

TSG 28 Agenda

TSG 28: Preservice mathematical teacher education at primary level

Session 1- July 13th, Tuesday (14:30-16:30)

1. Time: 14:35-14:50

Title of the Paper: **HOW PRE-SERVICE TEACHERS JUDGE AN UNEXPECTED STUDENT SOLUTION - EXPLICIT AND IMPLICIT CRITERIA**

Author(s): **Christin Laschke**, Bettina Rösken-Winter & Sven Schüller
Institution(s) (to school/department/research center) and Country/Region:
Humboldt-Universität zu Berlin, GERMANY

Short abstract of the paper:

Teachers' judgments on students' achievements need to be precise, and unbiased. "Educational standards" provide a frame for explicit judging criteria. However, previous research points to inadequate judgments by teachers driven by stereotypes when faced with an unexpected situation. In order to reveal pre-service teachers' (PST) judgments, we examine to which explicit criteria they refer when confronted with an unexpected student solution of a probability problem. Furthermore, we question whether implicit judging criteria matter, by combining the creative student solution with first names indicating a high or low social status or Vietnamese or Turkish immigrant background. In our study, 112 primary PSTs in their fourth bachelor term of a German university participated. The results show that the PSTs mostly used content-specific criteria (78 %), instead of providing rather generic rationales. Also, implicit criteria matter as judgments are biased by social background. In sum, the result point to the need to bring to mind these implicit criteria, and to strengthen students' use of explicit ones.

2. Time: 14:50-15:05

Title of the Paper: **AN ANALYSIS OF PRESERVICE TEACHERS' NOTICING OF STUDENT PATTERN GENERALIZATION STRATEGIES**

Author(s) : **Ji-Eun Lee & Mi Yeon Lee**
Institution(s) (to school/department/research center) and Country/Region
Ji-Eun Lee (Oakland University), Mi Yeon Lee (Arizona State), USA

Short abstract of the paper:

This study examines the characteristics of elementary pre-service teachers' (N=154) attention to student work, analysis of what they attended to, and suggestions for students' progress using a task involving pattern generalizations. The analysis includes participants' interpretations of sample student strategies and their suggested support plan for the improvement of student learning. While a wide range of aspects of student learning was noticed, the findings show the lack of sophistication in the analysis of student thinking and support for improvement. Also, there was a huge leap between the students' current thinking and the PSTs' suggested support. Based on these findings, we make some suggestions for preservice teacher education.

3. Time: 15:05-15:10

Title of the Paper: **DESIGNING TASKS FOR SUPPORT PRESERVICE PRIMARY TEACHERS' NOTICING OF GEOMETRICAL THINKING**

Author(s) : **Bernabeu, M.**; Moreno, M.; Llinares, S.

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

University of Alicante, SPAIN

Short abstract of the paper:

The aim of this research is to characterize the design of professional tasks for supporting noticing's preservice primary teachers of primary students' geometrical thinking. Jacobs, Lamb, & Philipp, (2010) describe three aspects of noticing, to attend to the evidences of geometrical thinking in the primary students' answers, to interpret them, and to justify their decisions. We have focused on noticing of geometrical thinking using the process of understanding of geometrical figures (Duval, 1995, 2017) and synthesis of researches about 2D-geometrical figures as knowledge to be used in attend to, interpret students' geometrical thinking and justify the teaching actions. We use three aspects to design professional tasks to enhance preservice primary teachers of primary students' geometrical thinking: a sociocultural perspective of preservice teachers' learning, learning trajectories of primary students' learning, and practical register.

4. Time: 15:15-15:25

Title of the Paper: **PRESERVICE CHINESE TEACHERS' RESPONSES OF A STUDENT INVENTED DECIMAL DIVISION ALGORITHM**

Author(s): **Jia He & Bo Zhang**

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

Augusta University, USA & Yang Zhou University, China

Short abstract of the paper:

This study investigated preservice Chinese elementary school teachers' responses to a student-invented decimal division algorithm. About two thirds of the participants correctly evaluated the invented method. They were able to apply the invented method to different types of decimal division problems and considered the validity. A few participants automatically made connections between the invented method and decimal multiplication algorithm. A few participants provided ideas to improve the invented method. The findings also reveal that about one third of Chinese PTs accepted Gang's method as valid or provided unclear or no responses. This suggests that Chinese PTs' understanding of decimal division is not as strong as it is reported in other content areas.

5. Time: 15.25-15:35

Title of the Paper: **STUDENT TEACHERS' NOTICING OF CHILDREN'S BELIEFS AND UNDERSTANDING IN MATHEMATICS**

Author(s): Guðbjörg Pálsdóttir

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

University of Iceland

Short abstract of the paper:

In teacher education it is important to give the student teachers opportunity to develop their professional identity and skills. In this paper the focus is on noticing and how and what is noticed from videos of mathematics lessons. Seventeen 4th year student teachers participated in a research on how a small group of children approached and dealt with mathematical tasks. They

performed three different lessons with 8 groups. The lessons were videotaped and analysed, partly by the whole group of student teachers and partly in pairs. In the analysing process the author (teacher educator) focused on what the student teachers noticed and how they reasoned about their noticing. The main findings are that they noticed emotional elements, children's expression of number sense and in their reasoning they focused on the spoken language and facial expressions. When they had watched the videos several times, their noticing developed and discussions about what to learn from them deepened. Videos from own teaching seem to give good support to student teachers' professional development.

6. Time: 15.35-15:45

Title of the Paper: **RELATIONSHIP BETWEEN PRESERVICE TEACHERS' KNOWLEDGE AND THEIR RESPONSES TO STUDENTS' ERRORS: MAKING WORD PROBLEMS FOR THE CONCEPT OF DIVISION**

Author(s): **Qintong Hu** ; Lynn Hodge & Shande King

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

Shandong University of Science and Technology, The University of Tennessee, Knoxville

Short abstract of the paper:

Using word problems to represent number sentences is a critical mathematical skill. This study examined preservice teachers' (PSTs) knowledge of making word problems for the partition and measurement models of the concept of division and their interpretations and responses to a student's error involving making word problems for a given division number sentence through a teaching scenario task. Twenty-one PSTs' responses were analyzed quantitatively and qualitatively. Analysis results revealed that PSTs have difficulties in making word problems for the measurement model of the concept of division, especially when fractions are involved. Responding to students' errors, the

PSTs who demonstrated knowledge proficiency in making word problems tended to explain underlying conceptual knowledge and engage students in the conversation of error analysis while the PSTs who failed to make correct word problems for both the partition and measurement models tended to provide students with general guidance that offers little help to correct errors and to build conceptual understandings of the topic.

7. Time: 15:45-15.55

Title of the Paper: **A STUDY ON WRITTEN FEEDBACK ON PRESERVICE TEACHERS' TEACHING PRACTICES AND ITS IMPACT ON NOTICING**

Author(s): **Müjgan Baki**, Zeynep Medine Özmen

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

Trabzon University, Trabzon, TURKEY

Short abstract of the paper:

This study investigates how written feedback on the assessment of preservice teachers' teaching practices affects their noticing. It was conducted with preservice elementary mathematics teachers taking the Special Teaching Methods course, and a quasi-experimental post-test design was used. In order to measure preservice teachers' noticing, a video-based post-test was used at the end of term. A rubric was developed to find out the preservice teachers' noticing levels. An independent t-test was conducted in order to see whether the difference between the experimental and control groups was statistically significant. Providing written feedback on the written assessment of preservice teachers' teaching practices was found to have a positive impact on their noticing.

8. Time: 15:55-16:05

Title of the Paper: **PROSPECTIVE TEACHERS' NOTICING OF STUDENT'S ALGEBRAIC THINKING: PATTERN GENERALIZATION**

Author(s): **Zeynep ÖZEL**; Mine IŞIKSAL-BOSTAN; Reyhan TEKİN-SİTRAVA

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

Kırıkkale University Middle East Technical University Kırıkkale University, TURKEY

Short abstract of the paper:

The purpose of the study was to investigate prospective middle school mathematics teachers' noticing of student's algebraic thinking within the context of pattern generalization. The data was gathered from thirty-two prospective teachers who enrolled in last year of one public university located in Ankara via a student's written work including his solution of a pattern generalization question and semi-structured interviews. According to the analysis of the data, nearly half of the prospective teachers could describe many mathematical details of student's solution. However, they had a difficulty in interpreting student's algebraic thinking based on his solution. Despite of prospective teachers' difficulty in interpreting student's thinking, vast majority of the prospective teachers could support the algebraic thinking of student with incorrect solution by asking follow-up questions.

9. Time: 16:05-16:15

Title of the Paper:

DEVELOPING PRESERVICE TEACHERS' NOTICING AND NOTIONS OF PRODUCTIVE STRUGGLE WITH VIDEO ANALYSIS

Author(s): Hiroko Warshauer; **Christina Starkey**; Christine Herrera; Shawnda Smith

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

Texas State University; Southern New Hampshire University; . California State University, Chico Texas Woman's University, USA

Short abstract of the paper:

This study examined the development of preservice teachers' (PSTs) perceptions of productive struggle in learning mathematics using video episodes which PSTs analyzed using a professional teacher noticing framework. Our qualitative study included 66 PSTs in a mathematics content course for prospective teachers. The video episodes served as representations of practice as PSTs observed students struggling with the course content they were studying. Findings reveal that the PSTs develop the ability to attend and interpret the mathematics underlying the student struggles. They also begin to identify teaching strategies and practices that appear potentially useful for supporting productive struggle. The use of a productive struggle framework helped the PSTs develop a language for discussing productive struggle. One implication for this study is to carefully weave opportunities to develop high-quality teaching practices such as support of productive struggle into the content course for teaching.

Session 2- July 13th, Tuesday (19:30-21:00)

10. Time: 19:30-19:45

Title of the Paper:

TRACING THREADS OF AWARENESS IN INITIAL TEACHER EDUCATION: PEER-COLLABORATION

Author(s): **Gwen Ineson, Julie Alderton**, Chronoula Voutsina, Kirsty Wilson, Gina Donaldson, Tim Rowland

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

Brunel University London, University of Cambridge, University of Southampton,

University of Birmingham, Canterbury Christ Church University, University of Cambridge, UK

Short abstract of the paper:

This paper reports on a UK project exploring the learning of preservice primary teachers whilst they engaged in doing mathematics and how this experience shaped their subsequent teaching. During university-based sessions, we presented a number of visual growing patterns for preservice teachers to investigate collaboratively and to consider possible approaches to use in their teaching. We draw on aspects of enactivism and the notion of reflective spection in the context of teacher learning, tracing threads between preservice teachers' retro-spection of their own learning and pro-spection of their approach to teaching. Our findings suggest that preservice teachers emphasize the importance of collaboration in 'seeing' what others 'see' and that this influences their teaching.

11. Time: 19:45- 19:55

Title of the Paper: **PRESERVICE MATHEMATICS TEACHER EDUCATION FOR THE MONTESSORI TEACHERS**

Author(s): **Kinful Lartebea Aryee**, Immaculate Kizito Namukasa, Marja Bertrand

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

Western University. USA

Short abstract of the paper:

This paper is in line with research on teacher learning which aims to support mathematics instructional reform in schools. Few mathematics educational reform studies focus on teacher learning and implementation of this learning in separate curriculum systems. This paper reports on the nature of mathematics-for-teaching in the Montessori teacher education system. To study the training experiences of teachers in a Montessori accredited school we interviewed and observed them. Findings indicated that the Montessori mathematics-for-teaching training strongly influences how teachers organize and prepare classroom learning environments, and how the teachers enhance the development of learning competencies, such as that of understanding concepts independently, among learners. Teachers' training, for example, focused on teaching through learning materials as well as the lessons for teaching each concept to learners. This research is, specifically, significant for designing teacher education course content that supports learning of reform instructional practices.

12. Time: 19:55-20:05

Title of the Paper: **EXPLORING PRE-SERVICE TEACHERS' MATHEMATICS LEARNING EXPERIENCES AND SELF-EFFICACY IN TEACHING PRIMARY LEVEL MATHEMATICS**

Author(s): Sangyeon Park

Institution(s) (to school/department/research center) and Country/Region
University of Florida, USA

Short abstract of the paper:

This study explores the mathematical learning experiences of four pre-service primary teachers in their final year of a state-approved teacher preparation program (TPP) at Florida university and their self-perceived mathematical competence and self-efficacy beliefs in teaching math. In this Qualitative case study, thematic analysis was used to analyze Questionnaires and in-depth interviews completed by the preservice teachers (PST). Findings suggest that pre-service teachers' self-perceived mathematics competence was expressed based on a comparison with the Language Arts (reading), and/or social studies. In addition, the mathematics content courses from TPP had a significant role in reforming the pre-service teachers' self-perceived competence in the mathematical concepts and in teaching math to students.

13. Time: 20:05-20-15

Title of the Paper: **DEVELOPING PROSPECTIVE TEACHERS' MENTAL MODELS OF EXPERTISE IN TEACHING ELEMENTARY MATHEMATICS**

Author(s): Xue Han

Institution(s) (to school/department/research center) and Country/Region
National Louis University, USA

Short abstract of the paper:

The study attempted to answer how the elementary teacher education curriculum-the Adaptive Cycles of Teaching (ACT) influenced the teacher candidates' mental models of student mathematics learning. The ACT is an intensive teacher education curriculum at a Midwest university of the US that draws on the core practices of teaching and engages teacher candidates in the cycles of designing a plan, enacting the plan, analyzing the lesson and synthesizing feedback and student learning data. The results showed that the teacher candidates embraced and enacted the ideas of employing pictorial representations in mathematics teaching and learning, encouraged the students to share different strategies, but it was challenging for them to anticipate students' possible mathematical ideas and connect students' different mathematical ideas in instruction.

14. Time: 20:15-20:25

Title of the Paper: **WHERE THE JOURNEY TO REFLECTIVE PRACTICE BEGINS: A CASE OF PRE-SERVICE TEACHERS**

Authors: Chikiwa Samukeliso & Graven Mellony

Institution(s) (to school/department/research center) and Country/Region
Rhodes University, SOUTH AFRICA

Short abstract of the paper:

Reflective practice has gained popularity in research that focuses on effective teaching and learning. Although there are challenges in defining the term 'reflection', its importance in the professional development of teachers is widely acknowledged. This paper reports on the preliminary findings of an on-going research study that explores pre-service teachers' reflective practice in the context of video-based lesson analysis. 18 pre-service teachers participated in the

study. We analyzed the written reflections using content analysis and found that pre-service teachers' reflective practice journey begins with basic description of general (rather than mathematical) classroom events with almost no analysis, critical reflection or engagement with possible alternatives

15. Time: 20:25-20:35

Title of the Paper: **PRESERVICE TEACHERS DESIGNING MEANINGFUL DIGITAL LEARNING ENVIRONMENTS USING MAKERSPACES FOR MATH**

Author(s) : **Anjali Khirwadkar** & Candace Figg

Institution(s) (to school/department/research center) and Country/Region
Brock University, CANADA

Short abstract of the paper:

Preparation for teaching in digital classrooms and designing learning environments for students immersed in a digital society has become increasingly important in teacher education programs where there is an urgent need for preservice teachers to be prepared to create meaningful digital learning experiences. This paper shares the findings from an exploratory study that introduces makerspaces to preservice teachers, and investigates the connections preservice teachers made between the teaching of mathematics and makerspace experiences. Findings suggest that participants gained knowledge and skills about the use of makerspaces for teaching mathematical concepts in primary/junior learning environments, developed their Technological Pedagogical and Content Knowledge through the makerspace activities, and conducted computational thinking skills throughout the workshop. A key finding was that through participation in the in-class makerspace, participants were able to describe how makerspace activities could be used to connect multiple strands in mathematics together to enable students to learn concepts holistically.

16. Time: 20:35-20:45

Title of the Paper: **SITUATION ANALYSIS ON THE TEACHING AND LEARNING OF STATISTICS AND PROBABILITY IN TEACHER TRAINING COLLEGES**

Author(s) : **Jean Claude Dushimimana** & Alphonse Uworwabayeho

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

Short abstract of the paper:

This paper adopted the quantitative and qualitative design approach to investigate the teaching and learning of statistics and probability in Teacher Training Colleges (TTCs) in Rwanda. It focuses on the pedagogical content knowledge appropriate to train pre-service primary teachers, teachers' attitudes and beliefs, and the integration of technology in the teaching and learning of statistics and probability. All mathematics teachers from 13 TTCs located across the country completed a questionnaire in order to analyze the current teaching practices; lesson observations and interview were conducted for 5 randomly selected teachers. The average correlation across different aspects considered (statistics and probability curriculum, teachers' pedagogical content knowledge, teachers' attitudes and belief, and the integration of ICT tools) are 0.43, 0.42, 0.39, and 0.45 respectively. The Pearson's correlation coefficient between the responses at each time point is 0.95 which shows a significant correlation between responses. Participants demonstrated positive attitude towards statistics and probability while lesson observations revealed that the teaching and learning focuses on the computation of statistical parameters with little life situations; there was also absence of technology integration in the teaching and learning process.

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

17. Time: 21:30-21:45

Title of the Paper: **MATHEMATICS WORKSHOPS: CHANGING THE PERCEPTIONS OF BOTH IN-SERVICE AND PROSPECTIVE TEACHERS WITH REGARD TO MATHEMATICS**

Author(s): Valentina Celi, José Ignacio Cogolludo, Raquel García Catalán, Elena Gil Clemente, **Inmaculada Lizasoain**, Ana María Millán Gasca, Luigi Regoliosi

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

Université Bordeaux, Universidad de Zaragoza, Universidad Pública de Navarra, Universidad de Zaragoza, Universidad Pública de Navarra, Università Roma Tre, Associazione Tokalon

Short abstract of the paper:

In this paper, we present a new format for mathematical workshops for pre-service teachers (PSTs) that seek to bring their university mathematical training closer to the school classroom reality while addressing issues such as confidence and their previous experiences of maths at school. The aim is to provide the participants with a group lived experience in order to change both their beliefs about the nature of mathematics and their attitude towards teaching it. The results of the implementation of an initial version of the workshops in a pilot phase of the project are presented here.

18. Time: 21:45-22:00

Title of the Paper: **SCHOOL UNIVERSITY PARTNERSHIP IN MATHEMATICS TEACHER EDUCATION: HOW PROSPECTIVE MATHEMATICS TEACHERS VIEW THEIR EXPERIENCES**

Author(s): **Rukiye Didem Taylan**, Zelha Tunç-Pekkan, Mustafa Özcan

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

MEF University, Turkey

Short abstract of the paper:

It is important for prospective mathematics teachers (PMTs) to integrate theoretical knowledge of teaching with school-based practical knowledge by way of structured field-based experiences. One proposed teacher education model which was developed in order to improve quality of teacher education by building connections between schools and universities in Turkey is the "University within School" model. According to this model, the PMTs gain field experience by working with students starting from the 1st year in their teacher education programs. The PMTs' first teaching related practices are in the form of tutoring and small group teaching, which aim to help them prepare for the whole class teaching. In this paper, different forms of school and university partnership experiences are described and PMTs' views on these experiences are investigated. Analyses of the PMTs' reflections on clinical experiences revealed the PMTs believed such experiences helped their professional growth in different ways.

19. Time: 22:00-22.10

Title of the Paper: **BUILDING A UNIVERSITY-SCHOOL PARTNERSHIP: FROM EARLY MISSTEPS TO EMERGING SUCCESS**

Author(s): **Ryan G. Zonnefeld**, & Valorie L. Zonnefeld,
Institution(s) (to school/department/research center) and Country/Region
Dordt University , USA

Short abstract of the paper:

University teacher preparation programs have often longed for stronger partnerships with K-12 schools, recognizing the value of regular field experiences for preservice teachers throughout their program. Dordt University recognized this importance and has been a leader in the state of Iowa (United States) in implementing the Professional Development School model of teacher preparation. This model has extended into the preparation of elementary mathematics teachers in an intensive university-school partnership where preservice teachers are deeply embedded in an elementary classroom throughout their mathematics pedagogy course.

20. Time: 22:10-22:20

Title of the Paper: **PRE-SERVICE ELEMENTARY TEACHERS DO STEM NIGHT: INQUIRY LEARNING AND AHA! MOMENTS**

Author(s): **Bridgette A. Fincher** & Derrel V. Fincher
Institution(s) (to school/department/research center) and Country/Region
Pittsburg State University, Oklahoma House of Representatives, USA

Short abstract of the paper:

STEM Nights provide an authentic audience for pre-service elementary teachers (PSETs) to engage elementary students, and their families, in inquiry mathematics activities developed through a process of lesson co-construction and peer feedback. This feedback, and subsequent participation in the STEM Nights, helps PSETs refine their mathematical pedagogical content knowledge and improve their mathematics self-efficacy. This paper discusses one feedback implementation in an elementary mathematics methods course and the qualitative results.

21. Time: 22:20 – 22:30

Title of the Paper: **FEATURES OF EXEMPLARY LESSONS OVER DIFFERENT DECADES: A COMPARATIVE ANALYSIS OF ELEVEN ELEMENTARY MATHEMATICS LESSONS IN CHINA**

Author(s): **Dongchen Zhao** & Yunpeng Ma
Institution(s) (to school/department/research center) and Country/Region
Harbin Normal University, China; Northeast Normal University, China

Short abstract of the paper:

This paper presents a comparative study on exemplary lessons of elementary mathematics over different decades in Mainland China. The selected exemplary lessons in this study were all honored as the first-class exemplary lesson in the national level teaching contests or exhibitions. Eleven exemplary lessons with three different topics were selected from the last decade of the 20th century and the first decade of the 21st century and then were analyzed from five dimensions—instructional objectives, lesson structure, instructional content, ways of teaching and learning, and usage of textbook. The results showed that both similarities and differences co-existed among the exemplary lessons over different decades, which reveals that the mathematics education reform is a successive and gradually changing process.

22. Time: 22:30-22:40

Title of the Paper: **IN WHAT WAYS DOES A MATHEMATICS CURRICULUM BASED ON THE THEORY OF MULTIPLE INTELLIGENCES AFFECT THE ATTITUDES AND BELIEFS OF PRE-SERVICE ELEMENTARY SCHOOL TEACHERS TOWARD MATHEMATICS?**

Author(s): Mark Arvidson

Institution(s) (to school/department/research center) and Country/Region
Azusa Pacific University, USA

Short abstract of the paper:

The Theory of Multiple Intelligences has proven to be an effective way to design curriculum for the mathematics classroom. However, many factors contribute to a general phobia of learning and teaching mathematics by pre-service teachers, not the least of which are the attitudes they bring to the classroom. This study explored the extent to which pre-service teachers' attitudes toward mathematics changed during a Multiple Intelligences based course, Mathematics for Elementary Teachers, and the correlation between pre-service teachers' initial attitudes toward mathematics and their achievement in the course. Utilizing the Attitudes Toward Mathematics Inventory (ATMI), the categories of value, enjoyment, motivation and self-confidence showed no significant change. However, initial attitudes about mathematics were positively correlated with the final exam grade ($p < .05$). While participants valued mathematics, their scores for enjoyment, motivation and self-confidence were neutral to negative. In sum, developing self-confident, motivated students who value and enjoy mathematics cannot be overstated, but the path for doing so is not so clear.

23. Time: 22:40-22:50

Title of the Paper: **THE IMPACT OF DEFINING ACTIVITY ON THE BELIEFS OF PROSPECTIVE ELEMENTARY TEACHERS**

Author(s): **Suzanne R. Harper; Dana C.Cox** & Jane M. Keiser

Institution(s) (to school/department/research center) and Country/Region
Miami University, USA

Short abstract of the paper:

This qualitative study sought to explore prospective elementary teachers' (PSETs) beliefs about the role definition plays in the learning of mathematics. PSETs completed activities using geometry software, and collaboratively created definitions of specific quadrilaterals. An assigned reading and written reflection of their experience followed. Data from these reflections were analyzed for themes and emergent categories. Experiences related to the process of defining enabled PSETs to see far greater subjectivity in the discipline of mathematics and to consider, perhaps for the first time, that they, too, were both able and deserving of becoming authors of mathematical ideas.

Session 4- July 17th, Saturday (14:30-16:30)

24. Time: 14:30-14:45

Title of the Paper: **EXPLORING HOW PROSPECTIVE TEACHERS POSE PROBLEMS: THE CASE OF $8x(-2)$**

Author(s): **Montes, M.**, Martín, J., Pascual, M.I., Climent, N., Carrillo, J.
Institution(s) (to school/department/research center) and Country/Region
University of Huelva, SPAIN

Short abstract of the paper:

Posing problems is an activity which is intrinsically bound up with the work of primary teachers with responsibility for teaching mathematics. This study explores how 121 prospective primary teachers construct problems which involve the operation $8x(-2)$ in their solution. To do so, we first focus on how trainees express different mathematical elements in the written register of representation. Then we consider the different possible solutions to the problems suggested by the prospective teachers, comparing these with the solutions that each trainee actually carried out on the problems they had devised. We also analyse the semantic categories of the problems posed, as well as their context. Our findings show that the prospective primary teachers come under some inconsistencies while posing their problems, related to the relationship between negative numbers and the context and also related to the anticipation of the negative nature of the solution.

25. Time: 14:45-15:00

Title of the Paper: **TORPEDO, A DIGITAL LEARNING ENVIRONMENT FOR DEVELOPING MATHEMATICAL PROBLEM-SOLVING ABILITY IN PRIMARY TEACHER EDUCATION**

Author(s): **Marjolein Kool & Ronald Keijzer**
Institution(s) (to school/department/research center) and Country/Region
Hogeschool Utrecht and Hogeschool iPabo, the Netherlands

Short abstract of the paper:

TORPEDO is a digital learning environment for pre-service teachers in primary teacher education for developing mathematical problem-solving ability during self-study. To achieve this, TORPEDO supports and challenges pre-service teachers' reflection after solving non-routine mathematics problems. To investigate the feasibility of the TORPEDO approach, 271 pre-service teachers used TORPEDO for one month in a pilot study. They used and evaluated TORPEDO's reflective elements differently. The results varied from pre-service teachers who experienced that reflection really contributed to the development of their problem-solving ability, to pre-service teachers who hardly reflected. The last group consist of those who found the problems too difficult to solve and reflect upon and those who used TORPEDO to prepare for the National Mathematics Test and preferred to do so by drill and practice. The research provides clues to improve TORPEDO so that it can provoke more reflective study behaviour, but for pre-service teachers who do not consider reflection valuable self-study in a digital learning environment may be insufficient to change this attitude.

26. Time: 15:00-15:15

Title of the Paper: **USING TECHNOLOGY FOR VIRTUAL REPRESENTATION OF TEACHING FOR DEVELOPING MATH TALK DURING PROBLEM SOLVING**

Author(s): **Melva R. Grant** & Signe Kastburg

Institution(s) (to school/department/research center) and Country/Region
Old Dominion University Purdue University

Short abstract of the paper:

This study addresses the question: How does virtual teaching influence preservice teacher confidence and efficacy of facilitating productive math talk during problem solving? Using TeachLive™, a classroom simulation environment with avatars as students, preservice teachers engage in this virtual representation of teaching to practice facilitating math talk. Findings suggests that the PSTs grew both confidence and efficacy for facilitating productive math talk during problem solving using a teach reteach approach to microteaching within a simulated representation of practice. One implication of this study is that the TeachLive™ virtual environment may offer PSTs taking online courses the benefit of practicing teaching strategies that require live learners in classroom settings.

27. Time: 15:15-15:25

Title of the Paper: **PRE-SERVICE TEACHERS' CONCEPTUAL UNDERSTANDING OF FRACTIONS: IMPLICATIONS FOR IMPROVING CURRICLUM STANDARDS AND CLASSROOM PRACTICES**

Author(s): **Suhaidah Tahir**, Masami Isoda, Munirah Ghazali & Dominador Dizon Mangao

Institution(s) (to school/department/research center) and Country/Region
Teacher Training Institute, MALASYA

Short abstract of the paper:

This research aims to investigate pre-service teachers' conceptual understanding and pedagogical content knowledge in teaching fractions. It describes pre-service teachers' understanding of fractions through their involvement in a workshop. They were exposed to a brief lecture on the essential theories revolving fractions to enable them to plan their mathematics lessons for maximum understanding and learning of fractions by their students in the future. A pre-post-tests were administered to draw out students understanding of fractions. Other data were gathered through observations and interview during the workshop. Significant findings and analyses will be reported in this paper as well as recommendations advanced.

28. Time: 15:25-15:35

Title of the Paper: **INTEGRATING EDTPA PREPARATION IN A METHODS OF TEACHING ELEMENTARY MATHEMATICS COURSE**

Author(s): Norma J. Boakes

Institution(s) (to school/department/research center) and Country/Region
Stockton University, USA

Short abstract of the paper:

In the United States, each state determines requirements for initial teacher licensure. Recently states have begun to adopt consequential, performance-based assessments that measure a preservice teacher's pedagogical competency within their licensure area as part of initial teacher certification requirements. This paper will discuss my approach to preparing elementary candidates for the mathematics aspect of the edTPA assessment in a methods of teaching course.

Work captured within the assessment is aligned to the National Council of Teachers of Mathematics' Principals and Standards (2000) for teaching including the development of conceptual understanding, procedural fluency and mathematical reasoning skills of learners. The edTPA-aligned course project created focused on the cycle of effective teaching (SCALE, 2018) that includes data informed decision making. Specifics of the course project and edTPA results from candidates are presented. Initial data on edTPA results are favorable with candidate mean scores at proficiency level for a novice teacher. This project can be of support to teacher

29. Time: 15:35-15:45

Title of the Paper: **ELEMENTARY PRESERVICE TEACHER'S UNDERSTANDING OF FRACTION - IN THE CONTEXT OF FRACTION DIVISION**

Author(s): **Hyun Jung Kang** & Paula Guerra Lombardi
Institution(s) (to school/department/research center) and Country/Region
University of Northern Colorado & Kennesaw State University, USA

Short abstract of the paper:

Division of fraction has long been a difficult topic in the elementary mathematics classrooms. The present study illustrate elementary preservice teachers' (PSTs) understanding of fraction division concept with various types of fraction division problems. The findings report that making a diagram of fraction problem is the most challenging task for PSTs, regardless of division problem type. The authors suggest that specific emphasis with rich story problem, carefully designed context with different types of division concept, and building fractional number sense can help both PSTs and students to reduce misconceptions and enhance deeper understanding of fraction division.

30. Time: 15:45-15:55

Title of the Paper: **DESIGN OF A LEARNING UNIT FOR PRE-SERVICE ELEMENTARY SCHOOL TEACHERS: DEFINITION OF THE BOUNDARY OF A 2D SHAPE**

Author(s): Alejandro López, Salomé Martínez, Aldo Ramírez, Ricardo Salinas
Institution(s) (to school/department/research center) and Country/Region
Universidad Andres Bello, Universidad de Chile, CHILE

Short abstract of the paper:

The process of constructing definitions is of great importance to understand the meaning and development of mathematics. However, this type of work usually is not present in pre-service teacher education. In this article we present and analyze the production process of a learning unit for pre-service teachers, aimed at developing the specific mathematical knowledge involved in the construction and use of a working definition of the boundary of a 2-D shape. We will discuss the design of the unit, the characteristics of the tasks, and how they evolved after implementation

31. Time: 15:55-16:05

Title of the Paper: **CONTRIBUTION OF A DIDACTIC COURSE ON THE DEVELOPMENT OF PRIMARY PRE-SERVICE TEACHERS' KNOWLEDGE OF MEASUREMENT AND GEOMETRY**

Author(s): **Israel García-Alonso**, Josefa Perdomo-Díaz, **Diana de las Nieves Sosa-Martín**
Institution(s) (to school/department/research center) and Country/Region

Universidad de La Laguna, SPAIN

Short abstract of the paper:

In this paper we present the main results obtained in a study on primary pre-service teachers' geometric and measurement knowledge. To collect data, we used a questionnaire about geometric definitions, visualization, surface, perimeter, volume and capacity. Participants were 133 students that answered the questionnaire at the beginning and at the end of a subject called Didactic of Measurement and Geometry, in the third year of their teacher training program. Results show an improvement in the items about definitions and areas and perimeter. However, greater depth is required in the concepts of volume and capacity, as well as the relationship between them.

32. Time: 16:05-16:15

Title of the Paper: **EXPLANATORY TALK IN THE TEACHING OF NUMBER CONCEPTS AND OPERATIONS TO PRE-SERVICE TEACHERS: A CASE OF ONE MATHEMATICS TEACHER EDUCATOR**

Author(s): Justina Longwe-Mandala
Institution(s) (to school/department/research center) and Country/Region
University of Malawi, MALAWI

Short abstract of the paper:

This paper reports on explanatory talk by one mathematics teacher educator in the teaching of number concepts and operations to pre-service primary school teachers in Malawi. Data was collected qualitatively in one pre-service teacher education classroom. Three mathematics lessons on the core element of number concepts and operations were video-recorded and transcribed. The study from which this paper emerges is guided by Mathematics Discourse in Instruction (MDI) and Mathematical knowledge for teaching (MKT) frameworks. Findings show movement between mathematical and nonmathematical word use. Findings also show that there was demand on the teacher educator to engage pre-service teachers in more explanations