PME NEWSLETTER

2025

INTERNATIONAL GROUP FOR THE
PSYCHOLOGY OF MATHEMATICS EDUCATION

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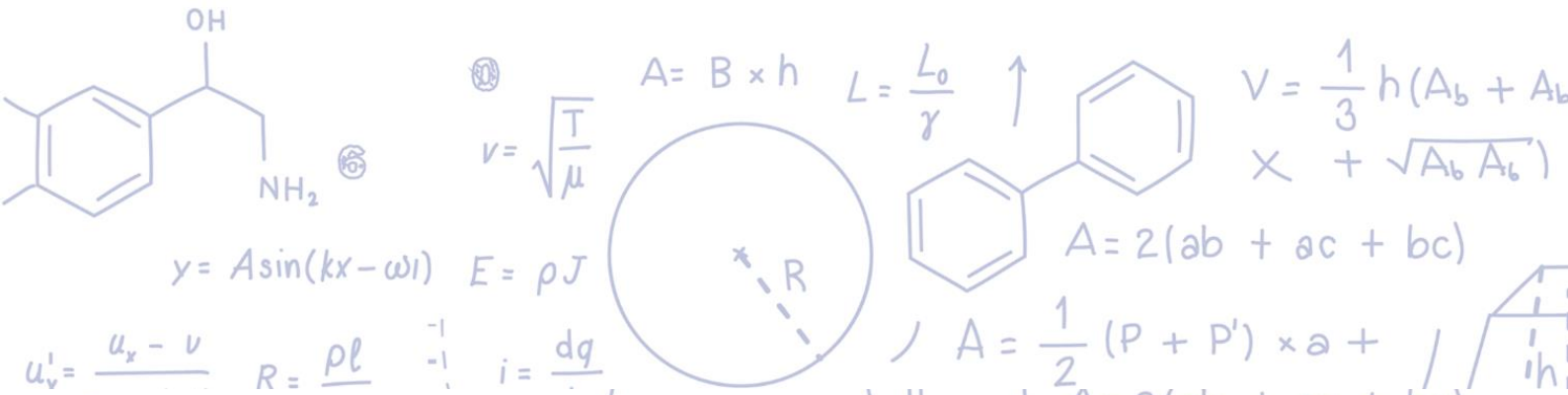


PME newsletter

INTERNATIONAL GROUP FOR THE PSYCHOLOGY OF MATHEMATICS EDUCATION

Message from the outgoing president

Dear members of PME,

While looking forward to a wonderful PME48 conference in Chile, I am also realizing that my term as president of IGPME is coming to an end. I can assure you all that I have very good feelings about this period, and that I am proud about IGPME as an organization and as a community.

IGPME was in a challenging period when I entered as a president. The pandemic urged the organization to hold online conferences for two years and interrupted several ongoing processes. Also currently, we have to work under difficult conditions: The world order is changing, we see increasing conflicts across the world, free speech and academic freedom are under increasing pressure, as are other human rights and educational systems. IGPME also has had its particular challenges in becoming a charity organization, obtaining an official bank account, dealing with increasing bureaucracy while organizing conferences across the world, and facing a larger need for Skemp grants.

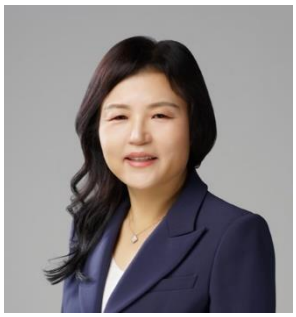
I am proud to say that in the past years we were able to address several challenges, thanks to the enthusiastic and competent teams I had the pleasure to work with: IC members, executives, an administrative manager, and conference organizers. Together with a membership that forms a real community, truly committed to "their" PME, this makes that IGPME stands strong in turbulent times, and important things have been realized or are in the pipeline. To name just a few: All proceedings from the rich history have been digitalized, we have digital voting in place for our Annual General Meetings, a range of activities for newcomers have been further developed – both at the conference and throughout the years -, and larger numbers of substantial Skemp grants than ever before have been handed out. Important work still needs to be done in many areas. Now that PME proceedings are Scopus indexed we need a better platform and format to host them, we need to redevelop our website to meet new demands, further deploy our digital archive and communication system, and find a sustainable way to fund Skemp grants.

I am confident that after my retirement as president, IGPME will be in very good hands with Oh-Nam Kwon, the International Committee and our new administrative manager Peter Gonscherowski. I wish to thank everyone for the great commitment, and look forward to a great future for PME, and to celebrate its 50th anniversary.

Wim van Dooren

Outgoing PME president
KU Leuven, Belgium

Message from the incoming president



Dear members of PME,

As I prepare to take on the role of President of IGPME, I do so with deep gratitude and anticipation. Like many of you, PME has long been a professional and intellectual home for me a place where research is not only shared, but where ideas are nurtured and in a spirit of openness, care, and community. I am honored to follow in the footsteps of Wim Van Dooren, whose thoughtful leadership has guided IGPME through complex and challenging times.

Looking ahead, we find ourselves in a rapidly evolving global context. Artificial intelligence, sustainability, and shifting social and political landscapes are reshaping education and research across the world. I believe PME is uniquely positioned to respond to these changes by deepening our scholarly contributions and by shaping how mathematics education engages with the world. My hope is that PME continues to serve as a global platform for high-quality research, inclusive dialogue, and bold thinking.

There is much important work to carry forward. We will continue to support participation through the Skemp Fund, enhance our digital infrastructure to improve access to proceedings and archives, and provide more opportunities for early-career researchers to contribute and lead. In the coming months, I also look forward to working with the International Committee and our new administrative manager, Peter Gonscherowski, to explore ways to improve our website and expand our year-round community activities.

As we approach PME's 50th anniversary, I invite you to help shape its next chapter. PME is more than a conference—it is a living community built on trust, shared purpose, and care for one another. I look forward to working together with you in sustaining and growing this extraordinary organization.

Oh Nam Kwon

Incoming PME president
Seoul National University, South Korea

2025 Conference in Chile

Santiago, Chile: July 28 to August 02, 2025

We look forward to welcoming you to the 48th conference of the International Group for the Psychology of Mathematics Education, in Santiago Chile

The Local Organizing Committee of the 48th Conference of the International Group for the Psychology of Mathematics Education is pleased to invite you to attend the conference to be held in Santiago, Chile, from July 28 to August 02, 2025.

The theme of the conference is "**Making sure that Mathematics Education Research reaches the classroom".** This theme has been chosen to emphasize the need to connect mathematics education research to the needs and reality of the classroom. The theme is particularly relevant in the Latin American region, which faces great challenges in providing mathematics education of quality for all students.

Welcome @(IG)PME48!

The PME conference in Chile is approaching. Many of us are looking forward to their next PME, while others will be participating in their first PME conference. It is part of the spirit of PME to come together at our annual conference to make new contacts, renew international connections, and exchange research in mathematics education.

This particularly includes welcoming those who are new to academia or, at the very least, new to the conference. For this, there are two specific events during the PME conference:

Before the conference itself, from the afternoon of Sunday, July 27th, to the morning of Monday, July 28th, there will be an Early Researchers' Day. It offers participants ample opportunities to meet other early-career researchers, learn about various methodological approaches, and gain insight into life in research and beyond. Registration for the ERD is part of the conference registration – for those of you who missed it: Be sure to register for the ERD @PME49 in Helsinki!

Shortly after the start of the conference, specifically on Tuesday, July 29th, during lunch between 12:50 and 14:20, the first-timers' meeting will take place. This meeting provides newcomers to the conference, as well as anyone else interested, with the opportunity to learn about iGPME as an international research society, its history, aims, and the various benefits PME offers its members (e.g., pre-submission support, Ombudspersons, ERD webinars). Furthermore, participants will have the chance to meet those currently leading PME to exchange ideas, pose questions, or raise concerns. In addition to familiarising themselves with PME, ample time is also allocated for participants to connect with other first-timers, fostering friendships and collaborations beyond their local peer groups.

We look forward to seeing you in Chile, whether old or new friends!

Prof. Dr. Daniel Sommerhoff
Vice President
International Group for the Psychology in Mathematics Education (IGPME)

PME 48
2025
SANTIAGO, CHILE

MAKING SURE THAT MATHEMATICS EDUCATION RESEARCH REACHES THE CLASSROOM

We wish to welcome you to the conference in July 2025 and hope that your visit and stay in Santiago, Chile, will be exciting, interesting, and inspiring. Our goal is to make the PME 48 conference inclusive, welcoming for all, and scientifically successful.

Your Hosts PME 48 in 2025 will be co-hosted by **Universidad de Chile** and **Universidad de O'Higgins.**

The venue for the conference will be the Faculty of Physical and Mathematical Sciences of Universidad de Chile.

Universidad de Chile Universidad de Chile is a public research university in Santiago, Chile. In 1841 the Chilean minister of public education, Manuel Montt, conceived the idea of funding a corporation for the "advancement and development of sciences and humanities". Andrés Bello, a Venezuelan poet and humanist, formulated the project, which, with small modifications, became a law on November 19, 1842, creating the Universidad de Chile. The foundation of the university came as an answer to the need to modernize the country which had become independent from Spain a little more than two decades before It replaced the Real Universidad de San Felipe, established in 1738.

The university was formally opened on September 17, 1843. During this period, the university consisted of five faculties: Humanities & Philosophy, Physical & Mathematical Sciences, Law & Political Sciences, Medicine, and Theology. During its first years the university gave considerable support to education, institutional organization (such as the "Civil Code", a model for America), the building of the road network to join the territory, and the energy and production infrastructure.

The university seeks to solve national and regional issues and to contribute to the development of Chile. It is recognized as one of the best universities in Latin America for its leadership and innovation in science, technology, social sciences, and arts through the functions of creation, extension, teaching, and research. It is considered the most important and prestigious university in the country. Its five campuses comprise more than 3.1 square kilometers (1.2 sq mi) of research buildings, healthcare centers, museums, theaters, observatories, and sports infrastructure. The institution has more than 40,000 undergraduate and graduate students, offering more than 60 different bachelor and professional degrees, 38 doctoral programs, and 116 master programs.

Notable alumni include Nobel laureates Pablo Neruda and Gabriela Mistral, twenty-one Chilean presidents, including the current president Gabriel Boric, and two presidents from other countries (Mexico and Ecuador).

Sources: https://en.wikipedia.org/wiki/University_of_Chile https://www.uchile.cl/

Universidad de O'Higgins Universidad de O'Higgins (UOH) is a Chilean public university, created by law in 2014 during the second government of President Michelle Bachelet. It is located in the Región del Libertador General Bernardo O'Higgins, where it develops its academic activities.

The university opened its first 13 undergraduate programs in March 2017. Together with Universidad de Aysén, they constitute the only two Chilean public universities created in more than two decades.

The Regions of O'Higgins and Aysén had been the only ones without public higher education institutions so far. 9 PME 48 – Second Announcement Universidad de O'Higgins' academic organization considers two types of units: institutes and schools. As a consequence, UOH has neither faculties nor departments. The UOH institutes are multidisciplinary academic units devoted to activities of scientific research, technological research, and R&D for capacity-building and solving relevant problems of the O'Higgins Region and problems of national and international importance.

The university currently has five research institutes: Institute of Agro-Food, Animal and Environmental Sciences; Institute of Education Sciences; Institute of Engineering Sciences; Institute of Health Sciences; and Institute of Social Sciences.

In addition, it has an Institute of Advanced Audiovisual Studies, focused on audiovisual creation. The UOH schools are academic units that organize, administer, and offer study plans leading to academic degrees and professional licenses. The university currently has five undergraduate schools: School of Agro-Food, Animal and Environmental Sciences; School of Education; School of Engineering; School of Health; and School of Social Sciences. Nowadays, Universidad de O'Higgins offers 27 undergraduate programs and has opened 2 doctoral programs, 5 master programs, and 2 medical specializations.

Sources: https://es.wikipedia.org/wiki/Universidad_de_O%27Higgins
https://www.uoh.cl

We look forward to the following Plenary lecturers

The Plenary Panel will be held according to the Oxford-Style debate protocol on the following topic:
"Mathematics education research must be useful for the classroom"

Soledad Estrella
Pontificia Universidad Católica de Valparaiso, Chile

Jinfa Cai
University of Delaware. United States of America

Judy Anderson
The University of Sydney, Australia

Wim Van Dooren
KU Leuven, Belgium

The panel for PME 48 consists of the following researchers:

Salomé Martinez
Universidad de Chile, Chile

Anthony Essien
University of the Witwatersrand. South Africa

Demetra Pitta-Pantazi
University of Cyprus, Cyprus

Maitree Inprasitha
Khon Kaen University. Thailand

Panel Chair: Tanya Evans
University of Auckland, New Zealand

Skemp – donate to Skemp

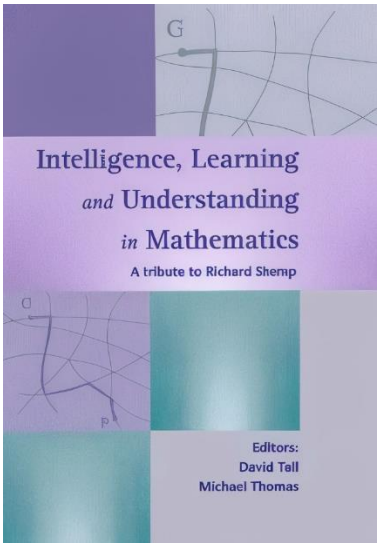
Richard Skemp Memorial Fund

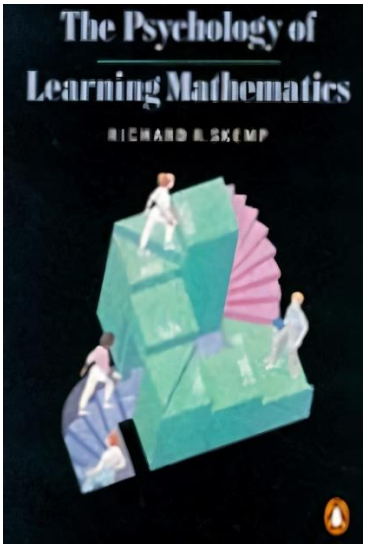
The Richard Skemp Memorial Support Fund was established to provide financial support for prospective PME participants from under-represented countries or countries in which insufficient financial support is available and who do not have personal means for self-financing in order to allow them to attend the conference. We are proud to announce that we were able to give a Skemp grant to 13 participants, in order to allow them to participate in the PME48 conference, totaling an amount of over 15000 euro.

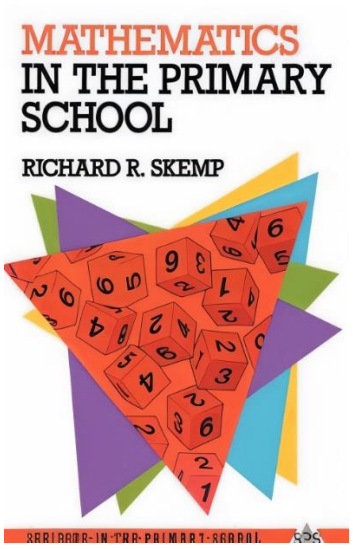
The Skemp Fund depends on donations from the members, and a reserve fund with occasional sources of income. By becoming a member of IGPME, you donate an amount of 10 euro to the Skemp Fund, but you can voluntarily increase this amount.

In order to sustain the level of support that we are currently giving; we need to increase the number and amount of donations. Therefore, if you can afford this, we highly welcome donations to the Skemp fund. This can be done during conference registration, but you may also donate at the conference venue in cash by contacting the Administrative Manager (**info@igpme.org**). If you wish to donate via a bank transfer, you can also contact the Administrative Manager to obtain the necessary details.

Many thanks for your support!







New IC member nominations

Looking for new members for the International Committee

At the Annual General Meeting, we will elect four new members of the International Committee (IC, also known as Board of Trustees) of IGPME. One of these members may be you!

We are looking for members of IGPME who want to engage for a period of four years in the IC. The IC members collaborate with the president to shape the policy of PME, take initiatives to strengthen the community and improve the scientific activities. They meet a day before and a day after the conference and do some additional meetings online throughout the year.

Being part of the IC is a great opportunity to get to know the organization from the inside, to get to know many people, and to make new friends for life.

If you consider standing for election, you can find the nomination form and procedure at https://www.igpme.org/organization/international-committee/

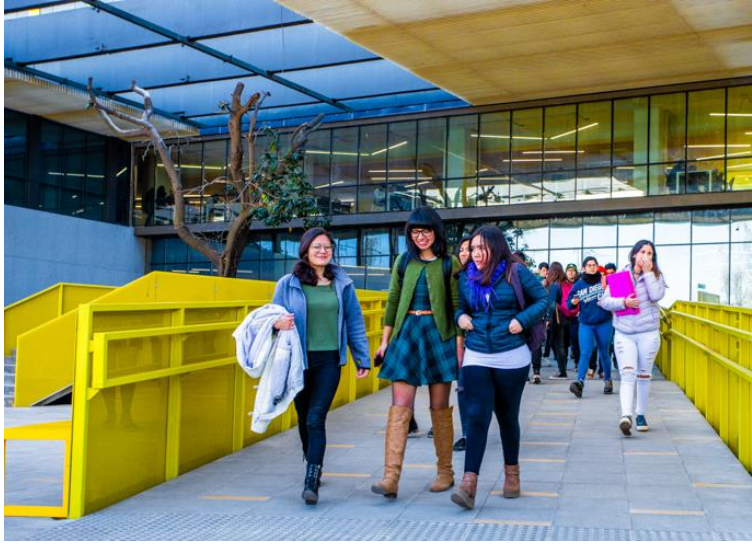
More…

Link to recorded plenaries on PME webpage

https://www.igpme.org/annual-conference/past-conferences/past-plenaries-and-panels/

PME YouTube Channel https://www.youtube.com/@PMESecretary

Working group reports from PME47 in Auckland, New Zealand.



Critical mathematical thinking for sustainable futures

Susan Staats (USA) and Rachel Helme (UK) Julia Aguirre, Chiara Andrà, Kim Beswick, Alf Coles, Sarah Digan, Vince Geiger, Jodie Hunter, Stefan Siller, Armando Solares, Jennifer Suh, Eva Thanheiser, Nina Unshelm, and David Wagner

In this Working Session we aimed to explore the challenges associated with understanding the notion of the human dignity as one of the fundamental rights for the learners of mathematics. Within the two sessions, we explored the following questions: 1) diverse perspectives about the concepts encompassed by the term human dignity; 2) experiences of teaching mathematics by using the concept of human dignity; 3) ideas for new and different ways of researching the incorporation of human dignity in mathematics classrooms activities and to explore the possibilities and challenges.

In the first session we discussed a range of different perspectives on conceptualisation and the importance of human dignity both as a concept and as it relates to mathematics education research. We discussed topics related to power, solidarity, relationships, community, relevance, and non-humans. We also discussed dignity that is given to one from the society versus dignity as sense from within, among other things. We also discussed dignity as related to intolerance and inequity. To exemplify our discussions we, visited the 'Our world in data' website, the page on violence against rights for children: https://ourworldindata.org/violence-against-rights-for-children and we explored the following questions: What mathematics do we see? What mathematics from school curriculum do we see? How does this information make us feel? What questions about human dignity can we pose? What stories are told and what stories are not told?

In the second session, we introduce our Norwegian Research Council funded project. The objective of this project is to strengthen the incorporation of human rights values (specifically: ethical awareness, human dignity and democratic participation) in Norwegian mathematics teacher education programmes. To work with concrete ideas, we introduce the 4-pillars of learning to live with commons: conconstruct together, collectively mobilies, live in a common world and attend and care. Then suppose that we wish to research human dignity in relation to the learning and teaching of mathematics with 12-year-olds: we explored ideas such as: How could we begin and what kind of tasks could we use? What are the challenges and possibilities? What experiences do you have in your own research? This WS is one "Developing human rights values in mathematics teacher education: Education with and by youth" project funded by the Research Council of Norway.

Poetic methods in mathematics education (POEME)

Andrew Hare, Rachel Helme, and Susan Staats

What is the layered, dialogical nature of poeticity in mathematics? How can poetic methods support commitments in the area of socially constructed mathematical identities trajectories and teacher's gestural and ethical practices? Should a focus on poeticity go beyond the examination of words alone towards words in context, connecting to the gestures and emotions that are alongside? Can patterns found in gestures and emotions be themselves poetic? This continuing working group asked the question "why does mathematical poeticity and its poetic methods require attention to the layers of gesture and to emotion?". A small group of people across two sessions examined the impact of giving attention beyond the words, considering the layers of gesture and emotion.

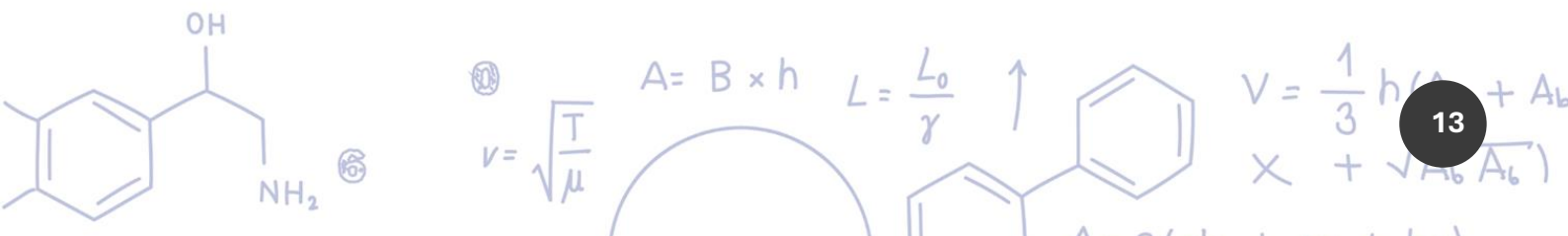
The first session examined both of these companions to words. We began briefly introducing our previous work on poetics from last year's working group. This included constructing and analysing pronoun poems (Helme, 2021) and repeated embodied phrases in mathematical talk (Staats, 2021).

We moved on to examining gesture, by reflecting on the 'regarding as' gestures in a video of a lecturer in their undergraduate abstract algebra lesson. These gestures refer to 'expressing with the body and hands the manner in which some writing is to be considered' (Hare, 2022). In the first viewing, the group paid attention to rhythms, repetitions, beginnings and endings, before discussing what was of concern or interest to each of them. In the second viewing, the group attended once again to the gestures, re-examining with their own focus in mind. In this brief analysis process, we asked questions about how and if the gestures enhanced the words?

What was happening when there were gestures without words? Are words only what is spoken by the lecturer or also what is written on the board (or both)? In what sense did the layering of gesture change the words or the layering of words change the gestures?

The second video centred on a discussion between a researcher and a teacher, which had been preamble to the focus of a research interview. For this second part of the first session, we gave attention to our individual emotional responses as we listened to, and read the transcript of, the interview. Individually within the group we traced our emotional responses as the teacher spoken about their experiences of teaching online during the Covid-19 pandemic. We asked questions such as, can my emotional responses be considered a form of poetic analysis? How do my responses guide the poem that I might create from this data? Should and how might my responses themselves by recorded? We discussed the idea of a shadow poem; a poem that traces emotional responses as a means of reflectivity, acknowledging the life experiences of the researcher as they research. At the end of the session, we discussed what conceptualisation of poeticity resonated with the each of the group, ready to practice on their own data in session two.

Session two began with reflecting on the first session. We talked about the scope of poetic methods including interpreting the unspoken through sharing emotions, values and rationalities; poetic methods availability for all languages; a range of data sets, including teacher reflections and interview, teacher-student engagement, student-student knowledge construction, and surveys.



Patterns were considered to represent things as they 'become' not as 'they are'.

Following on from the discussion, people choose to work individually or in small groups to construct a poetic artifact from their own data, considering two dimensions by reflecting on the companions to words. This could be through reflecting on gestures or emotions or some other sense that had emerged for them in session one. The questions the group asked themselves were: What to do with data? What do we attend to first, lens first before analysis or lens after analysis? How should we consider validity? (if at all) What about survey data? What about 'shadow' poems? The group were encouraged to move from 'can I do this…' (am I allowed?) to 'I wonder what will happen if I….' (a creative, autonomous process).

Everyone in the group identified patterning in that poetic methods require attention to the companions to words as well as the words themselves. Poetic methods are both seen and read and acted and felt. The working group ended by establishing an international community of those interested in poetic methods in mathematics education research. To date we have engaged in an asynchronous virtual writing retreat to write, read or reflect on poetic inquiry in mathematics education. We shared resources and readings as well as organising online sessions to discuss the week.

One member of the international community has gone on to using some ideas in their dissertation, another has submitted an article for review, and a group had plans to submit a poetic inquiry working group to another international conference. We hope to be able to begin work on an edited book around Poetic Methods in Mathematics Education Research. We will continue to develop the working group within, and beyond, the PME community.

References

Hare, A. (2022). Mathematics lecturing: Gestural practices in contexts. [Doctoral dissertation, Simon Fraser University]. Retrieved from summit.sfu.ca/item/35720.

Helme, R. (2021). I and THEY poetic voices in learning to listen to a student labelled as low attaining in mathematics.

International perspectives on proof and proving: recent results and future directions

David A Reid and Yusuke Shinno

The PME working group on 'International perspectives on proof and proving', met as Working Group 2 at PME-47 in Auckland, New Zealand. It was co-organised by David A Reid (Norway) and Yusuke Shinno (Japan).

The group first met at PME-43 in South Africa. Its aim is to foster research on proof and proving from an international perspective by bringing together research on proof and proving and international comparison. This is motivated by the strong increase in research into proof and proving in mathematics education over the past two decades, much of which has been conducted in single national and cultural contexts, without much attention to the roles these contexts might play. It remains unclear whether existing research results from single national and cultural contexts are transferable, or, indeed, if the assumptions on which the studies are based are valid elsewhere. There have been a few comparative studies in recent years, but considerable work remains to be done. The group subsequently met at PME-45 (Alicante, Spain) and PME-46 (Haifa, Israel).

At PME-47, we began by reviewing the aims and history of the group, before having a few short reports of recent related research. Silke Neuhaus-Eckhardt described the plans the WG made at PME-46. The group planned an international comparative study using surveys modelled on Celia Hoyles' survey of the proof conceptions of students in the UK. Some work was done on developing items for the surveys, but there was little progress after that. If there is interest in pursuing this project, the materials developed so far are available.

Yusuke Shinno reported on a Japan-German comparative research project that has been underway since 2019. The project is now engaged in comparing video-taped lessons in which proofs that the sum of three consecutive numbers in divisible by three are taught. A framework has been developed to compare the organisation of the lessons.

David A Reid presented some preliminary results from a comparison of Grade 1–9 curriculum documents in Denmark, Finland, Norway and Sweden. He observed that attention to proof is explicit in grades 7–9 in Denmark and Finland, and that proof-like activities are present in all years in Denmark, Finland and Norway, but only in Grade 7–9 in Sweden. Norway is unusual in that proof-like activities are separated from exploration and conjecturing (as a separate element of the curriculum) while proving, conjecturing and exploring are treated as part of a single process in the three other Nordic countries.

On the first day the participants introduced themselves and their interests. These formed the basis for forming sub-groups on the second day. Three subgroups formed, around:

- Comparing proof in first year university courses
- Comparing differences of language, the role of logic, etc. in textbooks and other resources
- Classroom based comparative research

Comparing proof in first year university course

Participants: Milena Damrau, Alon Pinto, Jude Buot, Farzad Radmehr, Alba Santin Garcia, George Kinnear, ***Silke Neuhaus-Eckhardt*** *(neuhaus@dmuw.de*

In the proof at university subgroup, we first discussed the transition to proof in different countries: When and how does it occur? In the following is a short summary from different countries:

- Iran: Apart from geometry, students majoring in mathematics and physics in high school, have a course on discrete mathematics that has three chapters and the first chapter is called An Introduction to Number Theory. There, students learn about reasoning and proof in mathematics in detail in the first subchapter and then apply it in the subsequent subchapters. In the calculus textbook for this major also a few theorems with proofs are provided but it is not that much.
- Norway: later, but curriculum changes at the moment
- Israel: geometry in secondary school, proof based courses linear algebra and analysis in university
- US: first year of university: lower division courses (calculus); around third year: proof based lectures (linear algebra): Transition to proof courses uses proofs in set theory or logic
- Australia: there are special courses in high school, analysis at university
- Spain: no transition, full on at university
- India: two column proofs in high school, Analysis / Linear algebra in first year university
- UK / Scotland: final year in school optional course, first year university linear algebra, second year introduction to proof (change of the curriculum at the moment)
- Philippines: two column proofs in high school, Calculus/ Analysis (proofs) first year, then summer sophomore, then linear algebra and more (longer) proofs, in discrete math class logic
- Germany: seldom at school, university starts with proof based-courses in analysis / linear algebra; there are sometimes short transition to proof courses before the start of university ("Vorkurse") or parallel at first year.

We also talked about different aspects in transition-to-proof courses as not everyone was familiar with these courses and were very interested in the typical structure and benefits. Mostly in common was a start with logic and proofs in set theory. There is also a paper by David and Zazkis (2019) about a characterisation of such courses in the U.S.

In addition, we recognised that while in some countries two-column proofs are often used and very well known, there were persons from other countries who never heard about them before coming to PME this year.

David, E. J., & Zazkis, D. (2019). Characterizing introduction to proof courses: a survey of U.S. R1 and R2 course syllabi. International Journal of Mathematical Education in Science and Technology, 51(3), 388–404. https://doi.org/10.1080/0020739X.2019.1574362

Comparing differences of language, the role of logic, etc. in textbooks and other resources

Participants: Alexander Holvoet, Beth Woollacott, Chen-Yu Yao, Csilla Zámbó, ***David A Reid*** *(david.reid@uia.no), Hui-Yu Hsu (Angela), Igor' Kontorovich, Jason Cooper, Keith Weber, Nathania de Sena Maier, Valentin A. B. Küchle*

As a fairly large group we discussed a wide range of possible foci. The included proofs presented in textbooks (especially ones we considered incorrect), which is related to what counts as a proof in different countries, and at different school levels. The logical and meta-mathematical assumptions in such proofs was also mentioned. We also discussed the relationship between linguistic correctness and logical correctness in proofs. Keith Weber drew our attention to a 2022 paper by Tanswell and Inglis on the use of imperatives in proofs, and this led to an informal comparison of how our different languages would express an instruction such as "Assume that...".

We decided to attempt in the coming year to make this informal comparison more formal. We will gather 'typical' examples of proofs in as many languages as is feasible, and attempt to explore the overall 'tone' of the proofs, through attention to verb forms and other linguistic indicators.

We will identify a set of proofs that appear in upper secondary school and university texts that we will compare.

Tanswell, F. S., & Inglis, M. (2022). The language of proofs: A philosophical corpus linguistics study of instructions and imperatives in mathematical texts. In Handbook of the history and philosophy of mathematical practice (online). Springer International Publishing.

Classroom-based comparative research

Participants: Jorge Olivares-Aguilera, Ödön Vancso, Yosuke Tsujiyama, Kota Kato, Masataka Kakinouchi, ***Yusuke Shinno*** *(shinno@hiroshima-u.ac.jp)*

This group discussed the characteristics of national mathematics curricula, followed by a discussion of the grades at which the teaching of proofs begins and in which domain it is situated. Although our group was relatively small (six people from Hungary, Chile and Japan), it allowed good communication between researchers from three countries with different geographical, linguistic and cultural backgrounds.

The Chilean curriculum has four basic competencies (argumentation, communication, modelling, problem solving), and proof and proving is seen as a content or activity for developing argumentation skills. In addition, as in many other countries, there has been a recent focus on computational thinking.

The Hungarian curriculum is characterised by the inclusion of discrete mathematics and probability at all grades in primary and secondary schools. Proofs have been absent from the curriculum for some time, but they have been re-introduced in recent curriculum revisions.

In the Japanese curriculum, proofs are the main content of geometry in middle schools and are taught systematically (proofs are also taught in algebra, but not as systematically as in geometry). The Japanese curriculum also emphasises competency, but this is not as explicit as in Chile and other countries, and proofs are only dealt with as content to be taught.

Thus, there are differences at the curriculum level between the three countries, but there is also common content related to proofs, such as the Pythagorean Theorem (Grade 8 in Chile, Grade 9 in Hungary and Japan). Although we could not discuss approaches to classroom study this time, there is a possibility of choosing a topic common to each country, such as geometry proofs, for collaborative research studies.

The working group welcomes additional collaborators in the work of the subgroups. If you would like to learn more, please contact the subgroup's contact person (in bold). Note that the topics of the subgroups overlap, and participation in more than one is certainly possible.

Mathematics in integrated stem: dilemmas and strategies for success	Creative methods for inquiry in mathematics education research	Human dignity and mathematics education
AnnaMarie Conner, Kristin Lesseig, Claire Miller, and Anna Bloodworth	*Markku S. Hannula, Tracy Helliwell, and Andreas Ebbelind*	*Yasmine Abtahi and Richard Barwell* *University of South-Eastern Norway; University of Ottawa, Canada*

Working Group Report: Creative methods for inquiry in mathematics education research

Submitted by *Markku Hannula (University of Helsinki, Finland), Tracy Helliwell (University of Bristol, UK) and Andreas Ebbelind (Linnaeus University, Sweden)*

The difficulty of relating to the experiences of another stems from the embodied nature of experience. Experience happens in and through our sensory body, of which our cognition is only part. To get close to understanding lived experience, we must make the observed social elements become personal by taking the role of the other (Prus, 1996). In this working group we took on the challenge of getting closer to the lived experiences of others (i.e., our research participants) by exploring creative methods of engaging with data. These approaches offered group members new and meaningful ways to connect with and better understand the lived experiences of others.

The aim of the working group was for group members to learn and engage in creative approaches to both *analysing* and *presenting* classroom data. The focus of the first session was working creatively with data (to get to know it/analyse it in multiple ways) and in the second session we experimented with creative ways of presenting research findings in publication reports, to enhance the experience of the reader. Group leaders shared an extract of classroom data with the group in the form of a video (involving two young children (six year-olds) solving a combinatorics problem together) as well as the transcript and the children's solution to the problem (which was to find all of the different ways that three bears can arrange themselves on a sofa together, i.e., an enumerative combinatorial task where the children are asked to find all permutations (when n = 3)).

After a short introduction based on Richardson's (2000) "crisis of representation", the whole group watched the video of the children working together on the problem and transcripts were also shared. Group members were offered a choice of three ways to interact with the classroom data, namely: *performing (drama)*; *creative writing*; and *illustrating*. In all groups, the idea was not to give or create factual accounts, but to employ creative methods as a way to get closer, on an emotional level, to the data and the experiences of the participants.

The performing group: The focus in this group was on using bodily experiences to deepen understanding of the research participants. This involved group members observing, mimicking, feeling and only afterwards to try to interpret and reflect. Group members recreated the scene as if they were the children, exaggerating non-verbal elements to explore how it feels. They were invited to invent inner voices to express unspoken thoughts and to then re-enact the scene including the inner voices.

Group members then discussed how their understanding might have shifted. At the end of the first session, some members performed there work to the rest of the group.

The creative writing group: The focus in this group was on employing creative writing strategies to explore beyond what was visible in the data. Group members were prompted to consider the data from different perspectives such as by looking at body language, or at what was not said asking what actions or intentions are present? And what gaps need filling to make full sense of the situation? Also employing tools such as the making strange tool (by exploring what a real outsider may find strange, unclear, confusing, or worth questioning) and the identity building tool (by asking what identities are being enacted and what roles or positions are available to them?). Group members could construct their own stories, situating them beyond the moment observed making use of speculative prompts such as to produce one or more diary entries written by the children (now or in ten years' time), reflecting on their relationship with mathematics, or to write a dialogue between one of the children and their parent that begins with the parents asking "how was school today?"

The illustrating group: The focus in this group was to engage with the data through recreating scenes, using colour to connect with mood, and to think about a hidden story that group members wanted to tell. Members of this group were given the option to create a story board using storyboard software, pencil, coloured pens and paper or by taking screen shots from video and adding captions/narrative/emojis. At the end of the first session, all group members shared their experiences in mixed groups.

In the second session, group members were prompted to move towards creating a research text based on their chosen modes of creativity. The focus was on expanding what might be considered a research text (beyond traditional formats) whilst focussing on the readers' experience. All outputs were shared via a group Padlet and shared/discussed at the end of the second session. Both sessions were well attended by conference participants.

References

Prus, R. (1996). Symbolic interaction and ethnographic research: Intersubjectivity and the study of human lived experience. New York Press.

Richardson, L. (2000). Writing: a method of inquiry. In N. Denzin and Y. Lincoln (Eds.), Handbook of Qualitative Research, (pp. 923–948). Sage.