

ABSTRACTS OF ALL SESSIONS

Note: Abstracts are ordered by submission number (under type of session)

PLENARY TALKS

THE COORDINATED AND SYSTEMATIC USE OF DIGITAL TECHNOLOGIES TO FOSTER, REFINE AND EXTEND STUDENTS' PROBLEM SOLVING EXPERIENCES

Manuel Santos-Trigo

Abstract: Mathematical problem solving is, has been, and will continue to be a prominent and evolving research and practice domain in mathematics education worldwide. What does it mean for students to engage in problem solving activities? What are the common problem solving principles that support and guide students' development of mathematical competences? What tasks are important to promote students' problem solving experiences? To what extent the students' coordinated use of different digital technologies offers them affordances and opportunities to represent, explore, and solve mathematical tasks? I will address these types of questions presenting and discussing exemplars to illustrate how both multiple purpose and ad hoc technologies can be used to frame, foster, and promote students problem solving approaches. In particular, I will characterise ways of reasoning that emerge during the construction and exploration of dynamic models of mathematical tasks.

TRADITIONAL MATHEMATICAL PROBLEMS UNRAVELLED WITH UNTRADITIONAL TOOLS: HINTS FROM THE PROBLEM@WEB PROJECT

Susana Carreira

Abstract: The fact that using digital technologies for tackling mathematical problems has a transformative effect on the nature of problem solving has been emphasised by many researchers in mathematics education. But how such transformation takes place in the solving of mathematical problems is still vague. At the same time we are witnessing the growing impact of digital technologies in the lives, activities and daily forms of communicating and accessing information of the young generation. They are seen as fluent in the use of digital tools, and their familiarity with such tools is increasingly common. What we still need to realise is the extent to which they take advantage of commonly available technological tools to engage in mathematical problem solving. The Problem@Web project gave us an opportunity to address this question by looking at children involved in two online mathematical competitions – the SUB12 and the SUB14. In this talk I will bring the idea of solving-and-expressing as a fundamental unity for examining the role of technologies in the ways students *see* the solution to a problem and *express* it with digital media.

TECHNOLOGY TO THINK AND FEEL WITH

Nathalie Sinclair

Abstract: Beginning with Papert, mathematics educators have acknowledged that the power of digital technologies in mathematics learning involved both cognitive and affective dimensions of experience. While many researchers who study the use of expressive technologies care strongly about the affective dimension, their papers and articles tend to focus on the cognitive - often with only a footnote or concluding remark on the students' pleasure or excitement. In this talk, I will discuss some of the challenging of doing research that adequately addresses the affective dimension of students' and teachers' experiences with expressive technologies, and then present some new theories that could support this work. Using examples of research involving young children engaging with TouchCounts, I will illustrate how these theories can provide insight into the way students make mathematical sense.

FROM TECHNOLOGICAL INNOVATION IN INDIVIDUAL MATHEMATICS CLASSROOMS TO LARGE-SCALE TRANSFORMATION OF TEACHING PRACTICES – MIND THE GAP!

Alison Clark-Wilson

Abstract: The ICTMT conference proceedings chart the development of technology use in mathematics education from the late 1990s to the current day. Throughout this period, the prevailing topics for plenaries, papers and workshops have been focused on the development of innovative classroom practices involving 'new' technologies. Alongside this, there has been a slow but emergent theme that has brought aspects of teachers' professional development to the fore - as attempts to scale the widespread use of technology by students have proved both challenging and expensive. In this plenary, I will draw on some key contributions to ICTMT conferences from the past in order to highlight some recurring themes that might inform future directions for our mutual endeavours. I will conclude by suggesting some essential design features of technology focused professional development for teachers of mathematics, which have been informed by work on the Cornerstone Maths project in England.

PAPER PRESENTATIONS

6. GETTING MATHEMATICS TEACHING UP TO SPEED WITH THE BLOODHOUND SUPERSONIC CAR

Michael McCabe and Surak Perera

Abstract: The Bloodhound Supersonic Car (SSC) attracted considerable attention as a show-piece of ICTMT10. Four years later the car is nearing completion ready for its initial trials in early 2015. Later in the year it will be taken to South Africa, where it is planned to reach supersonic speeds and break the existing world land speed record. By 2016 the intention is achieve a speed in excess of 1000mph. The primary objective of the Bloodhound project is to inspire the next generation with science, technology, engineering and mathematics. In this paper it will be explained how, just like the car itself, mathematical modelling of the car's motion can be progressively brought up to speed. Algebraic and numerical solutions to the equation of motion, with and without the use of technology, strongly motivate mathematical techniques studied at different university levels.

7. PARCING OF FUNCTIONS USING MATHEMATICA AND ITS APPLICATION FOR TEACHING OF DIFFERENTIATION

Valerii Nikishkin and Evgenii Vorob'Ev

Abstract: Computer algebra systems (CAS) are an important component of Information and Communication Technologies (ICT), which turned into a constituent part of education. In this paper, the didactics of application of Mathematica and its Internet version web Mathematica for teaching students the art of differentiation is considered. Mathematica ideally suits to the developing skills of differentiation. The reason for this is that a mathematical formula, which defines the elementary function of calculus, is a special case of a Mathematica expression. There is a command in Mathematica that identifies the syntactic structure of expressions and presents it in a form of a tree. This greatly simplifies differentiation and makes it easy to learn.

8. RIEMANN INTEGRAL: DIDACTICAL MEDIATION WITH GEOGEBRA SOFTWARE ARTICULATED WITH USUAL PRACTICES WITH 1ST YEAR GRADUATE STUDENTS IN MATHEMATICS TEACHING

Pedro Mateus

Abstract: In the article we present the results of an experimental teaching aiming to answer the question: how effective is a didactic mediation of concepts on Riemann integral, using GeoGebra software, articulated with usual practices, by students, based on their mobilized and available retrospective knowledge? The goal was to experiment a teaching and learning modes of the Riemann integral of real functions of a real variable, using GeoGebra software as instrument, articulated with usual practices. The study was based in Anthropological Theory of the Didactic - TAD by Chevallard and theory of instrumentation by Rabardel. It was a qualitative study in the form of case study, having appealed to some aspects of didactic engineering: design and a priori analysis of tasks; a posteriori analysis and internal validation. The experiment showed that the blended computer and usual practices processes promote construction of knowledge by students to the Riemann integral.

9. GUIDING STUDENTS INSTRUCTION WITH AN INTERACTIVE DIAGRAM: THE CASE OF EQUATIONS

Elena Naftaliev and Michal Yerushalmy

Abstract: The present study focuses on a specific class of interactive text called Guiding Interactive Diagrams (GID) and specifically on the functions of the boundaries designed to guide student's explorations. We report on an experiment in which 14- and 15-year-old students were challenged by an interactive task. The study provides evidence about the guidance's role and the control over the exploration that guiding interactive text grant to students engaged. Following Vygotsky's and Piaget's cognitive and social constructivism, we argue that in forming mathematical concepts students' exploration begins with spontaneous ideas relating to the context of the task, which they then develop with guidance supported by the design of the interactive text. To educators, who are challenged by the design and the implementation of interactive mathematics instructional materials, the study offers ways and terms to think about designs that limit the student's action and so support guidance, and at the same time remain an open space for student ideas.

10. REAL AND VIRTUAL HELIXES FOR THE INTRODUCTION OF TRIGONOMETRIC FUNCTIONS

Hitoshi Nishizawa, Wataru Ohno and Takayoshi Yoshioka

Abstract: The helix as a three-dimensional (3D) structure unites two different visual representations, a vector rotating around a unit circle and a sinusoidal wave; it has the potential to guide slow learners to understand the relation of trigonometric functions and their graphs, providing those learners with more intuitive and meaningful learning. However, the 3D object was difficult to draw on paper or chalkboard, thus difficult to use as learning material in actual lessons. In this study, the authors tried to examine the effect of using real and virtual 3D objects, which could be observed from different viewpoints and manipulated by students, especially

on understanding phase shift of a sine curve. A student group scored higher on a paper test of drawing a graph of sine curve after the introductory activities of observing and handling real and virtual helices. Further studies would be needed to confirm the effectiveness.

12. A VISUALIZAÇÃO DE VALORES MÁXIMOS E MÍNIMOS DE FUNÇÕES DE DUAS VARIÁVEIS / VISUALIZATION OF MAXIMUM AND MINIMUM VALUES OF FUNCTIONS OF TWO VARIABLES

Katia Ingar and Maria José da Silva

Abstract: This article is focused in extending the study of Duval in order to analyze the content of a graphic register of functions of two variables, that is to say, to study the visualization of mathematical objects represented in a R^3 Cartesian system, especially the visualization of maximum and minimum values of functions of two variables. We highlight the study of visual variables in the graphic register in R^3 because the visualization requires starting the chart reading for some visual values that indicate the characteristics of the represented phenomenon and thus relate them to theorems, which are presented in another register. This is why we propose the following question: how to discriminate visual variables in the graphic register of a function of two variables in order to understand the idea of maximum and minimum local values? In order to distinguish the visual variables in that graphic register, we make use of the CAS Mathematica since it constitutes an important means to visualization of the maximum and minimum local values.

13. THE CHALLENGE FOR MATHEMATICS TEACHER EDUCATORS: LEADING STUDENTS TOWARD TEACHING IN A TECHNOLOGICAL ENVIRONMENT

Irina Gurevich and Dvora Gorev

Abstract: The purpose of our research was to learn how pre-service teachers [hereunder – "students"] who studied as school pupils without technological tools adopt technology in their teaching. The research population consisted of 20 students from two academic years. All the students participated in two courses, a didactic course "Teaching Mathematic" and a pedagogy course. During the didactic course the students were asked to present their lesson plans that included usage of any technological tool, while during the pedagogy course the same students have been encouraged to use those tools in their teaching. In both courses the students were required to specify the added value, i.e. leading to qualitative changes in teaching of the mode of using the chosen technological tool. We found, that the students integrated various technological tools, like digital presentations and dynamical mathematical software in their lesson plans as well as in their practical teaching. We also found that the students, at earlier stage of their education, believed that the integration of technology could enhance their pupils' learning while at more late stage they realize the benefits of using technology for stimulating pupils' interest in learning as well as in more effective lesson planning.

16. TECNOLOGIAS DA INFORMAÇÃO E EDUCAÇÃO MATEMÁTICA / INFORMATION TECHNOLOGY AND MATHEMATICS EDUCATION

Celina Abar

Abstract: This work aims to discuss the process of integration of technology by the teacher of Mathematics according to the model of Innovation from Rogers (2003). This author presents concepts and explanatory categories, which may help understand the elements present in the process by which the teacher goes through from his contact with the initial idea of teaching with the use of information technology, IT, until his confirmation or not of adopting this proposal in his work. Thus, it is necessary an understanding about innovation and educational innovation, which implies an incursion on technological innovation and, ultimately, on the training of the teacher in face of a new pedagogical practice. The model of Rogers (2003) reveals itself as an important contribution to an understanding of the many variables that can play a role in the inclusion of technologies in the pedagogical practice.

19. A INFLUÊNCIA DO REGISTRO FIGURAL SOFTWARE GEOGEBRA NA APREENSÃO OPERATÓRIA E NA PESQUISA HEURÍSTICA DE FIGURAS / THE INFLUENCE OF THE FIGURAL RECORD GEOGEBRA ON OPERATIVE APPREHENSION AND HEURISTIC EXPLORATION OF FIGURES

Mariana Moran, Valdeni Franco and Karla Lovis

Abstract: This article discusses the influence of GeoGebra software in the operative apprehension and heuristic exploration of geometric figures through the solving of geometry problems. GeoGebra can be considered as a figural record according to the Theory of Registers of Semiotic Representations by Raymond Duval. In this article, we present a theoretical discussion about possible changes in figural records and show the results of a survey performed with some mathematics teachers of Basic Education, from southern Brazil, on the influence of this software on the reconfiguration operation of geometric figures. We concluded that, while solving math problems that come with the visual support of illustrations, GeoGebra software offers best contribution regarding operative seizures and heuristic potential of figures compared to other types of figural records.

20. FORMAÇÃO CONTINUADA PARA PROFESSORES E ACADÊMICOS: O ESTUDO DA GEOMETRIA EUCLIDIANA POR MEIO DO SOFTWARE GEOGEBRA / TEACHERS' AND UNDERGRADUATES' CONTINUING FORMATION: THE STUDY OF EUCLIDEAN GEOMETRY WITH GEOGEBRA

Karla Lovis, Maiara Lunkes and Mariana Moran

Abstract: Current discussion underscores the results provided in a university extension project on the teaching of Geometry by software GeoGebra. Eleven undergraduates from the Math course and 9 teachers from the high school participated in the project. The project's final suggestion was the implementation of activities involving Geometry and GeoGebra. It should be emphasized that no teacher took part in this stage due to wariness in the use of the computer and software. In most cases the teachers did not remember the concepts of the matter under analysis, whereas the undergraduates had fewer difficulties in this matter. It should be underlined that the development of the project was basic to show the need for more in-depth knowledge in Geometry and the use of other technologies. The project made possible favourable experiences for the undergraduates' teaching formation.

21. FLUÊNCIA NO USO DE TECNOLOGIAS DIGITAIS: UMA INVESTIGAÇÃO COM PROFESSORES DE MATEMÁTICA DO ENSINO BÁSICO / FLUENCY IN DIGITAL TECHNOLOGIES: AN INVESTIGATION WITH MATHEMATICS TEACHERS OF BASIC EDUCATION

Gerson Oliveira

Abstract: This paper reports a qualitative research that has as subjects a group of public basic education teachers in a process of continuing education in the state of São Paulo (Brazil). The research proposed the development of constructions that would be answers to mathematical problems using SuperLogo and GeoGebra software. Those constructions were related to themes like "construction of regular polygons" and "trigonometric relations in right triangle." The theoretical framework of this initiative includes elements of the theory of didactic situations and theory of technology use cycle in mathematics education. The analysis of the proposals submitted by the participants allowed us to establish an important link between mathematical knowledge of the teacher and fluency in the technologies employed from the exploration of the dynamic nature of the interfaces.

22. ENHANCING LEARNERS' GEOMETRICAL THINKING THROUGH LESSON STUDY USING GSP

Shafia Abdul Rahman and Lilla Adulyasas

Abstract: Geometry and hence, geometric thinking continue to be one of the problematic for learners. This study employed quasi-experimental and case study research design to investigate the effects of Lesson Study incorporating Phase-Based Instruction (LS-PBI) using GSP on Thai students' geometric thinking. Three groups of mixed ability Grade 7 students (aged 12 – 13) were chosen as participants in one of the schools in Yala Province, Thailand. These groups (Group 1: N = 30, Group 2: N = 28 and Group 3: N = 29) were taught the topic of Properties of 2D and 3D shapes in turn by three different teachers. Pretest and posttest were used to assess students' geometric thinking. Findings revealed that LS-PBI using GSP was effective in enhancing students' geometric thinking. There was a significant difference in the pretest and posttest scores in each group and there was a significant difference in the posttest scores among the three groups of students. This suggests that LS-PBI using GSP was effective in enhancing students' geometric thinking.

23. THE USE OF HANDWRITING RECOGNITION TECHNOLOGY IN MATHEMATICS EDUCATION: A PEDAGOGICAL PERSPECTIVE

Mandy Lo, Julie-Ann Edwards, Christian Bokhove and Hugh Davis

Abstract: In mathematics education, the lack of an intuitive means to enter mathematics expressions online has been a major barrier to effective communication, causing mathematics to be lagging behind in the development of online collaborative learning environments. This study evaluates the use of handwriting recognition technology as a potential solution from a pedagogical standpoint. With pedagogical needs in mind, a new handwriting recognition user-interface (MathPen) was developed as a research tool to investigate the teaching and learning perspectives through a) an expert review with practising teachers, and b) a usability study with undergraduate students.

25. GUMMI(D)NG UP THE WORKS? LESSONS LEARNED THROUGH DESIGNING A RESEARCH-BASED "APP-TUTOR"

Brent Davis

Abstract: Like many information technologies in recent history, including motion pictures and television, tablets and other "smart" interfaces are regarded by some commentators as solutions to persistent difficulties of school mathematics. These difficulties include personalization of learning, continuous formative assessment, genuine problem solving, bodily engagement, and simultaneous presentation of multiple interpretations of concepts. I report on such matters in the context of my own on-going involvement in the development of an app tutor intended to be attentive to these and other difficulties. I highlight that such technologies may not so much "solve" problems as "reconfigure" them.

26. PERSPETIVAS DE PROFESSORES DE MATEMÁTICA SOBRE O USO DE COMPUTADORES NAS PRÁTICAS DE ENSINO / MATH TEACHER PERSPECTIVES ABOUT COMPUTER USE IN TEACHING PRACTICES

Elieil Silva, José Fernandes, Bento Silva and Maria Raquel Morelatti

Abstract: This article describes some results of a research carried out in schools in the city of Braga, located in northern Portugal, on the use of computers by mathematics teachers in their classes. Based on data collected through a questionnaire, considerations are presented on this use according to the perspectives of 44 teachers participating in this research. The results show that most of the teachers surveyed (84.1%) integrates the computer in their teaching practices, while few (15.9%) did not use it. Show up, too, the prospects of these teachers on this integration to their teaching practices, indicating advantages, disadvantages and the reasons for the use of computers in their classes. The results demonstrate the satisfaction of these teachers with the use of computers in their teaching practices, recognizing the relevance of such use.

27. WHY BUTTONS MATTER, SOMETIMES - HOW DIGITAL TOOLS AFFECT STUDENTS' DOCUMENTATIONS

Florian Schacht

Abstract: The language that students use for documenting their solutions, ideas and actions is influenced by their use of digital tools. This paper reports on a study on how students' language changes when working with digital tools. Linguistic categories were empirically developed in order to describe the language that is used, e.g. buttons, commands or expressions referring to the operating system. The qualitative analysis of examples discussed in this paper shows the role of describing varieties when students document their actions, e.g. when referring to buttons. The discussion reflects on two referential units that documentations refer to, namely the digital tool itself and mathematics. Based on the analysis of different examples, specific situations will be discussed, in which different describing varieties might be appropriate. On that basis, the normative question of adequacy of documentations can be approached from an empirical perspective.

28. DESIGNING INTERACTIVE REPRESENTATIONS FOR LEARNING FRACTION EQUIVALENCE

Alice Hansen, Manolis Mavrikis, Wayne Holmes and Eirini Geraniou

Abstract: This paper describes a study that investigated the use of a tool in an exploratory learning environment (ELE) designed to support students' understanding of equivalent fractions. The study, part of a larger project, involved 67 9-11 year old students in England. It addressed the question: How does a partitioning tool support students' conceptual understanding of equivalence? Data were collected through observations, students' written work in an equivalence task, and a written self-reflection on learning at the end of their time in the ELE. Results showed that using the partitioning tool with an area representation was instrumental in challenging some students' preconceived ideas about equivalent fractions and that the students were able to develop situated abstractions about fraction equivalence.

29. FROM AN INTUITIVE-ORIENTED TO A CONTENT-ORIENTED UNDERSTANDING OF THE BASICS OF CALCULUS

Hans-Georg Weigand

Abstract: In recent decades, the approach to calculus in mathematics classrooms has changed: a quite formal approach—closely linked to the teaching of calculus at university and based on the sequence concept—has been transformed to an intuitive access to the concepts of limit and derivative. Nowadays empirical investigations with freshmen at the university show that knowledge and beliefs even of mathematics students stay on an intuitive level concerning the basic concepts of calculus. This is not a good basis for mathematics thinking at university science level. This talk is on the one hand a theoretical consideration concerning the basic concepts of calculus, the concept of limit and the concept of derivative. On the other hand it gives a strategy for a discrete access to calculus which can be seen as a content-oriented access to the basics of calculus.

31. MULTI-REPRESENTATIONBASED OBJECTIFICATION OF THE FUNDAMENTAL THEOREM OF CALULUS

Osama Swidan

Abstract: This study was designed to elaborate learning trajectory for the fundamental theorem of calculus. The learning trajectory is based on the structural decomposition of the fundamental theorem of calculus, and on tasks to be learned with multiple representational technology-based artefacts. The study was guided by the objectification theory, which considers learning as a matter of actively endowing the conceptual objects made available by the artefact with meaning. The analysis of the data identifies the foci involved in the elaborated learning trajectory.

32. CATO - A GUIDED USER INTERFACE FOR DIFFERENT CAS

Hans-Dieter Janetzko

Abstract: CATO is a new user interface, developed by the author as a response to the significant difficulties faced by engineers and students in their sporadically usage of CAS, written in Java. The usage of CAS in

mathematical lectures should be normal. But if the students have the mathematical lecture only one or two times the week, how they could follow the usage of CAS? How they could follow, when the lecturer has to use two different CAS? The author has developed a guided GUI which translated commands into the languages of different CAS. His intension was an intuitive operability for CAS. For example commands with more than one parameter has their own input windows with commentated input rows for every parameter. So the surface CATO orders the parameters uses the right brackets and separators. The author demonstrated the usage of CATO with Maxima and with the Math. Toolbox of MATLAB.

35. IMPROVEMENT OF GIFTED STUDENTS' VISUALIZATION ABILITIES IN A 3D COMPUTER ENVIRONMENT

Clara Benedicto, César Acosta, Angel Gutiérrez, Efraín Hoyos and Adela Jaime

Abstract: We present the software Cubes & Cubes, designed to help improve students' visualization abilities. It presents tasks asking to draw the orthogonal projections of given sets of stacked cubes, or asking to build a set of stacked cubes corresponding to given orthogonal projections. This software allows teachers to pay differentiated attention to their pupils, in particular to mathematically talented students. We describe the strategies used by some mathematically talented students to solve tasks posed by Cubes & Cubes, and we analyze their outcomes in terms of the amount of cognitive demand of their strategies.

36. YOUNG CHILDREN'S ANGLE SIZE ESTIMATION IN DYNAMIC GEOMETRY ENVIRONMENT

Harpreet Kaur

Abstract: This paper examines young children's thinking about angle size in a dynamic geometry environment during angle estimation tasks. Children used two types of routines frequently, firstly comparing angle measure with position of clock hands, and secondly repeating a small turn over and over in order to get to a bigger turn. Findings suggest that children used internal and external referents for angle size estimation. Children's gestures, motion and environment played an important role in their thinking.

37. HOW CAN TECHNOLOGY SUPPORT EFFECTIVELY FORMATIVE ASSESSMENT PRACTICES? A PRELIMINARY STUDY

Monica Panero and Gilles Aldon

Abstract: Formative assessment is a process that can inform both teacher and student of their understanding of knowledge at stake. Technology allows to get data, to arrange them and to share them. The FaSMEd project aims to study the effective role of technology within a formative assessment process. This paper presents a preliminary case study allowing to better understand how the teacher processes data from students using technology (i.e., tablets, student response system, IWB) and how he uses them to inform his teaching.

38. TEACHING MATHEMATICS WITH AN INTELLIGENT SUPPORT. A STUDY WITH PARAMETERIZED MODELING ACTIVITIES

Teresa Rojano and Montserrat García-Campos

Abstract: We report outcomes from a study that aims to investigate the role of feedback, by way of an intelligent support system, in parameterized modeling activities carried out by a group of tertiary education students. With such a system it is possible to simultaneously display on a computer screen a chat window and a window with a microworld, dynamically hot-linked to each other. While users work in the microworld, they can enter into dialogue with the system in natural language. In this paper we discuss the case of one pair of participant students, for whom the feedback provided by the intelligent support and by the microworld at key moments of the modeling activities were crucial for them to be able to build up a spreadsheet model and consequently, for their understanding of the long-term behavior of the phenomenon being modeled.

41. EXPERIÊNCIA DE FORMAÇÃO CONTINUADA DE PROFESSORES: USO EDUCACIONAL DE TABLETS PARA ENSINAR MATEMÁTICA NOS ANOS INICIAIS / EXPERIENCE OF CONTINUING TEACHER EDUCATION: TABLETS FOR EDUCATIONAL USE TO TEACH MATHEMATICS IN THE INITIAL YEARS OF PRIMARY SCHOOL

Marli Teresinha Quartieri, Maria Madalena Dullius, Lucy Alcântara, Italo Neide, Adriana Bergmann and Neiva Althaus

Abstract: This work presents partial results of an action research in progress, which aims to investigate the integration of technological resources, especially tablets, in the practice of teachers who teach Mathematics in the Initial Years of Primary School. To achieve this goal is being offered a continuing education course, whose didactic sequence is based on the exploration and problematization of educational activities using computational applications in tablets, and in the experience of teachers. In this report are socialized some educational activities that are being developed with the use of the application "Dessiner les formes", which allows the teaching of geometric shapes for the Initial Years of Primary School. The main results are that the participants are feeling safer to integrate tablets into their pedagogical practice, and that they believe in the productivity of this tool in the teaching of Mathematics.

42. SAMING, REIFICATION, AND ENCAPSULATION IN DYNAMIC CALCULUS ENVIRONMENT

Oi-Lam Ng

Abstract: This paper discusses the use of dynamic geometry environment (DGE) for facilitating three Sfardian processes for creating new discursive objects: saming, reification, and encapsulation. In particular, I provide an analysis of communication about a DGE sketch involving three high school students who had been enrolled in a calculus course where DGEs were consistently incorporated into the lessons. Findings suggest that the students used a combination of saming, encapsulation, and reification for exploring calculus ideas. Moreover, encapsulation was needed in order to develop an object-level discourse around the area-accumulating function. This paper raises implications about teaching mathematics with technology, particularly by attending to communications and changes in communications about functions as an ordered pair and a graph.

44. O SOFTWARE MATHEMATICA COMO APOIO AO ENSINO DE CÁLCULO I EM CURSOS DE ENGENHARIA / THE MATHEMATICA SOFTWARE AS A SUPPORTING TOOL FOR TEACHING CALCULUS I IN ENGINEERING COURSES

Elisângela Pavanelo and José Silvério Germano

Abstract: The main objective of this work is to present the results of an experiment related to the use of new technologies, experienced at the Calculus I discipline of the Engineering Course at ITA (Technological Institute of Aeronautics). Initially, key issues in the current learning process were identified and it was found that such difficulties are not exclusive to the Brazilian reality. Since the use of new technologies can contribute significantly to the learning process in higher education, key aspects of such approach were identified and the methodology was applied a group of students. We conclude that the new technologies used in a conscious way can contribute to the development of the foundation of mathematical knowledge, engaging the students and stimulating their commitment to the learning process.

45. IMPROVING PROGRESS THROUGH FORMATIVE ASSESSMENT IN SCIENCE AND MATHEMATICS EDUCATION (FASMED)

David Wright, Jill Clark and Lucy Tiplady

Abstract: This paper will report on the ongoing work and progress of the FaSMEd project, which is a design research project, now in the second year of a three year programme. FaSMEd aims to develop the use of technology in formative assessment classroom practices in ways that allow teachers to respond to the emerging needs of low achieving learners in mathematics and science. This international project adapts and develops existing research-informed pedagogical interventions (developed by the partners), suited to implementation at scale, for working with low attaining pupils and transforming teaching. The project aims to: foster high quality interactions in classrooms that are instrumental in raising achievement for low achievers and expand our knowledge of technologically enhanced teaching and assessment methods addressing low achievement in mathematics and science. The project will be producing a toolkit for teachers to support the development of practice and a professional development resource to support it.

47. DIGITAL ASSESSMENT-DRIVEN EXAMPLES-BASED MATHEMATICS FOR COMPUTER SCIENCE STUDENTS

André Heck and Natasa Brouwer

Abstract: Repeated formative, diagnostic assessment lies at the heart of student-centred, assessment-driven instruction, providing students and teacher with a continuous stream of information on the mastery of course topics. When integrated into an e-learning environment, formative assessment can make that information instantaneous, which is a crucial aspect for intelligent feedback in student-centred instruction. A digital mathematics course for computer science students is presented in which repeated formative assessment providing intelligent feedback and learning through worked-out examples have been fully integrated into a mathematics e-learning platform. We give examples of the benefits of this approach and discuss what still needs attention based on data from an intensive four week mathematics course.

48. TEACHERS' SUPPORT OF STUDENTS' LEARNING IN A COLLABORATIVE, DYNAMIC GEOMETRY ENVIRONMENT

Arthur Powell and Muteb Alqahtani

Abstract: We report on a study to understand how teachers' pedagogical interventions influence students' mathematical reasoning in a collaborative, dynamic geometry environment. A high school teacher engaged a class of students in the Virtual Math Teams with GeoGebra environment (VMTwG) to solve geometrical tasks that the research team designed to promote collaboration and mathematical justification. The VMTwG allows users to share both GeoGebra and chat windows to engage in joint problem solving. Our analysis of the teacher's implementation and students' interactions in VMTwG shows that his technological pedagogical content knowledge (TPACK) manifested through his pedagogical interventions and shaped his students' movement between empirical explorations and deductive justifications. This study contributes to understanding the interplay between TPACK, pedagogical interventions, and student movement towards more deductive justifications.

49. TASKS PROMOTING PRODUCTIVE MATHEMATICAL DISCOURSE IN COLLABORATIVE DIGITAL ENVIRONMENTS

Arthur Powell and Muteb Alqahtani

Abstract: Rich tasks can be vehicles for productive mathematical discussions. How to support such discourse in collaborative digital environments is the focus of our theorization and empirical examination of task design that emerges from a larger research project. We present the theoretical foundations of our task design principles that developed through an iterative research design for a project that involves secondary teachers in online courses to learn discursively dynamic geometry by collaborating on construction and problem-solving tasks in a cyber learning environment. In this study, we discuss a task and the collaborative work of a team of teachers to illustrate relationships between the task design, productive mathematical discourse, and the development of new mathematics knowledge for the teachers. Implications of this work suggest further investigations into interactions between characteristics of task design and learners mathematical activity.

51. A CALCULADORA GRÁFICA NA PROMOÇÃO DA ESCRITA MATEMÁTICA / THE GRAPHING CALCULATOR IN THE PROMOTION OF MATHEMATICAL WRITING

Sara Campos, Floriano Viseu, Helena Rocha and José Fernandes

Abstract: Through writing, students express many of their processes and ways of thinking. Since at high school level some of the activities are carried out with the graphing calculator, we intend to investigate the contribution of this resource to promote the mathematical writing in the learning of continuous nonlinear models at 11th grade. Adopting a qualitative methodology, we collected and analyzed the students' writing productions. What they write when using the calculator gives evidence about the information valued (when they sketch graphics without any justification); about the strategies used (when they define the viewing window and relate different menus on the graphing calculator); and about the reasoning developed (when they justify the information given by the calculator and the formulation of generalizations and conjectures validation).

52. WEEKLY ONLINE QUIZZES TO A MATHEMATICS COURSE FOR ENGINEERING STUDENTS

Sandra Gaspar Martins

Abstract: A set of weekly optional online quizzes, on Moodle, was applied to the 104 students of the Multivariable Calculus course (MC). Quizzes were scored up to two extra points to be added if the student scored more than 9 points (out of 20) on the exam. All the students got the same questions (there were not generated different questions). The students could resubmit the answers without penalty. There were usually several sub-questions embedded on each item. This study measure these quizzes effectiveness: students' adherence, the effect on the student's amount of study, the effect on the student's awareness of their own level of understanding, the effect on the outcome scores, and whether the students found it a fair and useful assessment tool. The approval rate highly increased in this semester. This success cannot be directly attributed to the quizzes; however there are some indicators that they gave a positive contribution.

53. TEACHING MATHEMATICS WITH AUGMENTED REALITY

Mauro Figueiredo

Abstract: Low achievement in mathematics education has been an increasing problem in the recent years in Portugal. According to a 2010 study from the U.S. Department of Education, blended learning classes produce statistically better results than their face-to-face. There is also an increasing number of students using smartphones and tablets in schools. Mobile devices gained popularity as an educational tool and there are many schools that used them frequently in educational activities to improve learning. In this paper, we introduce the use of Augmented Reality for providing activities that students can do at home and increase the time they spend learning and practicing mathematics. We present teaching activities that use different augmented reality technologies for presenting solutions to practical problems by multiple types of media, including videos, to be shown on top of interactive documents.

55. O JOGO ONLINE COMO FERRAMENTA PARA AUXILIAR NA RESOLUÇÃO DE PROBLEMAS MATEMÁTICOS / ONLINE GAMES AS TOOLS TO SUPPORT MATHEMATICAL PROBLEM SOLVING

Neiva Althaus, Madalena Dullius and Nélia Amado

Abstract: This work aims at promoting the integration of problem solving and pedagogical use of technological resources in mathematics learning. The research involves 6th graders from three state schools in Vale do Taquari/RS – Brazil. For the study, we carried out a teaching experiment based on the use of the Moodle platform. The research follows a case study methodology, with the purpose of finding the advantages of the use of technology in the problem solving activity. We intend to see how the previous use of digital applets was helpful to the students in the development of a strategy to solve the problems.

56. USING COMPUTER IN TEACHING MATHEMATICS AND ITS EFFECTS ON MOTIVATION AND LEARNING OUTCOMES OF STUDENTS IN A PRIMARY SCHOOL

Andrew Kwok, Brian Cheung and Lawrence Ng

Abstract: The present study investigated the effects of using computer in teaching mathematics. During the period of the experiment, teachers and students used the computer frequently in mathematics lessons: logging on websites on the Internet, playing You-tube video clips by Media Player, using tools in Word to make graphs, generating graph of linear algebraic equations by Excel spreadsheet, and presenting notes and examples with PowerPoint on interactive whiteboard. Results of the research findings are mixed. Some students support the use of computer in learning mathematics, attributing to the vivid and graphical visual representations that motivate them and engage them in learning. However, some students do not like the teacher using computer to teach mathematics because the steps and procedures were repetitive and boring. These students like more opportunities and time to ask questions and interact with the teacher.

61. TEACHING DIFFERENTIAL EQUATIONS USING BLENDED INSTRUCTION

José Gerardo Amozurrutia

Abstract: This is an ongoing project. A group of students of undergraduate level of the School of Mechanical and Electrical Engineering of the National Polytechnic Institute in Mexico City, here in after referred as the School is receiving every week two sessions in a computer room of the school and one in a traditional classroom. Online teaching is based on the Moodle platform. The pedagogical design of the course is based on constructivism and behaviourism and it is supported with Mayer's multimedia learning theory. The findings that have been observed so far show very good results whereas the progress is occurring according to learning plan; however some students are presenting some difficulties moving autonomously due to forgetfulness or lack of knowledge of some Integral Calculus concepts. The research will analyze the effectiveness of educational materials to promote learning.

62. INCORPORATING GAME APP A.L.E.X. INTO EXISTING MATHEMATICS CURRICULA: AN EXAMPLE FROM PRIMARY SCHOOL GEOMETRY

Andreas Kyriakides and Maria Meletiou-Mavrotheris

Abstract: This paper accounts on the main experiences gained from a study which incorporated A.L.E.X., an educational puzzle game available on iPad or Android tablet devices, within the primary school geometry. The study took place in a public primary school in Cyprus. A group of fifteen (n=15) Grade 6 pupils (8 boys and 7 girls; aged 11-12), was randomly selected to consist the sample. The A.L.E.X. application, accompanied with a worksheet, constituted the official medium of teaching. The design of the worksheet was such as to integrate technology with the measurement of the perimeter and area of rectangles. While working with A.L.E.X., children identified and processed geometrical principles that emerged spontaneously. These results concur with those of previously conducted studies which suggest that game apps can be used in the mathematics classroom as the machinery for children to become reflective and self-directed learners.

66. EXPLORANDO SUPERFÍCIES ATRAVÉS DE UM APLICATIVO / EXPLORING SURFACES THROUGH AN APPLLET

Paulo Semião

Abstract: In this article we present an applet developed by the author to analyse and explore the main quadric surfaces. It is also reported the analysis of an experience conducted over the teaching period to several courses related with the use of such tools in the classroom. The work showed that the use of these tools in conjunction with the traditional teaching methods significantly improve the knowledge and skills of students allowing that they acquire stronger and deep knowledge of the subjects, increasing in this way their confidence and self-esteem.

68. TANGRAM, TEACHING AND TECHNOLOGY

Sabine Stoecker-Segre

Abstract: In this paper we will review how Tangram as a classic puzzle with only three different basic shapes can be used to teach a variety of mathematical concepts, such as similarity, self-similarity, fractal dimension and binary numbers. We describe activities for young teenagers as well as for adults that can be carried out on the internet as well as in the classroom. We will relate to a collaborative article written by the users of a math internet site and will mention how we used this puzzle in a computer course for maths teacher trainees.

69. UNDERSTANDING AND QUANTIFYING AFFORDANCES OF THE MATHEMATICAL TASKS IN DYNAMIC AND INTERACTIVE MATHEMATICS LEARNING ENVIRONMENTS

Dragana Martinovic, Zekeriya Karadag and Seyda Birni

Abstract: This proposal describes our efforts to understand affordances of dynamic and interactive mathematics learning environments (DIMLE), and to develop a working rubric to quantify the degree of visual, dynamic, and explorative affordances of the mathematical tasks prepared in them. After providing background information and theoretical considerations for this study, we present our perspective on the DIMLE and their affordances. Following a brief review of literature, we outline the procedure on how the mathematical tasks were evaluated based on their degree of affordances. The proposal concludes with a working rubric for further studies.

71. THE NET GENERATION AND THE AFFORDANCES OF DYNAMIC AND INTERACTIVE MATHEMATICS LEARNING ENVIRONMENTS: WORKING WITH FRACTIONS

Zekeriya Karadag, Dragana Martinovic and Seyda Birni

Abstract: In this study, we investigated how the new generation of learners benefit from affordances of a dynamic and interactive mathematics environment—GeoGebra. Grade 6 and 7 students worked in the university computer laboratory in Turkey on a number of mathematical tasks, and their work was recorded with screen capturing software. Moreover, two graduate students videotaped and observed the participants working on their tasks. Analysis of data reveals that students' way of benefiting from this environment falls behind our expectations, although some advance uses were recorded.

73. ENGAGING STUDENTS IN ONLINE COLLABORATIVE PROBLEM SOLVING: TWO CASE STUDIES

Royi Lachmy

Abstract: This paper presents two case studies of engaging secondary school students in online collaborative problem solving activities. The activities were carried out in two online learning environments. The first one was based on a threaded-discussion asynchronous forum and used inquiry-based tasks in geometry. The second one was based on a social network and used highly-challenging proof tasks in geometry. Both environments were implemented during the school year by the teachers. The findings showed that students were engaged in autonomous and meaningful problem solving activities and for long-term period. The concept of student sense of achievements was used to explain sustained engagement in the activities.

74. COMPUTER-AIDED EXPLORING THE MATHEMATICS BEHIND TECHNICAL PROBLEMS – EXAMPLES OF CLASSROOM PRACTICES

Norbert Kalus

Abstract: The mathematics in technical problems can be discovered by computer-aided experiments. The framework is the BSc scheme in Computational Mathematics for “Virtual Product Development”. The required mathematical competencies as well as the required competencies in the application field of engineers have to be taken into account. The didactical concepts and the learning environment play an important role. Examples are presented from four different courses in the areas of statics, elasticity, finite elements and partial differential equations. It will be reported on the implementation within the curriculum at Beuth University of Applied Sciences Berlin, the classroom experiments and the teacher's role.

77. TECHNOLOGY IN MATHEMATICS TEACHING: NO USE AT ANY PRICE

Angela Schwenk

Abstract: More than 25 years of experience in mathematics teaching lead the author to the conclusion: Technology in Mathematics Teaching: Less is More. The international assessments TIMSS and PISA had a big impact on the mathematics education at school in Germany. The paradigm changed. “Reduce the curriculum to basics. Reduce the predominance of teaching the formal skills therefore improve the understanding.” (Baptist & Raab, 2007). Mathematics should be linked to real world problems. At school the focus is now on modelling using technology. Now we can observe the results of this development at university. Written exams show terrible elementary mistakes we rarely have seen before. And even overall fairly good students demonstrate these mistakes. We will give examples and little statistics of some of these problems. We also compare the level of books for mathematics used at German schools over years.

78. PRODUÇÃO DE CONHECIMENTO ACERCA DO TEOREMA DE PITÁGORAS EM AMBIENTE INFORMATIZADO / PRODUCTION OF KNOWLEDGE ABOUT THE PYTHAGOREAN THEOREM ON A COMPUTERIZED ENVIRONMENT

Pollyanna Sette and Regina Franchi

Abstract: This paper presents part of the activities carried out during a Master's research, in which the role of digital technologies were investigated in a group of humans-with-media for the production of knowledge about the Pythagorean Theorem. The research subjects were elementary school students. This qualitative study is theoretically based on the theoretical construct of humans-with-media and the role of dialogue regarded as a conversation that aims at learning. The results indicate that the GeoGebra software contributed to the creation of a learning environment, which favoured the students' actions in the construction of mathematical knowledge and provided rich possibilities of visualization of concepts and properties, enhanced by the dynamism of the trials from the constructions performed in GeoGebra.

79. SOFTWARES MATEMÁTICOS NAS AULAS DE MATEMÁTICA: UM ESTUDO SOB A ANÁLISE DO PROGRAMA ACESSA ESCOLA / MATHEMATICAL SOFTWARE IN MATH CLASSES: A STUDY UNDER THE ANALYSIS OF THE ACCESS SCHOOL PROGRAM

Debora Medeiros, Eliel Constantino and Maria Morelatti

Abstract: Under the perspective of a larger project entitled Mapping the use of information technology in Mathematics classes in State of São Paulo, supported by CAPES, Notice 049/2012 / CAPES / INEP, using data survey of state public schools of Presidente Prudente - SP, registered in the Access School Program, and having

a qualitative research study, the aim of this work is to identify the software that math teachers use as GeoGebra, Cabri, Winplot, etc.; prioritized content, being in the majority, study of graphics and geometry, and what the teachers say about the importance of using ICT for learning, as are the Mathematics classes with the help of ICT and the conditions provided by Access School Programme. Data were collected through interviews with professionals from schools and visits to these laboratories.

80. BECOMING MATHEMATICAL SUBJECTS BY PLAYING MATHEMATICAL INSTRUMENTS: GIBBOUS LINES WITH WIIGRAPH

Francesca Ferrara and Giulia Ferrari

Abstract: In this paper, we bring together the vision of the body in the inclusive materialism of de Freitas and Sinclair (2014) with the vision of playing mathematical instruments offered by Nemirovsky et al. (2013). We pursue these approaches to study an activity that involved a grade 9 class in graphing motion through the use of two Wiimotes, the remote controls of the Nintendo Wii. The students were asked to face some tasks that were designed with the aim of introducing the Wii as a mathematical instrument into the classroom. We propose that the students' ways of talking, moving and feeling, which are prompted by playing the instruments, are the knowledge that they are creating and the subjects that they are becoming, which we call mathematical instrumental subjects.

82. ABOUT THE AWKWARD PROCESS OF INTEGRATING TECHNOLOGY INTO MATH CLASS

Eleonora Faggiano, Antonella Montone and Michele Pertichino

Abstract: This paper briefly reports and discusses the findings of some studies (carried out over the past years within our research group) on the use of technology in mathematics teaching and learning, thus taking the shape of an overall a posteriori reflection with the aim of promoting further development. The first study concerned teachers' perceptions of technology in math class. The second study aimed at investigating how teachers orchestrate activities in a technology-rich class. The aim of the third study was to analyse the relationship between work with manipulatives and technologically instrumented work within a laboratory approach. The important role of the teacher is highlighted, seeking to individuate the crucial factors influencing the awkward process of integrating technology into math class.

83. CONCEPTUALISING AXIAL SYMMETRY THROUGH THE USE OF CABRI ELEM WITHIN AN INTEGRATED LABORATORY APPROACH

Antonella Montone, Eleonora Faggiano and Michele Giuliano Fiorentino

Abstract: The main idea of the study herein presented is to verify if an integrated laboratory approach, exploiting the potentialities of both physical and technological instruments, can afford the construction of a geometric concept. The specific aim is to investigate the potential and the effectiveness of the interactive activity books of Cabri Elem within an integrated laboratory approach. This paper presents an on-going research project which involves pupils at 3rd and 4th grades dealing with axial symmetry. According to the early results of the project it seems that the integrated use of concrete manipulatives together with the activity books could guide pupils towards the progressive geometric conceptualisation of axial symmetry and its properties.

84. A CONSOLIDAÇÃO DE UM GRUPO COLABORATIVO DE PROFESSORES DE MATEMÁTICA: UMA EXPERIÊNCIA DE FORMAÇÃO CONTINUADA PARA O USO PEDAGÓGICO DA WEB 2.0 / CONSOLIDATION OF A COLLABORATIVE GROUP OF MATHEMATICS TEACHERS: A CONTINUING EDUCATION EXPERIENCE FOR THE EDUCATIONAL USE OF WEB 2.0

Claudio Sanavria and Maria Raquel Morelatti

Abstract: This article describes part of the results of a doctoral research that aimed to investigate how a continuing education program with a collaborative approach can contribute to mathematics teachers' knowledge and reflective use of Web 2.0 resources in educational practice. Therefore, a training process was proposed and conducted, which excelled for collaboration as a motivating factor and for the possibility of the teacher to engage with the technological resources in real practice and subsequently share the experiences with the group. In this work, the results from the analysis of the group's constitution process and its consolidation as a collaborative group are presented and discussed. The results point to a longitudinal path of teachers towards the collectiveness, gradually establishing shared goals and having the group as a motivator to analyze their own practices.

85. THE IMPACT OF TECHNOLOGIES ON THE TEACHER'S USE OF DIFFERENT REPRESENTATIONS

Helena Rocha

Abstract: This study intends to characterize how the teacher uses and integrates the different representations provided by the graphing calculator on the process of teaching and learning functions at the secondary level. Specifically, it intends to understand the balance established between the use of the different representations, and the way these representations are articulated. The conclusions reached point to an active use of the graphic and algebraic representations and to a scarce use of the tabular representation. The conclusions also point to a

flexible articulation between the two representations usual used, assuming different forms and frequently an interactive approach, repeatedly switching between representations.

87. A LENS TO INVESTIGATE TEACHERS' USES OF TECHNOLOGY IN SECONDARY MATHEMATICS CLASSES

Maha Abboud-Blanchard

Abstract: This paper focuses on how ordinary teachers develop practices in technological environments. It examines also the factors that determine these practices. Broadly based on the frame of the activity theory, several theoretical tools and constructs were combined, adapted and used to identify and analyse relevant elements shedding light onto the complexity of teaching mathematics in such environments. In order to exemplify this theoretical development, a case study is presented about the use of GeoGebra by a secondary mathematics teacher. The research lens was both focused onto the tensions within the teacher's classroom activity, and onto the factors that determine this situated activity. The study provided deep insight into the teacher's technology-mediated activity and brought forth the contribution of this new theoretical development to a better understanding of the complexity of integration technology into day-to-day mathematics teaching.

89. HOW TO PROFESSIONALIZE TEACHERS TO USE TECHNOLOGY IN A MEANINGFUL WAY – DESIGN RESEARCH OF A CPD PROGRAM

Daniel Thurm, Marcel Klingler and Bärbel Barzel

Abstract: The German Centre for Mathematics Teacher Education (DZLM) together with the Ministry of Education is in charge of developing, delivering and evaluating a long-term continuing professional development program (CPD) with respect to graphics calculators (GC). In this paper we describe the design of the CPD program and two associated research studies. The studies aim at examining conditions which must be considered when designing a CPD program, and at investigating the effects caused by the CPD program on teachers' beliefs and classroom practices as well as on students' competencies. We developed a questionnaire to measure teachers' beliefs related to GC and a survey about the integration of the GC into classroom practice. Furthermore, an achievement test was constructed to measure students' competencies that focus on areas where the literature expects the GC to be relevant.

90. DEVELOPING HIGHER ORDER THINKING IN MATHEMATICS: THREE DIFFERENT INQUIRY BASED MODELS IN A DIGITAL ENVIRONMENT

Paraskevi Sophocleous and Demetra Pitta-Pantazi

Abstract: The importance of the design and the use of tasks with the use of technology is widely acknowledged. The paper presents three different task designs that aim to develop higher order thinking in mathematics with the use of technology. These models were guided by aspects of the Integrated Thinking Model about higher order thinking, features of the inquiry based learning and also utilized pedagogical principles regarding the use of technology. The three models discussed in the paper, approach inquiry based learning in different way. The degree of pedagogical guidance and the sequence of the tasks in the three instructional models are different. The three models are the following: the "open" (open-ended tasks with minimal guidance), the "guided" (guided tasks -> open ended tasks) and the "mixed" (open-ended tasks -> guided tasks -> open-ended tasks). Specific examples of these three environments are presented.

92. FORMATIVE FEEDBACK IN THE NUMBER STORIES PROJECT

Kate Mackrell

Abstract: The University of Chicago Number Stories project aims to enhance student engagement in solving real-world problems in a Cabri environment through the provision of effective feedback. This paper illustrates some of the current possibilities for feedback that are being developed and discusses the issue of providing feedback in open-ended situations.

93. ABORDAGEM DA CONVERGÊNCIA DE SEQUÊNCIAS INFINITAS EM AMBIENTES INFORMATIZADOS VISANDO À CORPORIFICAÇÃO DO CONCEITO / INFINITE SEQUENCE CONVERGENCE APPROACH IN COMPUTER-BASED ENVIRONMENTS AIMING AT THE EMBODIMENT OF CONCEPT

Daila Fonseca and Regina Franchi

Abstract: This paper presents part of a master's research, which used a qualitative methodology and aimed to verify whether the development of activities based on the embodiment of concepts – with the use of software – favours the understanding of sequences convergence and numerical series and assists the transition from elementary to advanced mathematical thinking. However, only the analysis of the sequences will be presented here. Exploration activities were implemented and built based on the theoretical frameworks of Advanced Mathematical Thinking and the Three Worlds of Mathematics, which sought the embodiment of the convergence concept through the software's manipulation and visualization. Data analysis leads us to believe that the activities promoted the embodiment of the convergence concept and offered opportunities for the development of the elementary to the advanced mathematical thinking.

96. SUPPORTING THE DEVELOPMENT OF COLLEGE-LEVEL STUDENTS' STATISTICAL REASONING: THE ROLE OF MODELS AND MODELING

Maria Meletiou-Mavrotheris, Efi Paparistodemou and Ana Serrado Bayes

Abstract: The transition from descriptive to inferential statistics is a known area of difficulties for students. This article shares the experiences from a teaching experiment in a graduate-level quantitative research methods course, which adopted a non-conventional approach to teaching statistics that put models and modelling at the core of the curriculum. Findings indicate that the informal approach to statistical inference adopted in the course, which focused on modelling and simulation using the dynamic statistics software Tinkerplots© as an investigation tool, promoted powerful ways of thinking statistically, while at the same time also developing students' appreciation for the practical value of statistics. The affordances offered by the technological tool for building data models and for experimenting with these models to make sense of the situation at hand, were instrumental in supporting student understanding of both informal and formal inferential statistics.

97. EXPLORING THE HISTORICAL DEVELOPMENT OF COMPUTER GAMES RESEARCH IN MATHEMATICS EDUCATION

Ulises Xolocotzin and Angel Pretelin-Ricardez

Abstract: About 40 years have passed since the first efforts to exploit the potential of computer games for supporting the teaching and learning of mathematics. A historical review is presented of the empirical research on computer games for mathematics education. First, it is observed that research remained virtually absent while the videogame industry achieved important developments. It has grown steadily during the last decade, reflecting the widespread availability of technologies for producing and playing games. Second, an analysis of the populations and mathematical domains in which computer games have been researched revealed a concentration on arithmetic for elementary school students. Other populations and domains remain largely unexplored. To conclude, we outline alternatives for a further development of computer game research for mathematics education.

98. THE PREDICTIVE NATURE OF PERCEIVED LEARNING FIT ON TEACHERS' INTENTION TO USE DGS IN GEOMETRY TEACHING

Marios Pittalis, Constantinos Christou and Demetra Pitta-Pantazi

Abstract: The purpose of this study was twofold. Firstly, to extend Technology Acceptance Model to assess secondary school teachers' intention to use Dynamic Geometry Software (DGS) in geometry teaching and, second, to examine the relations among the parameters of TAM and the role of external factors. We enriched TAM by integrating in the model the notion of "perceived pedagogical-learning fit", which refers to evaluating the pedagogical-learning appropriateness of teaching geometry with DGS based on a cognitive-learning model. The results of the study showed that perceived pedagogical-learning fit is the strongest predictive factor of intention to use, while the external factors affect only the "perceived ease of use". "Perceived usefulness" and "perceived ease of use" had weak indirect effects on intention to use through attitude.

99. USING TINKERPLOTS SOFTWARE TO LEARN ABOUT SAMPLING VARIABILITY AND DISTRIBUTIONS AS A BASIS FOR MAKING INFORMAL STATISTICAL INFERENCES

Luis Saldanha

Abstract: We report on a study involving an instructional sequence that engaged a class of 14 and 15-year old students in using TinkerPlots™ software to make informal statistical inferences on the basis of distributions of a sample statistic. The sequence involved a scenario and tasks entailing the comparison of multiple samples of two groups of organisms on a common attribute. Students engaged in 1) making sense of the scenario and a TinkerPlots simulation that produced distributions of a sample statistic, 2) interpreting a sequence of such distributions in relation to increasing sample size, and 3) inferring a value of the sampled population attribute. We highlight aspects of students' understandings of what an empirical sampling distribution represented in terms of the scenario's context, and aspects of their abilities to track the multi-tiered re-sampling process that began with a population and culminated with distributions of the sample statistic on which they based their inferences.

100. CONHECIMENTOS REVELADOS POR TUTORES EM FÓRUMS DE DISCUSSÃO COM PROFESSORES DE MATEMÁTICA / KNOWLEDGE REVEALED BY TUTORS IN DISCUSSION FORUMS WITH MATH TEACHERS

Agnaldo Esquinalha and Celina Abar

Abstract: We aimed to investigate the knowledge revealed by tutors of a continuing education course for mathematics teachers, offered in the distance. Initially, we follow the work of 32 tutors over a year, in order to typify its interventions in discussion forums with the course participants. From the results, we offer training to a new group of tutors in order to promote improvement in the actions that we consider below expectations. Between August 2012 and July 2013, we follow six tutors, the subjects of this research. For your training, TPACK theoretical framework was adopted. The research, qualitative, made use of the observation of the work of the tutors, which was analyzed by means of discursive types found in tutors' interventions in the discussion

forums. Our analysis indicated that affective and attitudinal components play a key role in the exercise of mentoring in this context.

101. O USO DOS TABLETS NO ENSINO DA GEOMETRIA NOS ANOS INICIAIS DO ENSINO FUNDAMENTAL: UMA EXPERIÊNCIA COM O APLICATIVO “SIMPLY GEOMETRY” / THE USE OF TABLETS IN TEACHING GEOMETRY IN THE EARLY GRADES OF ELEMENTARY EDUCATION: AN EXPERIENCE WITH THE APPLLET “SIMPLY GEOMETRY”

Lucy Alcântara, Maria Madalena Dullius and Susana Carreira

Abstract: In this paper we report an experience on the use of tablets in teaching geometry to a third grade class of elementary school. The teacher is a participant in a continuing education program and the teaching sequence that she has put into practice in the classroom allowed students to build knowledge through practical activities using the tablet for exploring the applet “Simply Geometry”. The present study focuses on the use of the tablet as a teaching tool in mathematics classes, which can contribute as much to the teaching as to the learning of geometry topics.

102. INTERACTIVE RESOURCES FOR AN ACTIVE DESCRIPTIVE GEOMETRY LEARNING

Vera Viana

Abstract: The author intends to promote a debate on the need to reorient Descriptive Geometry teaching practices in Portuguese High Schools, so that better responses to the present requirements are achieved, aiming so to improve students’ capacities to understand and represent the three-dimensional space, through a better comprehension of what they represent.

To exemplify the benefits of exploring digital tools with educational purposes, the author presents some interactive resources created with GeoGebra and Rhinoceros to complement Descriptive Geometry teaching, in order to simplify the learning process from the student’s perspective and illustrate the potentialities this software can offer to construct educational resources.

103. LEARNING TO APPLY MATHEMATICS IN ENGINEERING MODELLING THROUGH CONSTRUCTING VIRTUAL SENSORY SYSTEMS IN MAZE-VIDEOGAMES

Ana Isabel Sacristán and Angel Pretelín-Ricárdez

Abstract: This work is part of a research project that aims to enhance engineering students’ learning of how to apply mathematics in modelling activities of real-world situations, through the construction (design and programming) of video games. This work is framed in constructionism which considers that learning is facilitated through engagement in the construction of external objects (Papert & Harel, 1991). Here, we present the work of six university engineering students who were asked to build a videogame where a virtual mobile robot has to navigate a maze; this requires the modelling of combinational logic circuits, which in turn needs Boolean algebra and the simplification of logic equations. The programming of the videogame involved brainstorming and experimentation in a meaningful and motivating activity, where students were able to apply the theoretical mathematical knowledge in the design of the real world project (in this case a model of a digital system).

104. LEARNING MATHEMATICS FROM MULTIPLE REPRESENTATIONS: TWO DESIGN PRINCIPLES

Alice Hansen and Manolis Mavrikis

Abstract: This paper describes two design principles for designing mathematics tasks using technology. These are: The parallel instantiations principle. Presenting students with a large number of non-prototypical instantiations simultaneously and non-transiently perturbs their thinking and supports thinking-in-change. The discriminating tools principle: Discriminating tools enable children to differentiate between the tools’ feedback to acquire knowledge from their use. Students will learn within the task rather than merely from the task. These principles were first developed in a study on 9-11 year olds’ geometric defining and later applied and amended in a larger study that encouraged 9-11 year olds’ conceptual understanding of fractions. The paper presents how the principles were applied within the two studies.

105. FOR THE LOVE OF STATISTICS: APPRECIATING AND LEARNING TO APPLY EXPERIMENTAL ANALYSIS AND STATISTICS THROUGH COMPUTER PROGRAMMING ACTIVITIES

Maiite Mascaró, Ana Isabel Sacristán and Marta Rufino

Abstract: For the past 4 years, we have been involved in a project that aims to enhance the teaching and learning of experimental analysis and statistics, of environmental and biological sciences students, through computational programming activities (using R code). In this project, through an iterative-design, we have developed sequences of R code-based activities, that have been implemented in three institutions in Mexico and Portugal, in 8 postgraduate and 4 undergraduate courses; these are hands-on sets of tasks in R script that include computer programming work and are meant to be carried out collaboratively (a sample of an ANOVA activity is given). General results indicate that students tend to enjoy the courses; lose their fear of statistics;

develop competencies for applying statistical methods and using computational tools, such as R, on their own data that deepens their understanding of the biological phenomena they have to analyse.

106. STUDYING THE PROCESS OF DESIGNING DIGITAL EDUCATIONAL RESOURCES WITH THE AIM TO FOSTER STUDENTS' CREATIVE MATHEMATICAL THINKING

Chronis Kynigos and Elissavet Kalogeria

Abstract: The present paper studies the process by which members of a collective with diverse expertise and experiences, engaged in a joint enterprise to design an e-book targeting the stimulation of students' creative mathematical thinking (CMT). Our main aim was to investigate the role of this digital artifact (c-book: c for creativity) in helping these members to gain some understandings of each other's perspectives and knowledge. Our findings showed that the creation of the c-book evolved in four phases incorporating learning mechanisms and challenged the co-designers to make crossings between the boundaries of diverse expertise.

108. MATHEMATICS TEACHERS' INSTRUMENTAL GENESIS OF TECHNOLOGICAL MATERIALS

Paula Teixeira, José Matos and António Domingos

Abstract: Using the paradigm of activity theory, the central problem of this paper is the characterization of the processes through which teachers replicate, adapt, and improvise tasks of textbooks with use of technological resources (CD- ROMs and web portals). In other words, we seek to identify teachers' use of schemas in actions mediated by these technological elements. Two of us accompanied Portuguese secondary mathematics teachers in the assessment of learning tasks involving the use of new technological resources and the analysis of feedback of teaching performance after implementation in the classroom. This feedback was obtained from their peers, trainers and teachers' reflection on the actions in classes and occurred during the sessions of the training activities. The study shows that teachers plan coordinated tasks that integrate technology resources and apply them in classes adjusting them to the technological environment of their schools. However, some difficulties in interpreting feedback are revealed.

109. MATHEMATICS IN PRE-SERVICE TEACHER EDUCATION AND THE QUALITY OF LEARNING: THE MONTY HALL PROBLEM

Fernando Luís Santos and António Domingos

Abstract: If students acquire a new mathematical notion, according to Gray and Tall (1994), they pass through a proceptual divide. At a higher education institution in Portugal, students from different courses (education and business) came into contact with the Monty Hall problem in Statistics class. As a part of the learning environment the students have at their disposal all the technological apparatus they could use. The correct outcomes of two students (from the two courses) are analysed against the background of a model of analysis based on Tall's theory of the advanced mathematical thinking linked with SOLO taxonomy by Biggs and Collis (1982) and supported by Engeström (2001) third generation model of Activity Theory. In particular, the two different outcomes show that students can attain the same level, but may be operating in different levels: procedural thinking and proceptual thinking.

110. STUDENTS LEARNING ALGEBRA WITH APPLETS

António Domingos and Eduarda Oliveira

Abstract: The transition from arithmetic to algebra is a process that involves complex reasoning and it is a topic where the students present many difficulties. Many studies show that the teaching and learning of mathematics may be potentiated by the use of technology. On this paper we intended to show how the use of an electronic tool might help students solve equations. Student's deal formally with this kind of task in 7th grade for the first time and it is possible to identify how the tool mediates the learning process. The theoretical framework is based in the activity theory and the formulations of David Tall about the advanced mathematical thinking and the proceptual view of the mathematical concepts. Based in a qualitative approach and using an interpretative methodology, we observed two groups of students working with an applet during the process of solving equations. This work gives us evidences about the procedural and conceptual thinking developed by students and the role of the tool during this process. It is possible observe how the semiotic potential of the artefact mediate the learning process.

112. INTERACTIVE INTRODUCTION TO FIRST-ORDER ORDINARY DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS

Celestino Coelho, Rui Marreiros and Ana Conceição

Abstract: Differential equations constitute a large and very important branch of modern mathematics. From the early days of the calculus this subject has been an area of great theoretical research and practical applications in several branches of science. Despite this importance the largest part of the students reveals strong difficulties to understand the theory of differential equations and its applications. As a consequence of what was mentioned above we decided to create a new educational tool that accomplishes some of those goals, describing how this dynamic device can be used in the classroom when teaching the first approach of the first-order Ordinary Differential Equations (ODEs).

114. SOLVING PROBLEMS ON THE SCREEN: DIGITAL TOOLS SUPPORTING SOLVING-AND-EXPRESSING

Hélia Jacinto and Susana Carreira

Abstract: The main goal of this research is to understand the problem solving activity with everyday digital technologies, within the context of a beyond school mathematical competition, SUB14. Following a qualitative approach, we observed the activity of a young student, Marco, when solving a geometrical problem, aiming at describing and analysing his activity. The results show that the digital inscriptions presented in the statement trigger his visualization abilities which, in turn, assume a relevant role in understanding the problem, selecting a technological tool, planning and implementing a strategy. Based on the case of this student-with-computer we discuss the role of the everyday digital tools in the activity of solving-and-expressing the problems of the competition.

117. COMPLEX FUNCTIONS WITH GEOGEBRA

José dos Santos dos Santos and Ana Breda

Abstract: Complex functions, generally feature some interesting peculiarities, seen as extensions real functions, complementing the study of real analysis. However, the visualization of some complex functions properties requires the simultaneous visualization of two-dimensional spaces. The multiple Windows of GeoGebra, combined with its ability of algebraic computation with complex numbers, allow the study of the functions defined from \mathbb{C} to \mathbb{C} through traditional techniques and by the use of Domain Colouring. Here, we will show how we can use GeoGebra for the study of complex functions, using several representations and creating tools which complement the tools already provided by the software.

118. THE ROLE OF PEER AND COMPUTER FEEDBACK IN STUDENTS' MATHEMATICS LEARNING

Júlio Paiva, Nélia Amado and Susana Carreira

Abstract: In this paper we present an episode taken from a two years teaching experiment involving the regular use a Dynamic Geometry Software with a class of 7th graders. The learning context is centred on student-student-computer interactions. The overall aim of the research is to understand the role of the emerging peer and computer feedback in students' learning. We adopt a qualitative and interpretive research methodology. The data presented are related to an episode involving the actions of a pair of students while solving a geometry task with GeoGebra. The empirical data were analysed and interpreted by applying a model of feedback phases combined with a model of strategies devising. The results point to a strong connection between the role of peer and computer feedback and the forms of devising and revising strategies to solve the problem.

119. THE SUPPORT OF THE SPREADSHEET IN THE LEARNING OF TOPIC QUADRATIC EQUATIONS

Sandra Nobre, Nélia Amado and João Pedro Ponte

Abstract: In this paper we analyse the role of the spreadsheet in the development of algebraic thinking of grade 9 students in the study of 2nd degree equations. The research aims are (i) to understand how students approach their tasks in the spreadsheet, i.e., which representations they use and how they coordinate them, and (ii) the extent to which using spreadsheets in conjunction with working with paper and pencil, influences the development of algebraic thinking, particularly in the use of more formal (algebraic) language. Data analysis focuses on the productions and dialogues of a student while solving tasks with the spreadsheet in the classroom. The spreadsheet, articulated with working with paper and pencil, was important to the student's developing of her algebraic thinking in this topic, boosting the use of a more formal language.

121. REFLECTIONS OF DEVELOPMENTS IN EDUCATIONAL TECHNIQUES IN THE DESIGN OF A NEW TEXTBOOK ON DESCRIPTIVE GEOMETRY

Petra Surynkova

Abstract: The article discusses innovative methods in modernization of teaching descriptive geometry at the Faculty of Mathematics and Physics at Charles University in Prague. Our goal is to increase interest in studying classical and descriptive geometry primarily through 3D computer modelling. I have been seeking to establish a stronger connection between descriptive geometry and its practical application and the extension of descriptive geometry with knowledge of computer graphics and computer geometry. The integration of descriptive geometry with 3D computer modelling appears to follow as a logical step. In order to provide insight into more complex geometric problems and to increase the interest in geometry, I have integrated 3D computer modelling in my descriptive geometry lessons. I plan to use outputs from 3D computer modelling software into my new textbook on descriptive geometry for undergraduate students.

POSTERS

4. COMPARATIVE CASE STUDIES IN COLLEGIATE MATHEMATICS: TEACHING COLLEGE ALGEBRA COURSES IN HYBRID AND ONLINE FORMS WITH ONLINE INTERACTIVE AND EDUCATION SOFTWARE EMATH

Nilay Manzagol

Abstract: The increasing demand in online classes and effectiveness of online teaching and learning systems became important factors for most universities including Georgia State University to start offering 100% online courses along with traditional and hybrid courses. This poster is to show an examination of hybrid and online college algebra courses and their effects on student's achievement and attitudes towards College Algebra courses by using eMath online educational system.

17. USING DIGITAL TOOLS FOR COLLABORATIVE VISUALIZATION OF INTEGRALS BY ENGINEERING STUDENTS

Ninni Hogstad, Ghislain Isabwe and Pauline Vos

Abstract: This poster introduces a research which aims to answer questions on how engineering students can collaborate using a digital visualization tool and how the tool can contribute in the learning process at university level. In an empirical investigation students will be given designed mathematical tasks in which they can use a digital tool to explore different aspects of integrals.

18. A UTILIZAÇÃO DE AMBIENTE VIRTUAL DE APRENDIZAGEM PARA ENSINAR MATEMÁTICA NO ENSINO MÉDIO POR MEIO DO AMBIENTE KHAN ACADEMY / THE USE OF VIRTUAL LEARNING ENVIRONMENT TO TEACH MATHEMATICS IN HIGH SCHOOLS THROUGH THE KHAN ACADEMY ENVIRONMENT

Zionice Rodrigues and Bruna Torrezan

Abstract: The chosen platform is the Khan Academy, which is a non-profit organization that aims at "changing education for better"(KHAN, 2014) independently of the user being a student, a teacher, a parent or anyone interested in learning something new. This platform is entirely free. The results of an experiment with a high school student from a public school in Penápolis, Sao Paulo, Brazil will be presented.

30. I2CALC: UM APLICATIVO ANDROID PARA A APRENDIZAGEM DE NÚMEROS COMPLEXOS / I2CALC: AN ANDROID APP FOR LEARNING COMPLEX NUMBERS

Rafaela Sehnem and Rubilar Simões Junior

Abstract: The scenario of the teaching and learning of mathematics has changed significantly in recent years, due to the insertion of mobile technologies to access information. In this context, and considering the difficulties presented in the learning of complex numbers, was proposed the development and use of an Android application, in Portuguese, to broaden educational possibilities and stimulate the autonomy of students.

33. FACIAL EXPRESSION ANALYSIS AS A DATA ANALYSIS METHODOLOGY

Nashwa Ismail, Gary Kinchin and Julie-Ann Edwards

Abstract: Communication involves both verbal and nonverbal means to ensure a message is conveyed. Facial expression is acknowledged in contemporary views as one the most influential factors in non-verbal communication. This study investigates the use of the Facial Analysis Coding System (FACS) as a tool that can improve researchers' skills in reading the emotions of others to analyse data other than depending merely on the spoken language.

50. HANDLING 3D GRAPHIC OBJECTS DIRECTLY FOR THE LEARNING OF VECTOR EQUATIONS

Wataru Ohno and Hitoshi Nishizawa

Abstract: For learning vector equations of lines or planes in three dimensional (3D) space, relation between these 3D objects and vector equation plays an important role. In our laboratory we build learning contents on the web. In these contents students adjust the position or angle of a plane in virtual space, the system displays the equation reflected by the location of 3D object in virtual space. Students might find the hidden rules and mechanisms of the vector equation by themselves. Because such findings were based on her rich experience of tries and errors, they tended to stay longer in her memory and might become the foundation of her learning. For building such learning contents in virtual space, user interface was a bottleneck. Because computer screens and pointing devices such as mice or track-pads were 2D in nature, handling objects in the virtual 3D space required more complicated operations than in a 2D space. In this presentation we show two attempts to simplify the operations. The first approach is to improve the method of pointing a position, which is restricted on a plane parallel with the screen. The second approach is to use a 3D sensing device as an input. The user can locate some points in 3D space by holding her hand above the sensing device. The points follow the movement of her fingertips.

64. ASPECTS OF SCAFFOLDING IN A WEB-BASED LEARNING SYSTEM FOR CONGRUENCY-BASED PROOFS IN GEOMETRY

Keith Jones, Mikio Miyazaki and Taro Fujita

Abstract: This paper focuses on the pedagogical underpinnings of the design of a web-based learning support system for lower secondary school pupils who are just beginning to learn how to tackle deductive proving in geometry. In particular, we explain how the key features of our web-based system can scaffold learners' learning of congruency-based proofs in geometry.

65. THE POTENTIAL OF AUTHORING CREATIVE ELECTRONIC MATHEMATICS BOOKS IN THE MC-SQUARED PROJECT

Christian Bokhove, Manolis Mavrikis and Keith Jones

Abstract: The European 'MC-squared' project is fostering several so-called 'Communities of Interest' (CoI) (Fischer, 2001) in a number of European countries. These communities work on designing and developing digital, interactive, creative, mathematics textbooks, called c-books. The c-books are made in the online digital authoring environment in which authors can construct books with various interactive 'widgets'. Here we demonstrate some of the key features of the authoring environment and suggest how c-books can function as a useful catalyst for teacher professional development.

70. DIGITAL RESOURCE QUALITY AND EVALUATION: A PRE-SERVICE TEACHER EXPERIENCE

Ana Paula Jahn

Abstract: This poster briefly describes a pre-service teacher experiment concerning the development of quality assessment criteria of digital resources, as a way to get them involved with activities related to the contributions of the technology in mathematics education and its use in classroom.

86. A SALA DE AULA INVERTIDA DE MATEMÁTICA / THE FLIPPED CLASSROOM OF MATHEMATICS

Claudia Sabba and Marcelo Pratavieira

Abstract: The use of Information and Communication Technologies in the teaching and learning of mathematics by the practice of Inverted classroom can make this practice of this science more dynamic and efficient. In order to make the students constructors of their own knowledge, our goal is that through the use of software and new teaching ways you can learn to interact with students and direct them in order to make them authors in the learning process.

111. UMA PROPOSTA DE MATERIAL DIDÁTICO PARA O ENSINO DE ISOMETRIA E HOMOTETIA MEDIADO POR SOFTWARE DE GEOMETRIA DINÂMICA / A DIDACTICAL PROPOSAL FOR THE TEACHING OF ISOMETRY AND DILATION MEDIATED BY DYNAMIC GEOMETRY SOFTWARE

Rafael Vassallo Neto

Abstract: This work offers a didactical proposal for the teaching of isometry and dilation based on the theoretical frameworks of Investigative Activities and Educational Technologies. As theoretical perspectives we adopted the contributions from Ponte (2006), Borba (1999) and Zeichener (2008). As a teaching method we used the Van Hiele (1957) model. The presented activities are analysed from a qualitative research approach to find out evidences of effective learning.

113. REFLEXÕES SOBRE EDUCAÇÃO A DISTÂNCIA / REFLECTIONS ON DISTANCE EDUCATION

Rafael Vassallo Neto and Lícia de Medeiros

Abstract: Even though the research on Educational Technologies and on Distance Education has grown over the last years, there is still the need to conduct research involving the analyses of resources that may promote an effective, critical, dialogical and collaborative learning. The production of knowledge must surpass the one-to-one and one-to-many interactions in view of the many-to-many interactions in socio-interactionist environments aiming for learning.

116. LECTURERS' ATTITUDES TOWARDS INTEGRATING PEN-ENABLED TABLET PCS IN TEACHING ENGINEERING MATHEMATICS

Sergiy Klymchuk, Peter Maclaren and David Wilson

Abstract: The study investigates the attitudes and experiences of two lecturers involved in integrating pen-enabled Tablet PCs (penTPCs) in teaching engineering mathematics. One lecturer has 3 years of experience in using penTPCs (an 'expert'), while the other is a lecturer who is just beginning use of a penTPC in teaching (a 'novice'). Summary of the interviews with them are presented in the paper with some analysis of the similarities between the lecturers.

123. TASK DESIGN WITH GEOGEBRA 3D

Sara Vaz, Teresa Neto and Isabel Órfão

Abstract: The aim of our poster presentation is to present some examples of task design and analysis, in Euclidian Geometric, using the onto-semiotic approach.

125. TABLETS IN THE CLASSROOM

David Costa

Abstract: This poster aims to present some instructional aspects related to teaching and learning of mathematics in the first cycle of basic education with the use of mobile technologies, such as tablets. In Basic School of Marchil (Portugal), the use of tablet's aims to provide students with an extension of the subject taught by the teacher and developing skills and competences that are required for inclusion in our modern society in constant change.

132. SOLVING MATHEMATICAL PROBLEMS ON THE SOCIAL NETWORK FACEBOOK – A CASE STUDY

Cristina Seabra and Clara Coutinho

Abstract: The aim of this study is to investigate the support that Facebook can provide in the development of mathematical skills with regard to problem-solving. Following that premise, a case study was developed with students of the bachelor degree in Social Education. The results show that the participation in the group contributed to the learning process and, in particular, to problem solving.

135. THE PROBLEM@WEB PROJECT: DIGITALLY SOLVING AND EXPRESSING PROBLEMS BEYOND THE CLASSROOM

Susana Carreira, Nélia Amado, Hélia Jacinto and Sandra Nobre

Abstract: This poster focuses on the research strand concerning problem solving with technology from the Problem@Web project. We describe part of the results of the project, paying specially attention to how youngsters tackle and solve moderately challenging mathematical problems using digital tools of their choice in an online problem solving competition.

WORKSHOPS

46. COMBINING REALISTIC MATHEMATICS EDUCATION AND THE BRIDGE21 MODEL FOR THE CREATION OF CONTEXTUALISED MATHEMATICS LEARNING ACTIVITIES

Aibhín Bray and Danielle O'Donovan

Abstract: Bridge21 is a learning model that is supportive of a collaborative, technology-mediated, and inquiry-based approach to education. It challenges conventional models of teaching, empowering students to learn through technology and team-work. Research in Trinity College Dublin has developed a set of design heuristics for mathematics learning activities that integrates this paradigm with that of Realistic Mathematics Education (RME). Attendees will be introduced to the methodology and will actively engage in tasks consistent with the approach.

58. MODELAGEM COMPUTACIONAL PARA O ENSINO DE EQUAÇÕES DIFERENCIAIS ORDINÁRIAS / COMPUTATIONAL MODELING FOR TEACHING ORDINARY DIFFERENTIAL EQUATIONS

Maria Madalena Dullius

Abstract: In this workshop I present a proposal to explore ordinary differential equations in the context of problem situations using the software Powersim as a tool. The experience is part of a doctoral thesis and was developed with students enrolled in engineering courses. The theoretical approach of this study draws on the meaningful learning theory of Ausubel and the social interactionist theory of Vygotsky.

59. ATRMINI / ATRMINI

Ana Cristina Oliveira

Abstract: AtrMini is a collection of games aimed at young children that can be freely downloaded from the Atractor Website (<http://www.atractor.pt/mat/AtrMini>). It is a useful tool for teaching elementary mathematics, combining play with the acquisition of several competencies: as mental arithmetic, money use, combinatorial reasoning, etc.

63. CONSTRUINDO TRÊS MODELOS PLANOS PARA A GEOMETRIA HIPERBÓLICA E ISOMORFISMOS ENTRE ELES, POR MEIO DO GEOGEBRA 2D E 3D / BUILDING THREE TWO-DIMENSIONAL MODELS FOR HYPERBOLIC GEOMETRY AND ISOMORPHISMS BETWEEN THEM, USING 2D AND 3D GEOGEBRA

Valdeni Franco

Abstract: The construction of models that satisfy the axioms established in hyperbolic geometry contributed to the acceptance of such geometry. Felix Klein built a model plane and Henry Poincaré two plans models. In this workshop these three models and tools that enable construction of the Poincaré disk model and other,

exploiting several results that are relevant to hyperbolic geometry will be built. Using the 3D GeoGebra will be shown isomorphism between the three 2D models constructed in GeoGebra 2D.

91. THE NUMBER STORIES PROJECT: A DATABASE OF DYNAMIC REAL-WORLD ACTIVITIES

Kate Mackrell and Pierre Laborde

Abstract: The Number Stories Project, in which a collection of web-based dynamic mathematics materials is being developed, will be introduced and participants will have the opportunity to explore the online database and a number of activities. We are interested in potential partners to enable us to expand this database to include activities of interest in a wide diversity of international contexts.

115. FERRAMENTAS GRÁFICAS, DINÂMICAS E INTERATIVAS PARA O ESTUDO DE FUNÇÕES REAIS DE VARIÁVEL REAL / GRAPHIC, DYNAMIC, AND INTERACTIVE TOOLS FOR THE STUDY OF REAL FUNCTIONS

Ana Conceição and José Pereira

Abstract: Our main goal is to present the F-Tool concept, an interactive Mathematica notebook, designed specifically to explore the concept of real function, by analyzing the effects caused by changing the values of the parameters present in general analytical expressions. Each F-Tool allows the study of a typical class of functions providing graphical and analytical information in real time. It will be discussed the teaching possibilities offered by this dynamic educational software.

120. USING GEOGEBRA TO STUDY COMPLEX FUNCTIONS

José dos Santos dos Santos and Ana Breda

Abstract: The aim of this workshop to present some of the strategies studied to use GeoGebra in the analysis of complex functions. The first part will illustrate how to use the two graphical windows to represent complex functions of complex variable. The second part will present the use of the dynamic colour GeoGebra in order to obtain colouring domains that correspond to the graphic representation of complex functions. Finally, we will use the three-dimensional graphics window in GeoGebra to study the component functions of a complex function. During the workshop will be provided scripts orientation of the different tasks proposed to be held on computers with GeoGebra version 5.0 or higher.

122. EXPLORING MATHEMATICS THROUGH MULTIPLE REPRESENTATIONS

Koen Stulens

Abstract: Technology provides the ability to view different representations of mathematical concepts simultaneously: graphical, geometric, numeric and possibly symbolic. When dynamically linked multiple representations help students to see connections and build up knowledge step by step.

126. GECLA / GECLA

Ana Cristina Oliveira

Abstract: GeCla is a tool that concerns the mathematical study of symmetry of figures, especially in geometric patterns, boarder patterns and rosaces. It can be freely downloaded from the Attractor Website (<http://www.attractor.pt/mat/GeCla>). It is a useful tool to teach symmetry and it has a recreational character in allowing organizing competitions with students in different school levels.

SPECIAL SESSIONS

‘DIGITAL’ GENERATION OR ‘DUMBEST’ GENERATION? “YOUNGSTERS SOLVING MATHEMATICAL PROBLEMS WITH TECHNOLOGY” – BOOK LAUNCH

Susana Carreira, Keith Jones, Nélia Amado, Hélia Jacinto and Sandra Nobre

Abstract: Today’s youngsters are typified as either ‘digital natives’ or members of the ‘dumbest generation’ who know almost nothing. This special session marks the launch of a new book that reveals what youngsters (aged 8-14) can do when presented with interesting mathematical problems that they can solve in their own time and with whatever technology they have at hand. Reporting findings from the Problem@Web project, find out what today’s youngsters do when solving mathematical problems with their own choice of digital technology.

To conclude this special session, please join us for a welcome reception generously sponsored by Springer.

A MAN FOR THE TECHNOLOGY

José Paulo Viana

Abstract: The role of Bert Waits in spreading the use of the technology in teaching mathematics was absolutely unique.

We will talk about him - the teacher, the mathematician and the man - and the new ways students learn mathematics using the graphing technology.

WHAT DOES SOCIETY EXPECT FROM SCHOOLS IN TERMS OF WHAT STUDENTS LEARN IN MATHS AND TECHNOLOGY?

João Frederico Meyer

Abstract: In this presentation we will mainly focus our attention upon what society expects from Mathematical Education in terms of students' competencies and autonomy. I will try to stress the importance of combining Mathematical Modelling with the use of Technology in learning how to "read the world" - in the sense of the theory of Paulo Freire – in order to understand society, as well as highlighting the fact that even when teachers try to be the only subject in teaching processes, technologies create the environment for students themselves to be able to become the subjects of learning processes. I will also try to use my background as a professional Applied Mathematician to mention that not only does society need students to learn how to interact, learn, cooperate, criticize and evaluate situations in real life, but society also demands this from schools, teachers, institutions and curricula. Some examples will be presented in order to illustrate what this talk refers to.

WHAT IS SO SPECIAL ABOUT AUTOGRAPH?

Sabrina Pereira

Abstract: Autograph is the teacher's choice with its simple and effective interface. Brilliantly supported by online resources, Autograph is the student's choice too: its intuitive approach helps to build a solid understanding of basic principles through dynamic images.

In addition to an extensive feature list in probability and statistics, Autograph covers a wide range of topics in 2D from straight lines to differential equations, and Autograph broke new ground 10 years ago with the world's first 3D graphing facility. Come along, find out more and claim your free copy of Autograph 3.3.

USING THE GRAPHING CALCULATOR WHEN IT IS NOT ALLOWED

Jaime Carvalho e Silva

Abstract: There are certain problems that cannot be solved without a graphing calculator. But other problems seem to be "immune" to the use of calculators. We will try to prove that a graphing calculator can help to solve or even solve a lot of problems that at first sight should not be solvable that way. We will even discuss examination questions that explicitly ask for the graphing calculator not to be used. The idea is that one should not be thinking about getting a solution immediately, but exploring the problem for some moments and using a graphing calculator as an "insight tool" that can give an approximation of the exact solution sought or give an idea of what to look for as a solution.

DESIGNING AND HALF-BAKING WITH DYNAMIC 3D TURTLE GEOMETRY: THE SEARCH FOR NEW MATHEMATIZATIONS

Chronis Kynigos

Abstract: Turtle Geometry has widely been known as a programmable 2-dimensional intrinsic tool without dynamic manipulation.

We will use a Turtle Geometry which we call 'MaLT+' where

1. The turtle is not a turtle but an avatar moving in a sphere
2. Figures transform as a result of dynamic manipulation of variable procedure values.
3. Everything is on the web and personal files can still be downloaded or uploaded

We will ask the question 'how does design change' when we have this tool. What new avenues can we imagine for creating half-baked constructs for kids to re-mix or debug and how can we embed mathematics this is interesting and accessible to them. What can be constructed and visualized with this tool that cannot be done with physical materials or other 3D construction kits? How does a designer think about half-baking in 3 dimensions? There will be a presentation of two examples of such designs and an example of student mathematizations in one of them as starters for a discussion and production of new ideas and questions.

BETWEEN RIO GRANDE DO SUL AND THE ALGARVE: A BOOK FROM JOINT RESEARCH AND TEACHERS' TRAINING

Maria Madalena Dullius, Marli Quartieri, Nélia Amado and Susana Carreira

Abstract: We started to share ideas in Coimbra, Portugal, during a research seminar in Mathematics Education. A common interest on the pedagogical use of technologies was the beginning of a strong link between two universities, UNIVATES, in Lajeado/RS, and University of Algarve, in Faro, accomplished by the Brazilian and the Portuguese members of a research project on the integration of technological resources in basic education and on mentoring in teachers' continuing education. Besides the sharing of wonderful gastronomy (Portuguese and Brazilian), we have developed in this project joint experiences in teacher training and worked together in creating and exploring didactical resources for the classroom. We'll be talking about both!