Teachers' Association (KMPSZ) and the Ferenc Rákóczi II. Transcarpathian Hungarian Institute (II. RFKMF). The venue for the competition was the building of the Ferenc Rákóczi II. Transcarpathian Hungarian Institute. 175 Hungarian students from Hungary, Romania, Slovakia, Serbia and Ukraine participated. Looking at the problem set, we can conclude that solutions require less curriculum matters and more ideas and creativity. The performance of Hungarian students in Transcarpathia is below the average in all problems. We will try to find (at least in part) the reasons for this, and I suggest Some processing methods and problems to eliminate them. The performance of Hungarian students in Transcarpathia is below the average in all problems. We will try to find (at least in part) the reasons for this, and I suggest some processing methods and problems to eliminate them.

Ibolya Veress-Bágyi: *Augmented reality in mathematics learning*

Nowadays, digital education is one of the most important issues and the usage of mobile devices has a significant role in it, both in the classroom and in the out-of-school activities. Theses devices makes new opportunities possible in math education as well. I would like to present the technology of augmented reality based on the use of portable devices and the utilisation of it in math learning. I am going to present some math AR applications, remarking which learning skills can be improved by each of them. In order to reach the active, research-based and coherence searching learner attitude, we must provide a constructive learning environment. The AR applications can create this kind of environment which can

motivate students and give them easier access to previously difficult to understand topics helping problem solving learning in mathematics education.

Csilla Zámbó, Janka Szeibert, Csaba Szabó: *Improving problem solving and problem creating ability of preservice teachers*

It would be essential that pr service teachers could directly see the connections between university-level mathematics and secondary school-level mathematics and this way get a deeper understanding of the former one. The problem is that they have very few possibilities to practice this connective, sistematizing way of thinking. They need help in order to improve their attitude towards secondary school problems and their ability to solve and create problems. A possible solution to the problem and a way of developing skills of preservice teachers and helping them will be shown in the presentation.

List of abstracts of posters

Sándorné Kántor: *Presentation of Dissertationes Davidianae, Debrecen 1927-1940*

On the poster we present some details from the Dissertationes Davidianae Debrecen 1927-1940 joining to the lecture Mathematical Doctoral School of the Mathematical Seminar of the University of Debrecen at the beginning of the 20th century (1927-1940). We present detailed the didactical and historical themes.

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