

TSG Agenda

TSG _2_: _Mathematics education at tertiary level_ (number and title)

Class: 2 (Class A for TSGs with odd numbers; Class B for TSGs with even numbers)

****Please prioritize the sessions in “core-time” (from 19:30-23:00, Beijing time, i.e. Session 2, 3 for Class A and session 1, 2 for Class B) as they are friendly to most of the time zones in the world.**

Session 1, July 13th 19:30-21:00

Time 19:30-19:40: Introduction to the work of the TSG2

1. Time: 19:40-20:10

Title of the Paper: Transition between Paradigms in the university: The role played by the theoretical framework

Author(s) (with the presenter name in BOLD if more than 1 name here):

Ignasi Florensa¹, Marianna Bosch²

Institution(s) (to school/department/research center) and Country/Region:

¹Escola Universitària Salesiana de Sarrià, EUSS, Universita Autònoma de Barcelona, Spain

²IQS School of Management, Universita Ramon Llull, Spain

Short abstract of the paper (20 lines maximum):

There seems to be an agreement in the mathematics education community for a change of the dominant pedagogical paradigm, towards a new paradigm often characterised by general principles such as active-learning, student-centred, inquiry-based, etc.. However, the design and implementation of study processes based on these principles lack of a clear methodology and the implemented conditions of existence remain very fragile. We present in this paper, the preliminary results of the analysis of a university institution where a promising paradigm transition seem to exist. Three aspects that seem to play an important role in this transitional

process are considered. First, the existence of a shared theoretical framework (ATD) that includes the epistemological questioning in its foundational principles. Second, a shared methodology including explicit tools to model, question and describe knowledge in inquiry-based processes as dynamic and collective activities. Finally, a close collaboration between educational researchers and teachers, preventing researchers to conduct isolated experiences and helping teachers to connect innovation to research

2. Time: 20:10-20:25

Title of the Paper: The quality of mathematics teacher education at tertiary level in Uganda: is it relevant for 21st Century Mathematics Teachers?

Author(s) (with the presenter name in BOLD if more than 1 name here)

Marjorie Sarah Kabuye Batiibwe

Institution(s) (to school/department/research center) and Country/Region

Makerere University, Uganda

Short abstract of the paper (20 lines maximum):

Given that one poorly trained mathematics teacher affects mathematics achievement of more than 1000 learners during their practice, this study established the qualifications of mathematics teacher educators, the mathematics teaching methods courses they teach and how they teach pre-service mathematics teachers to teach secondary school level learners. The target population was mathematics teacher educators in each of the 14 government teacher education tertiary institutions in Uganda. Data were collected through document analysis, questionnaires, interviews and focus group discussions and analysed using descriptive statistics, categorisation and narratives. Findings indicated that three of the 14 government teacher education tertiary institutions in Uganda had qualified mathematics teacher educators and the mathematics teaching methods course units were taught to pre-service mathematics teachers in the absence of the actual secondary school mathematics content. Teaching was mainly through the traditional approaches. These coupled together make the quality of mathematics education at tertiary level in Uganda questionable.

3. Time: 20:25-20:40

Title of the Paper: From student scribbles to institutional script: Towards a commognitive research and reform programme for university mathematics education

Author(s) (with the presenter name in BOLD if more than 1 name here)

Elena Nardi¹, Irene Biza¹, Bruna Moustapha-Corrêa², Evi Papadaki¹, Athina Thoma¹

Institution(s) (to school/department/research center) and Country/Region

¹University of East Anglia, UK

²Universidade Federal do Estado do Rio de Janeiro, Brazil

Short abstract of the paper (20 lines maximum):

Commognitive studies offer a nuanced lens on datasets that evidence micro-level accounts of mathematical experience – and are now starting to explore the theory’s capacity to support the design, tracing and dissecting of discursive shifts in medium/long term interventions. Here, we focus on two university mathematics education (UME) examples of such interventions. The Norway-based study engaged biology students with biology-themed Mathematical Modelling activities to challenge deficit narratives about the role of mathematics in their discipline and about their mathematical competence and confidence. The Brazil-based study engaged teachers with activities which feature mathematical practices from the past and in today’s mathematics classrooms to trigger changes in teachers’ narratives about how mathematics comes to be and how its emergence can be negotiated in the mathematics classroom. We show how the discursive shifts orchestrated by these interventions generate new narratives about mathematics and its pedagogy, de-ritualised participation in mathematical routines and, ultimately, meta-level learning.

4. Time: 20:40-20:50

Title of the Paper: From a “strict and scary” class to the “active and favorite” subject: A long-lasting change in the teaching of mathematics at a first year military school in Chile

Author(s) (with the presenter name in BOLD if more than 1 name here)

Antonio Salinas Layana¹, Sergio Celis², Farzaneh Saadati²

Institution(s) (to school/department/research center) and Country/Region

¹Universidad de Chile, Chile

²Centro de Investigación Avanzada en Educación (CIAE), Chile

Short abstract of the paper (20 lines maximum):

The transition of students between the various educational subsystems is a complex process, which occurs through their passage through different contexts. This article analyzes the history of change in the way of doing math classes, in a military school in Chile whose purpose is to favor the transition of students between secondary education and professional tertiary education, in careers where mathematics are highly relevant. The analyzed change is characterized by moving from a traditional education model to one centered on the student. Our analysis used the idea of Morphogenesis developed by Margaret Archer. The data consists of interviews with all mathematics teacher and students, with special emphasis on the history of two mathematics professors who have been in the military school for 20 and 22 years. The results indicate the relevance of the teachers' agency over time, as a means to achieve significant changes that favor the transition of students. The institutional enabling factors that allowed the change are also highlighted.

5. Time: 20:50-21:00

Title of the Paper: Flipping a General Education mathematics course

Author(s) (with the presenter name in BOLD if more than 1 name here)

Fei Xue¹, Robert Nanna²

Institution(s) (to school/department/research center) and Country/Region

¹University of Hartford, USA

²Massachusetts Maritime Academy, USA

Short abstract of the paper (20 lines maximum):

In this paper, we describe the results of a study involving a flipped general education college mathematics course. Two instructors developed a comprehensive set of teaching materials for flipping M110 Modeling with Elementary Functions, and each taught two sections of the course—one flipped and the other which was taught largely via lecture. Common final exam grades, GPA, and DFW rates of the flipped and non-flipped sections were analyzed. These results, as well as a summary of students' attitudes about the flipped course, are presented here. We also outline the lessons learned from this project.

Session 2, July 14th 19:30-21:00

Time 19:30-19:40: Introduction to session 2, presentation of posters

1. Time: 19:40-19:55

Title of the Paper: The Secondary-Tertiary transition: An International perspective on where we are and how to move forward

Author(s) (with the presenter name in BOLD if more than 1 name here)

Alon Pinto, Hadas Levi Gamlieli, Boris Koichu

Institution(s) (to school/department/research center) and Country/Region

Weizmann Institute of Science, Israel

Short abstract of the paper (20 lines maximum):

The secondary-tertiary transition in mathematics education is a long-standing issue of concern. In this paper we present findings from an international survey on current challenges with respect to student transition, and on ways of moving forward. We examine the perspectives of 310 tertiary mathematics instructors from 30 different countries on different institutional measures for addressing student transition, on the effectiveness of these measures, on who should be leading future efforts to improve the situation, and on what should these efforts focus. Responses to the survey highlight that in spite of social and political differences, there are vast similarities in the way instructors in different countries and institutions experience student transition, and view local and national efforts to address it. On the basis of future projects outlined by the instructors, we discern design principles for future initiatives.

2. Time: 19:55-20:10

Title of the Paper: Conceptualizing Agency and Autonomy in Tertiary Mathematics

Author(s) (with the presenter name in BOLD if more than 1 name here)

Mariana Levin, John P. Smith III, Shiv S. Karunakaran, Valentin A.B. Küchle, Sarah Castle

Institution(s) (to school/department/research center) and Country/Region

Western Michigan University, Michigan State University, USA

Short abstract of the paper (20 lines maximum):

This paper describes an ongoing and iterative research effort aimed at conceptualizing the interrelated constructs of mathematical agency and autonomy in the context of mathematics teaching and learning at the tertiary level. We describe the impetus for our focus on agency and autonomy in students' early work in proof and proving at the collegiate level and then illustrate the dialogue between data from student interviews and reflection logs and our emerging definitions of agency and autonomy. We close with our provisional working definitions and a discussion of questions for future investigation.

3. Time: 20:10-20:20

Title of the Paper: Comparing two self-assessment models in a mathematics course – an exploratory study

Author(s) (with the presenter name in BOLD if more than 1 name here)

Jokke Häsä, Johanna Rämö & Juulia Lahdenperä

Institution(s) (to school/department/research center) and Country/Region

University of Helsinki, Finland

Short abstract of the paper (20 lines maximum):

In this experimental study, we compare two self-assessment models. In one model, the students assess their acquired skills, and in the other, they assess their coursework. We measure differences in approaches to learning, and examine how students experience the two models. The results indicate that the two models support the students differently, but more data are needed to confirm the findings.

4. Time: 20:20-20:30

Title of the Paper: Instructors, Mentors, and Students: A Cross-comparison of perceptions of student-centered instruction

Author(s) (with the presenter name in BOLD if more than 1 name here)

Kimberly Cervello Rogers¹, Sean P. Yee², Jessica Deshler³, Robert Petrusis⁴

Institution(s) (to school/department/research center) and Country/Region

¹Bowling Green State University, USA

²University of South Carolina, USA

³West Virginia University, USA

⁴Evaluation, Policy, and Research in Education Consulting, USA

Short abstract of the paper (20 lines maximum):

Forty-two novice collegiate mathematics instructors (CMIs) who were being supported in their use of student-centered techniques through a peer-mentoring program provided data about their use of such techniques during their teaching. The students in their courses and their mentors also provided data about their perceptions of the CMIs' implementation of student-centered instructional techniques, specifically around Student Engagement, Teaching Facilitation and Lesson Design factors. Results suggest that novice CMIs tended to overestimate their use of student-centered techniques within each of these factors compared to mentor-provided observation data and student-provided survey responses. Students, however, tended to report fewer instances of student-centered techniques than their instructors but more instances than that recorded by the mentors.

5. Time: 20:30-20:40

Title of the Paper: Mentoring of mid-career and Early-Career faculty

Author(s) (with the presenter name in BOLD if more than 1 name here)

James Sandefur, Michael Raney, Erblin Mehmetaj, David Ebenbach

Institution(s) (to school/department/research center) and Country/Region

Georgetown University, USA

Short abstract of the paper (20 lines maximum):

In this two-year study, two participants teach an introductory proof class to primarily math majors using a modified flipped approach, with support from a mentor. In particular, the participants teach sections in parallel with the mentor using already-prepared videos, text,

and worksheets which the participants can modify. The mentor and participants visit one another's classes and have an independent faculty member conduct a mid-semester review of the classes. Of concern is how this intense mentoring experience changes the attitudes of teachers towards more student-active learning approaches, how it changes a faculty member's beliefs about how students learn, and how students react to being taught using a modified flipped approach by faculty who are novices at this approach.

6. Time: 20:40-20:50

Title of the Paper: An approach to Transition of Mathematics of Secondary to Tertiary level Mathematics

Author(s) (with the presenter name in BOLD if more than 1 name here)

Gloria Inés Neira Sanabria

Institution(s) (to school/department/research center) and Country/Region

Universidad Distrital Francisco José de Caldas, Colombia

Short abstract of the paper (20 lines maximum):

There are multiple tensions between real analysis, school calculus, school geometry, school analytic geometry, abstract algebra, high school algebra, the arithmetic of the real numbers, the arithmetic of the rational, the arithmetic of the integer numbers, the arithmetic of the natural numbers, between the discrete and the continuous (and in the middle, the dense), between the finite and the current infinite (and in the middle, the potential infinite). There are aspects in which the notation of the calculus seems the same as the school algebra, but it is not, as seen above, all by the absence of the composition, by the understanding of the exponent (-1) as reciprocal, not as the inverse of the function, by the use of the apostrophe for the derivative, by the way of understanding the equalities that begin with "y = ..." as functions, by the juxtaposition of letters without indicating multiplication in the names of the functions (like "lnx"). We will document that it is a different semiotic record for a different conceptual system. Fundamental problem for practicing teachers and the training of future teachers.

7. Time: 20:50-21:00

Title of the Paper: The relational nature of supports for high priority mathematics students

Author(s) (with the presenter name in BOLD if more than 1 name here)

Behailu Mammo¹, Signe E. Kastberg²

Institution(s) (to school/department/research center) and Country/Region

¹Hofstra University, USA

²Purdue University, USA

Short abstract of the paper (20 lines maximum):

Suggested supports for college calculus have included peer tutoring. We explore one mathematics educator's (ME) experience of working with a peer tutor (PT) resulting in insights about relational characteristics of practice. Using a self-study methodology, we inquired into characteristics of one ME's experiences incorporating a PT into a system of supports for calculus students with the goal of supporting students to feel control of their intellectual growth. Study data included reflections on classroom practice from the ME and PT and student evaluation data from the course. The data sources were analyzed through a series of dialogues exploring how the inclusion of the PT impacted the ME's view of his practice. The dialogues resulted in a shift in emphasis away from understanding the PT's impact and toward understanding teaching in calculus as relational. We argue that understanding the ME's practice as relational allowed for a reconsideration of the nature of supports for underperforming students.

Session 3, July 16th, 21:30-23:00

Time 21:30-21:40: Introduction to session 3, presentation of posters

1. Time: 21:40-21:55

Title of the Paper: Characteristics of collective mathematical activity associated with states of student engagement

Author(s) (with the presenter name in BOLD if more than 1 name here)

Derek A. Williams¹, Jonathan López Torres², Emmanuel Barton Odro¹

Institution(s) (to school/department/research center) and Country/Region

¹Montana State University, USA

²North Carolina State University, USA

Short abstract of the paper (20 lines maximum):

In this study we investigated the nature of six preservice secondary mathematics teachers' engagement and collective mathematical activity as they worked in pairs. Students participated in five 1-hour sessions focused on concepts of logarithms. We analyzed pair- and whole-group argumentation to understand collective mathematical practices and individuals' contributions to argumentation. Self-reported data on student engagement were collected at two random times per session per student, which were further explicated through recall interviews. Results suggest contributing to mathematical ideas that function as-if-shared ways of reasoning which also prompt deeper understanding of ongoing work align with states of high engagement.

2. Time: 21:55-22:10

Title of the Paper: Investigating Mathematical Knowledge for Teaching and Quality of Instruction in US Community Colleges.

Author(s) (with the presenter name in BOLD if more than 1 name here)

Laura Watkins¹, Irene Duranczyk², Vilma Mesa³, April Ström⁴

Institution(s) (to school/department/research center) and Country/Region

¹Glendale Community College, USA

²University of Minnesota, USA

³University of Michigan, USA

⁴Chandler-Gilbert Community College, USA

Short abstract of the paper (20 lines maximum):

We present an analysis of the mathematical knowledge for teaching algebra and the connection with characteristics of instruction based on video data of instruction collected from 40 community college algebra instructors in the United States. Using a Wilcoxon sum ranked test to compare instructors with the highest and lowest scores on a test of mathematical knowledge for teaching algebra with the a rating on the mathematical errors and imprecisions coded in videos of their teaching, we found a statistically significant difference between these two groups of instructors, that suggests that instructors with higher scores on the knowledge test had a lower rating on errors and imprecisions.

3. Time: 22:10-22:20

Title of the Paper: A comparison of prospective mathematics teachers' conceptualizations of equity: two different contexts

Author(s) (with the presenter name in BOLD if more than 1 name here)

Kanita K. DuCloux¹, Corey M. Wadlington²

Institution(s) (to school/department/research center) and Country/Region

¹Western Kentucky University, USA

²West Kentucky Community and Technical College, USA

Short abstract of the paper (20 lines maximum):

Preservice mathematics teachers (PMTs) may have early and frequent opportunities to observe and teach in mathematics classrooms. What is lacking, however, are their opportunities to read about and discuss inequities that exist in mathematics classrooms to help prepare the PMTs to be advocates for equitable practices and improve the mathematics learning of every student. The purpose of this paper was to explore PMTs' from two different institutions conceptions of equity, namely access and power. Specifically, we investigated and compared their proposed responses to two hypothetical vignettes from mathematics department conversations. Preliminary results showed that the PMTs tended to consider both equality and equity in regards to calculator usage and mathematical discourse in the classroom.

4. Time: 22:20-22:30

Title of the Paper: The double discontinuity in teacher education – How to face it?

Author(s) (with the presenter name in BOLD if more than 1 name here)

Cydara Cavedon Ripoll, Luisa Rodríguez Doering

Institution(s) (to school/department/research center) and Country/Region

UFRGS - Universidade Federal do Rio Grande do Sul, Brasil

Short abstract of the paper (20 lines maximum):

Felix Klein, in 1908, points to two discontinuities in the formation of a math teacher. In the present work, intending to contribute to diminish these discontinuities, we report experiments with teachers and with first year students of Teacher's Degree. These experiments highlight the importance of regularly showing undergraduates the connections between the content being addressed in their mathematical courses and their future professional practice. It also highlights the importance of offering in service teachers' courses that deal with these connections.

5. Time: 22:30-22:40

Title of the Paper: Student reasoning about eigenequations in mathematics and quantum mechanics

Author(s) (with the presenter name in BOLD if more than 1 name here)

Megan Wawro¹, John Thompson², Kevin Watson¹

Institution(s) (to school/department/research center) and Country/Region

¹Virginia Tech, USA

²University of Maine, USA

Short abstract of the paper (20 lines maximum):

Students encounter advanced mathematical concepts in both mathematics classes and physics classes. What meanings do they develop about the concepts across the various contexts? We investigate students' meanings for eigentheory in quantum mechanics and how their language for eigentheory compares and contrasts across mathematics and quantum physics contexts. Using semi-structured individual interview data, we present students' interpretations of a mathematical 2x2 eigenequation, a spin- $\frac{1}{2}$ operator eigenequation, and a spin- $\frac{1}{2}$ operator equation in which the operation "flips" the spin state. Using discourse analysis, results characterize students' nuanced imagery for the equations and highlight instances of synergistic and potentially incompatible interpretations.

6. Time: 22:40-22:50

Title of the Paper: BullsEyes and Circles: Alternative scoring practices in collegiate mathematics courses

Author(s) (with the presenter name in BOLD if more than 1 name here)

Michelle Morgan, **Jeffrey J. King**

Institution(s) (to school/department/research center) and Country/Region

Western Colorado University, USA

Short abstract of the paper (20 lines maximum):

This qualitative case study focused on understanding the experiences of college students with two alternative scoring practice in collegiate mathematics courses: (1) the circle scoring practice in an upper-level Modern Geometry course, and (2) the bullseye scoring practice in an entry-level College Algebra course. For each course, the researcher engaged the course instructor, developer, and students in interviews about their experiences with the alternative scoring practices. In addition to interviews, the researcher observed each class for a period of four weeks. Using open coding, the researcher analyzed the transcriptions of each interview to explore emergent themes within and across the two cases. The results of this analysis offer several key themes and recommendations for implementation, including: 1) the emphasis on non-numerical scores de-emphasizing the punitive role of grades, 2) feedback being an essential component for students to be able to improve their score, 3) revisions as a motivator and being “stuck in a grade book” as a de-motivator.

7. Time: 22:50-23:00

Title of the Paper: Remediation Reform in United States tertiary education: From scaling innovations to innovation at scale

Author(s) (with the presenter name in BOLD if more than 1 name here)

Philip Uri Treisman

Institution(s) (to school/department/research center) and Country/Region

The University of Texas at Austin, USA

Short abstract of the paper (20 lines maximum):

In the United States, a significant number of students enter tertiary education with inadequate preparation for college-level mathematics. Tertiary institutions have historically placed underprepared students into multi-semester sequences of pre-requisite, non-credit-bearing remedial mathematics courses with the intent of giving students extra time to prepare for college-level coursework. A large and compelling body of evidence shows that traditional remediation has failed to support students' successful transition to college-level mathematics. In response, a growing movement of education systems and state governments are working at scale to replace traditional remediation with "co-requisite" models that directly place underprepared students into college-level classes with additional supports. Every evaluation of co-requisite remediation has shown substantial improvements in student success compared to the traditional model. However, important questions remain that should be addressed by future research.

Session 4 July 17th, 14:30-16:30

Time: 14:30-14:40 Introduction to session 4, preparation for the synthesis

1. Time: 14:40-14:50

Title of the Paper: Success of mathematics training and talent search programme in India

Author(s) (with the presenter name in BOLD if more than 1 name here)

Ajit Kumar¹ and S. Kumaresan²

Institution(s) (to school/department/research center) and Country/Region

¹Institute of Chemical Technology, Mumbai, INDIA

²MTTS TRUST, Hyderabad, INDIA

Short abstract of the paper (20 lines maximum):

Mathematics Training and Talent Search (MTTS) Programme is a four-week intensive summer training programme which has been organized since 1993 at various centres in India. MTTS is one of the most effective and unparalleled training programmes and it has made significant impact on mathematical scene in India. The aim of this paper is to give a brief introduction of this programme and look at why this programme has been so successful in India which has inspired hundreds of students to higher mathematics as their career.

2. Time: 14:50—15:00

Title of the Paper: Geometry for student teachers – A capstone course in mathematics with a multitude of links to school mathematics

Author(s) (with the presenter name in BOLD if more than 1 name here)

Max Hoffmann and **Rolf Biehler**

Institution(s) (to school/department/research center) and Country/Region

Paderborn University, Germany

Short abstract of the paper (20 lines maximum):

At Paderborn University, a new 6th semester geometry-course for upper secondary student teachers has been designed and taught by the presenting author of this paper as a part of his doctoral project. The accompanying research is done in a design-research paradigm. Part of the course design is directed to creating learning environments that help overcoming the second discontinuity of teacher education. During three iterations the entire course has been and will be evaluated and studied using various research methods. The first goal is a theoretically well-founded redesign. In a second step, we want to figure out design principles and conditions for successful learning environments that help to overcome the second discontinuity. In this contribution, we present a task from one of these environments, as well as first results of the accompanying research.

3. Time: 15:00—15:10

Title of the Paper: An innovative hands-on activity to facilitate the learning of group of symmetries in abstract algebra

Author(s) (with the presenter name in BOLD if more than 1 name here)

Tika Ram Pokhrel and Parames Laosinchai

Institution(s) (to school/department/research center) and Country/Region

Mahidol University, Salaya, Thailand

Short abstract of the paper (20 lines maximum):

In many cases, group theory is the first taught axiomatic mathematics and so is abstract algebra. Thus, the way teachers teach and students learn group theory is considered as the foundation with respect to development of mathematical abilities and attitude towards mathematics in higher level. It has been realized that permutation group (S_3) is the most common example throughout the group theory and students need to remember elements and their compositions. Review of different solution initiatives with practical perspectives

such as inclusion of seminar, visual and analytical approach, collaborative approach with ISETL and penny moving, etc. and theoretical perspectives such as inquiry based mathematics education, linking informal knowledge to formal mathematics and constructivist learning became helpful in this innovation. This innovative hands-on activity was developed by following design thinking approach with a view to bring changes in learning of group of symmetries in undergraduate level. This hands-on activity has two parts: one on the regular polygon (equilateral triangle and square) and permutation using these polygons including five worksheets to facilitate learning.

4. Time: 15:10—15:20

Title of the Paper: Errors of engineering students on the vector subspace concept

Author(s) (with the presenter name in BOLD if more than 1 name here)

Andrea Cárcamo and Claudio Fuentealba

Institution(s) (to school/department/research center) and Country/Region

Universidad Austral de Chile, Chile

Short abstract of the paper (20 lines maximum):

In this article, we present the results of an exploratory study whose objective is to identify the errors of the students with the definition of vector subspace. To do this, we analyze the answers of 210 first-year university students to a question about vector subspace of an individual evaluation. The responses of each student were observed to identify frequent errors linked to the concept of vector subspace. The results show that the majority of students made two types of errors: they do not use the definition of vector subspace and do not use the counterexample as a means to show that a set is not a vector subspace. These results will be used as inputs to look for teaching strategies that contribute to avoid these errors in Linear Algebra students.

5. Time: 15:20—15:30

Title of the Paper: Engineering students' approach to studying mathematics and its influence on their achievement

Author(s) (with the presenter name in BOLD if more than 1 name here)

Helena Johansson, Magnus Oskarsson and Hugo von Zeipel

Institution(s) (to school/department/research center) and Country/Region
Mid Sweden University, Sweden

Short abstract of the paper (20 lines maximum):

Previous research has addressed undergraduate students' approaches to studying mathematics from various perspective, with differing results regarding influences on achievements. This study contributes to the fields understanding by examine if and how engineering students' various approaches to studying mathematics, particularly a differential calculus course, affect their success on the course exam. Three questionnaires were distributed to the students and a logistic regression model showed that the habit to study regularly had a positive effect on exam results, whereas the strategy to imitate previous examples had a negative effect.

6. Time: 15:30—15:40

Title of the Paper: First year university students' goals and strategies

Author(s) (with the presenter name in BOLD if more than 1 name here)

Robin Göller

Institution(s) (to school/department/research center) and Country/Region
Leuphana University of Lüneburg, Germany

Short abstract of the paper (20 lines maximum):

This paper presents a category system for describing students' goals and strategies in dealing with the mathematical contents of the first year of study. Based on theories of self-regulated learning, categories were developed using Grounded Theory Methodology on the basis of interviews with 18 first-year students. The results show that the inclusion of different strategy classes and their theoretical foundation can be helpful and important for the description and understanding of students' practices. Although the results reported here are based on a small, qualitative sample, these categories provide a more holistic view of the everyday learning of mathematics students at universities with possible implications for research practices and institutional settings.

7. Time: 15:40—15:55

Title of the Paper: How university students perceive the importance of resources to study calculus and linear algebra

Author(s) (with the presenter name in BOLD if more than 1 name here)

Zeger-Jan Kock¹, Birgit Pepin¹ and Domenico Brunetto²

Institution(s) (to school/department/research center) and Country/Region

¹Eindhoven University of Technology, Eindhoven School of Education, The Netherlands,

²Politecnico di Milano, Department of Mathematics, Milano, Italy

Short abstract of the paper (20 lines maximum):

With a plethora of resources available to first year engineering students studying mathematics, it has become important to understand which resources are preferably selected by the students. In this survey study we investigated (1) which student clusters could be distinguished in the perceived importance of resources to study first year mathematics courses; and (2) how these clusters compared in terms of the variables measured in the survey. Participants to the survey were 403 Calculus and Linear Algebra students at a Dutch university of technology. To distinguish clusters in the data, we used “community detection” based on network analysis. Results showed that three clusters could be identified, which are portrayed and discussed in this paper. In one cluster, interactive digital resources for formative assessment were considered of some importance, while students in the other clusters preferred traditional curriculum resources, such as the textbook and lecturer explanations.

8. Time: 15:55—16:10

Title of the Paper: Gendered patterns in university students’ use of learning strategies for mathematics

Author(s) (with the presenter name in BOLD if more than 1 name here)

Lara Gildehaus and Michael Liebendörfer

Institution(s) (to school/department/research center) and Country/Region
Paderborn University, Germany

Short abstract of the paper (20 lines maximum):

We conducted a study analyzing students' learning strategies in courses for preservice primary teachers ($n = 118$), engineering students ($n = 969$), mathematic majors, physics majors and preservice secondary teachers ($n = 144$), and economics students ($n = 137$). The results show that the courses, students' self-efficacy, and their gender may explain their use of learning strategies. The typical behavior of women aligns to the stereotype of women being diligent and social. This result points to learning strategies as a helpful lens to describe women's unequal participation in higher mathematics. We discuss how to achieve a more equal participation by helping women to adapt their learning strategies to the requirements in mathematics or by changing the way mathematics is taught.

Time: 16:10-16:30

Discussion: Synthesis of the TSG2 works and conclusions