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Teaching
Mathematics and
Computer Science

Report of Meeting Researches in Didactics of Mathematics and Computer Sciences January 23 – 25, 2015 Novi Sad, Serbia

The meeting Researches in Didactics of Mathematics and Computer Sciences was held in Novi Sad, Serbia from the 23th to the 25th of January, 2015 at the University of Novi Sad. It was organized by the PhD School of Mathematics and Computer Sciences of the University of Debrecen and the Department of Mathematics and Informatics of the University of Novi Sad.

The 70 participants – including 42 lecturers, and 18 PhD students – came from 9 countries, 28 cities and represented 40 institutions of higher education.

After the warm welcome of professor Djurdjica Takači, the professor of the Department of Mathematics and Informatics of the University of Novi Sad, the conference was opened by professor Gyula Maksa, leader of the Didactic Program of the PhD School of Mathematics and Computer Sciences. He welcomed the participants and emphasized the importance of the fact that the conference was held this year at a new location, in Novi Sad, in Serbia.

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 sightseeing in the historical centre of Novi Sad.

In his closing speech, professor Károly Lajkó, ex-leader of the Didactic Program of the PhD School of Mathematics and Computer Sciences 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 Herendiné-Kónya, Djurdjica Takači and Gordana Stankov, 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: *The Cognitive Load Theory and Mathematics Learning and Teaching*

After some data and comments about the Hungarian mathematics teaching in elementary and secondary schools we analyze the cognitive architecture of human mind as basic factor in learning: the memory structure has three components: sensory memory, working memory and long term memory. From the limits of working memory follows the cognitive load theory. The cognitive load is the load caused by information acquisition, problem solving. Its types are: intrinsic, extraneous and germane cognitive load. In our talk we analyze the connections between mathematical problem solving and cognitive load. The decreasing of cognitive load can be happen by using open (goal free) problems, worked examples, completion problems. We present some own experiences to demonstrate the practicability of the theory.

IVANA ANTIĆ: *Educational games in Math classes*

We can achieve much in education by love, patience, understanding and playing. Safe and firm basis can be built during the Math lessons if children are interested in, if we try to develop their abilities, make them sensitive for recognizing and solving problems by methods which are based on experience. Playing encourages creativity and imagination in the best way so that children can expand their experience in learning and creating by developing their possibilities and skills. This short exposing will present one type of a game named “Chasing trophies” which is modeled on TV show “Survivor” and can be applied to any age in Elementary school, field of education and also to any school subject.

ESZTER ÁROKSZÁLLÁSI: *Development of the combinatorial thinking*

Often occur during the teaching the combinatorics that students hardly decide which formula is used while solving the task. Even if they decide what to do with the right formula they may find it difficult to enter the information into the formula correctly. In the case of large numbers is not easy to control the final result. I would like to present a teaching experiment, which was carried out at the Paksi Vak Bottyán Secondary School, Hungary. Tamás Varga Methodological Days (November 8 2014th) of the English section, we reported about a part of the experiment. Now in the presentation I would like to show you in more detail that which kind of difficulties arose during teaching. What strategies have helped to cope with the problems? What showed a pre-test, post test and the delayed test? What is the role of the continuous feedbacks and the immediate feedback? Can we achieve from the personal knowledge and the concrete knowledge to institutional knowledge and abstract knowledge?

TÜNDE BARANYAI: *The 8th grade students attitude toward the Mathematics ability test*

The aim of this paper is to study the 8 th grade school students attitude and toward the mathematics ability test. Researching methods used were documents and content analysis and surveying with questionnaires. Based on my research results, I formed recommendations so that mathematics program may become more efficient. Key words: attitude towards Mathematics, 8th grade students, ability test, curriculum of mathematics.

MIKLÓS BARTHA - ZOLTÁN ZAKOTA: *Using Forth Integrated with Pascal / C++ Development Systems in Education*

Forth is the first IDE (integrated development environment) 15 years before Turbo Pascal. The main advantage of Forth is that it is extensible. However integrating technologies like Internet, databases, 3D, etc. requires a considerably effort both from developers and later from users of a Forth implementation. Combining Forth with existing RAD systems offers the possibility to interface easily the needed functions with minimum effort and extension of the Forth system. The examples will show how simple and straightforward this procedure is. Examples will focus on classic educational subjects like turtle graphics and recursivity.

RADOSLAV BOŽIĆ: *A comparative analysis of mathematical education in compulsory education systems of Serbia, Croatia and Finland*

This paper analyses mathematical education in compulsory education systems of Serbia, Croatia and Finland. Applied comparative perspective provided

to identify similarities and differences in the legal regulations, duration of compulsory education, assessment systems, representation and status of the subjects, with emphasis on the analysis of educational objectives, contents, educational standards and requirements in terms of knowledge and skills of students for the subject of mathematics. The analysis has identified significant similarities in representation and status of mathematics as a subject, some differences in terms of educational contents and substantial differences in terms of educational standards and objectives of mathematical education and the principles of assessment. The advantages of this type of education in Finland, compared to Serbia and Croatia, are emphasis on the development of mathematical reasoning, application of the acquired knowledge in the everyday life and the primacy of descriptive assessment.

NATALIJA BUDINSKI: *Mathematical Models of Materials Science in High School Education*

In the presentation we propose examples how mathematical models of Materials Science can be used in high school education. Materials Science is an interdisciplinary field which considers the discovery and design of new materials, for example plastic, rubber, clay. This science combines elements of physics, chemistry, mathematical modeling, nanoscience and it can be used to illustrate a multidisciplinary approach to students. We have used materials science experiments to teach our students mathematical modeling on high school level. Students have explored the features of exponential function and its application.

MARINA ČIČIN-ŠAIN - SNJEŽANA BABIĆ: *Cost-effective and efficient programming for everybody*

Who needs programming? At first glance future programmers are the only ones who really have to know how to write a program. However many people that are not softer-developers use ICT on a level where the in deep understanding how a computer really work is necessary as negotiation about softer purchasing, write assignments for programmers, conclude agreements about software maintenance or write software for self-supporting. Today more or less almost everybody in one way or other needs to understand how a program work and in future this knowledge will be even more required. To achieve this goal it is important to start as soon as possible, from primary school or even earlier. In this paper a method for introducing programming to small children is explained which is both, cost-effective and efficient.

PETRA CSÁNYI - KATA FÁBIÁN - ZSANETT SZABÓ: *Do we really understand fundamental theorem of arithmetics?*

In 1957 Pierre van Hiele claimed wide application for the Van Hiele levels in understanding, both for more disciplines and for different subjects in mathematics. In the same work he presented a model for geometry. In our talk we sketch the idea of such a model for arithmetics and algebra. We introduce these levels via Canadian and Hungarian case studies on the understanding of the fundamental theorem of arithmetics.

PETRA CSÁNYI - KATA FÁBIÁN - ZSANETT SZABÓ: *Number theory: past and future*

In our talk we present a cross country survey about the lexical knowledge of Hungarian pupils of grade 7-12 in number theory. The picture we obtained showed an urgent need to reconsider the teaching in number theory in high school. In our talk we suggest two easy ways to resolve the situation.

CSABA CSÍKOS: *Adaptive expertise in mathematical problem solving*

Adaptive expertise refers to the ability to solve mathematical tasks efficiently and flexibly by means of using diverse strategies. In an educational sense strategy is a systematic plan that is consciously used and monitored in order to improve performance in learning. Adaptivity has at least three facets (or dimensions). Tasks variables, individual characteristics (preferences) and contextual variables all play their role in adaptive expertise. (1) A strategy that may be valuable for a given types of tasks will be ineffective for another branch of mathematical problem. (2) Students may have their personal preferences towards different strategies, and (3) the context in which the task is presented may also affect whether a given strategy will suffice or not. Several examples from our current research projects are shown in the presentations from three fields: mental addition, arithmetic word problems, and combinatorial reasoning.

EDITH DEBRENTI: *Using representations in the case of various word problems*

Meaningful learning and understanding are basic aspects of all kinds of learning and it is even more important in the case of learning mathematics. Numerous psychological studies confirm that using visuals in teaching helps a deeper understanding of concepts. I asked our kindergarten and primary teacher trainees to complete a test in mathematics. The problems in the test are appropriate for testing usable knowledge, since they require careful reading and understanding. In the case of various word problems we asked for arithmetic solution. I hypothesized that I had managed to convince students only partially to use representations

and arithmetic methods. I wanted to investigate the connection between different knowledge areas, levels (operations, conceptual understanding, problem and exercise solving), hypothesizing a causal relationship.

PÉTER FEJES-TÓTH: *Teaching of statistics in the agricultural curriculum - the example of two sample t-test*

In recent decades it became a basic skills to perform statistical analysis in many scientific and industrial areas such as agriculture or horticulture. This unquestionably improves decision-making and scientific performance, however, means a challenge for the tertier education. This is because the need and demand for reliable statistical knowledge does not come hand in hand with knowledge and skills in mathematics underlying statistics. In my presentation I use the two-sample t-test to introduce didactical challenges higher education needs to face. I describe the design of the curriculum. I present to what extent do we introduce the mathematical background of a statistical issue and why, and how do we ensure to deliver reliable knowledge without deeply understanding the base of statistics. I also introduce how do we “agriculturize” statistics, i. e. how do we make what we teach especially usable in this field of interest.

KRISTÓF FENYVESI: *Maths, Arts and Games for Digital Natives: Paradox Structures, Impossible Forms and Visual Illusions in Experience-Centered Mathematics Education*

As attitude-researches point out, students tend to sustain an aversion to mathematics, while remaining largely ignorant of how deeply embedded it is in the world around them. Most students however are able to recognize patterns and numerous research and empirical evidence indicates that they become easily motivated (and even fascinated) when mathematical connections are presented in ways which relate to their experiences by triggering their natural curiosities. The Experience Workshop Math-Art Movement has a number of pedagogical methods, which are connected to visual paradoxes and perspective illusions. There are certain digital games as well, which employ visual illusions as a part of their game mechanic. Most of these games were not designed as an educational game, but they may be used for educational purposes, to clarify mathematical concepts behind and related to visual illusions (symmetry, perspective, isometric projection etc.)

KRISTÓF FENYVESI - ILONA OLÁHNÉ-TÉGLÁSI: *Adventures on Paper! A new exercise book in English and Serbian for the experience-centered education of mathematics: bookshow by the editors*

Presentation of a new exercise book in English and Serbian for the experience-centered education of mathematics: bookshow by the editors.

VLADIMIR FRANCISTI - SLAVIŠA RADOVIĆ: *The impact of modern technology on tracking achievements and knowledge of students during primary school*

The future of every student, increasingly depends on what kind of knowledge and skills will he build up during his education and how prepared will he get for the challenges which he will be facing in life. The achievements are one of the most important feedback that the lecturer receives from his students. Next step for the lecturer is to monitor and accurately evaluate the achievements, so he can get a clear picture of where and what part of his lecture needs to be improved. Because this is a very delicate process, ICT (Information & Computer Technology) can help in this matter. This presentation aims to present an analysis tool for development of education and teaching practice, using modern platform designed specifically for the needs of initial testing knowledge and abilities of students. It will present a software which can have a prominent role in evaluation of an educational process. Particular attention will be directed towards defining analytical reports which will be able to obtain on the basis of information and material that the software collects.

KATALIN FÖLDESI: *Van Hiele test results of two groups of students*

I would like to briefly present the Van Hiele theory, which describes the level of geometrical thinking of students. Afterwards, I will introduce the test, developed by Usischkin and his colleagues, which categorizes the students' Van Hiele levels. During the fall of 2014, I had two Swedish student groups take the test. I had four geometry lessons with the first group after they took the test. The subject of these lessons were basic geometric terms, as well as concretization. I would like to summarize my most important experiences using the subject-matter of the course, my own observations during the lessons, and the students' written evaluations. Finally, I will compare and contrast these with their test results. The second group of students took the test during their first geometry lesson, too, right at the beginning of the lesson. I will compare the experiences of the course with the students' test results. A few of the students took the test one more time, at the end of the course, which leads to the possibility of new, interesting conclusions.

JÁN GUNČAGA - ROBERT JANIGA - JANKA MAJHEROVÁ: *Web 2.0 Tools in Education*

The aim of the presentation is to highlight the need of integrating new approaches into the educational process of students in their future teaching profession. We briefly describe the benefits of using web 2.0 tools and digital taxonomy in education. In the second part we process information dealing with the use of web 2.0 platforms in the teaching of different subjects. Using of multimedia presentations, animations or simulations, which are available at educational portals, provide better abilities to gain the knowledge. We are trying to evaluate the use of e-learning environment Moodle at the Faculty of Education, Catholic University in Ružomberok. We also mention our own experience with educational portals and the Geogebra software in creating and sharing of digital content. Using of different “educational tubes” on internet in mathematics and informatics education.

SÁNDOR HAMBALIK: *Automated visualization of important processes and protocols in local LAN and WAN based on text description parsing*

The first part of this contribution describes a software application intended to precisely visualize activity and protocols of LAN and WAN networks. Based on the experience gained from the use of this application we designed and developed a software environment to visualize (animate) network activity. The network visualization is generated according to the text description of specific protocol (given by RFC XXXX). The protocol specification is read and analyzed from the contents of respective TXT or XML files with the associated appearance given by CSS. The primary development goal was to facilitate understanding of processes in LAN and WAN networks. The target users are students and we suppose it would also help in training professionals in the field.

ESZTER HERENDINÉ-KÓNYA - MARGIT TARCSI: *Problems of using symbols during learning perimeter and area*

A wide range of experience, measuring, experiments are required to answer the question as to why quite a lot of learners have serious difficulties in determining the perimeter and area of basic shapes, such as triangles, rectangles, etc. We have also attempted to find reasons for the fact why frequently the concept is lost when the use of symbols are introduced. On the basis of an assessment carried out in a primary school we have managed to find answers to the question above and have also come to some conclusion.

VERONIKA IVANCSÓ: *The relationship of talent and competency*

I am a teacher in the Jedlik Ányos Secondary Grammar School since the September of 2013. I'm a second-year student in the Doctoral School of Mathematics and Computational Sciences of the University of Debrecen, in the Didactics-methodology program in correspondence course. My thesis title is "The criteria of mathematical talent and possibilities of its development in the secondary school". I analyzed two questions from a Combinatorics, Graph theory test, written by one of my classes, the information technology class of 11.D, in the light of competency and talent. I specified the competencies of the talented students, which I must develop during my job. Then I summarized my experience about the solutions provided by my students to the two questions, possible ways to deal with the more talented students, and ideas about the work with the less talented.

MARINA JOKIĆ: *Dynamic software in the service of solving mathematical problems*

This paper represents a description of the use of dynamic software in defining and solving mathematical problems. It is also a detailed realization of the teaching model with the help of dynamic software by applying G.Poly's model and Van Hiele's model of learning geometry. It was also applied in the implementation of the teaching process in Machine-electrotechnical secondary school in Krusevac.

MIRJANA JOVANOVIĆ: *Mathematical modeling with GeoGebra*

We present the mathematical modeling with the package Geogebra. Interested examples of the functions as mathematical models are analyzed. Quadratic functions and relationships cover a wide variety of applications in physics science and can be used to solve some optimization problems. In order to demonstrate to the students the purpose of studying this part of the curriculum, the concept of a quadratic relationship is related to problem posing and solving. The class is designed in such a way as to involve group work and the use of computers and the mathematical program package GeoGebra.

TÜNDE KÁNTOR: *Life and career of György Maróthi (1715-1744)*

György Maróthi, a professor of the Calvinist College of Debrecen, was born 300 years ago. He was one of the most far-reaching teacher character. His influence was general and national. He established a new epocha in teaching, he recognized the importance of teaching realia. He initiated the foundation of the first observatory in Debrecen. The 'Kántus' of the Calvinist College of Debrecen was founded by him. He put a great emphasis on the artistic teaching of singing. He published the first Hungarian work of music theory. His most important work

is a Hungarian schoolbook: *Arithmetica* (1743). This book charted a course for future development the schoolmaterial and methods of learning mathematics. He created a lot of technical terms of mathematics. He expressed his reform efforts in his works *Idea* (1740) and *Opiniones* (1741) and we find his ideas later in the *Methodus*.

LILLA KORENOVÁ: *Experiments for pupils using GeoGebra and a twine*

New technologies brought an opportunity into mathematics classes for the students to experiment, examine and form hypotheses already in high school. We are presenting one example of this experimentation, using GeoGebra and manipulation with paper, twine and pins. Students were solving a very standard mathematical task by creating a model and its digital representation using GeoGebra. By changing a few initial conditions of the task, they were able to generate very non-standard mathematical problems, which however, they were able to solve in GeoGebra. It is important for the education of mathematics, that the teachers are ready to be able to effectively integrate technology into educational methods and also realize, how technology can change the contents of school mathematics. We are presenting results of a research, whose aim was to determine the current condition of material equipment of schools in the area of digital technologies and the forms of its use by teachers while teaching mathematics.

VALENTINA KOSTIĆ - TANJA SEKULIĆ: *Mathematical Modeling and GeoGebra as Bridge between Natural Sciences and Mathematics*

The talk presents a systematic review of the use of new educational technologies and methods based on direct and immediate use of computers and mathematical modeling in teaching process. Computer models and simulations of processes and phenomena in the real world around us, based on mathematical modeling, are very effective in interdisciplinary approach to teaching. GeoGebra is software specially designed for use in educational purposes and it is becoming more and more popular in teaching and learning process. On the other hand, mathematical modeling, based on connecting real life with formal mathematical theories, gives students the possibility to manipulate with their knowledge and learn on real examples. Direct application of new teaching methods based on principles of mathematical modeling and information technologies are illustrated in the talk by the example of unified motion problem, processed by using mathematical modeling as teaching method and GeoGebra as software tool.

ZOLTÁN KOVÁCS: *Use of technology in problem solving and building concepts: potentials and pitfalls*

In the talk I expose three research questions: (1) How the use of technology impacts the Pólya’s model of problem solving. I analyse some case studies that illustrate this impact. (2) How to evaluate the usefulness of a technology tool. I try to draft a guide helping teachers to make decisions whether to use an application in the classroom, or not. (3) Whether there is any negative influence of using technology on the concept building process. My hypothesis is that in some cases technology tools set back the concept building process.

PÉTER KÖRTESI: *About a divisibility property of integers*

While teaching mathematical induction in a secondary vocational school, one of the students, Attila Nemes has “discovered” the following interesting property, if a number of the form $(n+1)p-np$ is divided by 3 the remainder always will be a multiple of 3 plus 1. I have shown him the proof, he got disappointed, but continued his “investigations” using a pocket calculator. We worked similarly about three-four weeks, discovering, and making up the proof of some properties, which are equivalent to the so called Fermat little theorem. Many years later, when working with a so called Self Made Mathematics Group at the University of Miskolc, with one of my students there, Attila Forgács we tested the validity of the statement with Maple, and “discovered” further properties, and recently, when preparing a seminar on computer algebra I did take the same example, and “found” further generalisation. I would like to present the story of this problem.

KATALIN MUNKÁCSY: *Hands-on history in mathematics teaching*

It is important to show for the socially disadvantaged pupils that learning of mathematics is important and interesting. We want to show for everyone the meaning and significance of some mathematical concepts. We connect the teaching history of mathematics and hands-on activity, in the frame of “teaching mathematics using historically-motivated physical objects”. In my planned reading I would like to show using the real objects and also mathematics software. I will show to portable ancient egyptian sundial and “How can we draw on hyperbolic plane by the help of Bolyai software?”. Because of rich mathematical and cultural background of these topics they can be used from the age of 10 until university level.

ILONA OLÁHNÉ-TÉGLÁSI: *SoNetTE - online courses for teachers*

For teachers-in-practice it is essential to train themselves continually, getting to know new methods and researches in their subjects. Nevertheless it often

occurs that they have no chance or not enough time to join the courses of universities and pedagogical institutes. The SoNetTE - Social Network inTeacher Education - project would like to give aid to solve this problem with the support of the European Union’s Lifelong Learning Program. The website developed by a consortium of 8 European universities offers online courses for teachers, student teachers and researchers in different subject groups. In my lecture I’d like to show the present course offers of the partner institutes, the online surface and the advantages of online courses.

ERIKA PERGE: *Colour sensitivity and space vision development of engineering students*

In the course our education activities we should place great emphasis on the development of engineering students’ skills, which are required for learning and practicing their profession at a high level. My presentation will recommend colour sensitivity and space vision development tools, methods and software applied at the Department of Basic Technical Studies, Faculty of Engineering of the University of Debrecen for refreshing pedagogical practices and improving their efficiency.

DUŠKA PEŠIĆ: *Visual modelling in teaching the concept of a continuous function*

Visual approach in teaching and learning the epsilon-delta definition of continuity is focused on the reinforcement of mathematical skills and deepening students understanding of concept of continuity. This mathematical model is used as means to develop specific mathematical knowledge of students in mathematical high schools by building on student’s prior understanding. It is also aimed to the cultivation of mathematical ingenuity and creativity by gradual and systematic guiding through the complexity of this demanding concept.

ILDIKÓ POMUCZNÉ-NAGY: *The necessity to include mathematical problem solving in the education of future primary school teachers*

At the beginning of the school year 2014/15, I have conducted a research with the first year students of the Teacher Training Faculty at the College of Kecskemét. I have asked students to solve a list of basic primary school level mathematical problems. With this, I would like to assess the elementary level mathematical problem solving capabilities of these students. I have categorised the results based on the problem solving methods of these students in both correct and incorrect cases, and also based on how successful their methods were. In my presentation I would like to not only introduce the effectiveness of the methods used, but to show and summarise the individual answers, the reasoning behind

the answers and the argument methods applied by the students. The goal of my work is to point out the need for an improvement in the mathematical education of teacher students, especially in their mathematical problem solving.

BRANKA RADULOVIĆ - MAJA STOJANOVIĆ: *Instructional effectiveness of teaching methods in physics - the case of unit Capillarity*

The use of different teaching methods has resulted in different quality and quantity of students' knowledge. For this reason, it is important to constantly review the teaching methods and applied most effectively. One way of determining instructional efficiency is by using cognitive load and student achievement. Cognitive load can be generally defined as a requirement for working memory resources that are needed to meet the goals of the cognitive activities in certain situations. So, the aim of this study is examining the instructional effectiveness of two teaching methods that are commonly used in teaching physics in the Republic of Serbia.

MARIJA RADOJIČIĆ - SLAVIŠA RADOVIĆ - DUŠAN DŽAMIĆ - MIROSLAV MARIĆ: *The influence of technology in inclusive learning: Platform “Završni ispit”*

Inclusive education is very specific in comparison to regular classes. Conditioned by the pupils' abilities, it requires special planning and implementation. In addition to the obstacles in the form of limited abilities of pupils, there is a problem of a lack of pupil's motivation. One way to motivate these pupils is the use of ICT resources and tools. This talk use example of final exam and gives a reason for making of educational software in order to make better educational environment and opportunities both for pupils and teachers. Within the talk will be discussed learning with educational platform “Završni ispit”, which main objective are making same opportunity for all pupils in preparing for the final exam at the end of eight years of primary education. Learning with platform is adapted to pupils needs, so that pupils with developmental disabilities can focus on solving a problem in task, not only on the mechanical interpretation skills. Pupils are able to achieve interaction with peers using a common platform as an aid to learning.

KATALIN RICHLIK-HORVÁTH: *Our responsibility in school education*

The goal of the school education to develop student's competencies. Who can only understand the level you want it sent to that new ideas are. Interdisciplinary curriculum is represented by the NAT. How it takes place on a daily basis? It can cause stress the uncoordinated school education? How the students feel satisfied?

GYÖNGYI SZANYI: *The investigation of students' skills in the process of function concept creation*

Function is the basic concept of Mathematics, more particularly, the Mathematical Analysis. With the appropriate development of function approach it becomes possible for the students to use function models to describe mathematical and non-mathematical problems. After the analysis of the function concept development process, as a part of a mathematical research, build on the van Hiele levels I investigated the rule-following and rule recognition skills of 6th form students (12-13 years) participating in the Ukrainian and Hungarian secondary education. I describe the results of the study in my lecture.

IBOLYA SZILÁGYINÉ-SZINGER: *The Role of Activity in Teaching Axial Reflection and Symmetry*

The basis of learning geometric transformations, thus axial reflection as well is inductive cognition based on gaining empirical knowledge. Starting out from the concrete and gathering experience from various activities, such as folding, clipping, drawing, and the use of mirror will finally lead to the formulation of general relationships. In the junior classes pupils observe the reflected image of different geometric figures in space and plane by using plane mirror by gaining experience in a playful way. They construct reflections of geometric solids and they produce the reflections of simple plane figures and axial reflections by means of folding, clipping and drawing. Activities have an equally important role in teaching axial reflection in junior high school as well. Producing axially reflected shapes is possible in several ways: by means of moving, using transparent paper and drawing on grid and by construction.

ARPAD TAKAČI: *Mathematical modelling and simulation in teaching*

We present the introduction of mathematical modelling process and simulation and its application for education. We analyze several mathematical models and their simulations by using the Anylogic program, including population dynamic, Malthus and Verhulst, Lotka Volterra, pilot ejections alcohol models, bouncing ball, Heart model and others.

DJURDJICA TAKAČI - GORDANA STANKOV - IVANA MILANOVIC: *Efficiency of learning environment using GeoGebra when calculus contents are learned in collaborative groups*

In this talk we present a modern approach of teaching mathematics based on the computer supported collaborative learning (CSCL) of calculus contents. The collaborative learning was used in calculus course at the University of Novi Sad,

Serbia, for examining functions and drawing their graphs. In 2012 the authors decided to improve the collaborative learning introducing GeoGebra application. Small four member groups were formed by using Kagan’s (1994) principles. Two groups of students, the experimental, and the control one were observed. The students in the experimental group learned with the help of GeoGebra, and the students in the control group learned without using GeoGebra.

BETTINA TÓTH: *Modeling competency and steps of modeling*

The word ‘modeling’ is certainly familiar for all, and it also bears a different meaning for everyone. In my presentation I will talk about a chosen interpretation of mathematical modeling, and about the components of modeling competency. I will present the case study related to the aforementioned competencies, which was carried out in an eight-grade secondary school. Students of the school have solved modeling tasks in a way that they have not encountered similar exercises beforehand. I will talk about the most commonly chosen solving methods, and about typical errors, deficiencies as well.

ADRIENN VINCZÉNÉ-VARGA: *Software techniques in engineering computations*

It is natural to use free mathematical software packages in engineering computations. The typical capabilities are numeric and symbolic computations, algebraic, trigonometric and matrix functions, graphics capabilities, conditional programming, flexible and easy to use interface. From the viewpoint of mathematical education of engineers we are also motivated to pique our students’ interest in free mathematical software packages. At the Department of Basic Technology Skills (Faculty of Engineering, University of Debrecen) a special material has been developed to propagate the use of such tools as one of the up to date competencies in many areas of science, technology and engineering. The talk is devoted to present a preview of Software techniques in engineering computations.

List of abstracts of posters

TÜNDE KÁNTOR: *Documents to the life and career of György Maróthi (1715-1744)*

The aim of this poster is to present original documents concerning Maróthi’s life and career. In the new and easy available documents (Websites, Wikipedia, lexicons) sometimes we find false information. For a long time the date of Maróthi’s birth was not known exactly. Therefore some books mentioned only

the year of his birth (B. Szénássy). Owing to an error of Márton Sain nowadays in many sources we find a false date (18.06.1715) instead of the correct one (11.02.1715). The works of Béla Tóth and Béla Jausz are correct. We shall present the following documents: Nomina Infantum (11.02.1715), the cover of Arithmetics of Debrecen (1577), the covers (1743, 1763, 1782) and some parts of Maróthi’s Arithmetics (Foreword and modeltasks).

CSABA KÉZI - IMRE KOCSIS - GUSZTÁV SZÍKI - ADRIENN VINCZÉNÉ-VARGA - ATTILA VÁMOSI: *Software techniques in engineering computations*

It is natural to use free mathematical software packages in engineering computations. The typical capabilities are numeric and symbolic computations, algebraic, trigonometric and matrix functions, graphics capabilities, conditional programming, flexible and easy to use interface. We are mainly interested in numerical computations. The problems we are going to solve are typical in engineering education. They allow us to compare the tools of different software packages in practice.

KATALIN MUNKÁCSY: *The international project: MiMa*

ELTE’s centre of teaching mathematics takes part in an international study. The name of the program comes from the abbreviation of the English title, Mathematics in the Making. With mathematics didactics researchers of England, Portugal, Italy and Germany we examine how to teach mathematics by hands-on activity and we use some elements of fine art. We are waiting for your questions, notes, suggestions.

RITA NAGYNÉ-KONDOR - GUSZTÁV SZÍKI: *Motivating learning in Engineering Mechanics and Mathematics with GeoGebra*

Why it is so important to learn mathematical methods and concepts, and where and how they can be applied? Using engineering and Dynamic Geometry applications in teaching Mathematics (and applying our course book “Mathematical tools in engineering applications”) makes the connection between mathematics and the special engineering subjects clearer for the engineering students. Besides their use in education the GeoGebra applications can be useful tools in different engineering fields like dynamic model calculation of alternative drive vehicles, useful help for example for designers of pneumobiles.

ERIKA PERGE: *“SZÍN-Játék” program element - Playing with colours*

The Department of Basic Technical Studies, Faculty of Engineering of the University of Debrecen launched series of events for high school students. “SZÍN-játék” (Playing with colours) programme is a part of this series of events. “SZÍN-Játék” programme element was realized in the framework of “TÁMOP-4.2.3-12/1/KONV-2012-0048 Acknowledgement and dissemination of scientific achievements by the researchers, teachers and students of the University of Debrecen” project. The aim of this programme element is to provide comprehensive knowledge about colour theories and their applications by using colour paints, colour light and our Colour Theory multimedia training. Our training tool is recommended for engineering and arts students of high schools and universities.

MARGIT VÉGH: *Questionary of area calculation*

In addition to an effective solution the quality of thinking also is important, as well as the fact that the students should be motivated to work on the problems. The aim of my poster is to present the questionary I applied for VII grade students and to analyze the typical errors.

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