

TSG 32 Agenda

TSG 32 : Knowledge in/for teaching mathematics at primary level

Class: B

Session 1

1. 19:30 – 19:40

Introduction

2. 19:40 – 19:55

Exploring Preservice Teachers' Noticing of Resources That Support Productive Struggle and Promote Equity

Christine Alyssa Herrera, Shawnda Rae Smith, Christina Starkey, **Hiroko Kawaguchi Warshauer**

California State University, Chico, Texas Women's University, Southern New Hampshire University, Texas State University, USA

This study examines the development of preservice teachers' (PSTs) understanding of student resources that support productive struggle and promote equity in a semester-long mathematics content course through video analysis. Our qualitative study examines 39 PSTs in two sections of a mathematical content course for prospective elementary teachers. Findings suggest that PSTs could identify a variety of resources leveraged by teachers and students who engaged in productive struggle, such as translanguaging, peer interactions, and mathematical thinking.

3. 19:55 – 20:05

Addition and Multiplication Teaching in the Multi-Grade Primary School

Yolanda Chávez Ruiz, Lorena Trejo Guerrero

Escuela Normal de Rincón de Romos, Universidad Nacional Autónoma de México,
Mexico

The present work shows the result of an investigation, related to the teaching of addition and multiplication in primary school. The emphasis was placed on the teaching process, the relationship established by the teacher when addressing the concepts of addition and multiplication using natural numbers is observed. We consider the teachers experience and methods to be relevant; we study his class considering the point of view of his colleagues, reflecting collectively on the nature of learning and the implications of students' mathematical thinking. The teachers Eligio study case allows us an approach to what we consider observed knowledge of the teacher, by the way of giving meaning to the mathematical contents treated in the classroom.

4. 20:20 – 20:35

Primary Teachers' Recognition of Students' Mathematical Reasoning and Beliefs About Teaching and Learning

Carolyn A. Maher, James A. Maher, Louise Cherry Wilkinson

Rutgers University, Syracuse University, USA

An experimental study of preservice primary teachers' learning to recognize students' mathematical reasoning from videos revealed that the future teachers' beliefs about teaching and learning were associated with success in identifying students' forms of reasoning. During this semester-long intervention, preservice teachers whose beliefs were consistent or moved in the direction of consistency with National Council of Teachers of

Mathematics (NCTM) Standards were more successful in recognizing students' reasoning than teachers whose beliefs were generally inconsistent. Eighty percent of the preservice teachers who held a set of pre and post intervention beliefs consistent with standards exhibited growth on a reasoning task. Implications for optimizing teaching, and learning are considered.

5. 20:30 – 20:45

6. 20:35 – 20:45

Why Does $1/4:1/5$ Equal $5/4$? A Case of a Post-Graduate Student's Understanding of Common Fractions Division

Barbara Beata Pieronkiewicz

Institute of Mathematics, Pedagogical University of Cracow, Poland

This article addresses the issue of post-graduate (PG) programs qualifying for teaching mathematics as a second subject. The regulations applicable to this matter in Poland allow people with limited mathematical experiences, such as e.g. kindergarten teachers, to recruit for such studies. To the same extent as their future students, these persons become the victims of the current system, which allows the possibility of obtaining documented qualifications with little chance of gaining real competences. This article reports on an example provided by a PG student who conducted a lesson on common fractions division in 5th grade of primary school. At the initial stage of planning her lesson, she proposed to introduce the invert-and-multiply algorithm with a task she considered leading to the equation $1/4:1/5=5/4$. In this paper I take a closer look at that example and analyse it within the framework of the levels of cognitive demands of mathematical tasks.

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Session 2

1. 21:30 – 21:35

Introduction

2. 21:35 – 21:45

Elementary Preservice Teachers' Expected Challenges in Teaching Pattern Generalization

Mi Yeon Lee, Ji-Eun Lee

Arizona State University, Tempe, USA

We explored how elementary preservice teachers (PSTs) solve a pattern generalization problem and what challenges they expect to face as they teach elementary students the problem. A written questionnaire was administered to 154 participants at a large Southwestern university in the US. An inductive content analysis method was used to analyze the data. Findings suggested that two-thirds of PSTs perceived their lack of pedagogical knowledge as challenges particularly in effectively and clearly explaining, supporting students conceptual understanding, or handling multiple methods to solve the problem and followed up by their lack of content knowledge and knowledge of students. We discuss implications to address these challenges in teacher education programs.

3. 21:45 – 21:55 **CANCELLED**

Affordances of Measurement Approach: Pre-Service Teachers' Knowledge of Fraction Magnitude

Muteb M. Alqahtani, Arthur Belford Powell

State University of New York at Cortland, Rutgers University-Newark, USA

This paper contributes to the theme that focuses on teacher learning, specifically, Acquisition of mathematical knowledge in teacher training. This study investigates the

affordances of a measuring approach in pre-service teachers (PSTs) learning about fraction magnitude. Ninety-six PSTs engaged in re-examining fractions from a measuring perspective during 15-week semesters. They completed pre- and post-tests that assess their fraction knowledge using different representational models: discrete and continuous. Even though PSTs interacted only with a continuous model to represent fractions, findings show statistically significant increases in their scores on the post-test with questions that used different representational models. Results also show that the measuring approach allowed PSTs to represent fractions greater than one using the different representational models more accurately. This study shifts investigating fraction learning from an exclusive focus on a partitioning perspective to a measuring approach and highlights its affordances.

4. 21:55 – 22:10

Pre-Service Primary Teachers' Knowledge and the Mathematical Practice of Defining

Verónica Martín-Molina

Universidad de Sevilla, Spain

An exploratory study on pre-service primary teachers' knowledge of the mathematical practice of defining is presented in this paper. This study is based on the premise that pre-service teachers need to know not only the definitions that they must teach but also the mathematical process that leads to the construction of those definitions. To determine pre-service teachers' knowledge of defining, small groups of pre-service teachers were asked to describe, construct, and select definitions for three geometrical solids. Their engagement with mathematical discourse was analyzed by using Sfard's (2008) theory of commognition and then compared with what their lecturer expected from them. This led to some findings on the knowledge of those pre-service teachers, and to conclude that their teacher training program needs to be improved to better support them in their acquisition of mathematical content knowledge.

5. 22:25 – 22:55

Seeing Mathematics Through the Lens of Children's Mathematical Thinking: A
Perspective on the Enhancement of Mathematical Knowledge for Teaching

Randolph Philipp, John (Zig) Siegfried, Eva Thanheiser

San Diego State University, San Diego, USA

Effective teaching of mathematics requires that practicing teachers focus simultaneously on mathematics and on children's ways of reasoning about mathematics. Furthermore, this dual focus is important for the preparation of prospective teachers. Viewing mathematics through the lens of children's mathematical thinking provides authentic experiences for practicing teachers to develop richer content knowledge and motivates prospective teachers' learning of mathematics for teaching, and, more important, changes and deepens the mathematics they see. A focus on mathematics through the lens of children's mathematical thinking also makes possible a focus on culturally relevant mathematical differences.

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Session 3

1. 14:30-15:00 **CANCELLED**

Flexibility in Mental Calculation

Elisabeth Rathgeb-Schnierer

University of Kassel, Germany

Flexibility in performing mental arithmetic has become an important focus for mathematics educators and supporting elementary students to develop flexible and adaptive expertise a central aim in mathematics education. In the past two decades, research in mathematics education has been aimed at understanding mental processes that contribute to making up mental flexibility and adaptive expertise. Therefore, different

approaches have been invented for conducting empirical research, and contemporary results lend strong support for the development of mental flexibility in elementary classrooms. The presentation aims to answer two questions: How do elementary students develop flexibility, and what are elementary teachers supposed to know? It starts with a short summary of research results, highlights different notions of flexibility, and points out prerequisites for promoting mental flexibility in elementary mathematics education. Finally, a teaching approach gets introduced, which was developed and investigated in different research projects. It combines problem-solving with specific activities for fostering number sense and metacognitive competencies (Zahlenblickschulung). This approach forms the focus in our in- and pre-service teacher training program.

2. 15:05 – 15:15 **CANCELLED**

An Analysis of Novice Primary School Teachers' Knowledge of Mathematics Curriculum

Gönül Günes, Furkan Keleş

Trabzon University, Fatih Education Faculty, Department of Basic Education, Turkish Ministry of Education, Turkey

This study aims to analyze novice primary school teachers' mathematics teaching knowledge. Accordingly, primary school teachers' curriculum knowledge regarding data processing learning area was investigated. This is a descriptive study and employs case study method, which is one of the qualitative research methods. Data for this research were acquired from 100 primary school teachers with five years of work experience in the field. A test designed for the data processing learning domain was used as the data collection tool. The collected data was analyzed through the rubric developed by the researchers. The research findings show low level of competency among beginning primary school teachers with regard to their curricular knowledge, which is a subcomponent of mathematics teaching knowledge. The research revealed that in-service training activities should be prioritized in order to remedy the teachers' shortcomings in this regard.

3. 15:15 – 15:30

Towards a Dialogic Analysis of Mathematical Problem-Solving Knowledge for Teaching in a Lesson Study Group

Stéphane Clivaz, Valérie Batteau, Audrey Daina, Luc-Olivier Bunzli, Sara Presutti

Lausanne University of Teacher Education, Switzerland

This paper presents an ongoing research about the development of teacher mathematical knowledge for the teaching of problem solving in a lesson study process. While the context of the study, the analytical framework that is currently being developed and the research questions will be discussed in this proposal, the preliminary results will be presented in ICME14.

4. 15:40 – 16:00

Teacher Time Out as Site for Studying Mathematical Knowledge for Teaching

Reidar Mosvold, Janne Fauskanger, Kjersti Wæge, Raymond Bjuland

Norwegian University of Science and Technology, University of Stavanger, Norway

The special mathematical knowledge that is needed for teaching has been a popular object of study for decades, but there is still a need to develop more robust methods for studying mathematical knowledge for teaching. This paper argues that teacher time outs in rehearsals and enactments might be a productive site for studying mathematical knowledge for teaching, because they are close to the mathematical work of teaching, because they provide a first-hand perspective on experienced demands of the work, and because they allow for collaborative discussions among professionals in close proximity to the actual demands as they are experienced inside the work of teaching. Three

examples of teacher time out situations from an ongoing project are presented as a starting point for discussion.

5. 16:00 – 16:15

A Comparative Study on the Professional Knowledge of Elementary Mathematics Teachers in Shanghai and Hong Kong - From Two Scenarios in Data Handling and Geometry

Kam Ling Lao

The Open University of Hong Kong, Hong Kong-China

East Asian students outperformed their Western counterparts in mathematics in international studies. Shanghai and Hong Kong are two cities of China with very different educational contexts but both are under the influence of Confucian heritage culture. This paper aims to investigate the similarities and differences, as well as the inadequacy, if any, of the professional knowledge of elementary teachers in the two cities. In a qualitative research, scenario-based semi-structured interviews were conducted with 24 elementary mathematics teachers, 12 from each city. The paper extracted and discussed findings from two scenarios, one in data handling and one in geometry. Compared with Shanghai's participants, Hong Kong participants' misconceptions and missing concepts were relatively fundamental in geometry. However, the superiority of Shanghai participants did not exist in data handling.

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Author 1	Title	email	Time	Duration	Type	
			13.07.21 19:30	10	Intro	
1a	Hiroko Warshawer	Exploring Preservice Teachers' Noticing of Resources That Support Productive Struggle and Promote Equity	hiroko@txstate.edu	13.07.21 19:40	15	Long
1b	Yolanda Chávez Ruiz	Addition and Multiplication Teaching in the Multi-Grade Primary School	ltrejog@cinvestav.mx	13.07.21 19:55	10	Short
			13.07.21 20:05	15	Break	
1c	Carolyn Maher	Primary Teachers' Recognition of Students' Mathematical Reasoning and Beliefs About Teaching and Learning	cmaher.edu@gmail.com	13.07.21 20:20	15	Long
1d	Barbara Beata Pieronkiewicz	Why does $1/4:1/5$ equal $5/4$? A case of a post-graduate student's understanding of common fractions division	barbara.pieronkiewicz@up.krakow.pl	13.07.21 20:35	10	Short
			13.07.21 20:45	15	Conclusion	
			16.07.21 21:30	5	Intro	
2a	Mi Yeon Lee	Elementary Preservice Teachers' Expected Challenges in Teaching Pattern Generalization	mlee115@asu.edu	16.07.21 21:35	10	Short
2b	Muteb Alqahtani	Affordances of Measurement Approach: Pre-Service Teachers' Knowledge of Fraction Magnitude	muteb.alqahtani@cortland.edu	16.07.21 21:45	10	CANCELLED
2c	Verónica Martín-Molina	Pre-service primary teachers' knowledge and the mathematical practice of defining	veronicamartin@us.es	16.07.21 21:55	15	Long
			16.07.21 22:10	15	Break	
2d	Randolph A. Philipp	Seeing Mathematics Through the Lens of Children's Mathematical Thinking: A Perspective on the Enhancement of Mathematical Knowledge for Teaching	rphilipp@sdsu.edu	16.07.21 22:25	30	Invited
			16.07.21 22:55	5	Conclusion	
3a	Eisabeth Rathgeb-Schnierer	Flexibility in Mental Calculation: How do Elementary Students Develop Flexibility and what are Teachers Supposed to Know?	rathgeb-schnierer@mathematik.uni-kassel.de	17.07.21 14:30	30	CANCELLED
			17.07.21 15:00	5	Break	
3b	Gönül Güneş	An Analysis of Novice Primary School Teachers' Knowledge of Mathematics Curriculum	amgunes@trabzon.edu.tr	17.07.21 15:05	10	CANCELLED
3c	Stéphane Clivaz	Towards a Dialogic Analysis of Mathematical Problem-Solving Knowledge for Teaching in a Lesson Study Group	stephane.clivaz@hepl.ch	17.07.21 15:15	15	Long
			17.07.21 15:30	15	Break	
3d	Janne Fauskanger	Teacher Time Out as Site for Studying Mathematical Knowledge for Teaching	janne.fauskanger@uis.no	17.07.21 15:45	15	Long
3e	Polly Lao	A Comparative Study on the Professional Knowledge of Elementary Mathematics Teachers in Shanghai and Hong Kong - From Two Scenarios in Data Handling and Geometry	plao@ouhk.edu.hk	17.07.21 16:00	15	Long
			17.07.21 16:15	15	Conclusion	
pa	Yury Marcela Cano Murillo	Mathematics Curriculum in the Context of Didactic Knowledge: The Case of the Elementary Teacher	yury.cano@udea.edu.co	17.07.2021 13:00 18.07.2021 13:30		Poster
pb	Huey Lei	Developing Analytical Models of Pedagogical Content Knowledge: A Case Study of Mathematics Teachers in Macao	lei.huey@usj.edu.mo	17.07.2021 13:00 18.07.2021 13:30		Poster
pc	Sheila Oyella Amuko	Teacher Knowledge on Students Thinking towards Learning Mathematical Concepts of Area in Primary Schools in Kiambu, County Ruiru sub-county.	oyella2014@gmail.com	17.07.2021 13:00 18.07.2021 13:30		Poster