



Rethinking Mathematics Education Together

47th Annual Meeting of the International Group for the Psychology of Mathematics Education (PME 47)

17-21 July 2024

Auckland, New Zealand

Conference Programme



MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND



Conference Agenda

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WIFI INFORMATION

For Massey:

As a guest or visitor to Massey, you can use the MUGuests Wi-Fi or Eduroam. This open, public network has a data limit of 600MB a day.

For Albany Senior High School (ASHS):

- Locate the SSID called "ASHS-Guest" in your list of available networks.
- Select "ASHS-Guest" and click on "Connect."
- Enter the password "ashs2024" when prompted, and then click "Next."
- Once connected, a browser window will automatically open.
- You will be directed to a Captive Portal login page.
- Enter the password "DyBMFfWvv" and click "Login."

MAPS

SIR NEIL WATERS (SNW)		INNOVATION COMPLEX (IC)	QUAD BLOCK B (QB)	MASSEY BUSINESS SCHOOL (MBS)	ATRIUM BUILDING (AT)
• SNW 2.31	• SNW 2.36	• IC Foyer	• QB 3	• MBS Auditorium	• AT 1
• SNW 2.32	• SNW 100	• IC 1.07	• QB 7	• MBS 2.15	• AT 3
• SNW 2.33	• SNW 200	• IC 1.15			• AT 7
• SNW 2.34	• SNW 300				• AT Round Room
• SNW 2.35	• SNW Foyer				

Albany Senior High School (ASHS) is about 5-minute walk away



Session Overview

Wednesday, 17/July/2024

<p>1:00pm - 2:00pm Location: Atrium Round Room</p>	<p>Early Researchers Day lunch</p>
<p>2:00pm - 4:00pm Location: Atrium Round Room</p>	<p>Registration</p>
<p>4:00pm - 5:30pm Location: Sir Neil Waters Lecture Theatre Building 300</p>	<p>Opening: Opening Ceremony Session Chair: Jodie Hunter Overflow room is Sir Neil Waters 200</p>
<p>5:30pm - 7:00pm Location: Sir Neil Waters Lecture Theatre Building 300</p>	<p>Plenary: Mellony Graven: “Going national from the ground up: the case of the mental starters assessment project” Overflow room is SNW Lecture Theater 200</p>

Thursday, 18/July/2024

<p>9:00am - 10:30am</p> <p>Location:</p> <p>Massey Business School Auditorium</p>	<p>Plenary2: Keith Weber: “How should mathematics education researchers think about proof?”</p>
<p>10:30am - 11:00am</p> <p>Location:</p> <p>Atrium Round Room</p>	<p>Morning Tea</p> <p>All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer.</p> <p>Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>
<p>11:00am - 11:40am</p>	<p style="text-align: center;">Research Reports Session 1</p>
<p>Research Report 1.01</p> <p>Location:</p> <p>Atrium Building AT1</p> <p>Session Chair:</p> <p>Julia Maria Aguirre</p>	<p>STRESS MATTERS? A CORRELATIONAL AND EXPERIMENTAL STUDY ON THE IMPACT OF STRESS ON FRACTION NUMBER LINE ESTIMATION</p> <p>Wim Van Dooren, Jordy Heusschen</p> <p>We investigated the impact of stress induction on the accuracy with which upper primary school learners conduct a fraction line number estimation task. The accuracy was investigated in a stress free and stress-induced condition, and reported stress levels were compared across conditions. A distinction was made between learners who are considered average mathematics performers as opposed to weak mathematics performers. Overall, stress induction led to lower accuracy, both for average and weak learners, while weak learners experienced a stronger increase of stress due to stress induction. Implications are discussed.</p>
<p>Research Report 1.02</p> <p>Location:</p> <p>Learning Space 1 (ASHS)</p> <p>Session Chair:</p> <p>Suzanne M Abdelrahim</p>	<p>ADDITION AND SUBTRACTION PROFICIENCY INVOLVING NEGATIVE INTEGERS IN ZAMBIA</p> <p>Shun Sudo, Koji Watanabe, George Chileya</p> <p>Zambia is recognised for its low academic proficiency in south-eastern Africa. Urgent attention is needed to develop basic arithmetic skills, as seen in children, resorting to methods such as drawing sticks to count for calculations such as $7 + 9$, and only one in three correctly computing $-4 - 2$. This study reveals the calculation algorithms used by Zambian children in addition and subtraction, including operations with negative integers. When providing incorrect answers, children associate calculations with those they can already perform correctly. This insight highlights the importance of developing instructional strategies that build upon existing abilities to address the pressing need for enhancing basic arithmetic proficiency in Zambia.</p>
<p>Research Report 1.03</p> <p>Location:</p> <p>Innovation Complex Room IC1.07</p> <p>Session Chair:</p> <p>Uffe Thomas Jankvist</p>	<p>MATHEMATICAL REASONING AND PROBLEM-SOLVING IN PISA 2022 – HOW DO PERFORMANCE PROFILES VARY ACROSS COUNTRIES?</p> <p>Jenni Ingram, Gabriel Lee, Jamie Stiff</p> <p>In PISA 2022, a new process subdomain was introduced focused on mathematical reasoning. This process was seen as the core of the problem-solving process that typifies PISA mathematics assessments. The results of PISA 2022 suggest that students in some countries have relative strengths specifically in mathematical reasoning, relative to the other problem-solving processes, while in other countries, this is an area of relative weakness. In this paper, we explore whether distinctive country profiles can be identified based on relative differences in performance on the four subdomain processes using Latent Profile Analysis. The profiles identified offer further support for considering the role of cultural and language contexts when comparing performance in international education studies.</p>
<p>Research Report 1.04</p> <p>Location:</p> <p>Learning Space 2 (ASHS)</p> <p>Session Chair:</p> <p>Sebastian Gross</p>	<p>Grundvorstellungen in University Mathematics – The Definition of the Limit of a Sequence</p> <p>Karyna Umgeltinger, Sebastian Geisler</p> <p>In this paper, we analyse the presentation of the definition of the limit of a sequence using the theory of Grundvorstellungen. Grundvorstellungen are mental images that lie behind mathematical concepts and support the development of valid concept images. The sample consist of six definitions presented by six different lecturers at German universities. The results show that lecturers usually address at least one Grundvorstellung when introducing the definition of the limit of a sequence. However, it is questionable, if this is enough to form a coherent concept image of the limit of a sequence. Finally, we give implications for further research.</p>

<p>Research Report 1.05</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Jessica Hoth</p>	<p>Effect of Prompts on Expectancies for Success, Task Values, and Costs in Problem Posing</p> <p><u>Janina Krawitz</u>, Katharina Wiehe</p> <p>Recent research has shown that problem-posing prompts affect students' achievement-related outcomes in problem-posing tasks. This study extends such findings by investigating the effects of problem-posing prompts on students' motivational outcomes. Ninth- and tenth-graders (N = 78) were prompted to pose easy and difficult problems. Subsequently, each student reported their expectancy for success, task values, and perceived cost in relation to posing easy versus difficult problems. The results revealed that posing easy compared with difficult problems positively affected expectancy for success, utility value, attainment value, and perceived cost but not intrinsic value. An implication of this study is that including the prompt to pose easy problems in problem-posing tasks is important for students' motivation.</p>
<p>Research Report 1.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Eva Thanheiser</p>	<p>PROFILING INITIAL PEDAGOGICAL PRACTICES DURING MATHEMATICS PROFESSIONAL LEARNING AND DEVELOPMENT</p> <p><u>Jodie Hunter</u>, Julia Hill, Robyn Jorgensen, Roberta Hunter</p> <p>Disparities in educational outcomes potentially indicate inequitable educational practices. This shows the importance of considering pedagogical practices in use in mathematics classrooms and the shifts in practice during professional learning. The study presented in this paper used a specially designed profiling tool to document the pedagogical practices used by 139 teachers in the first year of a professional learning initiative focused on ambitious teaching, culturally sustaining mathematics pedagogy, and mathematical wellbeing. The results showed that pedagogies focused on a supportive classroom environment were more evident than those related to ambitious or culturally sustaining mathematics pedagogy. We explain how profiling lessons can be used to identify areas that require more professional learning opportunities.</p>
<p>Research Report 1.07</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Koji Watanabe</p>	<p>MATHEMATICS TEACHERS' REIFIED IDENTIFYING</p> <p><u>Kawamura Mayumi</u></p> <p>The aim of this paper is twofold: first, it proposes how the analysis of students' implicit and indirect identifying as found in previous studies, can be used as for the analysis of teachers' identities; second, it seeks the characteristics of actions according to which teachers' identities are manifested. To achieve this aim, I analyzed a trigonometric ratios class that took place in the first year of a Japanese public high school. It was found that indirect verbal identifying was found in the activities set by the teacher for the students, and implicit nonverbal identifying was found in the teaching arts used by the teacher. I also demonstrate that the teacher intentionally set learning opportunities for exploration routine while simultaneously having the students perform a ritual routine.</p>
<p>Research Report 1.08</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Ron Tzur</p>	<p>DIFFERENCES IN MATHEMATICS LEARNERS ACCORDING TO IN-SERVICE AND PRE-SERVICE TEACHERS</p> <p><u>Anna Hummel</u></p> <p>Discussing which differences in learners are relevant for or in mathematics learning differs greatly depending on who is asked and their stance of observation. This paper provides empirical insight into group discussions among pre-service and in-service elementary school mathematics teachers, discussing differences in mathematics learners based on their experiences in practice. Comparing categories of differences that were made explicit, reveals similarities and divergences between participating groups. Beyond presenting first results on teachers' innate attributions of difference to learners without theoretically operationalizing lines of differences beforehand, a possible link between the meaning of relevance and the shared context where these differences emerge is discussed.</p>
<p>Research Report 1.09</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Jason Cooper</p>	<p>PROSPECTIVE TEACHERS' UNDERSTANDING OF THE INDIRECT PROOF OF THE CONVERSE OF THE INSCRIBED ANGLE THEOREM</p> <p><u>Masakazu Okazaki</u>, Keiko Watanabe</p> <p>This study clarifies the geometric thinking of prospective teachers on the converse of the inscribed angle theorem toward van Hiele's fourth level concerned with the understanding of an indirect proof structure. As a result of the analysis, the understanding process was divided into four stages from two perspectives: acceptance of the theorem and construction of the indirect proof. The difference between the first and second stages relates to whether the background theory is the direct proof scheme or logic that permits the intuitive acceptance of the theorem. The third stage relates to indirect argumentations that are facilitated by assuming impossible objects. The final formal proof stage relates to the logical structure under conditions for which the secondary statement involving impossible objects can be proved as contradictory.</p>
<p>Research Report 1.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Ronnie Karsenty</p>	<p>OPERATIONALIZING RE-PRESENTATION TO INVESTIGATE AND SUPPORT STUDENTS' COVARIATIONAL REASONING</p> <p><u>Kevin C. Moore</u>, Erin Wood, Sohei Yasuda, Irma E. Stevens, Biyao Liang, Halil I. Tasova</p> <p>Within the body of work on students' covariational reasoning, researchers have called for more explicit attention to the ways theoretical constructs are operationalized to develop characterizations of student thinking. Addressing this need, we outline how von Glasersfeld's (1991) notion of re-presentation—the act of reconstructing something previously experienced in its absence—has informed our research program on students' covariational reasoning. Specifically, we illustrate its multimodal use in framing claims regarding the extent a student has constructed a particular covariational relationship.</p>

<p>Research Report 1.11</p> <p>Location: Learning Space 6 (ASHS)</p> <p>Session Chair: Iresha Gayani Ratnayake</p>	<p>A PRELIMINARY ANALYSIS OF TWO PROOF LESSONS FROM AN INTERNATIONAL COMPARATIVE PERSPECTIVE: A CASE STUDY ON GERMAN AND JAPANESE GRADE 8 CLASSROOMS</p> <p><u>Yusuke Shinno</u>, Fiene Bredow, Christine Knipping, Ryoto Hakamata, Takeshi Miyakawa, Hiroki Otani, David Reid</p> <p>In this paper, we aim to offer a preliminary analysis of two proof lessons from a comparative perspective. A case study presented in this paper focuses on German and Japanese grade 8 classrooms, where a common topic for a proof in algebra is introduced. Using the categories adapted from Boero's (1999) six phases, we discussed how the two lessons are organized differently, especially in the activities regarding the categories: 'pre-activities', 'exploration of proof ideas', and 'formulation of a proof'.</p>
<p>Research Report 1.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Audrey Cooke</p>	<p>Learning routes for algebraic thinking development in preschool</p> <p><u>Elena Polotskaia</u>, Nathalie Sylvia Anwandter Cuellar, Annie Savard, Virginie Robert</p> <p>In this theoretical essay, we use observations from our ongoing research with preschool children to question the theoretical frameworks available for studying the developmental trajectories of algebraic thinking in young children. We critically analyse two approaches. The theoretical approach employed by Early Algebra presumes that elementary students develop algebraic thinking by using some knowledge of numbers and arithmetic operations. The theoretical approach employed by Davydov, and his followers presumes that the most general ideas of algebraic thinking are prerequisites for the study of numbers and operations. How do these approaches interplay to allow for an interpretation of what we observe in preschool?</p>
<p>Research Report 1.13</p> <p>Location: Learning Space 7</p> <p>Session Chair: Egan J Chernoff</p>	<p>Students' explanations for unit conversions: specifying underlying structures to be addressed</p> <p><u>Sofia Bielinski</u>, Susanne Prediger</p> <p>Visual models have been widely used to promote students' understanding for mathematical procedures. Yet students' explanations using visual models can reveal underestimated complexities that need to be unpacked to provide targeted learning opportunities. In our qualitative study, we analyzed how 10–12-year-old students explain the conversion of mass units, and we unpacked what different connections between representations need to be verbalized. The analysis revealed that students who connect the representations draw upon three kinds of underlying structures: bundle structures, refinement structures, and place-value structures. All should be explicitly focused on and supported in future designs for teaching-learning arrangements.</p>

<p>12:00pm - 1:00pm</p>	<p style="text-align: center;">Oral Communication Session 1</p>
<p>Oral Communication 1.01</p> <p>Location: Learning Space 1 (ASHS)</p> <p>Session Chair: Pamela Vale</p>	<p>12:00pm - 12:20pm A new thinking of fractions 'fracturing' <u>Aehee Ahn</u></p> <hr/> <p>12:20pm - 12:40pm Comparing Chinese Primary students' conceptions of improper fractions and mixed numbers <u>Xixi Deng</u>, Rui Ding, Xinchun Wang, Michael Sun, Bingqian Wei, Ron Tzur</p> <hr/> <p>12:40pm - 1:00pm NUMBER LINE ESTIMATION OF FRACTIONS: A COMPARATIVE STUDY <u>Khemduth Singh Angateeah</u>, Anna Neena Georges, Mark Winter</p>
<p>Oral Communication 1.02</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Olive Chapman</p>	<p>DEVELOPMENT OF THE PROSPECTIVE MATHEMATICS TEACHERS NOTICING THROUGH THE MTSK MODEL <u>Diana Zakaryan</u>, Ledher López</p> <hr/> <p>TEACHERS NOTICING IN THE MATHEMATICS CLASSROOM: INSIGHTS FROM TRU MATH FRAMEWORK <u>Jaclyn Murawska</u>, Jing Guo, Qiaoping Zhang</p> <hr/> <p>ANIMATING CLASSROOM REALITIES FOR ENHANCED TEACHER NOTICING <u>Jihwa Noh</u>, Byeongsoo Kim, Ho Kyoung Ko, Nan Huh</p>
<p>Oral Communication 1.03</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Jodie Hunter</p>	<p>Parents and Teachers Talking About Mathematics Education: Connecting Home and School <u>Marta Civil</u>, Fany Salazar</p> <hr/> <p>SHIFTING DEFICIT PERSPECTIVES OF TEACHER-PARENT PARTNERSHIPS: POST-COVID TEACHER STORIES <u>Pamela Vale</u>, Mellony Graven</p> <hr/> <p>ENGAGING WITH MATHEMATICS AVERSE ADULTS THROUGH STORIES AND REFLECTIONS <u>Caroline Yoon</u></p>
<p>Oral Communication 1.04</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Maitree Inprasitha</p>	<p>EXPLORING THE RELATIONSHIP BETWEEN MATHEMATICAL VALUES AND ACHIEVEMENT AMONG GIRLS: A COMPARATIVE ANALYSIS IN SINGLE-SEX VS. CO-EDUCATIONAL SETTINGS USING TIMSS 2019 NZ DATA <u>Huayu Gao</u>, Tanya Evans, Gavin Brown</p> <hr/> <p>The use of person-oriented research methodology in identifying student and teacher values in mathematics education <u>Justine Sakurai</u>, Cath Pearn, Wee Tiong Seah</p> <hr/> <p>A PHENOMENOLOGICAL STUDY OF THE FORMATION PROCESS OF VALUES IN MATHEMATICS LEARNING <u>Mitsuru Matsushima</u></p>

<p>Oral Communication 1.05</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Keiko Hino</p>	<p>GRAPH LITERACY AND MAGNITUDE PROCESSING ABILITIES: A STUDY OF AGES 3 TO 6 <u>Eugenio Chandia</u>, Paloma Nahuelhual, Anahí Huencho, Gamal Cerda</p> <hr/> <p>TEACHER ACTIONS TO SET UP FIVE-YEAR-OLD STUDENTS TO ENGAGE IN MATHEMATICAL PRACTICES. <u>Emily Louisa Pearce</u></p> <hr/> <p>DOES AGENCY IMPACT YOUNG CHILDREN'S OPPORTUNITIES TO ENGAGE WITH MATHEMATICS? <u>Audrey Cooke</u>, Maria Johansson, Eva Norén</p>
<p>Oral Communication 1.06</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Barbara Jaworski</p>	<p>Seeking Evidence of Grounding in an Online Mathematical Discourse in Combinatorics <u>Maria Digi Anna Mance Avila</u>, Maria Alva Aberin</p> <hr/> <p>LEARNING TWO-SAMPLE T-TESTS WITH EXPERIMENTS AND VISUALIZED TOOLS <u>Ching-Ching Yang</u>, Jenn-Tsann Lin</p> <hr/> <p>AN ANALYSIS OF STUDENTS' PERSPECTIVES ON USING TEKS IN DETERMINING THE SAMPLE SPACE OF AN EVENT <u>Dennis Lee Jarvis Baring Ybañez</u>, Catherine Palisoc Vistro-Yu</p>
<p>Oral Communication 1.07</p> <p>Location: Learning Space 2 (ASHS)</p> <p>Session Chair: George Kinnear</p>	<p>TEACHING AND LEARNING THE DERIVATIVE TO FUTURE COMMERCIAL ENGINEERS Maritza Galindo Illanes, <u>Adriana Breda</u>, Gemma Sala-Sebastià, Vicenç Font</p> <p>STUDENTS' MEANINGS FOR THE INTEGRAL CONCEPTS <u>Anatoli Kouropatov</u>, Lia Noah-Sella, Tommy Dreyfus, Dafna Elias</p> <p>UNIVERSITY STUDENTS' PERSPECTIVES ON MATHEMATICS AND THEIR CONCEPTUALIZATION OF FUNCTIONS <u>Angel Mae Opelanio Ombid</u>, Dennis Lee Jarvis Baring Ybañez, Catherine Palisoc Vistro-Yu</p>
<p>Oral Communication 1.08</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Jenni Ingram</p>	<p>PEDAGOGICAL PRACTICES: PISA 2022 DATA ANALYSIS OF INQUIRY-BASED AND TEACHER-DIRECTED APPROACHES Marcel Derkum, <u>Tanya Evans</u></p> <hr/> <p>RETRIEVAL PRACTICE - A TOOL TO NARROW THE KNOWLEDGE GAP IN LEARNING HIGHER MATHEMATICS <u>Anna Muzsnay</u>, Csaba Szabó</p> <hr/> <p>Does highlighting key information help or hinder mathematical reading? <u>Bethany Rose Woollacott</u>, Lara Alcock, Matthew Inglis</p>
<p>Oral Communication 1.09</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Nicola Hodkowski</p>	<p>AN EMPIRICAL STUDY OF THE EFFECT OF USING LONG TERM GAMIFICATION IN HIGH SCHOOL MATHEMATICS LESSONS <u>Janka Szeibert</u>, Sára Szörényi</p> <hr/> <p>Exploring the Influence of Online Homework Format on Problem-Solving Strategy Use on Related Rates of Change Problems in Calculus Tyson Cassada Bailey, <u>James A. Mendoza Alvarez</u></p> <hr/> <p>Maximizing Performance and Minimizing Dropout Rates with Flow: A Gamified Mathematics Course <u>Sára Szörényi</u>, Krisztina Anna Stirling, Evelin Anna Geszler</p>

<p>Oral Communication 1.10</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Catherine Anne Pearn</p>	<p>UNPACKING THE COMPLEXITY OF TEACHERS' THINKING THROUGH THEIR DESIGN OF INSTRUCTIONAL MATERIALS Sze Looi Chin, Ban Heng Choy, Yew Hoong Leong</p> <hr/> <p>CHARACTERISING TEACHERS' KNOWLEDGE IN TEACHING DIVISION USING SORT-SEQUENCE-ACT (SSA) METHOD Su Ngin Chia, Ban Heng Choy</p> <hr/> <p>TRANSFORMATION OF A MATHEMATICS TEACHER'S KNOWLEDGE FOR TEACHING THE CONCEPT OF LIMIT Cristián Aldo Bustos Tiemann, Elisabeth Magdalena Ramos Rodríguez</p>
<p>1:00pm - 2:30pm</p> <p>Location: Atrium Round Room</p>	<p>Lunch break</p> <p>All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer.</p> <p>Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>
<p>1:30pm - 2:30pm</p> <p>Location: Innovation Complex Room IC1.07</p>	<p>Newcomers Lunch</p> <p>First time PME guests. Please collect your lunch from either the Atrium Road Room or the IC Foyer and join us in IC 1.07 to meet and greet other first-time participants and the international committee.</p>
<p>2:30pm - 4:00pm</p>	<p style="text-align: center;">SEMINAR & WORKING GROUPS SESSION 1</p>
<p>Location: Atrium Building: AT 7</p>	<p>Seminar Day 1 WRITING PME RESEARCH REPORTS: A SEMINAR FOR EARLY- CAREER RESEARCHERS Kotaro Komatsu, Peter Liljedahl, Sean Chorney</p>
<p>Location: Atrium Building AT1</p>	<p>WG1: Mathematics in integrated STEM: dilemmas and strategies for success A. Conner, K. Lesseig, C. Miller & A. Bloodworth</p>
<p>Location: Atrium Building: AT 3</p>	<p>WG2: International perspectives on proof and proving: recent results and future directions D. A Reid & Y. Shinno</p>
<p>Location: Innovation Complex Room IC1.07</p>	<p>WG3: Critical mathematical thinking for sustainable futures J. Aguirre, C. Andra, K. Beswick, A. Coles, S. Digan, V. Geiger, J. Hunter, S. Siller, A. Solares, J. Suh, E. Thanheiser, N. Unshelm & D. Wagner</p>
<p>Location: Innovation Complex Room IC1.15</p>	<p>WG4: Human dignity and mathematics education research Y. Abtahi & R. Barwell</p>
<p>Location: Quad Block B Room QB3</p>	<p>WG5: Poetic methods in mathematics education A. Hare, R. Elizabeth Helme & S. Staats</p>
<p>Location: Massey Business School Room MBS2.15</p>	<p>WG6: Creative methods for inquiry in mathematics education research M. S Hannula, T. Helliwell & A. Ebbelind</p>
<p>4:00pm - 4:30pm</p> <p>Location: Atrium Round Room</p>	<p>Afternoon Tea</p> <p>All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer.</p> <p>Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>

Thursday, 18/July/2024

<p>4:30pm - 5:10pm</p>	<p>Research Reports Session 2</p>
<p>Research Report 2.01 Location: Atrium Building AT1 Session Chair: Rachel Marie Restani</p>	<p>THE INFLUENCE OF BILINGUALISM ON CHILDREN'S SELF-EFFICACY BELIEFS IN MATHEMATICS <u>Yuhwa Hong</u> This study investigated the association between bilingualism and children's self-efficacy beliefs in mathematics using fourth-grade U.S. data from the 2019 TIMSS. Employing the Students Confident in Mathematics (SCM) scale in TIMSS as a dependent variable and including control variables such as gender, academic achievement, engagement, and socioeconomic status, this study showed that bilingual children have significantly higher self-efficacy beliefs in mathematics than non-bilingual children.</p>
<p>Research Report 2.02 Location: Learning Space 1 (ASHS) Session Chair: Achim J. Lilienthal</p>	<p>Early division prior to formal instruction: Young children explain their solution strategies. <u>Luca Wiggelinghoff, Andrea Peter-Koop</u> This paper is embedded in a larger international study of young children's understanding of division prior to formal instruction. Real-world related division problems typically can be interpreted as either partitive or quotitive division and respective solution strategies. However, previous papers have identified children using grouping strategies that are typically related to a quotitive context for solving partitive division problems. The related drawings and written result do not explain the under-lying thinking process. Hence, this paper focusses on the results of a qualitative study in which children were asked to explain their solution with or without modelling.</p>
<p>Research Report 2.03 Location: Innovation Complex Room IC1.07 Session Chair: Julia L Hill</p>	<p>Examining student wellbeing and parental educational attainment in a U.S. college mathematics course <u>Marcelo Alonso Almora Rios</u> Promoting student wellbeing in mathematics may be one way to tackle long-standing equity issues in tertiary mathematics education. To expand our understanding of wellbeing in domain-specific settings, this research paper presents findings from a pilot study examining the relationship between wellbeing and parental educational attainment in 140 predominantly first- and second-year college students in the United States taking an introductory statistics course. Findings suggest that first-generation college math students experience a greater sense of engagement, meaning, and—most notably—accomplishment in their math classes than students from higher educational backgrounds. This study frames student wellbeing in mathematics today as an issue that is highly relevant for universities and math departments in the long run, offering a way to measure the wellbeing of students via a five-dimensional operational model.</p>
<p>Research Report 2.04 Location: Learning Space 2 (ASHS) Session Chair: Anton Bastian</p>	<p>INQUIRY MATHEMATICS TEACHING IN A UNIVERSITY BRIDGING COURSE: CHALLENGES FOR STUDENTS AND TEACHERS <u>Barbara Jaworski, Despina Potari, Nikolaos Metaxas, Theodossios Zachariades</u> This paper reports a study on the design and enactment of inquiry teaching approaches in a University Bridging Course, offered in a lecture format. In particular, the development of these approaches by the teachers, and the students' reactions to these as well as the tensions that both teachers and students experienced are investigated. The data consists of recordings of the lectures and students' work as well as interviews with the students and reflective discussions between the teachers. The analysis is based on the three layers of inquiry model of Jaworski (2019) and the framework of Potari et al., (2023). The identified tensions of teachers and students reveal challenges in the developmental process of inquiry approaches in the socio-cultural context.</p>
<p>Research Report 2.05 Location: Learning Space 3 (ASHS) Session Chair: Takashi Kawakami</p>	<p>HOW DOES MATHEMATICAL CREATIVITY IN ALGEBRA CHANGE ACROSS SECONDARY UNDER STUDENT-CENTERED AND TEACHER-CENTERED PEDAGOGY? <u>Ying Zhang</u> This study explores the developmental trajectory of mathematical creativity within secondary students, and whether this trajectory differs between pedagogy. A comparative case study of two Chinese secondary schools (Grades 7-9) was conducted, which in our prior research we found differ significantly in their delivered pedagogy: one is more student-centered pedagogy and the other more teacher-centered pedagogy. Using cross-sectional data, this study conducted within- and between-school comparisons at the beginning of Grade 8 (N=182) and at the end of Grade 9 (N=162). Notable findings included significant differences between the creativity of Grade 8 and Grade 9 students, with the latter group demonstrating creativity that was twice as high. This trend applies for both schools, regardless of the pedagogy students received.</p>

<p>Research Report 2.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Stanislaw Schukajlow-Wasjutinski</p>	<p>WHAT NOVICE MATHEMATICS TEACHERS PERCEIVED IN ASSESSING STUDENTS' LEARNING OF FUNCTIONS</p> <p><u>Runyu Zhang, Shuhui Li, Qiaoping Zhang</u></p> <p>This study explores the perceptions of 96 novice mathematics teachers on assessing students' learning of functions via a collaborative task of constructing a specific test in China. By analyzing the 23 teacher-constructed tests, the study reveals that these teachers demonstrated strong subject knowledge in designing mathematics tests and tended to construct more high-level questions with an object-level functional thinking focus, multiple steps, and high cognitive loads, aligned to or above the curriculum standards and presented in a purely mathematics context using mixed representations. The results provide evidence to explain the possible gaps between teachers' intended curriculum and attained curriculum, and also reflect the values of novice mathematics teachers in assessing students' learning of functions.</p>
<p>Research Report 2.07</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Jyoti Rookshana Jhagroo</p>	<p>UNVEILING PROSPECTIVE TEACHERS' CONCERNS: USING A GUIDED REFLECTION PROCESS AS PART OF MATHEMATICS TEACHER EDUCATION</p> <p><u>Galit Nagari-Haddif, Ronnie Karsenty, Abraham Arcavi</u></p> <p>This report presents insights from a study focusing on guided reflection processes of prospective mathematics teachers. The study explores how two prospective teachers, in their practicum year, use the Six Lens Framework (SLF) - a tool originally designed for the professional development of practicing teachers. The findings highlight unique concerns of future teachers and demonstrate how reflection focused on distinct aspects of practice can contribute to their learning from observed lessons. We present various kinds of analyses performed on the teachers' accumulating reflections and discuss the differences and similarities between the two teachers' implementation of SLF. Finally, we suggest implications for teacher education.</p>
<p>Research Report 2.08</p> <p>Location: Learning Space 8 (ASHS)</p> <p>Session Chair: Jen Munson</p>	<p>BEYOND IMMEDIATE ERROR REPAIR: HOW TO SUPPORT TEACHERS' DECISION MAKING FOR ENHANCING UNDERSTANDING: AN EXPERIMENTAL STUDY</p> <p><u>Sebastian Gross, Susanne Prediger</u></p> <p>How can diagnostic reports from formative assessment tools support teachers to derive decisions for enhancing students' understanding? In an experiment with 178 teachers, we compared two support conditions: The Error-Analysis report analyses student errors in detail, the Next-Goal report additionally explicates the next learning goal for this student. A quantitative analysis of teachers' task selections revealed that teachers using Next-Goal reports tended to select tasks focusing on more foundational learning goals than teachers using Error-Analysis reports and that they justified their selections significantly more often by referring to the essential learning goals. We conclude that Next-Goal reports can indeed better support teachers' targeted decision making.</p>
<p>Research Report 2.09</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Anna Hummel</p>	<p>Prospective math teachers' vision of high-quality mathematics instruction with technology: A focus on role of the teacher</p> <p><u>Allison W. McCulloch, Lara K. Dick, Nina G. Bailey, Jennifer N. Lovett, Joshua Wilson, Purity Muthitu</u></p> <p>We report on a study of preservice secondary mathematics teachers' instructional vision evolves as a result of engaging in practice-based approach to learning how to teach mathematics. Findings show that preservice teachers developed a more sophisticated vision of the role of the teacher.</p>
<p>Research Report 2.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair:</p>	<p>THE ROLE OF MATHEMATICS AND INSTRUCTIONAL PRACTICES IN INTEGRATED STEM EDUCATION</p> <p><u>Carina Spreitzer, Verena Kaar, David Kolloosche, Konrad Krainer</u></p> <p>The integration of science, technology, engineering, and mathematics (STEM) in education has gained momentum, driven by the acknowledgment that real-world challenges demand a holistic approach. This study explores the intersection of integrated STEM and mathematics. The research assesses eleven existing materials according to instructional practices and the role of mathematics. Results reveal a comprehensive incorporation of STEM instructional practices. However, the role of mathematics is often used as an ancillary discipline, employed primarily as a tool in STEM activities. Only a minority of materials explicitly integrate mathematical concepts within interdisciplinary contexts. The findings underscore the need for a more pronounced role of mathematics in integrated STEM education.</p>
<p>RR 2.11: Research Report 2.11</p> <p>Location: Learning Space 6 (ASHS)</p> <p>Session Chair: Yusuke Shinno</p>	<p>EFFECTS OF THE TYPE OF ARGUMENT ON STUDENTS' PERFORMANCE IN PROOF-RELATED ACTIVITIES</p> <p><u>Milena Damrau</u></p> <p>Different types of arguments, such as empirical arguments and generic proofs have been discussed in the literature regarding students' convictions and their potential for proof comprehension. However, their influence on proof-related activities is still not clear. The experimental study presented in this paper aims at closing that gap. Data from N=430 first-year university students suggests that generic proofs are easier to understand than ordinary proofs. Moreover, it indicates that students' self-reported conviction by different types of arguments does not reflect their actual conviction of the truth of statements. The findings highlight students' difficulties with the relation between the validity of the statement and that of its proof and provide a basis for developing courses in a manner that eases the transition to proof-based mathematics.</p>

<p>Research Report 2.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Nuria Planas</p>	<p>CREATING A SENSE OF BELONGING IN THE ELEMENTARY MATHEMATICS CLASSROOM: RESPONDING TO (SOME OF) PAOLA VALERO'S 2023 PME PLENARY</p> <p><u>Eva Thanheiser</u>, Molly Robinson, Sugimoto Sugimoto, Byeonguk Han, Courtney Koestler, Mathew Felton-Koestler</p> <p>Mathematics classrooms need to be spaces where each student experiences a sense of belonging, but what does this look like in an elementary mathematics classroom? To examine this issue, we designed lessons that allowed all students to see themselves and their classmates in the data they examined and thus learn mathematics while learning about themselves. We videotaped these lessons and analysed them using the construct of Belonging. We found that allowing students to explore ideas about themselves both allowed them to experience a sense of belonging as well as engage in the mathematics and contextual goals of the activity. We identified target teaching and learning practices to achieve these goals.</p>
<p>Research Report 2.13</p> <p>Location: Learning Space 7 (ASHS)</p> <p>Session Chair: Sofia Bielinski</p>	<p>Human Graphs as Mathematical Dramatic Codifications</p> <p><u>Katherina von Bülow</u></p> <p>In this paper, critical educator Paulo Freire's theory and method of codification/decodification is applied, by means of a drama technique, to mathematics education. A classroom activity, in which students' bodies form a frozen tableau representing data on wealth disparity, is described. The study focuses on students' perceptions of their own relationship with the social issue and with mathematical representations of the data. Students' discussion and written reflections on the activity are analysed thematically. A parallel is drawn between shifts in students' recognition of themselves within the issue of social concern and shifts in their critical perceptions of mathematical representations of the data.</p>
<p>5:30pm - 6:10pm</p>	<p>Research Reports Session 3</p>
<p>Research Report 3.01</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Yuhwa Hong</p>	<p>A Preliminary Systematic Review on How Productive Struggle is Defined in Mathematics Education Research</p> <p><u>Nitchada Kamlue</u>, Laura R. Van Zoest</p> <p>This systematic review investigated how productive struggle was defined in studies investigating productive struggle in mathematics learning. Following PRISMA guidelines, we identified 10 such peer-reviewed journal articles from the Scopus database from 2007 to 2023. We reported (a) (proxy) definitions of productive struggle for each study; (b) structural elements across the definitions—subject, action, object, and aim; and (c) synthesizing aspects across the definitions—definition foci and features of the objects. Finally, we initiated the process of rethinking together how to investigate what it means for mathematics learners to engage in productive struggle by sharpening the productive struggle construct.</p>
<p>Research Report 3.02</p> <p>Location: Learning Space 1</p> <p>Session Chair: Luca Wiggelinghoff</p>	<p>A UNIDIMENSIONAL, MULTI-STRAND MEASURE VERIFIES A 6-SCHEME MODEL OF FRACTIONAL REASONING</p> <p>Ron Tzur, <u>Rui Ding</u>, Bingqian Wei, Michael Sun, Beyza Dagli, Xixi Deng</p> <p>We report on a new assessment to help address the problem: How may a feasibly large-scale written-test, informed by a 6-scheme constructivist model, measure students' fractional reasoning in different countries? We developed and validated the 35-item measure as a proxy of labor-intensive assessment forms of this model. We used mixed methods to develop it in English, translate it to Chinese, and analyze its properties to verify that (a) it is reliable ($\alpha > 0.95$) and valid (unidimensional) and (b) each scheme's items constitute a stand-alone, reliable ($\alpha > 0.7$) strand. We present initial findings of student responses (USA, $n=61$; China, $n=217$) that indicate similarities in their reasoning and discuss implications of our design, validation processes, and findings about students' fractional reasoning to theory, future research, and practice.</p>
<p>Research Report 3.03</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Marcelo Alonso Almora Rios</p>	<p>EFFECTS OF TEACHING STUDENTS TO SOLVE OPEN MODELLING PROBLEMS ON UTILITY, INTRINSIC, AND ATTAINMENT VALUES</p> <p><u>Stanislaw Schukajlow</u>, Janina Krawitz, Katharina Wiehe, Katrin Rakoczy</p> <p>Task values are important for learning. However, prior research has indicated a lack of studies that have addressed students' task values in mathematics. In the following study ($N = 293$), we analyzed (1) the relationships between intrinsic, attainment, and utility values and (2) how teaching students to solve open modelling problems affects these values. Students in the experimental group were taught how to solve open modelling problems, whereas those in the control group were taught how to solve real-world problems with no missing information. Students reported their values before and after the intervention. The results revealed positive relationships between values plus a trend toward a positive effect of the intervention on utility value. We conclude that content-related interventions in modelling can improve motivational outcomes.</p>

<p>Research Report 3.04</p> <p>Location: Learning Space 2 (ASHS)</p> <p>Session Chair: Karyna Umgelter</p>	<p>USING APPLICATIONS IN FIRST-SEMESTER CALCULUS FOR ENGINEERING. SOURCES OF APPLICATIONS, USE OF TEXTBOOKS, AND EXTERNAL CONSTRAINTS.</p> <p>Alejandro S. González-Martín, Gisela Hernandez-Gomes</p> <p>In this paper, we analyse the use of applications by instructors with different backgrounds teaching first-semester calculus in engineering programmes. Adopting the perspective of the Anthropological Theory of the Didactic (ATD), we investigate the teachers' sources of these applications, as well as the teachers' rationales for using or not using them. Our results indicate that while teachers may draw on their professional experience as a source of real-world applications, some opt to adhere to examples provided in the course textbook. Moreover, other constraints, such as the perceived size of the syllabus, the heterogeneity of classes, and the students' lack of advanced knowledge may hinder teachers' use of applications.</p>
<p>Research Report 3.05</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Janina Krawitz</p>	<p>VICARIOUS LEARNING SCRIPTED VERSUS UNSCRIPTED VIDEOS: PROBLEM-SOLVING BEHAVIORS</p> <p>Michael Foster</p> <p>Vicarious learning research is a growing area of inquiry examining the learning of students who observe video-/audio-taped students engaged in learning (Mayes, 2015). To date, several projects have reported on the learning gains of indirectly participating in dialogue. However, an important question remains about the influence the nature of the dialogue—whether it is scripted or unscripted—has on viewers. For this study, two sets of dialogic videos were created capturing the inquiry process of students engaged in either unscripted or scripted dialogue. Each video type was shown to a pair of students over five research sessions. Using thematic analysis, patterns and differences between how each pair used their respective set of videos were identified. Preliminary findings suggest a difference in the pairs' problem-solving behaviors.</p>
<p>Research Report 3.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Runyu Zhang</p>	<p>Co-constructing an image of valued mathematics teaching: Noticing and naming strengths in video records of practice</p> <p>Anna Hoffmann, Jen Munson</p> <p>While much of the literature on supporting teacher noticing in video records of practice advocates for a neutral approach, recent research on classroom-based noticing has pointed to the value of applying a strength-based lens. In this study, situated in a video-based professional development program in which teachers were asked to attend to strengths, we explored what teachers identified as strengths in video records of mathematics teaching and to whom they attributed these strengths. Analysis of six discussions identified five themes: (1) Designing and engaging in the mathematical space, (2) Designing and engaging in the discursive and collaborative space, (3) Establishing norms, (4) Growth, and (5) Engagement. This study suggests affordances for designing teacher noticing protocols for video records with a strength-based lens.</p>
<p>Research Report 3.07</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Galit Nagari-Haddif</p>	<p>Teachers' motivations to transition to de-streamed secondary mathematics</p> <p>Kaitlin Riegel, David Pomeroy, Sara Tolbert, Kay-Lee Jones</p> <p>An initiative supported by the Ministry of Education to combat educational inequity has positioned de-streaming New Zealand secondary mathematics as a critical issue. Using the lens of self-determination theory (SDT), understanding teachers' beliefs, motivations, and goals in de-streaming may facilitate this transition. This report presents the results of a thematic analysis on interviews from 11 secondary mathematics teachers. Findings suggest that teachers can internalise goals of externally introduced de-streaming initiatives and teacher intrinsic motivation can originate from knowledge of the broader negative consequences of streaming. Practical implications are discussed together with the results.</p>
<p>Research Report 3.08</p> <p>Location: Learning Space 8 (ASHS)</p> <p>Session Chair: Ying Zhang</p>	<p>THE SIGNIFICANCE OF TEACHING TO RECOGNISE THE MATHEMATICAL TERMS AND NOTATIONS</p> <p>Lucian Olteanu, Constanta Olteanu</p> <p>While the concept of a function has been extensively researched worldwide, there has been limited investigation into how functions are taught in the classroom and the students' opportunities to understand the uses of notation in two upper-secondary classroom settings. This paper aims to address this gap by examining the content presented in a textbook and within the teaching that occurs in two upper secondary classrooms. Data for the analysis were collected from two classes, involving two teachers and 45 students, and included video recordings of lessons and tests. The analytical framework is grounded in variation theory. The findings underscore the crucial role of teaching in providing students with the opportunity to discern the meaning of the notation related to the concept of a function.</p>

<p>Research Report 3.09</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Allison W. McCulloch</p>	<p>Study satisfaction, program change, and dropout intention of mathematics preservice teachers from an expectancy-value theory perspective</p> <p><u>Robin Göller</u>, Lara Gildehaus</p> <p>In this paper, we aim to better understand the relations of mathematics preservice teachers' mathematics-specific expectancy, values, and costs with their intention to drop out or change their study program as well as with their study satisfaction. Based on data from 209 mathematics preservice teachers, we analyze a structural equation model that highlights the importance of students' expectancy for success as well as the mediating role of students' emotional cost for dropout intention, study program change intention, and study satisfaction. These findings have theoretical and practical implications, which are discussed.</p>
<p>Research Report 3.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Carina Spreitzer</p>	<p>MODELLING PERFORMANCE USING FUNCTIONS: RELATION TO PERSON CHARACTERISTICS AND DIFFERENT SOLUTION APPROACHES</p> <p><u>Michael Jonscher</u>, Marielena Menzel, Sebastian Geisler, <u>Stefanie Rach</u></p> <p>Although mathematical modelling is undoubtedly a key competence, students often encounter challenges when working on modelling tasks. In a study with 122 tenth- and eleventh-grade students, we examined students' performance in modelling using functions by predicting it based on task values, self-concept, content knowledge, and prior achievement. In addition, we analysed students' solution approaches. Results indicate that students with high content knowledge and self-concept perform better in modelling. Both algebraic and graphical solution approaches enable precise solutions, but algebraic approaches are often abandoned. These results contribute the importance of both content knowledge and self-concept for modelling and indicate the potential of graphical assistance for algebraic solutions.</p>
	<p>RR 3.11: Research Report 3.11 Cancelled</p>
<p>Research Report 3.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Masakazu Okazaki</p>	<p>PRESERVICE TEACHERS' USE OF TEACHER MOVES THAT PROVIDE SENSE-MAKING OPPORTUNITIES TO STUDENT WHEN THEY IMPLEMENT NUMBER TALKS</p> <p><u>Simon Byeonguk Han</u>, Byungeun Pak</p> <p>Supporting students to make sense of mathematical ideas is crucial in mathematics classrooms. Number Talks center students' mathematical ideas, which is suitable for pursuing students' sense-making of mathematics. However, there are a very limited number of empirical studies regarding the efficacy of Number Talks. Also, teacher moves during the Number Talks have not been studied yet. In this study, we analyzed videos of 22 Preservice Teachers' 48 Number Talks from grades 3 to 5. We examined what teacher moves were used and their frequencies in the Introducing and Idea Sharing phase. We identified nine teacher moves, either constructive or interactive, and their frequencies, which could potentially support students' sense-making, within three teaching practices in NTs.</p>

Friday, 19/July/2024

<p>9:00am - 10:30am</p> <p>Location: Massey Business School Auditorium</p>	<p>Plenary3: JeongSuk Pang: "Five words for rethinking mathematics education"</p>
<p>10:30am - 11:00am</p> <p>Location: Atrium Round Room</p>	<p>Morning Tea</p> <p>All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer.</p> <p>Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>
<p>11:00am - 11:40am</p>	<p>Research Reports Session 4</p>
<p>Research Report 4.01</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Nitchada Kamlue</p>	<p>MAPPING COGNITIVE ENGAGEMENT AND MOTIVATION: FINDINGS FROM THE ORRSEM PROJECT</p> <p><u>Karen Skilling</u></p> <p>The ORRSEM Project is concerned with secondary mathematics teachers' Observations, Recordings and Reports of Student Engagement and Motivation. A framework is presented that maps important motivational theories to types and levels of engagement, bringing achievement motivation and mathematics education research together. The findings from 4 teacher workshops sought teachers' descriptions of 41 engagement characteristics. Specifically, the 15 cognitive engagement characteristics are detailed because they are fundamentally valuable for educational outcomes, yet they are the least clearly conceptualised aspects of engagement research. The findings revealed that experienced teachers' are adept at identifying and describing the nuanced phases of self-regulation strategies and metacognitive processes.</p>
<p>Research Report 4.02</p> <p>Location: Learning Space 1 (ASHS)</p> <p>Session Chair: Rui Ding</p>	<p>IS IT A FRACTION, OR SHALL I DIVIDE IT?</p> <p><u>Linda Marie Ahl, Ola Helenius</u></p> <p>The fraction representation can symbolize different mathematical concepts because the symbol a/b is polysemic. Since students' difficulties in acquiring the different conceptual meanings that the fraction representation denotes are well documented in research, we examined two commonly used textbook series in Sweden concerning how the polysemic aspect is displayed by analyzing how fractions and division are introduced and how the first image of the concepts is challenged with other images. We found one-sided representations of fractions as part of the whole, division as quotients greater than one, and weak support for understanding the polysemic aspect of a/b.</p>
<p>Research Report 4.03</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Qiaoping Zhang</p>	<p>CHINESE STUDENTS' MATHEMATICAL WELLBEING THREE YEARS ON: A RE-ASSESSMENT IN GRADE 6</p> <p><u>Juan Zhong, Veysel Akçakın, Wee Tiong Seah</u></p> <p>The mathematical wellbeing (MWB) of 76 students in a suburban elementary school in Chengdu, China were assessed twice, once in 2020 when they were part of a bigger Grade 3 participant group, and again in 2023 when they were in Grade 6. The same questionnaire was used, with its presentation adjusted to match students' ages. Variable/facet parameters were determined using Many Facet Rasch Measurement, and the Rasch-Welch t-test was employed to compare differences between Grades 3 and 6. Analysis found that the fulfilment of the same values contributed to students' MWB at both grade levels. However, at Grade 6, MWB was associated with more experiencing of the valuing of accomplishment and perseverance, less experiencing of engagement and bliss, and similar levels of relationship and meaningfulness.</p>
<p>Research Report 4.04</p> <p>Location: Learning Space 2 (ASHS)</p> <p>Session Chair: Katherina von Bülow</p>	<p>Students' views of e-assessment feedback in undergraduate mathematics</p> <p><u>George Kinnear, Paola Iannone</u></p> <p>This paper reports on undergraduate mathematics students' views on the feedback delivered through an e-assessment system, based on thematic analysis of interviews with 20 students. The results highlight students' views on the content of feedback – with many students expressing a preference for detailed, specific feedback, and mixed opinions about whether e-assessment delivered this. Students also reported strategic approaches to using the feedback. The findings resonate with existing frameworks on students' interactions with feedback, and provide a basis for further work to explore students' views toward e-assessment feedback in other contexts.</p>

<p>Research Report 4.05</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Mike Foster</p>	<p>AN EMPIRICAL EVALUATION OF USING INSTRUCTIONAL VIDEOS IN DIFFERENTIATED INSTRUCTION FOR EIGHTH GRADERS' LEARNING OF MATHEMATICAL PROBLEM SOLVING</p> <p><u>Yu-Hsuan Dai, Kai-Lin Yang</u></p> <p>This study aimed to develop instructional videos for assisting differentiated eighth graders' learning in mathematical problem solving. To evaluate the effect of the intervention strategy, we used pre- and posttests on the participants' performance and learning motivation as well as semi-structured interviews to understand high, medium, and low-achieving participants' perceptions of the learning experience. The results showed that the teaching designs had significant effects on improving students' performance and learning motivation in mathematical problem solving. The interviews revealed that the effect may have resulted from using the instructional videos for individual learning pace, clarifying the concepts applied for problem solving, and providing clear instructional guidance, especially for low-achieving students.</p>
<p>Research Report 4.06</p> <p>Location: . Quad Block B Room QB3</p> <p>Session Chair: Vanessa Magdalena Bialy</p>	<p>BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE: EXPLORING A COLLABORATIVE ASSEMBLAGE OF MATHEMATICIANS AND MATHEMATICS EDUCATORS</p> <p><u>Yiorgos Mavrommatis, Despina Potari</u></p> <p>In the evolving landscape of undergraduate mathematics education research, the collaboration between mathematicians and mathematics educators has been an area of study. Drawing on Assemblage theory, this research explores the formation of a collaborative group, as process oriented, in the between space of research and practice. The study investigates the affordances and constraints that shape and are shaped by collaborative praxis in the context of a three-year collaboration between mathematics educators and mathematicians. The analysis reveals the complexities, tensions, and potentialities within the collaborative assemblage, offering insights into what such a group can accomplish in the nexus of research and practice.</p>
<p>Research Report 4.07</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Kaitlin Riegel</p>	<p>PSYCHOLOGICAL THEORY AND INNOVATIONS IN REFORMS OF MATHEMATICS EDUCATION – A QUESTION OF DISCOURSE AND GRAMMAR</p> <p><u>Johan Prytz, Uffe Thomas Jankvist, Linda Ahl, Iresha Ratnayake</u></p> <p>This philosophical essay delves into the role of theories in mathematics curriculum reforms, particularly how theories can contribute to creating and implementing innovations. Using the concepts of discourse and grammar of schooling, we investigate two well-researched Swedish curriculum reforms. With these two concepts, we discuss the possible contribution of the underlying theories to the success of one reform and the failure of the other.</p>
<p>Research Report 4.08</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Lucian Olteanu</p>	<p>NAVIGATING THE JOURNEY FROM PROFESSIONAL DEVELOPMENT TO THE CLASSROOM: ACCOUNTABLE TALK IMPLEMENTATION IN PRIMARY MATHEMATICS CLASSES</p> <p><u>Merit Deri, Ronnie Karsenty, Baruch Schwarz</u></p> <p>Orchestrating high-quality dialogic discourse in primary mathematics classes is a considerable challenge for teachers. Research on the design and impact of professional development (PD) programs aimed at this challenge is limited. In particular, studies examining the trajectory of change in teachers' quality of discourse during and after PD programs are scarce. Our research focused on a specific type of discourse named Accountable Talk (AT). In this report we describe the cases of two mathematics teachers who participated in a PD program around AT. We followed them into their classes, to assess the impact of the PD on the quality of the discourse. Findings point to factors that may affect teacher learning and implementation of AT.</p>
<p>Research Report 4.09</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Robin Göller</p>	<p>Math for teaching or university? - Preservice teachers' motivation in their first study year</p> <p><u>Lara Gildehaus, Michael Liebendörfer</u></p> <p>Many preservice teachers lose their motivation in mathematics during their first year of study, displaying an unfavorable view of not being interested in mathematics. Given the evidence that they are not only interested in mathematics, but teaching as well, we operationalized career- and subject-specific dimensions in their motivation for mathematics, using expectancy-value-cost theory. Findings based on 209 higher-secondary and primary preservice teachers show a great fit between the theoretically anticipated model and the empirical data. The motivational development based on those dimensions shows a decrease for subject-specific interest but an increase for subject-specific relevance, indicating a shift from intrinsic to extrinsic motivation, while career-specific values remain stable in the first year. Practical implications how to address career-specific values in mathematics teacher education are being discussed.</p>

<p>Research Report 4.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Elin Berggren</p>	<p>Modelling with experiments - students' trait values mediated by students' state values <u>Marielena Menzel, Michael Jonscher, Stefanie Rach, Sebastian Geisler</u></p> <p>Students' motivation is crucial for successful learning. This study focusses on a repetitive structure of modelling tasks with experiments to examine the development of students' motivation, distinguishing between their stable trait value regarding mathematics in general and their variable state value regarding a certain task. Studies show a tendency for students to dislike modelling tasks. Thus, we chose that context to foster students' motivation. In this quantitative semi-experimental study, 111 secondary school students work on modelling tasks related to linear and exponential functions. Mediation analysis indicate that students' trait and state values are clearly related and that the students' state values partly mediate the changes of students' trait values before and after working on the modelling tasks.</p>
<p>Research Report 4.11</p> <p>Location: Learning Space 6 (ASHS)</p> <p>Session Chair: Lukas Hellwig</p>	<p>Formal and linguistic breaches of conventions in written student proofs <u>Nathania de Sena Maier, Silke Neuhaus-Eckhardt</u></p> <p>Learning how to prove is difficult. Especially at the beginning of their studies, students may have difficulties with the mathematical language, but also with the academic language or the formal presentation of a proof. To investigate this, we analyzed 124 students' attempts at proofs from 34 linear algebra submissions using qualitative content analysis. The analysis aimed to identify potential linguistic and formal breaches of convention. Nearly all submissions contained breaches at the level of academic language, mathematical language and at the level of the proof structure. One reason for this may be that the proofs students see in their lectures may not be model proofs. Implications for future research are discussed.</p>
<p>Research Report 4.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Fany Salazar</p>	<p>PARENT PERCEPTIONS OF THEIR MATH PARENTING ROLES IN THE HOME MATH ENVIRONMENT <u>Anastasia Betts, Ji-Won Son</u></p> <p>Type A growing body of research has demonstrated the critical importance of the early home mathematics learning environments of children prior to the onset of formal schooling in kindergarten. However, very few studies have looked specifically at factors that influence the motivations and decision-making of parents with respect to their math parenting. This study used the RESET framework to examine the perceptions of parents (n = 847) of 4- to 5-year-old children who were not yet in kindergarten to better understand how they perceived their role and actions in the HME. Better understanding of parents as agents in the HME can inform stakeholders desiring to improve the success of home intervention and support programs.</p>
<p>Research Report 4.13</p> <p>Location: Learning Space 7 (ASHS)</p> <p>Session Chair: Kevin C. Moore</p>	<p>Investigating students' understanding of algebraic letters using Latent Class Analysis <u>Katrin Klingbeil, Filip Moons</u></p> <p>To design valid assessment tools, it is necessary to understand what hurdles, common errors and misconceptions students encounter in the tested domain. Identifying typical patterns of thinking can be helpful to diagnose and communicate students' understanding to teachers. In this report, we investigate response patterns of 2051 German Year 7 and 8 students to six multiple-choice tasks of the SMART test "Meaning of Letters" that has been designed to assess the letter-as-object misconception. Using Latent Class Analysis, six response patterns could be identified. These patterns are described and analysed, and implications for improving the current assessment discussed.</p>
<p>12:00pm - 1:00pm</p>	<p>Oral Communication Session 2</p>
<p>Oral Communication 2.01</p> <p>Location: Learning Space 1 (ASHS)</p> <p>Session Chair: Masataka Koyama</p>	<p>NUMBER TALKS IN SECONDARY MATH CLASSROOMS <u>Richelle Marie Marynowski, Sandy Bakos</u></p> <hr/> <p>IMPACT OF THE PROBLEM-BASED LEARNING MODEL ON THE ACHIEVEMENT IN NUMBER SEQUENCES AMONG SENIOR HIGH SCHOOL STUDENTS IN CHINA <u>Huixin Gao, Kwan Eu Leong</u></p> <hr/> <p>AN ALTERNATIVE QUANTITATIVE LENS ON LAVIE-SFARD'S DEVELOPMENTAL MODEL OF NUMERICAL DISCOURSE <u>Christine Chambris, K. {Ravi} Subramaniam</u></p>

<p>Oral Communication 2.02</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: JeongSuk Pang</p>	<p>PRE-SERVICE TEACHERS' CURRICULAR NOTICING: ATTENDING TO FRACTION ACTIVITIES' FEATURES <u>Juan Manuel González-Forte</u>, Cristina Zorrilla, Pere Ivars, Geneida Fernández</p> <hr/> <p>BULDING AN INSTRUMENT TO CHARACTERIZE TEACHER NOTICING ABOUT ARGUMENT AND MATHEMATICAL MODELING COMPETENCIES <u>María Victoria Martínez Videla</u>, Victoria Arriagada, Horacio Solar</p> <hr/> <p>A CROSS-CULTURAL COMPARISON OF MATHEMATICS TEACHERS' NOTICING ON TASK POTENTIAL IN DEVELOPING FLEXIBLE PROBLEM-SOLVING STRATEGIES <u>Yu-Ting Lin</u>, Josephine Paul, Anke Lindmeier, Anika Dreher, Feng-Jui Hsieh, Ting-Ying Wang</p>
<p>Oral Communication 2.03</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Marta Civil</p>	<p>DEVELOPING EFFECTIVE SCHOOL LEADERSHIP FOR CULTURALLY SUSTAINING MATHEMATICS PEDAGOGY PROFESSIONAL LEARNING AND DEVELOPMENT <u>Mary Annie Lourie Rahiti</u></p> <hr/> <p>FOLLOWING A CONVERSATION SCRIPT: ADDRESSING THE DISCORD OF THE IMPACT OF LANGUAGE SUPPORTS IN PEER INTERACTIONS FOR MULTILINGUAL STUDENTS <u>Rachel Marie Restani</u>, Margarita Jimenez-Silva, Tony Albano, Suzanne Abdelrahim, Rebecca Claire Ambrose, Robin Martin</p> <hr/> <p>A Study of Bilingual Mathematics Teaching on Second-Graders' Learning Effect – Taking the topic of Length as an Example <u>Yenting Lai</u></p>
<p>Oral Communication 2.04</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Markku Hannula</p>	<p>Creating a Positive Learning Environment: Preliminary Results <u>Kien Lim</u>, Hilda Sotelo</p> <hr/> <p>Math Wellbeing and Math Value Among Taiwanese Upper Elementary School Students in Mathematics Learning <u>Yu Shan Ting</u>, Yu Liang Liou</p> <hr/> <p>Valuing in mathematics curriculum and textbooks for grades 1 and 2 <u>MinYoung Oh</u></p>
<p>Oral Communication 2.05</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Lynn Hodge</p>	<p>VOCABULARY AS AN INDICATOR OF NUMBER SENSE? A CASE STUDY WITH PRE-SCHOOL PUPILS <u>Oduor Olande</u></p> <hr/> <p>ENRICHING PRIMARY MATHEMATICS LESSONS THROUGH PICTURE STORY BOOKS: AN OVERVIEW <u>Ergi Acar Bayraktar</u></p> <hr/> <p>Improving mathematical thinking by playing board games in mathematics lessons <u>Csilla Zámbo</u>, Anna Muzsnay, Janka Szeibert</p>
<p>Oral Communication 2.06</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Vincent Stephan Geiger</p>	<p>INTEGRATING MATH INTO PLANETARY SCIENCE PBLs FOR THE DIVERSE CLASSROOM UTILIZING EQUITABLE PROFESSIONAL LEARNING <u>Tiana Woolard</u>, Deena Khalil, Alexandra Matiella Novak, Jennifer Heldmann</p> <hr/> <p>INQUIRY- AND MODELLING-BASED LEARNING IN AN ARCHAEOLOGICAL SITUATION <u>Pere J. Falcó-Solsona</u>, Carlos Ledezma, Gemma Sala-Sebastià, Vicenç Font, Adriana Breda</p> <hr/> <p>MATHEMATICAL CONSCIOUSNESS AND THE ECOSYSTEM: AN EXAMPLE OF MATHEMATICAL MODELLING <u>Richard Barwell</u></p>

<p>Oral Communication 2.07</p> <p>Location: Learning Space 2 (AHS)</p> <p>Session Chair: Boris Koichu</p>	<p>Homework at univeristy - why do students (not) do assignments? <u>Silke Neuhaus-Eckhardt</u>, Hans-Stefan Siller</p> <hr/> <p>Messaging for Success: Student Perceptions of Nudges in First-Year Tertiary Mathematics <u>Alex Che Yeung Lee</u>, Antony Sowards, Paul Hernandez-Martinez, Jason Skues</p> <hr/> <p>DIMINISHED CONFIDENCE IN THE LIGHT OF MISSED CURRICULUM OPPORTUNITIES <u>Sarah Bansilal</u></p>
<p>Oral Communication 2.08</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Tanya Evans</p>	<p>EXAMINING HOW TEACHERS ADAPT AND IMPLEMENT A HIGHLY PRESCRIBED MATHEMATICS CURRICULUM: THE SWEDISH CASE <u>Tuula Koljonen</u></p> <hr/> <p>Eriching Math Teaching Guides: a Competency-Based Framework <u>Albert Vilalta</u>, Jordi Deulofeu, Laura Morera</p> <hr/> <p>21ST CENTURY COMPETENCIES: DIDACTICAL INSIGHTS ON CHANGES IN THE MATHEMATICS CURRICULUM <u>Evelin Anna Geszler</u>, Janka Szeibert</p>
<p>Oral Communication 2.09</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Sebastian Geisler</p>	<p>CHATGPT AS A TUTORING TOOL FOR NONPARAMETRIC STATISTICS: A COMPREHENSIVE ANALYSIS <u>Joel Lagundi De Castro</u>, Dennis Lee Jarvis Baring Ybañez</p> <hr/> <p>Embracing the Age of Artificial Intelligence: Teachers' Knowledge and Practice on the Responsible Use of AI in Mathematics Education <u>Joseph Ma. Steven Sales Cabalo</u>, Pablo Agos Regalario, Jenny Pandi Macalalad</p>
<p>Oral Communication 2.10</p> <p>Location: Learning Space 4</p> <p>Session Chair: Tracy Helliwell</p>	<p>A Self-Based Collaborative Concept Exploration Approach to Mathematics Teachers' Learning <u>Olive Chapman</u></p> <hr/> <p>Teachers' professional development and mathematics LSA: first result of national project <u>Giada Viola</u>, Federica Ferretti, Alessandro Gambini, Francesca Martignone, Carlotta Soldano, <u>Camilla Spagnolo</u></p> <hr/> <p>MATHEMATICS PD ONLINE AND IN PERSON: DO STRUCTURE AND FACILITATION MOVES VARY? <u>Victoria Shure</u>, <u>Vanessa Bialy</u>, <u>Pöhler-Friedrich Pöhler</u>, <u>Bettina Roesken-Winter</u></p>
<p>Oral Communication 2.11</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Laura Van Zoest</p>	<p>NEW INSIGHTS FROM "IDENTITY SITES": OPERATIONALISING MATHEMATICS LEARNER IDENTITY WITH A THEATRE METAPHOR <u>Lisa J Darragh</u></p> <hr/> <p>Influence of prior knowledge on pre-service teachers' performance in solving Fermi problems <u>Carlos Segura</u>, César Gallart, Irene Ferrando</p> <hr/> <p>A STUDY ON THE DETERMINATION INDICATORS FOR MATHEMATICAL LITERACY QUESTION: FROM THE PERSPECTIVES OF THE SCHOOL TEACHERS <u>Chia-Jui Hsieh</u>, Yu-Zhen Zhang, Lin-Chieh Tsai, Ching-Wen Chiu</p>

<p>1:00pm - 2:30pm Location: Atrium Round Room</p>	<p>Lunch break All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer. Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>
<p>1:30pm - 2:30pm Location: Massey Business School Auditorium</p>	<p>Policy Meeting</p>
<p>2:30pm - 3:10pm</p>	<p>Research Reports Session 5</p>
<p>Research Report 5.01 Location: Atrium Building AT1 Session Chair: Karen Skilling</p>	<p>UNDERSTANDING STUDENTS' REASONS AND AIMS OF EFFORTS AND PERSISTENCE IN MATHEMATICS Elaine Yu Ling Cai, Gregory Arief D. Liem In the present study, we investigate the 'aims' elementary school students pursue through effort and persistence (i.e., their achievement goals) and the 'reasons' driving them (i.e., their motivations) in their mathematics classes. Self-report instruments measuring students' motivational reasons, achievement goals, and effort and persistence in their mathematics classes were administered. Mediation path analysis showed that achievement goals, collectively, played a significant mediating role in almost all the links connecting motivational reasons to effort and persistence. Autonomous motivation was associated with greater effort and persistence. Self-based goals strengthened the positive direct effects of autonomous motivation on effort and persistence.</p>
<p>Research Report 5.02 Location: Learning Space 1 (ASHS) Session Chair: Ola Helenius</p>	<p>AN INVESTIGATION OF LENGTH ESTIMATION SKILLS OF HIGH SCHOOL STUDENTS WITH MILD INTELLECTUAL DISABILITY Hsin-Mei E. Huang, Xuan Liao, Jessica Hoth, Silke Ruwisch, Aiso Heinze This study investigated the length estimation skills of high school students with mild intellectual disabilities (N = 39) by means of a paper-and-pencil assessment and interviews. The results showed that the students performed differently in different estimation situations involving size discrepancy and accessibility of to-be-estimated objects. The students tended to underestimate the lengths of daily objects. The uses of body parts, objects in convenience, mental rulers such as 1, 10 and 15 cm as reference points through unit iteration were the strategies reported by the interviewees.</p>
<p>Research Report 5.03 Location: Innovation Complex Room IC1.07 Session Chair: Heather Lynn Johnson</p>	<p>Students' conceptions about mathematics for climate change and related issues Chiara Andrà, Domenico Brunetto In recent PME and ICMI conferences, a need for curriculum innovation that takes into account the role of mathematics in understanding and contrasting climate change and related issues has been stressed by prominent scholars, taking a rather cognitive stand. In this paper, we focus on the affective side of the phenomenon, arguing that the students' conceptions both about mathematics and about climate change and related issues need to be taken into consideration in order to make such an innovation effective. Hence, we report and analyse the narratives that a small sample of students enrolled in an Environmental Sciences program produced during the activity of writing a letter to a fictitious class of students living in the future describing how mathematics has helped humans to survive in the next 200 years.</p>
<p>Research Report 5.04 Location: Learning Space 2 (ASHS) Session Chair: Alejandro S. González-Martín</p>	<p>ESSENTIAL PROGRAM FEATURES IDENTIFIED BY STUDENTS WORKING TOWARD A DOCTORATE IN MATHEMATICS EDUCATION Scott Courtney, Anita Alexander What are the essential components of a doctorate program in mathematics education or didactics of mathematics concerning research, coursework, seminars, and collaboration? The purpose of this study was to learn from doctoral students across the world about how their programs in mathematics education are preparing them for research and teaching in mathematics education; how their programs provide academic research and writing support; and what they view as missing from their experiences. Online surveys, along with follow-up interviews from a subset of survey respondents, indicated that doctoral students from 17 different countries stressed the importance of international collaboration, examining fundamental theories of learning mathematics, and identified a need for more support with academic writing.</p>

<p>Research Report 5.05</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Yu-Hsuan Dai</p>	<p>EXPLORATIONS WITH AMBIGUITIES IN MATHEMATICAL PROBLEM-SOLVING</p> <p><u>Elin Berggren</u></p> <p>This study explores the characteristics of narratives in a problem-solving discourse, where the reasoning processes of two students are analysed. It aims to examine the factors contributing to endorsing students' generated narratives during the process. The results indicate that explorative actions are characteristic of the narratives generated by the students. The primary factors contributing to the endorsement of narratives are identified as "Ambiguity of difference in sameness" and "Ambiguity of generalization". Awareness of these different ambiguities, their nature, and their role in the discourse is crucial for how mathematics teacher educators can support students' development in mathematical reasoning.</p>
<p>Research Report 5.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Georgios Mavrommatis</p>	<p>Learning to teach mathematics with instructional technology: A praxeological analysis of a Swedish mathematics teacher education course</p> <p><u>Farouq Sessah Mensah</u></p> <p>The study used the Anthropological Theory of the Didactic to understand how, why, and what is privileged in a Swedish mathematics teacher preparation course. A mathematics teacher-educator interview was analysed using a reference model. The study results show that teaching with instructional technology in cognitive ways was privileged pre-didactically, didactically, and post-didactically. The didactical cognitive praxis addressed teachers' and learners' use of instructional technologies. The privileged didactical logoi linking the praxis were competencies (förmågor) in the Swedish upper secondary curriculum. The privileged meta-didactical praxis was the decomposition, representation and approximation of practice, with some implicit meta-didactical logoi discussed.</p>
<p>Research Report 5.07</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Lisa J Darragh</p>	<p>EXPLORING PERCEIVED VALUE DIFFERENCE SITUATIONS IN AUSTRALIAN MATHEMATICS CLASSROOMS</p> <p><u>Anni E, Wee Tiong Seah</u></p> <p>Recent research has highlighted how students might disengage from classroom activities when their values and their teachers' are different. The present study examined 625 secondary school students' perspectives and experiences to better understand what these value difference situations look like. Analysis of the 29 identified instances of value differences revealed the need to propose a new category - mathematical content value - to add to the existing classification of values. The findings reveal an issue where students often struggle to appreciate the value of learning specific mathematical content, even when teachers emphasise its practical usefulness. The results also highlight that teacher' excessive reliance on textbooks runs counter to student' mathematics educational values, hindering their learning.</p>
<p>Research Report 5.08</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Merit Deri</p>	<p>Snapshots of a teacher's productive talk moves when orchestrating a whole-class discussion</p> <p><u>Ban Heng Choy, Jason Lai</u></p> <p>Orchestrating productive mathematics discussions by building on students' ideas is challenging. Although certain talk moves involving eliciting student responses are associated with this high-leverage practice, they may not be sufficient for enhancing student reasoning. Telling, on the other hand, may play an important role despite the perception they are contradictory to a more interactive stance in teaching. In this paper, we examined how an elementary school teacher orchestrated a productive whole-class discussion through the skilful interweaving of talk moves and telling.</p>
<p>Research Report 5.09</p> <p>Location: Learning Space 5 (ASHS)</p> <p>Session Chair: Lara Gildehaus</p>	<p>EFFECTS OF REFLECTION PHASE TIMING ON PRE-SERVICE MATHEMATICS TEACHERS' DIAGNOSTIC PROCESSES</p> <p><u>Stephanie Kron, Daniel Sommerhoff, Kathleen Stürmer, Stefan Ufer</u></p> <p>Research on pre-service teachers' diagnostic competence revealed that they could benefit from simulation-based learning environments to foster their diagnostic competence. It is emphasized that the diagnostic processes leading to diagnostic judgments should be investigated to understand the development of diagnostic competence. Instructional support, implemented in the simulation-based learning environment, is assumed to affect diagnostic processes positively. This contribution investigates the effects of different timings of reflection phases (concurrent versus final) on the quality of diagnostic processes of N=66 pre-service mathematics teachers. Results reveal that effects of reflection phases on the quality of the diagnostic process differ in accordance with its timing.</p>
<p>Research Report 5.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Marielena Menzel</p>	<p>PERFORMANCE OF JUNIOR HIGH SCHOOL STUDENTS' COMPUTATIONAL THINKING IN MATHEMATICAL PROCESS</p> <p><u>Lan-Ting Wu, Feng-Jui Hsieh</u></p> <p>This study explores the performance of junior high school students in computational thinking within mathematical tasks, which were systematically designed based on 4 computational thinking elements and 3 PISA mathematical processes. We employed inductive analysis to explore types of responses from 60 junior high school students, with 30 students from each of the 7th and 9th grades. The results showed that students performed well in decomposition and pattern recognition but performed relatively weaker in abstraction. Their algorithm designs could be classified into three major types: graph-oriented, direct code-oriented, and pattern code-oriented. The 9th-graders outperformed 7th-graders in algorithmic design. As long as students could design algorithms for simple cases, they had no difficulty with more complex cases.</p>

<p>Research Report 5.11</p> <p>Location: Learning Space 6 (ASHS)</p> <p>Session Chair: Nathania de Sena Maier</p>	<p>FROM INNOVATION TO IMPACT: FACTORS SHAPING THE SCALING SUCCESS OF THE TRIUMPHS PROJECT</p> <p>Iresha Gayani Ratnayake, Linda Marie Ahl, Johan Prytz, Uffe Thomas Jankvist</p> <p>The paper recounts the successful implementation story of the TRansforming Instruction in Undergraduate Mathematics via Primary Historical Sources (TRIUMPHS) project. Our analysis of the project involved examining influential factors (Century & Cassata, 2016) and scaling dimensions (Coburn, 2003). We identified how influential factors and strategies employed by the TRIUMPHS project positively impacted scalability, particularly highlighting sustainability. These findings underscore the importance of innovation, user engagement, and the operational context in driving project expansion and long-term viability.</p>
<p>Research Report 5.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Anastasia Betts</p>	<p>Algebraic Seeds for Graphing Functions</p> <p>Mathías Agustín López, Susanne Strachota, Bárbara Brizuela, María del Carmen Pérez-Martos, Angela Murphy Gardiner, Maria Blanton</p> <p>This case study of one first grade student involves the analysis of three interviews that took place before, during, and after classroom teaching experiments (CTEs). The CTEs were designed to engage children in representing algebraic concepts using graphs. Using a knowledge-in-pieces perspective, our analysis focused on identifying students' natural intuitions and ways of thinking algebraically about a functional relationship represented using graphs. Findings reveal four seeds, two of which were identified in prior studies, and how the activation and coordination of these seeds results in students' production of function graphs.</p>
<p>3:30pm - 4:30pm</p> <p>Location: Atrium Building AT1</p>	<p>National Presentation: AOTEAROA NEW ZEALAND MATHEMATICS EDUCATION RESEARCH AND CURRICULUM DEVELOPMENT</p> <p>Presented by Jodie Hunter, Naomi Ingram, Generosa Leach, Tony Trinick, Sze Looi Chin</p> <p>This national presentation will focus on mathematics education research and curriculum development related to Aotearoa New Zealand. We recognise that there are many countries that share similar histories of colonisation. We begin by highlighting that the educational systems in Aotearoa New Zealand have been heavily influenced by colonisation with a resulting negative impact on both Indigenous Māori and Pacific peoples in relation to mathematics teaching and learning (Allen & Trinick, 2021; Hunter & Hunter, 2018; Trinick & Heaton, 2021). With the underpinning of centering indigenous knowledge and developing social justice and equitable mathematics classrooms, the presentation will provide an overview of policy, curriculum changes, initiatives, and research projects that have transformative potential.</p> <p>During the first part of the presentation, we will provide background information in relation to schooling structures and mathematics education including both historical context, successes, and ongoing challenges. This part of the session will include an overview of the changes in curriculum and policy development over the past 30 years from 1993 until present times. We will then shift focus to examine Māori and Pacific initiatives in mathematics education. This part of the presentation will focus on both policy development and research studies which have centred Māori or Pacific knowledge, language, and ways of being in relation to mathematics education. We will finish with our concluding remarks to summarise the key-points of the session.</p>

3:30pm - 4:30pm

Location:
Albany Senior High School

Poster Presentations

Improving engineering mathematics problem-solving through interactive computer simulation and animation

Ning Fang, Seyed Tajvidi

A Case Study of MGTA Growth in Supporting Group Work

Kelsey Isla Quaisley, Mary Beisiegel

A COMPARATIVE ANALYSIS OF CHINESE AND KOREAN MATHEMATICS TEXTBOOKS FOCUSING ON THE EQUAL SIGN IN GRADE 1 AND 2

JoHyeon Chang

A Graph-Theoretic Analysis of Calculus Textbook Tasks

Haile Marie Gilroy

A study of Chilean early childhood education study plans with a focus on mathematics education and gender and SES inequities

Claudia Cornejo Morales, Mayer Soto Sarmiento, David Maximiliano Gomez

Bibliometric Analysis of Research on the Usage of Augmented Reality (AR) in Mathematics Education

Daniel Vadim O'Brien, Katherine Riding

Cognitive Conflict as Instructional Strategy for teaching Logical Principles

Alexander Holvoet

CONCEPT OF EQUIVALENCE IN THE CONTEXT OF WEIGHT: A CASE STUDY IN KINDERGARTEN

Nathalie Silvia Anwandter Cuellar, Elena Polotskaia, Virginie Robert, Ildiko Pelczer, Raphaëlle Dufour

Creating Space for Data, Art, and Stories: Student-Created Data Visualizations for Community Learning

Lynn Hodge, Yilang Zha **Using Teaching Applications in University-level Mathematics Courses**

Elizabeth Arnold

EFFECTS OF UNIVERSALLY DESIGNED SERIOUS GAMES STUDENTS' FRACTION KNOWLEDGE

Jessica Hunt Hunt

Mathematical Reasoning in a Middle-School Mobile Security Intervention

Suzanna Schmeelk, Carolyn Maher, Rasha Abadir, Victoria Krupnik, Louise Wilkinson

Mathematics on the river, mathematics of the river

Chiara Andrà, Alberto Doretto, Cristina Scalvini

The Proposal of Emergent Hypothesis Modelling in Statistics Education

Hiroto Fukuda

CREATION AND VALIDATION OF THE ALGEBRA CONCEPT INVENTORY IN THE TERTIARY CONTEXT

Claire Wladis, Kathleen Offenholley, Benjamin Sencindiver, Nils Myszkowski, Geillan Dahab Aly

(Mis)alignment of Teacher- and Student- Facing Texts in a Geometry Unit Across Curricula

Soobin Jeon

CULTIVATING STEM AFFINITY THROUGH INFORMAL MATHEMATICS-BASED CODING AND ROBOTICS ACTIVITIES

Mina Sedaghat Jou, Anton Puvirajah, Uriah Mcclain

DEVELOPMENT OF MULTIPLICATION LESSONS AIMING AT THE PROGRESS OF PROPORTIONAL REASONING

Hisae Kato, Hiraku Ichikawa, Keiko Hino

Differences in student proofs across media

Vasiliki Laina

EFFECTIVE TEACHING IN MATHEMATICS CLASSROOM: FROM THE LOW-ACHIEVERS' PERSPECTIVES

Yun Hsia Pai

ELEMENTARY STUDENTS' UNDERSTANDING OF VARIABLES THROUGH A UNIT ON PATTERNS AND CORRESPONDENCE

JeongSuk Pang, Ji-Eun Lee

Emerging Principles of Digital Task Design to Support Students' Developing Graphing Meanings

Claudine Margolis, Teo Paoletti, Allison Olshefke

ENGINEERING DESIGN: A CYCLE TO SOLVE AUTHENTIC PROBLEMS AND DEVELOP COLECTIVE CREATIVITY

Isabel Vale, Ana Barbosa, Isabel Cabrita

ENHANCING ALGEBRA LEARNING IN TAIWANESE JUNIOR HIGH STUDENTS THROUGH A DIGITAL MICROWORLD

Tai-Yih Tso, Feng-Lin Lu, Shu-Hao Hsu

Enhancing Self-Regulated Teaching in Mathematics: A Lesson Study Approach

ChangHua Chen, ChiaHui Lin

Examining names in different languages through math

Simon Byeonguk Han, Amanda Sugimoto

EXPLORING STUDENTS' GRAPHING MEANINGS USING EYE-TRACKING TECHNOLOGY

Erin Wood, Sohei Yasuda, Kevin C. Moore

EXPLORING THE EFFECTIVENESS OF TRANSFORMING MATHEMATICS-GROUNDING ACTIVITIES INTO DIGITAL EXPERIMENT ACTIVITIES

Tai-Yih Tso, Shu-Hao Hsu, Feng-Lin Lu

EXPLORING THE ROLE OF DATA EXPLORATIONS IN MATHS LEARNING

Jasneet Kaur

Investigating the facilitation of self-regulated learning by mathematics teachers: A perspective on teacher agency

Chia-Hui Lin, Chang-Hua Chen

IS MIDDLE SCHOOL MATH ENOUGH FOR OCCUPATIONS? DATA FROM PRACTITIONERS' RATINGS

Su-Wei Lin, Chao-Jung Wu, Yuan-Horng Lin, Hong-Wen Chang

LINEAR NIM-DIGITAL – PROBLEM-SOLVING DEVELOPMENT OF WINNING STRATEGIES

Birgit Brandt, Andreas Kirsche

Linking virtual and physical manipulatives by designing learning environments

Jan Löffert, Jessica Hoth

Making sense(s) of functions: A design engaging blind learners through movement and sound

Krause Christina, Gfrerrer Johanna, Fischer Michael, Pumm Aaron

Managing figure and ground in mathematical discourse

Susan Kimberley Staats, Claire Halpert, Alyssa Kasahara

MATHS EDUCATION LABS - ECHOES ON TEACHER TRAINING

Américo Silva, Isabel Cabrita, Isabel Vale, Ana Barbosa

Measuring and Promoting Teacher Noticing for Inclusive Mathematics Education

Anton Bastian, Natalie Ross, Sarah Strauß, Isabelle Klee-Schramm, Johannes König, Gabriele Kaiser

Monologic centering analysis for group work

Allison L. Gantt

PRESERVICE MATHEMATICS TEACHERS AS TEACHER-RESEARCHERS

Leah Atienza Nillas

PRIMARY SCHOOL STUDENTS' UNDERSTANDING OF TIME MEASUREMENT - COMPONENTS OF A CONCEPT OF TIME

Lukas Knorr, Jessica Hoth, Constanze Schadl

SATISFACTION, SATISFACTORINESS, MOTIVATION AND AMBIENTAL FACTORS OF SECOND YEAR UNIVERSITY STUDENTS

Jacopo Vicini, Chiara Andrà, Matteo Pezzutto

Students' reasoning through graph conventions

Brandi Rygaard Gaspard, Hwa Young Lee, Mai Bui, Hamilton Hardison, Teo Paoletti, Lucinda Ford, Holly Zolt, Stephanie Tarigan

Students' understanding of the "general validity" of mathematical statements and proofs

Sarah Lundt, Milena Damrau, Stefan Ufer

What's Good in Math?

Michelle Friend, Gabriel Meints, Kirsten Tetzlaff, Betty Love, Nicole Infante

Task Design Principles to Support Graph Reasoning

Teo Paoletti, Allison L. Gantt, Srujana Acharya, Claudine Margolis

THE CONVERGENCE OF FORMAL AND INFORMAL MATHEMATICS LEARNING: USING PLANETARY SCIENCE TO BRIDGE THE GAP AND ENGAGE WITH DIVERSE COMMUNITIES

Tiana Woolard, Deena Khalil, Alexandra Matiella Novak, Jennifer Heldmann

SURFACING FAMILY PRACTICES THAT SUPPORT FRENCH IMMERSION STUDENTS IN MATHEMATICS

Julianne Denyka Gerbrandt

TAILORING STRATEGIES TO ENHANCE READING COMPREHENSION AND ACHIEVEMENT IN GEOMETRY

Chao-Jung Wu

SUCCESSIVELY, COLLECTIVELY ANALYTICAL ARGUMENTATION IN PHILOSOPHICO-MATHEMATICAL CLASS DISCUSSIONS ABOUT INFINITY

Julchen Brieger

Studying the relationship between students' functional thinking and algebra performance

Anneli Christina Blomqvist

Trends and predictors of math anxiety in Canada: The role of learning strategies

Haoyi Wang

TWO-COLOURED TOWERS AND BEYOND: NAVIGATING AND DEVELOPING PRE-SERVICE TEACHERS' COMBINATORIC AND PROBABILISTIC THINKING

Gale Louise Russell, Egan Chernoff

<p>4:30pm - 5:00pm</p> <p>Location: Atrium Round Room</p>	<p>Afternoon Tea</p> <p>All breaks on Thursday and Friday will be held simultaneously in the Atrium Round room and the Innovation Centre Foyer.</p> <p>Specialist food options i.e. gluten free, dairy free, veg/vegan etc will only be available in the Atrium Round Room.</p>
<p>12:00pm - 1:00pm</p>	<p>Oral Communication Session 3</p>
<p>Oral Communication 3.01</p> <p>Location: Learning Space 1(ASHS)</p> <p>Session Chair: Susanne Marie Strachota</p>	<p>THE RELATIONSHIP BETWEEN UNDERSTANDING EQUIVALENCE AND RELATIONAL THINKING <u>Atsushi Sawada</u></p> <hr/> <p>FACILITATING ARITHMETIC-ALGEBRA TRANSITION WITH PROGRESSIVE LINKING STRATEGY <u>Huansen Jian</u>, Yanxing Qi</p> <hr/> <p>ASSESSMENT OF BIG IDEAS OF EQUIVALENCE: INVESTIGATING AN AGGREGATED APPROACH <u>Jahangeer Mohamed Jahabar</u>, Tin Lam Toh, Eng Guan Tay, Cherng Luen Tong</p>
<p>Oral Communication 3.02</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: David Wagner</p>	<p>DEVELOPING PRE-SERVICE MATHEMATICS TEACHERS' COMPETENCY IN DESIGNING MODELING TASKS <u>Hee-jeong Kim</u>, Gima Lee, Byoung-rag Soh, Yun Hwa Noh, Jinfa Cai</p> <hr/> <p>EXPLORING ALGEBRAIC TASK DYNAMICS, PRE-SERVICE TEACHERS' REASONING AND SENSE-MAKING <u>Monica Jonsson</u>, Constanta Olteanu</p> <hr/> <p>Pre-service primary teachers' decision making: Attending to relevant pedagogical content knowledge aspects <u>Tjorven Lea Seibold</u>, Christin Laschke, Lars Meyer-Jenßen, Bettina Rösken-Winter</p>
<p>Oral Communication 3.03</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Sean Chorney</p>	<p>What math do I need to know? Perspectives on special education teachers' knowledge <u>Juan Luis Piñeiro</u>, Eder Pinto</p> <hr/> <p>Gender and socioeconomic biases in adults' judgments of children's mathematical arguments Jorge Peña Araya, Maria Guerrero, Claudia Cornejo Morales, <u>David Maximiliano Gomez</u></p> <hr/> <p>FOSTERING GENDER EQUALITY IN FINANCIAL MATHEMATICS UNIVERSITY PATHWAYS AND PROFESSIONS Amedeo Matteucci, Adamaria Perrotta, Francesco Saverio Tortoriello, <u>Iliaria Veronesi</u></p>
<p>Oral Communication 3.04</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Rachel Elizabeth Helme</p>	<p>DOES EVERYONE HAVE TO KNOW BY HEART HOW MUCH 8 TIMES 7 IS? A CROSS-SECTIONAL STUDY ON STUDENTS' VIEWS AND PERFORMANCE <u>Csaba Csíkos</u>, Ildikó Bereczki, Fanni Biró</p> <hr/> <p>A MULTIPLE-CASE STUDY ON THE PROCESS OF APPRECIATING THE AESTHETIC QUALITIES OF MATHEMATICAL OBJECTS <u>Hayato Hanazono</u></p> <hr/> <p>A STUDY OF ELEMENTARY SCHOOL STUDENTS' CORE LEARNING OUTCOME REGARDING DESIRABLE ATTRIBUTES <u>Anucha Kovata</u>, Dhanachat Anuniwat, Kanita Pamuta, Narumon Changsri, Maitree Inprasitha</p>

<p>Oral Communication 3.05</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Stefan Ufer</p>	<p>Teacher actions to support mathematical reasoning through the use of a conceptual starter in upper primary classrooms <u>Lauren Kaye Frazerhurst</u></p> <hr/> <p>PROBLEM SOLVING: THE EFFECTIVE CHOICES OF REPRESENTATIONS <u>Ana Barbosa, Isabel Vale</u></p> <hr/> <p>VISUAL SOLUTIONS: A RESOURCE TO SOLVE CHALLENGING PROBLEMS AND BE CREATIVE <u>Isabel Vale, Ana Barbosa, Isabel Cabrita</u></p>
<p>Oral Communication 3.06</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Jennifer Suh</p>	<p>EXPLORING COMPUTATIONAL THINKING IN INQUIRY-BASED MODULES FOR VOCATIONAL HIGH SCHOOLS <u>Lin-Chien Tsai, Chia-Jui Hsieh, Jeng-Shin Wu</u></p> <hr/> <p>Designing Opportunities for Computational Thinking: Leveraging Family Stories and Community Practices in Teacher Professional Development <u>Lynn Hodge, Amy Maples</u></p> <hr/> <p>ENHANCING STUDENTS' IDEAS OF ALGORITHM WITH COLORING BOOK IN MATHEMATICS CLASSROOM <u>Narumon Changsri, Maitree Inprasitha, Roberto Araya, Masami Isoda</u></p>
<p>Oral Communication 3.07</p> <p>Location: Learning Space 2(ASHS)</p> <p>Session Chair: Helena Johansson</p>	<p>UNIVERSITY STUDENTS' READING OF MATHEMATICAL PROOFS VARIES BY CONTEXT AND PROFICIENCY LEVEL <u>Takuo Oguro, Masahiko Okamoto, Mitsuru Kawazoe</u></p> <hr/> <p>LECTURER'S TOOLS FOR TEACHING PROOFS AND PROVING <u>Angeliki Mali</u></p> <hr/> <p>Mathematicians' oral communication of their research to a mathematics education researcher <u>Rox-Anne L'Italien-Bruneau</u></p>
<p>Oral Communication 3.08</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: David A Reid</p>	<p>How Teachers' Actions Prompt Dialectic and Dialogic Mathematical Argumentation <u>Sheena Tan</u></p> <hr/> <p>THE FUNCTIONS OF ARGUMENTATION: A LITERATURE REVIEW FOR MATHEMATICS EDUCATION <u>Jorge Olivares-Aguilera, Manuel Goizueta</u></p> <hr/> <p>TEACHER LEADERS PROGRAM TO SUPPORT TEACHER NOTICING IN PROMOTING MATHEMATICAL MODELING AND ARGUMENTATION COMPETENCIES <u>Horacio Solar, Florencia Gómez, María Victoria Martínez, Andrés Ortiz</u></p>
<p>Oral Communication 3.09</p> <p>Location: Learning Space 3 (ASHS)</p> <p>Session Chair: Wim Van Dooren</p>	<p>AN ERP STUDY ON MEASURING STUDENTS' DETECTION OF EQUIVALENCE FRACTIONS <u>Chen Yu Yao, Hui Yu Hsu, Tsu Jen Ding</u></p> <hr/> <p>Applying multilevel modelling to analyse factors affecting mathematics performance in New Zealand schools: Evidence from TIMSS data <u>Tanya Saxena, Tanya Evans, Stephanie Budgett</u></p> <hr/> <p>ADAPTATION OF THE MONTY HALL PROBLEM AS AN ACTIVITY FOR HIGH SCHOOL PROBABILITY <u>Harold Vertudes Mangubat, Angel Mae Opelanio Ombid, Dennis Lee Jarvis Baring Ybañez</u></p>
<p>Oral Communication 3.10</p> <p>Location: Learning Space 4 (ASHS)</p> <p>Session Chair: Andreas Ebbelind</p>	<p>FROM THE INTENDED TO THE PERCEIVED CURRICULUM: TEACHER'S PERSPECTIVES ON CURRICULM CHANGE <u>Yoshinori Shimizu</u></p> <hr/> <p>Navigating Professional Roles: A Qualitative Analysis on Shifts in Teacher's Beliefs <u>Jude Buot, Lester Cu Hao</u></p> <hr/> <p>MATHEMATICS TEACHER EDUCATORS' PERSPECTIVES ON THEIR PREPAREDNESS FOR ONLINE TEACHING <u>Annatoria Zanele Ngcobo, Jyoti Jhagroo, Msebenzi Rabaza, Justice Enu</u></p>

Saturday, 20/July/2024

<p>9:00am - 10:30am</p> <p>Location: Sir Neil Waters Lecture Theatre Building 300</p> <p>Session Chair: Armando Solares-Rojas</p>	<p>Plenary Panel</p> <p>The Plenary panel will be held according to the Oxford-style debate protocol on a topic related to the theme of the conference: Rethinking Mathematics Education Together.</p> <p>The panel for PME 47 Conference currently consists of the following researchers:</p> <p>Nuria Planas – Universitat Autònoma de Barcelona, Spain Tony Trinick – University of Auckland, New Zealand Stefan Ufer – University of Munich, Germany Vilma Mesa - University of Michigan, United States of America</p>
<p>10:30am - 11:00am</p> <p>Location: Sir Neil Waters Lecture Theatre Building Foyer</p>	<p>Morning Tea</p>
<p>2:30pm - 3:10pm</p>	<p>Research Reports Session 6</p>
<p>Research Report 6.01</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Yasmine Abtahi</p>	<p>Relationality in Productive Struggle: A Somali Algebra Conversation Susan Kimberley Staats, Claire Halpert, Alyssa Kasahara, Emily Posson, Fardus Ahmed</p> <p>This paper analyses relationality as a source of mathematical meaning during productive struggle in a multilingual, Somali and English algebra conversation. Relationality—meaningful interpretations based on interactions of multimodal dialogue, past language occurrences, mathematical writing, and learning environments—can take the form of conversational repetition. We show that the students’ conversational repetition allowed them to express uncertainty in useful ways, exploring what it means to explain mathematically, and transforming the Somali meanings of words “add” and “write” in ways that enhanced their work towards algebraic generalization. Our analysis deepens the theoretical understanding of productive struggle when it involves uncertainty in explaining and sensemaking.</p>
<p>Research Report 6.02</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.31</p> <p>Session Chair: Hsin-Mei E. Huang</p>	<p>Geometry learning of students with general learning difficulties: An eye-tracking study on the identification of quadrilaterals Maïke Schindler, Anna Lisa Simon, Elisabeth Czimek, Benjamin Rott, Achim J. Lilienthal</p> <p>Geometry is an important mathematical domain, especially for students with general learning difficulties (LD). However, not much is known about geometry learning of students with LD, possible difficulties, and needs for support. The aim of this paper is to investigate if and how students with LD differ in the identification of quadrilaterals from students without LD. We carried out an eye-tracking study with 184 students (20 with LD, 164 without LD) in which students were asked if given shapes were quadrilaterals. We analyzed students’ error rates (from their oral responses) and their strategies, based on qualitative analysis of eye-tracking videos. We found that students with LD tended to make more mistakes than students without LD and to regard the quadrilaterals more often holistically, paying less attention to their properties.</p>
<p>Research Report 6.03</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Alicia C. Gonzales</p>	<p>AGE MATTERS WHEN IT COMES TO STUDENTS’ ATTITUDES TOWARD ONLINE MATHEMATICS ASSESSMENTS Erica Dorethea Spangenberg</p> <p>This study established how students’ attitudes toward online mathematics assessments relate to age due to the shift to online learning during COVID-19. Quantitative data were collected through an adapted Attitudes Toward Mathematics Inventory from 734 students in seven South African schools. Although enjoyment, perceived usefulness, ease of use, and self-confidence in engaging in online mathematics assessments decline with age, they are significantly lower for students 13-16 years old compared to those older (17-22 years) and younger (10- 12 years). Intrinsic motivation is statistically the same for older and younger students but significantly lower for students who are 13-16 years old. This study suggests further research on affective aspects influencing specific types of online mathematics assessments.</p>
<p>Research Report 6.04</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.32</p> <p>Session Chair: Scott Courtney</p>	<p>Self-efficacy expectations of mathematics university students Stefanie Rach, Timo Kosiol, Stefan Ufer</p> <p>Self-efficacy expectations, which are learners’ estimation of being able to solve a task, are an important motivational variable in learning processes. Learners with high expectations may be more ambitious when dealing with mathematical tasks, particularly in the challenging entry stage of a university program. It is not clear how situation and person characteristics influence these expectations. Results of a study with 338 students enrolled in mathematics study programs show that stable person characteristics, such as different facets of self-concept, and the mathematical practice required in the task (calculating, modelling, and proving) interact in predicting self-efficacy expectations. The results shed light on the complex interplay of person and situation characteristics, highlighting the situation-specificity of expectations.</p>

<p>Research Report 6.05 Location: Sir Neil Waters Lecture Theatre Building 2.33</p> <p>Session Chair: Catarina Andersson</p>	<p>Instructions in math problems: Are proof tasks considered more difficult by university students? Lukas Hellwig, Sebastian Geisler Proof tasks are the most used tasks in university mathematics programs. They pose a particular challenge at the transition from school to university because first-year students often have little experience with proofs from school. It can therefore be assumed that they are less likely to tackle these tasks or to find them easy. This study examines the extent to which students are guided by the wording – in terms of used operators – of proof tasks when assessing them. N=298 first-year students were surveyed. A MANOVA revealed no significant differences in situational interest, self-efficacy and perceived difficulty that could be attributed to the used operators. However, personal characteristics had an influence on the perceived difficulty of tasks. Implications of the results for further research are deduced and discussed.</p>
<p>Research Report 6.06 Location: Quad Block B Room QB3</p> <p>Session Chair: Farouq Sessah Mensah</p>	<p>Teacher Noticing of Pre-Service and In-Service Secondary Mathematics Teachers - Insights Into Structure, Development, and Influencing Factors Anton Bastian, Johannes König, Gabriele Kaiser Teacher noticing is a crucial component of teachers' professional competence and has become a focus of educational research. However, evidence based on large-scale quantitative studies of the construct's structure, development, and influencing factors is scarce. Thus, in this paper, we briefly present the results of three recent studies that address these research gaps, summarize and discuss the findings, and formulate implications for future research. In the studies, we assessed noticing skills of pre-service and in-service teachers cross-sectionally and in a pre-post design, respectively, using an established standardised video-based instrument. Results shed light on the facet structure of teacher noticing, its development with increasing teaching experience, and the impact of learning opportunities in initial teacher education.</p>
<p>Research Report 6.07 Location: Sir Neil Waters Lecture Theatre Building 2.34</p> <p>Session Chair: Anni E</p>	<p>Contemplating the Role of Mathematical Egotism Rebecca Leticia Burtenshaw This theoretical paper considers Mathematical Egotism's role in the development and reinforcement of particular views of mathematics, beliefs about mathematics, and students' beliefs about themselves. Various literature, examples, and considerations are presented in exploring how Mathematical Egotism contributes to students' disengagement, disillusionment, or disaffection with mathematics. This paper also provides a possible antidote via Mathematical Empathy.</p>
<p>Research Report 6.08 Location: Quad Block B Room QB7</p> <p>Session Chair: Pauline Tiong</p>	<p>TEACHER AGENCY AND THE USE OF CURRICULUM MATERIALS ACROSS CULTURAL CONTEXTS Janine Remillard, Lara Condon, Tuula Koljonen, Heidi Krzywacki, Riku Sayuj Using an ecological and dynamic view of teacher agency, this study explores the relationships between teachers' professional actions and decisions, mathematics curriculum materials (CMs), and cultural norms and values at play in four educational contexts: Finland, Flanders (Belgium), Sweden, and the United States. The data were drawn from a survey of 397 teachers (grades 1-6), inquiring into self-reported use and perceptions of their CMs. Analysis of the most commonly reported CMs illustrated characteristics that reflect cultural values in each context. Survey findings indicated that teachers in all contexts use CMs purposefully and in relation to their own ideas about teaching. We also found context-specific differences in how teachers relied on CMs for different curricular aims, adding complexity to notions of CM use.</p>
<p>Research Report 6.09 Location: Sir Neil Waters Lecture Theatre Building 2.35</p> <p>Session Chair: Camilla Spagnolo</p>	<p>Mathematics teacher educators' expertise based on pedagogical communication Jonei Barbosa, Olive Chapman This study aimed to understand features of expertise of Mathematics Teacher Educators (MTEs) based on their pedagogical communication in the form of academic booklets to support preservice teachers' learning. The booklets, authored by experienced Brazilian MTEs, were analysed using grounded theory methods. The findings offer insights of MTEs' expertise in terms of three pedagogical contexts (mathematics, teaching mathematics, and academic research) and bridge-building skills linking these contexts. The study offers a basis to enhance our understanding and conduct future research on MTEs' expertise.</p>
<p>Research Report 6.10 Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Lan-Ting Wu</p>	<p>Simulations of Problem-Based Lessons: Using a Conjecture Map to Relate Design and Outcomes Gil Schwartz, Patricio Herbst, Amanda Brown Virtual simulations are a promising tool for mathematics teachers' preparation and professional development. This paper focuses on a set of simulations of a problem-based lesson, illustrating how their design informed prospective teachers' changes in decision-making during simulations. Using a design-based approach and conjecture mapping, we trace the processes that could be attributed to the observed changes in teachers' decisions. The analysis shows that after completing the set of simulations, teachers increased their selection of student work that relates to the lesson goal, regardless of its correctness. The paper contributes to the understanding of virtual simulations as a sustainable tool for teacher preparation and professional learning.</p>

<p>Research Report 6.11</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.36</p> <p>Session Chair: Mathilde Hitier</p>	<p>YOUTUBE CONTENT CREATORS' DISCOURSE: A MULTIPLE CASE STUDY ON THE CROSS PRODUCT USING COMMIGNITION AND POSITIONING THEORY Farzad Radmehr, Kristin Krogh Arnesen, Anita Valenta</p> <p>Many university students turn to YouTube as a learning resource to reinforce their mathematical learning. However, there is a lack of research in mathematics education on the learning potentials of this type of resource. Through a multiple case study with two cases, we utilize commognition and positioning theory to investigate (a) what types of mathematical discourse are demonstrated and (b) how YouTube content creators position themselves and their viewers in the learning resources on the cross product. The findings indicate that different types of mathematical discourse are promoted (i.e., rituals vs. explorations), and different positioning occurs on the cross product (e.g., similar to many tutors helping students to get correct answers vs. promoting a storyline that mathematics makes sense, similar to discourse of many mathematicians).</p>
<p>Research Report 6.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Mathias Agustin Lopez</p>	<p>Children's Beginning Use of Multiplication in Early Proportional Reasoning: Examination of Written Work by Second Graders Keiko Hino, Hisae Kato, Hiraku Ichikawa</p> <p>In this study, we explore how learning whole-number multiplication relates to progress in early proportional reasoning. We conducted two written surveys of 64 Japanese second-grade children, aged 7–8, before and after learning whole-number multiplication. The change in children's performance depended on the numerical features of the presented problems. We analyzed how they used multiplication to solve the problems in the "after learning" survey and identified four codes on their uses of multiplication: "use the form of the expression," "use in the process of calculation," "use to simplify the problem," and "use to find the relationship between two quantities." We discuss how these codes relate to the change in children's proportional reasoning that they had previously developed.</p>
<p>11:50am - 12:50pm</p>	<p style="text-align: center;">Oral Communication Session 4</p>
<p>Oral Communication 4.01</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.31</p> <p>Session Chair: Mellony Holm Graven</p>	<p>What is functional thinking? An ontological analysis of different definitions Anneli Blomqvist, Lovisa Sumpter</p> <hr/> <p>KNOWLEDGE OF PATTERNING AMONG JAPANESE KINDERGARTEN TEACHERS Atsuya Fukuzawa</p> <hr/> <p>YOUNG STUDENTS FUNCTIONAL THINKING: RECURSIVE MEANS OR AN EMERGING FUNCTIONAL RULE Bridget Wadham</p>
<p>Oral Communication 4.02</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Alf Coles</p>	<p>LEVELS OF NOTICING IN EXPERT MATHEMATICS TEACHERS WHEN TEACHING THE PYTHAGOREAN THEOREM Ledher M. Lopez, Diana Zakaryan</p> <hr/> <p>HOW DO JAPANESE TEACHERS INTERVENE STUDENTS' MATHEMATICAL META-RULES? Yuka Funahashi</p> <hr/> <p>EXPLORING MATHEMATICS TEACHERS' NOTICING ON ADDRESSING STUDENT THINKING — A CROSS-CULTURAL COMPARISON BETWEEN TAIWAN AND GERMANY Fung-Wen Yeh, Josephine Paul, Anika Dreher, Anke Lindmeier, Feng-Jui Hsieh, Ting-Ying Wang</p>
<p>Oral Communication 4.03</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Susan Kimberley Staats</p>	<p>Storylines experienced by Indigenous and newly migrated mathematics students David Wagner, Sacha Dewolfe, Julianne Gerbrandt</p> <hr/> <p>PARENT-CHILD INTERACTIONS: MOTHERS DOING MATHEMATICS WITH THEIR CHILDREN Fany Salazar, Marta Civil</p> <hr/> <p>Ethnomathematics: Learning from Reality Karli Bergquist</p>

<p>OC 4.04: Oral Communication 4.04 Location: Innovation Complex Room IC1.07 Session Chair: Chiara Andrà</p>	<p>DEVELOPMENT OF A FOUR-INDICATOR MATHEMATICAL CREATIVITY TEST FOR GRADE FIVE STUDENTS <u>Rhett Anthony Latonio</u>, Catherine Vistro-Yu</p> <hr/> <p>Conceptions of Mathematical Creativity of High School Students IN CHINA <u>Yuhan Wen</u>, Xinrong Yang</p>
<p>OC 4.05: Oral Communication 4.05 Location: Sir Neil Waters Lecture Theatre Building 2.36 Session Chair: Vilma Mesa</p>	<p>Transformative teaching: Enhancing educators and practices through task-oriented learning <u>Natalia Karlsson</u>, Constanta Olteanu</p> <hr/> <p>PRIMARY TEACHERS' CONCEPTIONS OF PROBLEM SOLVING <u>Mary Achieng Ochieng</u>, Penina Kamina</p> <hr/> <p>Investigating Problem Posing in Mathematics Classrooms: What Makes a Problem Good? <u>Anna Krisztina Stirling</u>, Csaba Szabó, Csilla Zámbo</p>
<p>OC 4.06: Oral Communication 4.06 Location: Innovation Complex Room IC1.15 Session Chair: Narumon Changsi</p>	<p>EXPERIENTIAL LEARNING FOR MATHEMATICAL THINKING & 21ST CENTURY COMPETENCIES <u>Leng Low</u>, Wan Teh</p> <hr/> <p>EQUATION-TYPE TASKS IN FINNISH GRADE 3 TEXTBOOKS <u>Markku S. Hannula</u></p> <hr/> <p>ON DEVELOPING TEACHING MATERIALS IN USING CONTINUED FRACTIONS TO EXTRACT SQUARE ROOTS <u>Yung-Fa Lin</u>, Hak Ping Tam</p>
<p>OC 4.07: Oral Communication 4.07 Location: Sir Neil Waters Lecture Theatre Building 2.32 Session Chair: Sarah Bansilal</p>	<p>ANALYZING THE RELATIONSHIP BETWEEN UNDERGRADUATE STUDENTS' COMBINATORIAL THINKING AND COMPUTATIONAL THINKING <u>Won Jung</u>, Oh Nam Kwon</p> <hr/> <p>STRUCTURING PLCs FOR COLLEGE-LEVEL INSTRUCTIONAL CHANGE <u>Jessica Gehrtz</u>, Priya V. Prasad</p> <hr/> <p>Mathematical communication: the first-year undergraduate perspective <u>Alba Santin Garcia</u>, TriThang Tran</p>
<p>OC 4.08: Oral Communication 4.08 Location: Atrium Building AT1 Session Chair: Richard Barwell</p>	<p>ARE YOU QUITE SURE OF CONSIDERING ETHICS AS OUR RESEARCH ALPHA? <u>Daiki Urayama</u></p> <hr/> <p>What does Interpretive Description have to offer mathematics education as a research methodology <u>Kerri Spooner</u></p> <hr/> <p>MATHEMATICS TEACHER EDUCATORS AND PRACTICUM PARTNERSHIPS DURING THE PANDEMIC <u>Jyoti Rookshana Jhagroo</u>, Zanele Ngcobo, Msebenzi Rabaza, Justice Enu</p>

<p>OC 4.09: Oral Communication 4.09 Location: Sir Neil Waters Lecture Theatre Building 2.33 Session Chair: Yoshinori Shimizu</p>	<p>Is transparent also beautiful? features of graphs that make them accessible in students' views <u>Luca Doria, Andrea Amico</u></p> <hr/> <p>COLORFUL CIRCLES AND ARROWS: WRITING GESTURES IN ONLINE TUTORING SESSIONS <u>Nicole Infante, Keith Gallagher, Deborah Moore-Russo, Michelle Friend</u></p> <hr/> <p>Students' Graphing Activity & Digital Task Design: The Sketch-to-Animation Bottle Problem <u>Claudine Margolis</u></p>
<p>OC 4.10: Oral Communication 4.10 Location: Sir Neil Waters Lecture Theatre Building 2.34 Session Chair: James A. Middleton</p>	<p>A COIN FLIP SEQUENCE CONTENTION: RELATIVE PROBABILITY COMPARISON RESEARCH IS INCLUSIVE <u>Egan J Chernoff</u></p> <hr/> <p>Categorization of Figure-related Mathematics content and Navigation from spatial ability perspective <u>Li Jung Chang, Yu Yao Yao</u></p> <hr/> <p>CHARACTERIZATION OF SPATIAL ABILITY: AN ERP COMPARISON BETWEEN GEOMETRY AND CARTOGRAPHY <u>Tsu-Jen Ding, Hui-Yu Hsu, Yin-Hsuan Yeh, Chen-Yu Yao</u></p>
<p>12:50pm - 1:50pm Location: Sir Neil Waters Lecture Theatre Building Foyer</p>	<p>Lunch break</p>
<p>1:50pm - 3:20pm</p>	<p>SEMINAR & WORKING GROUPS SESSION 2</p>
<p>Location: Atrium Building: AT 7</p>	<p>Seminar Day 2: WRITING PME RESEARCH REPORTS: A SEMINAR FOR EARLY-CAREER RESEARCHERS Kotaro Komatsu, Peter Liljedahl, Sean Chorney</p>
<p>Location: Atrium Building AT1</p>	<p>WG2.1 MATHEMATICS IN INTEGRATED STEM: DILEMMAS AND STRATEGIES FOR SUCCESS A. Conner, K. Lesseig, C. Miller & A. Bloodworth</p>
<p>Location: Atrium Building: AT 3</p>	<p>WG 2.2 INTERNATIONAL PERSPECTIVES ON PROOF AND PROVING: RECENT RESULTS AND FUTURE DIRECTIONS D. A Reid & Y. Shinno</p>
<p>Location: Innovation Complex Room IC1.07</p>	<p>WG 2.3 CRITICAL MATHEMATICAL THINKING FOR SUSTAINABLE FUTURES J. Aguirre, C. Andra, K. Beswick, A. Coles, S. Digan, V. Geiger, J. Hunter, S. Siller, A. Solares, J. Suh, E. Thanheiser, N. Unshelm & D. Wagner</p>
<p>Location: Innovation Complex Room IC1.15</p>	<p>WG 2.4 HUMAN DIGNITY AND MATHEMATICS EDUCATION RESEARCH Y. Abtahi & R. Barwell</p>
<p>Location: Quad Block B Room QB3</p>	<p>WG 2.5 POETIC METHODS IN MATHEMATICS EDUCATION A. Hare, R. Elizabeth Helme & S. Staats</p>
<p>Location: Massey Business School Room MBS2.15</p>	<p>WG 2.6 CREATIVE METHODS FOR INQUIRY IN MATHEMATICS EDUCATION RESEARCH M. S Hannula, T. Helliwell & A. Ebbelind</p>

3:30pm - 4:10pm

Research Reports Session 7

Research Report 7.01

Location:
Atrium Building AT1

Session Chair: Bianca Nicchiotti

MIGRANT STUDENTS' PERCEPTIONS OF EXPERT SYSTEMS IN MATHEMATICS CLASSROOMS IN CANADA

Yasmine Abtahi, Heidi Stokmo, Athar Firouzian, Richard Barwell, Christine Suurtamm, Ruth Kane

International migration flows have had a growing impact on mathematics classrooms in many parts of the world. Research suggests that many students from immigrant backgrounds face challenges in the learning of mathematics. We present findings from a study designed to explore how migrant students experience mathematics classrooms in Canada. We utilised Bauman's notion of expert systems to analyse how migrant students position themselves with respect to authorities in mathematics classrooms. Our findings show students do perceive elements of the expert systems, which hinders the feeling of equality and inclusion in the mathematics classroom, resulting in three tensions. These tensions allow us to recognise the structural constraints within which migrant students operate and the perceived opportunities for multiplicity of expertise.

Research Report 7.02

Location:
Sir Neil Waters Lecture
Theatre Building 2.31

Session Chair: Maike Schindler

Relevant measurement skills to solve word problems with lengths

Jessica Hoth, Constanze Schadl

Several instances in daily life require dealing with lengths. These challenges are generally connected to real-life situations and require (among other things) skills to measure, estimate, or convert lengths. In order to analyse the extent of these interrelations, we assessed 277 third and fourth-grade students' skills in solving word problems with lengths. We used a latent multiple regression model to explore the predictive contributions of length measurement, estimation, and conversion skills. Even though all latent variables are significantly correlated, only students' length conversion skills explain relevant variance in the solving word problems skills, while their length measurement and estimation skills did not.

Research Report 7.03

Location:
Innovation Complex Room
IC1.07

Session Chair: Erica Spangenberg

STUDENTS' PERSPECTIVES ON TEACHING BEHAVIORS TO ENHANCE THEIR MOTIVATION FOR PARTICIPATION IN MATHEMATICS CLASS COMMUNICATION

Chang-Min Chiang, Ting-Ying Wang, Feng-Jui Hsieh

This study explores the factors contributing to the teaching behaviours that can enhance students' motivation to participate in classroom communication, from the perspective of students. A questionnaire, developed based on a year-long qualitative investigation, was administered to 542 junior high school students. Exploratory factor analysis was applied separately to three communication-related learning activities: listening to the lecture, asking questions, and discussing with peers. Eight factors relating to three facets — students' cognitive needs in mathematics, a safe environment and good atmosphere, and teachers' arrangements of modes and materials for activities — are identified. The study also revealed the inevitable intertwining between cognitive and affective facets from the factors identified.

Research Report 7.04

Location:
Sir Neil Waters Lecture
Theatre Building 2.32

Session Chair: Charlott Thomas

NAVIGATING FLIPPED LEARNING: INSIGHTS FROM A GRADUATE-LEVEL ALGEBRAIC GEOMETRY COURSE

Sang Hy un Kim, Tanya Evans, Ofer Marmur

This study explores the integration of flipped learning into a graduate-level algebraic geometry course, addressing gaps in understanding its implementation at this educational level. Through an exploratory case study, students' experiences were examined, and thematic analysis revealed that students had nuanced perceptions of this integration with four major themes arising: Preparation and Workload, Content Interaction, Social Interaction, and Resources. While students appreciated collaborative aspects and the emphasis on problem-solving, challenges emerged, including an increased workload and a strong preference for explicit forms of instruction. This research underscores the need for further exploration to refine flipped learning practices and gain a comprehensive understanding of its implications on student experiences in graduate mathematics education.

<p>Research Report 7.05</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.33</p> <p>Session Chair: Stefanie Rach</p>	<p>DOES STUDENTS' CREATION OF PROBLEM-SOLVING VIDEOS ENHANCE THEIR EXAM PERFORMANCE?</p> <p>Igor' Kontorovich, Hongjia (Henry) Chen, Ian Jones, Nicolette Rattenbury, Padraic Bartlett</p> <p>We explore the impact of undergraduates' creation and peer reviewing of problem-solving videos on their exam performance. In a large first-year course for non-mathematics majors, students were provided with a bank of problems from past exams with historically low scores. As part of the homework assignment, the students video-recorded a solution to a problem of their choice, while elaborating on the involved concepts and steps. Then, the submitted videos were randomly allocated for peer reviewing. We consider this activity through the lens of effective digital task design and deep active learning. Quantitative results offer some evidence of the positive impact of the activity on students' performance on similar problems in a final exam.</p>
<p>Research Report 7.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Elena Polotskaia</p>	<p>ILLUSTRATING A METHOD FOR ANALYZING MULTIMODAL ARTIFACTS USED IN TRANSACTIONS OF PRACTICE</p> <p>Patricio Guillermo Herbst, Gil Schwarts, Amanda Brown</p> <p>We illustrate how concepts from systemic functional linguistics are adapted for the analysis of multimodal representations of practice used in activities where teachers and teacher educators transact meanings about practice. We focus on the transactive register used to project practice meanings to the audience of these representations. We showcase the systems called visibility (how much of the classroom experience happening is made visible to the viewer), temporality (how sequence and duration of events are represented), and theme (how semiotic resources maintain and develop themes). We apply these systems to examine the differences between two storyboards of algebra lessons that were used in a professional development context and the different kinds of reactions teachers offered to the different storyboards.</p>
<p>Research Report 7.07</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.34</p> <p>Session Chair: Rebecca Leticia Burtenshaw</p>	<p>Proposal for the study of mathematics teachers' beliefs based on the analysis of their actions</p> <p>Graciela Acevedo, Luis R. Pino-Fan</p> <p>In recent years, research on mathematics teachers' beliefs has increasingly focused on their relationship with the instructional practices of teachers. This article proposes a model that enables the study of mathematics teachers' beliefs through comprehensive analysis of their actions in the classroom. The proposal incorporates the notions of teachers' actions, norms and metanorms of the Ontosemiotic Approach as its articulating axis. Furthermore, this paper presents an example of a practical implementation of these levels of analysis in the study of a prospective teacher's beliefs, showing the viability of this model.</p>
<p>Research Report 7.08</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Janine Remillard</p>	<p>MATHEMATICAL KNOWLEDGE FOR TEACHING COLLEGE ALGEBRA AT COMMUNITY COLLEGES</p> <p>Vilma Mesa, Inah Ko, Irene Duranczyk, Patrick Kimani, Laura Watkins, Dexter Lim, Mary Beisiegel, April Ström, Bismark Akoto</p> <p>We report on the relationship between community college instructors' performance on an instrument measuring mathematical knowledge for teaching college algebra with their teaching experience and their frequency of using specific tasks of teaching. The findings support the argument that the instrument assesses critical knowledge for teaching college algebra. We propose further work based on these findings.</p>
<p>Research Report 7.09</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.35</p> <p>Session Chair: Jonei Barbosa</p>	<p>ENACTING MULTIPLE POSITIONS IN BECOMING A MATHEMATICS TEACHER EDUCATOR</p> <p>Tracy Helliwell, Andreas Ebbelind</p> <p>This paper initiates a longitudinal study that explores the growth and development of mathematics teacher educators (MTEs), particularly those transitioning from mathematics teacher to university-based MTE. While existing research often employs self-based methodologies, this study adopts positioning theory as an alternative approach, examining Mikaela, a lower primary school teacher transitioning to a university-based MTE in Sweden. The paper contributes to the broader understanding of growth and development, offering insights into the challenges and strategies involved in transitioning from mathematics teacher to MTE. The study marks the beginning of a more extensive exploration of this transition process, emphasising the need for a nuanced conceptualisations of MTE learning and expertise.</p>

<p>Research Report 7.10</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Gil Schwartz</p>	<p>TWO MORE OR TWICE AS MUCH? PROPORTIONAL REASONING STRATEGIES IN GRADES 5 TO 7</p> <p><u>Ildikó Bereczki, Csaba Csíkos</u></p> <p>Proportional reasoning determines the school performance of students not only in mathematics, but in other areas, and it plays an important role in everyday life as well. The early emergence of proportional reasoning is influenced by many factors, including the recognition of multiplicative relationships. In our research, we examined proportional reasoning by means of the interview method among 5th, 6th, and 7th-grade students. During the interview, in addition to solving proportional problems, the students solved open-ended problems that gave insight into their additive and multiplicative thinking. Our data and results can bring us closer to understanding the important requisites of proportional reasoning and the possible developmental step between additive and multiplicative reasoning strategies.</p>
<p>Research Report 7.11</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.36</p> <p>Session Chair: Farzad Radmehr</p>	<p>DO YOU SEE MATH? HOW BAYESIAN INFERENCE AND INTERNET MEMES CAN SHED LIGHT ON STUDENTS' UNDERSTANDING OF MATHEMATICAL CONCEPTS</p> <p><u>Giulia Bini</u></p> <p>This study examines mathematics students' engagement with visual resources, using Bayesian inference and Wittgenstein's "seeing as" concept to explore how they use meme templates to represent mathematical concepts. The analysis of memes created by two high-school students reveals the significant influence of their mathematical knowledge and conceptual understanding on their representations, uncovering strengths and weaknesses not easily captured by conventional tasks. The findings contribute a fresh viewpoint on students' understanding of mathematical concepts, broadening the conversation on the role of visual inputs in mathematics education.</p>
<p>Research Report 7.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Christine Chambris</p>	<p>A FRAMEWORK FOR ANALYZING LONG-TERM EARLY ALGEBRA PROGRESSION IN TEXTBOOK SERIES</p> <p><u>Ola Helenius, Linda Marie Ahl</u></p> <p>We present a two-dimensional framework capable of characterizing the algebra content in textbook series spanning over at least all years of comprehensive schooling. Our framework extends well-known previous work and subdivides school algebra into algebra classes such as structure, operations on non-numerical symbols, functional thinking, and patterns. In each class, we characterize the presented content according to the explicitness levels potential, formal and explicit. We examine two book series, both spanning nine years of schooling, and in one series, two versions for grades 1-3. Results include a radically different focus on algebra in the middle grades in the two series and overarching trends that algebra content is well spread out over school years early but tends to come in bursts in later school years.</p>
<p>4:10pm - 4:40pm</p> <p>Location: Sir Neil Waters Lecture Theatre Building Foyer</p>	<p>Afternoon Tea</p>
<p>4:40pm - 6:10pm</p> <p>Location: Sir Neil Waters Lecture Theatre Building 300</p>	<p>AGM: Annual General Meeting</p> <p>Overflow room is SNW Lecture Theater 200</p>
<p>7:00pm</p>	<p>CD: Conference dinner</p> <p>Conference dinner at 7:00pm at the Spencer Hotel</p> <p>Buses leave at 6:30 from Massey University</p>

Sunday, 21/July/2024

<p>9:00am - 10:30am</p> <p>Location: Sir Neil Waters Lecture Theatre Building 300</p>	<p>Plenary4: Boris Koichu: “The secret life of mathematical problems through the lens of research-practice partnerships”</p> <p>Overflow room is SNW Lecture Theater 200</p>
<p>10:30am - 11:00am</p> <p>Location: Sir Neil Waters Lecture Theatre Building Foyer</p>	<p>Morning Tea</p>
<p>11:00am - 11:40am</p>	<p>Research Reports Session 8</p>
<p>Research Report 8.01</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Sze Looi Chin</p>	<p>GENDER DIFFERENCES IN RELATION TO PERCEIVED DIFFICULTY OF A MATHEMATICAL TASK</p> <p><u>Bianca Nicchiotti, Camilla Spagnolo</u></p> <p>The theme of perceived difficulty in mathematics is current, but it has only been considered in the last few years. This study aims to highlight gender differences in relation to perceived difficulty of a mathematical task, and factors influencing it. Italy is one of the countries with the largest gender gap in mathematics, hence there is the interest in analysing perceived difficulty considering it as a key to better understand. We started considering as a benchmark the nationwide quantitative analysis of gender gaps in two INVALSI tasks, characterized by different gender gap levels. Then, we link students' perceived difficulty to these two tasks, analysing qualitatively the differences between boys' and girls' perception. Preliminary findings point out that girls' perception is mainly related to personal consideration.</p>
<p>Research Report 8.02</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.31</p> <p>Session Chair: Oh Nam Kwon</p>	<p>MENSURATING THE AREA OF A STOLEN LAKE: MATHEMATISING AN HISTORICAL EVENT</p> <p><u>Sean Chorney</u></p> <p>In this research report, students mathematise the image of a drained lake and reflect upon the repercussions of the draining, specifically in terms of an Indigenous nation which had lived beside the lake from time immemorial. Using Google Earth, students explore the notion of area by comparing the lake with a personal landmark in their locality. The study explores how students describe area in terms of new mathematical relations. From their descriptions, six themes emerged that enrich the conceptions of area.</p>
<p>Research Report 8.03</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Generosa Angela Leach</p>	<p>ATTITUDES TOWARD MATHEMATICS AND GRAPHS INFLUENCE GRAPH REASONING AND SELECTION</p> <p><u>Heather Lynn Johnson, Courtney Donovan, Robert Knurek, Kristin A. Whitmore, Livvia Bechtold</u></p> <p>We report on a mixed methods study in which we investigated college algebra students' attitudes toward mathematics and graphs in connection to their graph reasoning and graph selection. Students (n=599) completed a fully online survey of their attitudes toward math and graphs in conjunction with a fully online measure of their graph reasoning and selection for dynamic situations. Using structural equation modelling, we explored how students' attitudes might link to their graph reasoning and/or graph selection. We found that more positive attitudes toward mathematics and graphs linked to more quantitative forms of graph reasoning and more accuracy in graph selection.</p>
	<p>Research Report 8.04</p> <p>Cancelled</p>
<p>Research Report 8.05</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.33</p> <p>Session Chair: Andrea Peter-Koop</p>	<p>ANALYSIS OF THE COGNITIVE ACTIVATION OF COMBINATORIAL TEXTBOOK TASKS IN GRADE 11 AND 12</p> <p><u>Charlott Thomas, Birte Pöhler</u></p> <p>Various studies have shown that textbooks and their tasks are essential for mathematics learning. This also applies to combinatorics, with which learners often have difficulties. Accordingly, the combinatorics chapters of five textbooks for the upper secondary school level in Germany were analyzed. The analysis revealed that the textbook tasks predominantly require procedural thinking and show little variety in other task types (declarative and conceptual thinking). The homogeneity of combinatorics tasks in textbooks must be revised as it may impair students' cognitive activation, an essential aspect of teaching quality.</p>

<p>Research Report 8.06</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Keith Weber</p>	<p>FACILITATORS' CATEGORIES WHEN NOTICING A FICTIONAL PD-SITUATION: PEDAGOGICAL CONTENT VS. GENERAL PEDAGOGIC FOCUS</p> <p><u>Vanessa Magdalena Bialy, Victoria Shure, Malte Lehmann, Bettina Roesken-Winter</u></p> <p>Professional development (PD) courses contribute to the improvement of mathematics instruction, requiring facilitators to possess specific expertise for effective navigation of complex instructional scenarios. This study explores the identification of clusters pertaining to facilitators' categories when engaging in noticing of a fictional PD situation. Three clusters emerged: Cluster A exhibits the use of pedagogical content knowledge on the PD level (PCK-PD), cluster B accentuates general pedagogical content knowledge on PD level (GPK-PD), and cluster C strongly emphasizes GPK-PD. Although facilitators (N = 156) across clusters share similar teaching experiences, variations exist in their facilitation experiences. These findings provide valuable insights for aligning PD courses with the specific needs of facilitators.</p>
<p>Research Report 8.07</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.34</p> <p>Session Chair: Luis R Pino-Fan</p>	<p>Emotional associations with mathematics: Using the lenses of affect and identity to understand preservice teacher stories</p> <p><u>Ofer Marmur, Lisa Darragh</u></p> <p>Key events in one's mathematical learning journey are often recalled with strong emotions and possibly implicated in one's relationship with mathematics. The relationships preservice teachers form with mathematics will, in turn, impact greatly on the way in which they teach the subject in the future; thus an understanding of these relationships is important for the mathematics education field. In this paper we utilise two complementary theoretical lenses, affect and identity, to unpack the written stories of memorable mathematics learning events told by preservice teachers, revealing the deep emotions involved in associating or disassociating with mathematics. We argue the use of each lens enables us a different understanding of the data, yet combined they provide theoretical and practical insight that is greater than the sum of its parts.</p>
<p>Research Report 8.08</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Inah Ko</p>	<p>STUDENTS' BELIEFS CONCERNING THE NATURE OF MATHEMATICS – ARE THEY DIFFERENT WITH REGARD TO SCHOOL AND UNIVERSITY MATHEMATICS?</p> <p><u>Sebastian Geisler</u></p> <p>Students' beliefs concerning the nature of mathematics are considered to play a crucial role for a successful transition from school to university mathematics. As school and university mathematics differ considerably, distinguishing between students' beliefs regarding school and university mathematics seems necessary. In this paper, a new questionnaire differentiating beliefs between both facets of mathematics is presented and analysed. Confirmatory factor analysis with data from N=153 students shows that students' beliefs can be distinguished empirically and that students hold significantly different beliefs regarding the nature of school and university mathematics.</p>
<p>Research Report 8.09</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.35</p> <p>Session Chair: Anneli Christina Blomqvist</p>	<p>STUDENTS' CHANGING METARULES DURING AND AFTER WATCHING DIALOGIC INSTRUCTIONAL VIDEOS</p> <p><u>Alicia Gonzales, John Gruver</u></p> <p>Dialogic instructional videos feature authentic conversations of students as they engage in complex mathematical problems. Because these videos show students engaging in rich mathematical interactions students might use them as models for how they should engage in such interactions. In this study, we investigated how watching a dialogic video that showed two students creating pictures to illustrate mathematical relationships shaped what two pairs of students thought was necessary to include in their own pictures. We found that while the video the students watched did indeed shape what they thought was necessary to include in their pictures, the degree to which they felt they needed to mirror the pictures in the video varied considerably.</p>
<p>Research Report 8.10</p> <p>Cancelled</p>	
<p>Research Report 8.11</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.36</p> <p>Session Chair: Giulia Bini</p>	<p>'DODGING THE BULLET': CONSTRAINTS ON THE USE OF DERIVATIVES IN MECHANICS COURSES.</p> <p><u>Mathilde Hitier, Alejandro S. González-Martín</u></p> <p>The calculus notion of derivative plays a central role in kinematics. However, previous research shows that at the college level, instructors rely more on ready-to-use formulas than on covariational reasoning when teaching kinematics. In this paper, we identify constraints placed on mechanics teachers when working with the derivative in a kinematics context. Our results indicate that the traditional separation of knowledge into different branches (e.g., mechanics and differential calculus) has a strong impact on the teaching practices of mechanics instructors. Specifically, what students learn (or do not learn) in their calculus courses places limitations on mechanics teachers, restricting their use of tools from calculus to fully develop students' understanding of motion and instantaneous rate of change.</p>

<p>Research Report 8.12</p> <p>Location: Massey Business School Room MBS2.15</p> <p>Session Chair: Csaba Csikos</p>	<p>LANGUAGE AS A TRANSPARENT RESOURCE FOR DEVELOPING MATHEMATICAL UNDERSTANDING</p> <p><u>Pauline Tiong</u></p> <p>While the notion of language as a resource is not new and of increasing interest in mathematics education research, not many researchers focus on understanding the notion from the perspectives of teachers.</p> <p>Motivated by an interest to understand the existing state of how teachers are noticing and using language (particularly the mathematics register) as a resource in the mathematics classroom, this paper reports the findings from a task-based interview conducted with one teacher. By accounting for the teacher's responses to the interview through the lens of language-related dilemmas and orientations, I was able to glean insights into how she notices and uses language (particularly the mathematics register) as a transparent resource primarily for developing understanding in the teaching and learning of mathematics.</p>
<p>11:50am - 12:50pm</p>	<p>Oral Communication Session 5</p>
<p>Oral Communication 5.01</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.31</p> <p>Session Chair: Kotaro Komatsu</p>	<p>IMPACT OF AUGMENTED REALITY ON PRIMARY SCHOOL STUDENTS' LEARNING EXPERIENCES OF COORDINATES</p> <p>Khemduth Singh Angateeah, <u>Divia Renu Ramrakha</u>, Parwez Neeamuth</p> <hr/> <p>AN INTEGRATION BETWEEN ART AND MATHEMATICS IN LEARNING GEOMETRICAL ATTRIBUTES OF OBJECTS</p> <p><u>Khem Khenkhok</u>, Chitipat Prasertsang, Maitree Inprasitha, Narumon Changsri, Piyasak Pukcothanung</p> <hr/> <p>COMPARISON BETWEEN GEO-STICK AND DYNAMIC GEOMETRY SOFTWARE STRATEGIES IN TEACHING TRIANGLE INEQUALITY</p> <p><u>Hui-Yu Hsu</u>, Shijie Yang</p>
<p>Oral Communication 5.02</p> <p>Location: Quad Block B Room QB3</p> <p>Session Chair: Patricio Guillermo Herbst</p>	<p>Different Ways Students Interpret Axes on Graphs</p> <p>Allison Olshefke, <u>Teo Paoletti</u>, Claudine Margolis, Allison L. Gantt, Hwa Young Lee, Hamilton Hardison</p> <hr/> <p>SUPPORTING MATHEMATICS TEACHERS' PLANNING OF MULTIMODAL TEACHING</p> <p><u>Helena Johansson</u>, Malin Norberg, Magnus Österholm</p> <hr/> <p>THE DIFFERENCES IN INTEGRATED STEM TASK VALUES BETWEEN MATHEMATICS AND OTHER STEM TEACHERS</p> <p><u>Kai-Lin Yang</u>, Xiao-Bin He</p>
<p>Oral Communication 5.03</p> <p>Location: Quad Block B Room QB7</p> <p>Session Chair: Ban Heng Choy</p>	<p>Intentional acts of teaching: Supporting students to co-construct mathematical meaning</p> <p><u>Generosa Leach</u></p> <hr/> <p>Sense of Belonging in General Education Math</p> <p><u>Michelle Friend</u>, Andrew Swift, Betty Love, Nicole Infante</p> <hr/> <p>Voluntary math clubs - A sustainable model for implementing educational innovation?</p> <p><u>Jason Cooper</u>, Aamer Badarne</p>

<p>Oral Communication 5.04</p> <p>Location: Innovation Complex Room IC1.07</p> <p>Session Chair: Wee Tiong Seah</p>	<p>Emotion Graphs: Middle School Students' Engagement During Informal Geometry Activities Adrienne Springer, <u>Bailey Bontrager</u>, V. Rani Satyam, Christine Lee Bae</p> <hr/> <p>MATHEMATICS PERFORMANCE OF TAIWANESE STUDENTS WITH DIFFERENT MINDSETS <u>Su-Wei Lin</u></p> <hr/> <p>EXPLORING STUDENTS' ERRORS ON ESTIMATING LENGTHS <u>Ricarda Holland</u>, Jessica Hoth</p>
<p>Oral Communication 5.05</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.35</p> <p>Session Chair: Ting-Ying Wang</p>	<p>VALIDATING A MEASURE OF MATHEMATICAL KNOWLEDGE FOR TEACHING COLLEGE ALGEBRA <u>Mary Beisiegel</u>, Laura Watkins, Vilma Mesa</p> <hr/> <p>METACOGNITIVE TOOLS IN MATHEMATICS EDUCATION AS MEANS TO ADDRESS THE IMPOSTER PHENOMENON <u>Uzuri Albizu-Mallea</u></p>
<p>Oral Communication 5.06</p> <p>Location: Innovation Complex Room IC1.15</p> <p>Session Chair: Juan Manuel González-Forte</p>	<p>What $A=2\pi rh$ Tells Us: A Framework For Multiplicative Objects With Formulas <u>Irma Stevens</u></p> <hr/> <p>Exploring the impact of bar model virtual manipulatives in algebra learning within technology-enhanced settings <u>Hwee Sim</u>, <u>Claire Poh</u></p>
<p>Oral Communication 5.07</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.32</p> <p>Session Chair: Ofer Marmur</p>	<p>TASK DESIGN PRINCIPLES FOR PROOFS AND REFUTATIONS FOCUSED ON IMPROPER DIAGRAMS AND CORRESPONDING ARGUMENTS IN PAPER-AND-PENCIL ENVIRONMENTS <u>Yosuke Tsuji yama</u>, Kota Kato</p> <hr/> <p>A Move Analysis of Mathematical Proof <u>Valentin A. B. Küchle</u>, Paul C. Dawkins</p>
<p>Oral Communication 5.08</p> <p>Location: Atrium Building AT1</p> <p>Session Chair: Patricio Luis Felmer</p>	<p>PEDAGOGICAL FUNCTIONS OF REPRESENTATIONS IN GENERAL AND VOCATIONAL HIGH SCHOOL TEXTBOOKS: THE CASE OF LIMITS AND DERIVATIVES <u>Pin-Chen Guo</u>, Kai-Lin Yang</p> <hr/> <p>Exploring the Intersection of Visualization and Language through Cognitive Restructuring Dennis Lee Jarvis Baring Ybañez, <u>Lester Cu Hao</u></p> <hr/> <p>Three-Phase Cyclical Flipped Classroom Model: Design and Effects on Productive Disposition <u>Patrick John Martinez Fernandez</u>, Angela Fatima Hilado Guzon</p>
<p>Oral Communication 5.09</p> <p>Location: Sir Neil Waters Lecture Theatre Building 2.33</p> <p>Session Chair: Igor¹ Kontorovich</p>	<p>Students' uses of the ChatGPT in solving a mathematical modelling task <u>Ky ungwon Lee</u>, Oh Nam Kwon</p> <hr/> <p>LEARNING EFFECTS OF MODELS WITH VARYING LEVELS OF ABSTRACTION DURING DIGITAL PRACTICE <u>Michele Carney</u>, Joe Champion, Angela Crawford, Patrick Lowenthal</p> <hr/> <p>A new agora: the role of AI-shaped debate in transforming mathematics education <u>Amedeo Matteucci</u>, Ilaria Veronesi, Francesco Saverio Tortoriello</p>

Oral Communication 5.10

Location:
**Sir Neil Waters Lecture
Theatre Building 2.34**

Session Chair: **David Maximiliano
Gomez**

**PROSPECTIVE TEACHERS' MOVES FOR FOSTERING STUDENTS' UNDERSTANDING IN
RELATION TO THEIR DIAGNOSTIC JUDGEMENTS**

Jennifer Dröse, Lena Wessel

**THE IMPORTANCE OF THE ELICITATION PROCESS IN FORMATIVE ASSESSMENT: A
CASE STUDY**

Catarina Andersson, Torulf Palm, Mikael Winberg

A systematic review of mathematical reasoning

Marte Kristoffersen Senneset, Lovisa Sumpter, Andreas Pettersen

12:50pm - 1:50pm

Location: **Sir Neil Waters
Lecture Theatre Building
300**

Closing Ceremony

Overflow room is SNW Lecture Theater 200