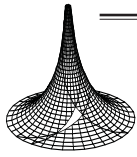

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Teaching
Mathematics and
Computer Science

Report of Meeting
Researches in Didactics of Mathematics and Computer Sciences
January 27 – 29, 2017 Budapest, Hungary

The meeting Researches in Didactics of Mathematics and Computer Sciences was held in Budapest, Hungary from the 27th to the 29th of January, 2017 at Eötvös Lorand University. It was organized by the Doctoral School of Mathematical and Computational Sciences of University of Debrecen and the Department of Mathematics Teaching and Education Centre Institute of Mathematics.

The 62 participants – including 43 lecturers and 20 PhD students – came from 7 countries, 22 cities and represented 35 institutions of higher and secondary education.

After the warm welcome of Ödön Vancsó, head of Department of Mathematics Teaching and Education Centre, Eötvös Lorand University in Budapest the conference was opened by professor Zsolt Páles, leader of the Doctoral School of Mathematical and Computational 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 Budapest, in Hungary.

The subjects presented in the lectures and posters of the conference were of great variety. Beyond the researches on the didactics of mathematics, the use of alternative methods in teaching mathematics, history of mathematics there were several lectures on different subjects in computer sciences.

A very memorable event of the meeting was the walking on the Danube riverside in the city center.

In his closing speech, professor Gyula Maksa, leader of the Didactic Program of the Doctoral School of Mathematics and Computer 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

Gabriella Ambrus: *Problem-solving teaching and learning a survey among student teachers*

Rethinking the math teaching ideas, creating and facilitating discussions of the practice of teaching situations is very important in the study of student teachers. As research shows, teachers develop their basic teaching concepts already at the initial phase of their careers and essentially follow them later, so the right approach and the related didactical knowledge that can be flexibly improved, are essential in the student teachers' lives. Schoenfeld (1985) pointed out that the individual system of beliefs (belief-system) has an essential role in the problem solving. One's beliefs about mathematics determine how one chooses to approach a problem, which techniques will be used or avoided, how long and how hard one will work on it, and so on. The belief system establishes the context within which we operate. So a problem oriented approach is very important in the teaching and learning of mathematics that is why our student teachers have o lot of practical task to develop their competencies on this field. In the presentation will be shown an example of a complex task that require the active participation of students, developing their proper approach about mathematics and its teaching, which can help the future teachers to improve their teaching approach, to improve their mathematical-methodological knowledge. In connection with the task some results of an international survey will be discussed as well.

Eszter Árokszállási: *There are many opportunities to make mistakes. Development of combinatorial thinking of secondary school students (12-16 years old)*

While solving the problems of combinatorics is very easy to make mistakes for students in the secondary school. Even the most experienced teachers can make a mistake easily. In my research, I am looking for answers to classroom conditions to what could be the reason and how can I help my students. This

presentation introduces the research work carried out between May and June 2016. Demonstrates how the students developed a two-year research period. Which mistakes could be corrected and which are not.

Gergő Asztalos: *Application facilities of mobile devices in physical experiments*

In today's modern world, the usage of the smart-phones is growing fast. The number of the applications that help, entertain, or even informate users in a particular topic is growing continuously. The evolution of our society is fundamentally influenced by the extent of the way we can pass the accumulated experience for the future generation. The school is the institution where it gets an ambitious form within a structured manner. In the course of the scientific experimentation, students have the opportunity to reveal and present a naturally phenomenon, explore relationships and understand regularities. The experimentation, trial and error are one of the most exciting human activities. We would like to introduce a teaching resource that could help in understanding and learning the laws of the natural processes in compliance to challenges in today's world. While making the specification of the application, we paid special attention that the developed software would present the different processes. As well, it can provide opportunities for the students to make theoretical conclusions and to set up and verify hypotheses. This application mainly focuses on the group in age range of 10-18 but we look for the opportunities of how we could improve our software to be applied in thinking development for other age groups.

Tünde Baranyai: *The Primary and Preschool Pedagogy specializations students' attitude toward the mathematical admission examination at Babes-Bolyai University, Satu Mare*

The main objective of the research is Primary and Preschool Pedagogy specialization students' opinion toward the mathematical admission examination. Researching methods used were documents and content analysis and surveying with questionnaires. From the results, we could conclude that the students began to prepare for the mathematics admission test, and the students consider that mathematical concepts are useful for their future, they can solve easily the each of problems.

László Budai: *The development of the problem-solving ability with the help of plane-space analogies*

For the analogy diverse approach, it's possible: thinking operation, mentality, structure mapping, kinds of similarity. The usage of the analogies proves to

be very efficient device in the course of the development of the problem-solving abilities in the education. The analogy may help the students in it for the creative one to be produced in the course of the problem solving (creator) their reply, and it may contribute to the conservation of new information. The presented plane-space analogies in the lecture constitute a certain part of a high-school subject interest group taking aim at the development of this abilities, which one contributed to the development of the participant students' problem-solving ability with a positive direction according to our experiences.

Antal Csáky: *Analysis and encoding of errors in student solutions of context-based mathematical tasks*

The submitted contribution is concerned with analysis of errors made by students when solving context-based mathematical tasks. The contribution comprises evaluation of six tasks which were designed by a research project in Slovakia. The errors in the student solutions were identified and classified primarily following Newman´s error categories and additional categories suggested by the authors of the contribution, who furthermore propose 12 error subtypes. The analysis of errors in the student solution was compared by the classic scoring evaluation.

Csaba Csapodi: *How much knowledge students need for the high school final exams in mathematics? A comparison between Hungary and Germany*

The aim of this study is to compare the final exams in mathematics in Hungary and Germany (exemplified by the federal state Berlin). Both the high school curricula and the examination systems in these two countries very considerably. Therefore we have to consider not only the level of mathematical knowledge which is needed to pass the exams but also the wideness of knowledge and skills which students need and the predictability of the examination tasks. I take these influencing factors into account by analysing Hungarian and German examination assignments during the last five years especially in the fields of non-linear equations, functions and analysis. As a result we can identify significant differences in the conceptions of teaching mathematics and in the expectations towards the students.

Edith Debrenti: *Comparison of mathematical knowledge of teacher training college students*

In the course of teacher training we place great emphasis on the development of the problem solving ability, therefore we raise more exercises and word problems that are unknown for the person who has to solve them. This way, he/she has to find the steps to the solution, the algorithm. In this research, we have

used a mathematical test containing ten word problems, which can be solved by correct interpretation, and understanding, thus being adequate for the study of applicable knowledge. The participants of the research are: Primary School and Kindergarten Teacher Training College's students at Partium Christian University Oradea and the first year full time and correspondence training students of the BA Training College of the University of Nyiregyhaza. The students that participate in the research represent different institutions, thus it is also possible to compare their knowledge.

Éva Dékány: *Impact of secondary school mathematical shortcomings for university studies*

The author examines the causes of unsuccessful students' failures at university during their studies of mathematics. By her experience, when students learn the concepts of higher mathematics and solving problems they face with some difficulties that can be largely traced back to the shortcomings of their secondary school mathematics knowledge. For example, students can't apply derivation and integration rules that they know because their knowledge of the extension of the power concept and the power identities are lacking; they do not understand the operations with fractions, especially algebraic fractions; they do not know elementary algebraic identities or can't apply them correctly and quickly; The author's opinion is supported by images from exams and she points to some possible solution to the problem.

András Ferenc Dukán - Csaba Szabó : *The mathematical performance of freshmen*

It's a well-known fact that a huge part of university freshmen's mathematical knowledge is under the expectation of the universities. However in many Hungarian universities there are placement tests and catch-up courses. Anyway it's obvious that the university studies are not continuously integrated into secondary school studies. In our research we examine these tests and courses. We check four Hungarian universities placement tests and those results. We've compared the tasks to the Hungarian curriculums and the results to the expectable performance. The main question is if the students have had the necessary knowledge and if yes when lost it.

István Faragó: *Discrete Epidemic Models and their Qualitative Properties*

The description and mathematical investigation of the epidemic propagation is an interesting area of applied analysis. One of the first epidemic models is known as the SIR model. This model was given by Kermack and McKendrick

and has the form

$$S' = -aSI,$$
$$I' = aSI - bI,$$
$$R' = bI.$$

Here $I = I(t)$, $S = S(t)$ and $R = R(t)$ denote the number of the infective, susceptible and recovered members of the population, respectively. This model describes only the temporal change of the number of the members in the given subpopulations but does not give any piece of information about the spatial distribution of the individuals. This knowledge would be very important for preventive purposes. In our presentation, we construct such models for epidemic propagation that contain also the above spatial information. We give the discrete versions of the continuous models and investigate their qualitative properties. We deduce conditions for the validity of these properties. The results will be illustrated by computer simulations. (Joint work with Róbert Horváth.)

Péter Fejes-Tóth: *Teaching high school mathematics in computer lab*

We teach high-level computer-aided statistics for students majoring in agriculture without the rigorous background of mathematics. Similarly, in informatics classes, we show how to solve certain optimization problems using Excel, also without a deeper understanding of the mathematical background. Thus, the question arises whether some more advanced statistics, including hypothesis testing, could be added to the descriptive statistics, what is now in the high school curriculum. Moreover, could we solve some optimization problems without accurate mathematical analysis background, of course all in a computer lab, using an appropriate software?For some secondary schools in Hungary following foreign curricula, such education, (e.g. in statistics), is already a common practice. In my presentation, I discuss how we can present in public education mathematical problems that can be easily solved by computer in a computer lab, even in the frame of informatics classes. The emphasis should be, however, not on the use of the potentials of informatics, but on small changes of the curriculum enabling the above issues.

Alex Friedlander: *Some Types of Creativity-Promoting Tasks*

In this talk, I will present some types of tasks that have the potential of promoting middle-grade students' mathematical creativity: conventional tasks posed in non-conventional timings; tasks of problem posing; tasks that require constructing examples; tasks that require divergent thinking; tasks that require reversed thinking. For some of these tasks, qualitative and quantitative data of student work were collected and will be presented at the conference. The examples

and the findings are based on research and on my experience as a curriculum designer.

Katalin Földesi: *Calculus? Insufficient!*

Upper level teaching of calculus is of particular importance, as even today it is the basis of most technical education programs, and it is almost equally important in the education of future high school teachers. Since in Sweden a considerable percentage of the high school math curriculum is either calculus, or preparation towards calculus, it is important that all high school math teachers have a solid foundation in the subject, and the beginning of this foundation must be built during the college years. The lecture is a case study in which we gather the underlying issues for why a Swedish high school student teacher failed at his first calculus exam. Next, we seek an answer to the question whether it is possible for the student teacher to succeed at the exam by finding solutions to some of the issues above, and whether it will provide him with enough help in getting to a higher level in his independent math studies.

Katalin Földesi: *Analysis of solutions to problems received at a geometry exam*

A group of students who are studying to become teachers have attended a mathematics course in the first half of the autumn semester. They will teach mathematics in the fourth to the sixth year of primary school in Sweden. At the course, they studied geometry intensively for two weeks and then took an exam. I have analysed their solutions to five selected problems of the fifteen problems in the exam.

Vladimír Francisti - Ján Gunčaga: *Mobile Distance Collaborative Learning of Functions*

In this contribution we present a modern approach of teaching mathematics based on the mobile distance collaborative learning of function contents. Variety of technologies has been used for distance education to enhance interaction between students but none has been easily available and accessible as mobile phones. The usage of mobile phones in supporting students is most suitable in Serbia because it is affordable and has the ability to connect less privileged people to information. Despite evidence that mobile phones can be used successfully as a cognitive delivery tool, the pedagogical approaches of mobile phones have not yet been fully explored. The collaborative learning has been used in calculus course at the University of Novi Sad, Serbia, for examining functions and drawing their graphs for almost five years. In 2016 the authors decided to improve the collaborative learning preparing new internet platform for learning functions concept

that is accessible not only with a computer, but with every mobile phones with a internet connection. The student in the experimental group has been learning the function concepts without the new internet platform and for the students in the control group the internet platform was freely available and accessible at any time. Visualization and dynamic character of the teaching will be discussed.

Zsolt Fülöp: *Transition from arithmetic to algebra in lower secondary school education*

The shift from arithmetic to algebra is considered to be a difficult but an essential step for mathematical progress. The main aim of this paper is to report a study that explores the thinking strategies and the most frequent errors of Hungarian grade 6 students in solving some problems involving arithmetical first-degree equations. The present study also aims at identifying the main arithmetical strategies attempted to solve a problem that can be solved algebraically. The analysis focuses on the shift from arithmetic computations to algebraic thinking and procedures. Many studies have shown that pupils in lower secondary school education (age 12-14) encounter difficulties with learning algebra. Therefore they mainly use arithmetical and numerical checking methods to solve word problems. By numerical checking methods we mean guess-and-check and trial-and-error. We will give a detailed presentation of the false position method. In our opinion this method is useful in the lower secondary school educational processes, especially to reduce the great number of random trial-and-error problem solving attempts among the lower secondary school pupils. We will also show the results of some problem solving activities among 50 grade 6 pupils at our school. We analysed their problem solving strategies and compared our findings with the results of other research works.

Ján Gunčaga - Robert Janiga: *Methodology of using virtual laboratories and computer simulations in teaching STEM subjects*

Virtual laboratories in teaching at secondary schools bring a number of benefits. In the contribution we want to devote their use in a particular aspect and document their use in teaching STEM subjects. A primary task was to create and customize virtual laboratories for the actual needs of the subject and students. The greatest advantage of using virtual laboratories is particularly high price of real measuring devices wherein virtual laboratories allow performing measurements to a similar extent as the actual apparatus in a much lower cost. In the

program of teaching we use the methodological approaches with following principles: principle of small steps, respect students´ own pace by involving students and their educational process into their permanent activity.

Ákos Győry: *On the development of geometrical thinking of secondary grammar school students talented in mathematics*

We monitored changes of geometrical thinking of students specialized in mathematics in Miskolc with the help of a test from the article Van Hiele Levels In Secondary School Geometry by Zalman Usiskin, and our own test. The tests were written with students from different classes. Based on the tests we analysed changes of Van Hiele levels of each student during the summer holiday, and tried to explain the results.

Sándor Kántor: *Can we teach how to solve competition problems?*

It is known that to solve competition problems requires specific subject knowledge and also requires some kind of special thinking skills. So if we want to teach how to solve competition problems, we have to decide what to teach (in this case what the math curriculum should be). The question about the special thinking skills is easily solved, since it is a well-known didactical thesis that teaching thinking skills is accomplished by practicing thinking. In my presentation I will analyze what is the specific subject knowledge needed by12-18 year old students, on which they can practice their thinking skills, to be successful in solving competition problems.

Dániel Katona: *The Hejny-method*

Milan Hejny has been working on the development of a mathematics teaching method within the problem-solving and discovery learning traditions since the 1970s. His method is currently applied by around 20 percentage of the Czech schools in the primary and lower-secondary education. The Hejny method, based on 12 key principles, facilitates the development of students' mental mathematical schemata and helps them to discover mathematics on their own and with joy. The aim of the presentation is to review the method, offering an introduction to it. The data presented is primarily based on the presenter's visit to Hejny's H-mat o.p.s. organization in Prague in January 2017. Hejny-class observations, talks with Hejny-teachers and educational professionals who are responsible for the current development of the method, as well as a selection of English language publications about the method form the basis of the presentation.

Ildikó Kézér: *Investigation of the composition of arithmetic functions*

We investigate some problems related to the commutativity of the composition of arithmetic functions. The concept of commutativity arises many times in high school maths, so it is natural to study the composition of functions, namely the equation $f(g(n)) = g(f(n))$, where f and g are such well known arithmetic functions as $d(n), \varphi(n), \sigma(n), \omega(n)$, or $\Omega(n)$. We it infinitely many solutions; can we determine every solution; can we find suitable values in the range of both functions f and g for which the equation is, or is not solvable, respectively. We need just the basic facts about the above functions, and we use only elementary methods in the proofs. We present some interesting questions, their solutions, and raise some unsolved problems. This topic can be discussed well in secondary school, mainly within the framework of group study sessions: observing these types of questions gives children a chance to make some experimentation, this way they experience how to develop and extend a question, how to conjecture the answer and how to ask new questions. We also show how we can use several mathematical software in these discoveries (GeoGebra for instance).

Lilla Korenová: *Circle in geometry at primary school*

Geometry in elementary mathematics education is not emphasized enough. Children get acquainted with the circle in their kindergarten years, and learn how to construct it using a pair of compasses. The pupils have difficulties with the algorithm of constructing a circle, because they perceive it as a general shape, rather than a set of points with an equal distance from a given point on a plane. The foundation of our research is to introduce the circle using a constructivist, active approach from the pupil's perspective, while also using digital technologies. We conducted the research with 4th and 5th grade pupils (four classes all together). As we theorized, the upper mentioned method of teaching yields better results in geometry constructions, e.g. while constructing a triangle. We present the results of these findings.

Beatrix Kovács: *Teaching mathematics in a digital educational environment*

The topic of my research is teaching mathematics in a digital learning environment. The research of this topic is justified by the sociocultural changes affecting the learning-teaching process in school, which also influence the methodology of teaching mathematics. I am examining the possibilities of teaching problem-solving thinking, the application of the inductive and deductive ways of teaching, the transformational connections between the visual representation of the exercises and conceptual thinking, and the possibilities of the digital competence of

pupil and teacher assisting self-sufficient learning, in correlation with equipment usage. One of the premises of the research is that digital competence has an effect on problem-solving thinking. Technology enables both teacher and pupil to choose from the strategies leading to the solution in a reflective way, and to ponder on which thinking procedure they should choose.

Eszter Kónya - Zoltán Kovács: *Relationship between the algorithmic skills and the mathematical understanding - a case study*

We investigate the relationship between students' algorithmic skills and their background mathematical knowledge regarding these skills. We chose a problem based on the well-known method of prime factorization taught in school, but it had to apply in unusual situation: How many zeros are at the end of the number $n!$, where a) $n = 10$, b) $n = 100$? Solve the problem in general as well. We evaluated the written works of 80 high school and university students, furthermore the record of a classroom discussion.

Katalin Munkácsy: *Calculus in the secondary schools and at the universities*

In recent years, I examined in non-math majors the mathematics the curricula. Expected mathematical knowledge and skills of the students at the end of the first academic year are compared to the secondary school mid-level mathematics curricula. We can find many new areas and methodological thoughts in the new curriculum. A lot of knowledge is missing, what the young students easily can learn and they can use them in higher education. I would like to show some examples.

Anna Muzsnay - Csaba Szabó: *Geometric approach development of the Hungarian high schools*

In this paper we analyzed the level of understanding geometry of the Hungarian public education students. Our study is based on the latest version of the Van Hiele Model originally established in 1950. The National Curriculum declares which is the optimal stage of a given grade. This was compared with the requirement of the school leaving exam. There exists a worldwide accepted test to measure the level of a certain student that was filled out in a number of high school for our experiment. Based on our experiences we gave an overview on the geometry developmental level of the high school students. The summery of the results are as follows: The skills required by the school leaving exam does not go beyond the expected geometrical level of an eighth grade elementary school student. In general students learning mathematics in three lessons per a week (the non-faculty) are not able to develop above level 2 (which is required from a

fourteen years old student). This level is nearly constant during the high school years. The freshmen are clearly divided in two groups according to their geometrical achievements: Members of the first group are still at elementary school level, while members of the other group are at the stage of a 12th grade student.

Ilona Oláhné-Téglási: *The role of definitions in mathematics and in lifeplayful approaches*

One of the most important didactical questions of teaching mathematics is constructing concepts. We have learned the methods of this from Skemp and Bruner. We know, that the way we lead our students to a definition of a mathematical concept can be very long, sometimes we can measure it in school years: from the objective representation to the symbolic, from the action to the abstraction. In my speech I'd like to focus on the need of definitions in mathematics education and in real life. I'd like to some examples of methods and games with which we can draw attention on the importance of definition in mathematics.

Ildikó Papp: *3D printing and modelling in education*

In recent years, 3D modeling is one of the most popular optional courses at Faculty of Informatics in Debrecen. During 2016, acquiring a 3D printer a new curriculum titled Introduction to 3D printing and modeling was devised. The aim of my talk and associated poster is to present our experiences of this course, applied software products and students' assignments.

Csaba Szabó - Anna Muzsnay: *Dressed up problems – the danger of missing dress code*

Dressed-up word problems are one of the three types of mathematical problems besides modeling problems and intra-mathematical problems. We can distinguish them by their strength of connection to reality. Contrary to intra-mathematical problems "dressed-up" word problems are related to reality, but not as strongly as modeling problems. The aim of the talk is to show how dangerous could be to dress up mathematical problems. We present three examples where the dress-code were missed resulting sometimes serious sometimes humorous confusion.

Gyöngyi Szanyi: *Concept images of primary school students about function*

The concept of function is of fundamental importance to the learning of mathematics. Like most mathematical concepts, the function concept cannot be acquired in one step, formation of it is a long process. Hence, laying a foundation of this fundamental concept should be initiated with thorough preparatory work

before its introduction to pupils. Studies done in light of function concept formation processes in Ukrainian and Hungarian curriculum and textbooks showed that the Hungarian curriculum and textbooks prescribe more targeted preparatory work from the elementary school to establish the concept of function. The investigations among one class of Hungarian and one class of Ukrainian students in 6th and 7th grades concluded that starting with a preparatory work of function from elementary school has positive effects on their familiarization with the constructive elements of the concept and to the development of skills related to it.In our presentation we look for the answer to the following questions: (1) with different concept formation processes, what kind of concept images of function are developed by the previously investigated students at the end of the 8th grade? (2) What is the relationship between students' definitions of function and their formed images about it?

Janka Szeibert - Csaba Szabó: *Teaching abstraction for third year math students*

An advanced organizer is a cognitive instructional strategy used to promote the learning and retention of new information. These organizers are applied usually in advance of learning, and are aiming for achieving a higher level of abstraction. In the paper a teaching experiment is presented for the Abstract Algebra course for 3rd year math teacher students. The course is very challenging for teacher students and the grades are standardly disastrous. The main feature of the experiment is that we introduce a new type of advanced organizer. Namely we present a practical application of the on-going material at the end of every lecture. We followed the studying habits of the class all over the semester. At the end the exam grades were obviously better, the average of the class improved from 1.99 to 3.42 and the failure rate dropped from 36 to 4 percentages.

József Udvaros: *Analyzing the effects of OOP helper application in Slovakian secondary schools*

Nowadays students of secondary schools are familiar with the usage of computer very soon, lot of them are even capable of handling user applications very cleverly. This is satisfying for most of them. Those who imagine their future in programming or system developing, need to have deeper knowledge about object oriented programming, however, students do have it at very low level or not at all. We want to make sure whether this supplement is true, so different examinations have recently been made at Slovak secondary schools with Hungarian teaching language. We have reached a conclusion that the students´ knowledge

of object oriented programming is deficient. We could archive better results by using proper applications as a visual aid. In this paper we examine the efficiency of an application made by us.

Attila Vámosi: *Tips and tricks for making examination in Moodle*

Electronic exams made with the Moodle system can greatly facilitate the examiners job, but only few people use this option. The presentation will review the examination system of the Moodle, the uploading of the question bank, the creating of the test, and the range of the available statistics. Then answers some frequently asked questions and misunderstandings, and give tips and show tricks related to secure examinations.

Ödön Vancsó: *Different sources of the probability's notion*

This brief presentation illustrates the author's ideas with some prototype tasks and problems. In midpoint stands development of probability's notion in school mathematics reflecting to work of T. Varga, T. Nemetz and K. Bognár on this field.

Erika Veres: *What is the geometric message of a vector expression?*

In the present lecture based on the concrete example of vectors we are going to present our view of the fundamental difference between the usage of series of problem row and problem cluster. While compiling the problems talent management in Transcarpathia, workshop sessions were primarily taken into consideration. A number of series of problems rows were chosen from the sphere of elementary geometry, the solutions of which were arranged into a problem cluster with the help of vector geometry. The arrangement of problems was accomplished based on mathematical interdependence; the chosen solving methods were adjusted to the students' precognitions and age characteristics. The variation of methods, the formation of the structure of the problem cluster was implemented according to methodological principles based on Bruner's representation theory and Paivio's dual coding theory, the dissymmetry of the human brain. The ideas applied as examples were taken from the heritage of Istvan Reiman, who for years successfully prepared the Hungarian team for the Mathematical Olympiad.

Adrienn Vinczéné-Varga: *Mathematics for engineering students*

What is the optimal amount of the theory in engineering mathematics education? How to be precise and effective at the same time? How to be in step with the rapid development of informatics? We present an attempt to answer these

questions by a textbook containing higher level mathematics, especially calculus, for engineering students.

List of abstracts of posters

Tibor Kenderessy: *"Computer dissection"*

A short lecture prepared for open day of a grammar school, which is about the development and technical background of the data storage, while they may take devices in hand that could not be touched anyway.

Ildikó Papp: *Students' assignments - Introduction to 3D printing and modeling*

In recent years, 3D modeling is one of the most popular optional courses at Faculty of Informatics in Debrecen. During 2016, acquiring a 3D printer a new curriculum titled Introduction to 3D printing and modeling was devised. The aim of our poster is to present our experiences of this course and some examples of students' assignments.

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