December 2014 / January 2015

PME Newsletter

International Group for the Psychology of Mathematics Education

Message from PME President Barbara Jaworski

Dear colleagues in PME, it is my pleasure to wish you a very happy new year and all the best of peace and joy in 2015.

This issue of our newsletter is brought to you from a new editorial team. Maike Vollstedt (Germany) continues as editor and she is joined by Keith Jones (UK), a current member of the IC. The retiring editor in Cynthia Nichol (Canada) to whom we express our wholehearted thanks for her wonderful work in editing our newsletter over the years – thank you Cynthia! I welcome the two editors and thank them very much for this issue of our newsletter.

Our PME conference this year takes place in Hobart at the University of Tasmania, Australia. The theme is *Mathematics*

Inside this issue

Message from the Editors

Welcome to our December 2014 / January 2015 Newsletter. In this issue we bring reports from PME 38 and the cordial invitation to PME 39 in Hobart, Tasmania. In addition, there is information about standing for the IC and the new PME handbook.

There were changes in the PME Newsletter team: We have to say farewell to Cynthia Nicol and thank her for her great engagement for the Newsletter in the last years – and we welcome Keith Jones of England in the Newsletter team.

Enjoy reading the Newsletter! Take care.

Keith Jones (d.k.jones@soton.ac.uk) and Maike Vollstedt (vollstedt@math.uni-bremen.de)

Message from PME President Barbara Jaworski (continued)

Education: Climbing Mountains, Building Bridges and reflects the particular landscape at Hobart as well as challenging us to see our scientific area through these metaphors. The Chair of the Local Organising Committee and the International Programme Committee is Professor Kim Beswick; we thank Kim and her team for their ongoing work on our behalf. You can find the First Announcement on the PME 39 website at http://www.pme39.com/ and some further information follows below.

PME 40 will herald our 40th year in PME when our conference will take place in Hungary, chaired by Professor Csaba Csíkos of the University of Szeged. As part of celebrating 40 years, the IC decided to invite a team of editors to prepare a new PME handbook for 2016. This should celebrate another decade of PME research from the previous handbook which was published for 30 years in 2006. We decided to invite the editors of the previous handbook, in order to build on their earlier experience, plus one further editor. Thus, the editors of the new handbook are Angel Gutierrez (Spain), Paolo Boero (Italy) and Gilah Leder (Australia). A decision has been taken to invite authors who were not invited for the 30 year handbook. It is expected that the handbook will again be published by SENSE.

You will find more general matters about PME on the IGPME web page at http://igpme.org/.

Queries can go directly to our Administrative Manager, Prof. Dr. Bettina Rösken-Winter via the email info@igpme.org. I look forward to meeting you again in Hobart.

Barbara Jaworski
January, 2015

PME International Committee Report

Treasurer Portfolio Group (TPG) Report

Submitted by Olive Chapman, PME Treasurer

The Treasurer Portfolio Group responsibilities include: managing the financial transactions of IGPME (e.g., making payments and deposits, responding to financial queries, issuing confirmations), maintaining records, advising on fiscal questions from present and future conference organisers, and preparing annual financial reports.

Two members of the TPG ended their terms at PME38 in Vancouver. Bettina Dahl Soendergaard (Denmark) completed her term as treasurer and member of the International Committee (IC), and Tai-Yih Tso (Taiwan) as member of the IC. We thank them for their valuable work for the TPG over the past year. A special thanks to Bettina for her leadership of the Group and her committed management of the finances of organization.

During PME 38, Olive Chapman (Canada) was elected Treasurer of IGPME by the IC, with Keith Jones (UK) continuing as member and Stanislaw Schukajlow-Wasjutinski (Germany) as a new member to make up the current TPG.

The TPG has been working on various projects this year, which are of interest to the larger IGPME community. Some items we continue to work on:

1. New bank

We currently hold bank accounts in Finland but because of changes to the Finnish laws that require us to conduct business in Finland to continue to hold the account there we are currently working on moving the accounts to a bank in the UK. This was approved by the IC. This will also be necessary if the organisation continues to pursue being registered as a charity in the UK.

2. Financial policies

We are reviewing the history of financial policies of IGPME to update, revise and consider new ones as deemed necessary.

3. Minimum emergency fund

IGPME continues to be financially strong. We continue to work on a proposal to address the minimum amount of money the organization should hold to guaranty covering its normal operating expenses in case of a situation that results in no income in a year and covering conference expenses in case of a "catastrophic event" that leads to an untimely cancellation of a conference.

Standing for the PME International Committee (IC)

Barbara Jaworski, President of PME 2013-2016

Each year, at the PME conference, 4 members of the PME IC retire. This means in general that they have completed a 4-year period on the IC. It means also that we need to recruit 4 new members.

It is very rewarding to participate in the work of the IC and so contribute to PME and its role in our Mathematics Education Community. In this message, I say something briefly about the work of the IC and then tell you how to stand to become an IC member.

IC activity

Each member of the IC contributes to the overall work of PME. This involves:

1) Attending IC meetings before (1.5 days) and after (1 day) each conference.
2) Becoming a member of one of four portfolio groups, which are:
   a. The PPG – Policy Portfolio Group – dealing with PME policy
   b. The SPG – Secretary's Portfolio Group – dealing with communication in PME
   c. The TPG – Treasurer's Portfolio Group – dealing with finance in PME
   d. The VPPG – Vice President's Portfolio Group – dealing with the academic programme(s) in PME
3) Playing a role in the work of the chosen group, undertaking tasks as agreed with other members.

The IC has an Executive Committee consisting of President, Vice President, Secretary, Treasurer and Leader of the PPG. This committee meets regularly by Skype during the year between conferences.

The IC has a special forum as part of the IGPME website where communications between IC members take place.

Becoming a member of the IC

You need to contact the Administrative Manager of PME, who is currently Bettina Roesken-Winter, via info@igpme.org. She will send you the appropriate application document to complete. You will be asked to write something about your participation in PME and what you bring to PME in terms of your own academic and research experience. You will need two PME members to nominate and second your application. At any time there must be no more than three members from any country, including the President, so you need to check the current membership of the IC.

At the annual conference, all such application documents will be placed on a central noticeboard visible to all people attending PME that year. Thus PME members can see who is standing and read the information provided. At the Annual General Meeting (AGM) those standing for election will be introduced by their nominator. There will then be an election by secret ballot through which the required number of members will be appointed.

Please consider standing for the PME IC.

PME38 Reports

PME Young Researchers' Day at PME38

Submitted by Nathalie Sinclair & David Pimm (Simon Fraser University, Canada)

The first PME Young Researcher Day (now Early Researcher Day) took place in Vancouver on the UBC campus during the 24 hours preceding the opening of PME 34. There were some 80 participants from twenty different countries who took part, each of whom was either in their final year of their doctoral dissertation or one year either side of this, which became a primary selection criterion from the 120 initial applicants. In addition, there were 16 journal editors, workshop leaders and panellists who contributed to different parts of the programme (Michelle Cirillo, Jenny Cramer, Brent Davis, Francesca Ferrara, Susan Gerofsky, Andrew Hare, Merrilyn Goos, Harpreet Kaur, Ami Mamolo, Silke Ladel, David Pimm, David Reid, Carlos Miguel Ribeiro, Tim Rowland, Nathalie Sinclair, Keith Weber).

There were two plenary sessions and two workshop sessions (each participant chose two from four, as each workshop was offered twice). The first plenary session involved journal editors from *Educational Studies in Mathematics*, *For the learning of mathematics* and *Research in Mathematics Education*, each speaking for 10 minutes about the ethos of their journal as well as one or two issues concerned with submission, publishing and reviewing of articles. This was followed by a question and answer session with the audience. The second plenary session, *Life after dissertation*, consisted of a panel of four speakers, each of whom had finished their dissertation within the past five years and were pursuing an academic career, offering cautionary tales as well as personal narrative concerning their specific early

PME Young Researchers' Day at PME38 (continued)

trajectory within academia. This was followed by a very lively discussion and interactive period which ran over the scheduled time.

The four workshops, whose topics were primarily determined by means of a questionnaire that was sent out to potential participants, were as follows: *Working with language data at the edges: Moving beyond word counts, Working with body data: from theory to research practice, Working with teacher as data* and *Working with reasoning and argumentation data*. There were approximately twenty participants in each workshop, which lasted for two hours.

On the first evening of the YRD, there was a dinner at a pub on campus, where participants could meet in a much more informal setting and continue to connect other people at a similar stage in their professional education. "Networking" was also a significant desire expressed by the participants prior to arrival. The YRD also enabled those participants who had not been to PME before to attend the first-timers meeting, surrounded by people with whom they had already spent the past 24 hours. One participant subsequently wrote, "If I hadn't attended YRD, it would have been very easy for me just to rely

PME Young Researchers' Day at PME38 (continued)

on that set of connections throughout the conference, and unintentionally avoid meeting folks from outside that network. Thanks to YRD, though, I met many folks in a similar academic position to myself that I'd never met before, and those relationships developed over the conference." We also received the following comment, "I met a ton of folks from outside my normal networks and made a number of collegiate friendships that I never otherwise would have. In my mind, that was an incredibly powerful part of YRD!" With regard to workshop participant, someone wrote, "It was one of the best experiences at PME that I had. I have always felt 'on the fringe' with my interests. It was exciting to think about my own work differently and thrilling to see the other participants interested in things I like too."

The evaluation of YRD was carried out by the members of the IPC.

Discussion Group 2: Exploring Horizons of Knowledge for Teaching

Submitted by Nicholas H. Wasserman, Ami Mamolo, C. Miguel Ribeiro, and Arne Jakobsen

During the first session of this discussion group devoted to Horizon Knowledge for Teaching (HCK) at PME, the primary activities of the group revolved around three presentations (given by the four DG coordinators) and subsequent discussion of the different perspectives on the mathematical horizon represented. Participants were called to compare and contrast some of the differences and similarities of the discussed conceptualizations, and ways that they may support or enhance one another in research and practice. Such discussions and reflections were then complemented with some questions to be considered by the participants to be further deepened in the next discussion group session:

- What primary impacts might HCK have on the work of teaching? What are some examples / episodes from your own classroom experiences?
- What are some methodological approaches (potentialities and constraints) to study HCK?
- What are some ways to access and develop HCK in and for teaching?

The second session had as a starting point the previously mentioned questions and was devoted, mainly, to discussion and reflections amongst participants. The beginning and end were reserved for whole group comments. In between, the DG participants split into three

Discussion Group 2: Exploring Horizons of Knowledge for Teaching (continued)

groups, based on primary interest in one of the questions above, and discussed and reflected upon their (possible) answers for and reservations about those questions. These were shared and recorded with the whole group. What follows below tries to capture some of the group's thoughts concerning each one of the proposed reflection questions:

What primary impacts might HCK have on the work of teaching? What are some examples / episodes from your own classroom experiences?

This question allowed discussion about (possible) relationships between curricular knowledge and HCK, where participants noted that HCK may provide a more profound understanding of the curriculum content and relationships amongst those ideas. Some of the discussed examples included students' confusion over what is the "biggest number" and what is "infinity + 1", as well as unconventional approaches to finding the area of a rectangle using geometric means. The examples were given as a means to explore the fact that HCK allowed teachers to draw out important distinctions (e.g., between arithmetic and geometric means) as well as provide more than a "no, not correct" answer to student confusion.

What are some methodological approaches (potentialities and constraints) to study HCK?

Methodological approaches were parsed out according to studies which might: access and assess HCK; develop HCK and explore its impact on teacher effectiveness; and explore its manifestation in teaching practice. Concerning the first issue, some of the discussions were centered on task conceptualization, and interviews and observations that would allow focusing on such problems. How to understand HCK's impact, as well as ways leading to its development, on and for teaching was noted as a challenging methodological question, with concerns around visibility and self-reporting. Questions were raised also around how to "measure" the manifestation of HCK, whether HCK is something known or enacted, and how we might frame what constitutes HCK.

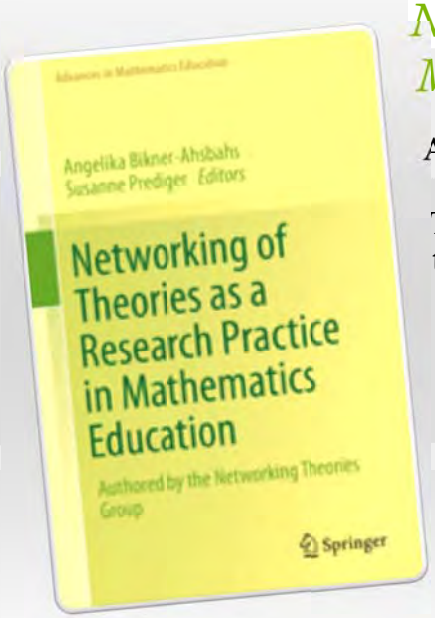
What are some ways of developing HCK in and for teaching?

Several ideas emerged during the discussion from participants' own experiences and reflections as teacher educators, mathematics students, and mathematics teachers. Attention was paid to past-future learning trajectories, as well as breadth of connections. One of the ideas that emerged concerned the fact that different horizons exist for different subgroups of mathematically-engaged professions (e.g., engineers; teachers; mathematicians; teacher educators). This last question led to several suggestions on possible ways on how to approach developing HCK. Amongst those ways we can find: using examples, ideas, or problems that can lead to the formation of new concepts, linked possibly with a genetic approach; activities that explicitly link HCK and curriculum related knowledge (e.g., divisibility in the curriculum with numbers extends to more challenging abstract problems, which could be explicitly linked to broaden HCK); concepts do not necessarily need to extend to other more abstract concepts, but rather HCK can provide

Discussion Group 2: Exploring Horizons of Knowledge for Teaching (continued)

"broader view" to see more aspects of simple concepts, and broaden processes to support more in-depth mathematical thinking, also indicating that the horizon could be more related to processes than content; teacher preparation at the secondary level could that includes practicum at an elementary school (this is already done in some institutions as a way to acclimatize students to the professional setting, as well as give a sense of "past trajectories" so that methods for secondary teaching are informed by experience and knowledge of what occurs in previous school stages); and linking graduate level mathematics with school mathematics, being one of the possible presented examples the writing of a lesson plan for elementary or secondary school based on these advanced concepts (e.g., how dynamical systems can relate to the specific content of a lesson in grade 7) – such an approach was conveyed by one of the participants as an important opportunity to boil down the concept to its roots, analyze where it came from, what it is connected to, and how it could connect to the content those students were supposed to deal with.

Book Announcement



Networking of Theories as a Research Practice in Mathematics Education

Angelika Bikner-Ahsbahs & Susanne Prediger (Eds.) 2014

This book explains and illustrates what it means to network theories; it presents networking as a challenging but fruitful research practice and shows how the Networking Theories Group dealt with this challenge considering five theoretical approaches, namely the approach of Action, Production, and Communication (APC), the Theory of Didactical Situations (TDS), the Anthropological Theory of the Didactic (ATD), the approach of Abstraction in Context (AiC), and the Theory of Interest-Dense Situations (IDS).

ISBN: 978-3-319-05389-9

http://www.springer.com/education+%26+language/mathematics+education/book/978-3-319-05388-2

Discussion Group 2: Exploring Horizons of Knowledge for Teaching (continued)

Overall, from the group's discussion emerged some ideas that seem worth mentioning. For example, in terms of some of the ways that HCK might impact practice, participants seemed to emphasize two aspects: 1) responding to unplanned situations, including seeing the mathematical significance of student ideas/approaches; 2) designing examples, problems and tasks – HCK potentially influences the example choice (perhaps connecting to future ideas), the design approach (emphasizing certain concepts), and the ease of example creation (parsing out extraneous stuff). And while much of the conversation about HCK revolved around more advanced mathematical ideas, there also seemed to be inclusion of a less advanced horizon as part of the notion, a sort of knowing vertical and horizontal connections across the curriculum (but outside of what can be considered curricular knowledge); however, it was also noted that including too much within the notion of HCK might cause it to lose some of its meaning as a concept.

Amongst group members, there were widely different interpretations of HCK, with little movement towards agreement as to what might count as the mathematical landscape of the horizon, what might be evidence of such knowledge, or whether HCK actually exists as a useful construct. Most people in the DG felt there was some value based on their own experience related to knowing the mathematical horizon, but what precisely that was or how to conceptualize the notion more generally felt elusive. The lack of common conception about and understanding of HCK made discussing ways to further research about it challenging. As a community of mathematics educators, the DG has served to bring this matter to the surface, with the hope of further propelling more work to move the field forward in terms of the notion of HCK. Also as a result of the discussions in and reflections on the DG, the need for next steps, for which we intend to contribute, was appointed. Amongst those next steps is the need for bringing together examples and vignettes of HCK in practice to help the field discern and ascertain a more common conception and understanding about HCK as well as its potentialities and constraints in and for teacher education (and the role of teacher educators' knowledge about such).

Discussion Group 3: Mathematical Discourse that Breaks Barriers and Creates Spaces for Marginalized Students

Submitted by Roberta Hunter, Marta Civil, Beth Herbel-Eisenmann, David Wagner

The aim of the discussion group was to consider ways in which marginalised students could be provided with space to equitably access mathematical discourse and practices. The goal of the two sessions was to create discussion on ways to use, innovate on, extend, and create a new tool which could be used to both scaffold and analyse marginalised students' access to discourse and mathematical practices.

The discussion group was led by four researchers and sixty-seven participants attended the first session. Many of the same participants attended the second session (although the numbers were lower) and there was an addition of eight new attendees.

Prior to the first discussion group session, articles were posted on the PME conference site and attendees were asked to consider the following questions:

1. What experiences and research can you share related to how barriers to the discourse have been identified and removed for different groups of marginalised students?
2. How do these articles inform your work with increasing (or limiting) participation of marginalised students?
3. What ideas do you have about innovating on and extending the frameworks to create a new tool to increase student participation in the mathematical discourse?

In the first discussion group session the participants were provided with opportunities to describe and make links with their own practices related to how barriers to the discourse had been identified and removed for different groups of marginalised students within their own context. The rich discussion provided evidence of international interest and activities the discussion group participants are undertaking to address this topic.

Following the initial discussion a Communication and Participation Framework (Hunter & Anthony, 2011) designed to support teachers to scaffold diverse students to engage in mathematical practices was presented. This Framework was used as a tool to critique video footage of the mathematical interactions of a group of students of Mexican origin in the U.S. as they engaged in problem solving in their home language (Spanish) (Civil, 2012) . Extensive participant discussion supported interrogation of the possibilities the Communication and Participation Framework held to inform actions teachers might take to provide space in reasoned mathematical discourse for marginalised students.

The focus of the second session of the discussion group was another Framework, which centred on authority structures within the classroom (see

Discussion Group 3: Mathematical Discourse that Breaks Barriers and Creates Spaces for Marginalized Students (continued)

Herbel-Eisenmann & Wagner, 2010; Wagner & Herbel-Eisenmann, 2014). This Framework was used as an analytical tool to revisit the same video footage of the first day. As the participants viewed a section of the video record they explored the classroom discourse for aspects of personal authority, discourse as authority, discursive inevitability, personal latitude and any indicators of authority structures or other authority structures.

The session concluded with a rich discussion which examined the possible purposes the frameworks might serve individually and what they might accomplish together that they do not accomplish individually to support marginalised students to access space in the mathematical discourse.

References

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Discussion Group 4: Negative Numbers: Bridging Contexts and Symbols

Submitted by Nicole Wessman-Enzinger (Illinois State University) and Laura Bofferding (Purdue University)

The discussion group, Negative Numbers: Bridging Contexts and Symbols, was co-organized by Laura Bofferding (Purdue University), Nicole Wessman-Enzinger (Illinois State University), Aurora Gallardo (Cinvestav), Graciela Salinas (Cinvestav), and Irit Peled (Haifa University). This discussion group emerged in response to a working group on negative numbers at PME-NA 35 (Lamb et al., 2013) to extend the scholarly discussion with an international audience. Across the two days of sessions there were about 21 participants from a

Discussion Group 4: Negative Numbers: Bridging Contexts and Symbols (continued)

variety of countries: Canada, Finland, Germany, Israel, Italy, Mexico, Taiwan, and the United States.

Session 1: Literature Review of PME and PME-NA Proceedings

To kick off the first meeting, after group introductions, Laura Bofferding and Nicole Wessman-Enzinger jointly prepared and presented a comprehensive literature review of negative numbers based on past PME and PME-NA proceedings. Discussion centered on the following themes present within the PME and PME-NA proceedings: participant ages, theoretical use, integer concepts and the meaning of the minus sign, addition and subtraction, multiplication and division, and historical highlights. One of the main points of the literature review is that there is substantial research on student thinking about negative numbers in the PME and PME-NA proceedings over the past 38 years; however, integer research needs to make better connections within this body of work. For example, there is a need for investigations that connect research on addition and subtraction to order or the meaning of the minus sign or multiplication and division. Keeping with the title, "Building bridges," we discussed the possibilities of building connections between content areas in future research.

The discussion and lively debates from the participants in this session were mostly focused around the following two questions:

- What does it mean to understand negative numbers?
- What is a negative number?

Each of the participants wrote a response to what they think it means to "understand negative numbers." These responses were compiled and placed on an online forum for participants. Some of the participants highlighted the complex use of the minus sign, which is also present in the literature. Drawing upon the PME literature, the use of the minus sign can be viewed as: binary, unary, and symmetric.

Table 1: Meaning of the Minus Sign

Binary	The minus sign is used to indicate subtraction between a minuend and subtrahend.
Unary	The minus sign establishes a formal negative number, relative or directed number, and isolated number or result/solution.
Symmetric	The minus sign indicates an opposite or an action to make opposite.

Further, the question, "Does the development of the signed number concept depend on the model used? In what ways?" was discussed and served as a transition for the presentations in the second session.

Session 2: Modelling Perspectives & the Meaning of Negative Numbers

Irit Peled started the second session with a presentation, "Constructing Models for Teaching Signed Numbers." In this presentation she highlighted mathematical models, didactical models, and contextual/real-life situations for the integers (Peled & Carraher, 2008). She illustrated a need for future research to address

Discussion Group 4: Negative Numbers: Bridging Contexts and Symbols (continued)

the "grey area" between these models. She challenged participants to think about what it means to reason about negative numbers within these different models.

Aurora Gallardo and Graciela Salinas gave a presentation, "Negative Numbers vs. Subtraction." This presentation served as an interesting response to the prior day's debates on the meaning of the minus sign and the meaning of negative numbers. The presentation took the participants through much of Gallardo's consistent work within PME and the field, highlighting different contexts of the negative numbers: historical contexts, geometrical contexts, physical contexts, and chemical contexts. In this presentation, significant discussion revolved around Gallardo's framework for understanding the meaning of negative numbers (Gallardo, 2002). We discussed the framework for negative number acceptance: subtractive number, relative number, signed number, isolated number, and formal negative number. The presentation concluded with some discussion of their next directions of research, which includes investigating understanding of integers within kinemathematics (Matais & Gallardo, 2012) and chemical contexts.

Figure 1. Participants that discussed the next steps for the discussion group at the end of the second session.

Discussion Group 4: Negative Numbers: Bridging Contexts and Symbols (continued)

Next Directions

At the conclusion of the second session, some participants stayed to discuss the next directions of the discussion group (see Figure 1). Two different ideas emerged from this conversation. The first idea is to hold a monthly reading and discussion group. Different seminal pieces will be selected and shared with participants throughout the year. Discussion questions for each of these pieces will be posted in the online forum, where participants can respond to the questions. The second idea is to share commonly-used curriculum materials and standards for negative numbers to initiate an international comparison of these materials. It was decided that the conference co-chairs would contact the participants in the early fall about each of these areas of investigation. If anyone was not able to participate in these sessions but is interested in participating in the reading group or receiving email updates please contact Laura Bofferding (lbofferding@purdue.edu) or Nicole Wessman-Enzinger (nmenzinger@gmail.com).

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Discussion Group 5: Numeracy across the Curriculum[1]

Submitted by Merrilyn Goos (The University of Queensland), Helen Forgasz (Monash University), Vince Geiger (Australian Catholic University)

The aim of this Discussion Group was to explore international perspectives on embedding numeracy across the school curriculum, a new field of study in which there has been little research to date. Our purpose was to initiate discussion on this theme with a view to instigating collaborations and, therefore, provide the basis for a proposal for a Working Session at PME39.

The first 90 minute session was attended by 13 participants from nine countries. We introduced this session with a synopsis of our theoretical model and current research. Small groups were formed to discuss theoretical perspectives that underpin different conceptualisations of numeracy and how research on numeracy draws on (or differs from) research on workplace learning, mathematical modelling and critical mathematics. Participants were also asked if "numeracy across the curriculum" was an issue relevant to their own educational contexts and to consider how mathematics education researchers could work with teachers to assist them to embed numeracy across the curriculum. The small groups reported back to the whole group the responses to the issues that they had discussed.

Numeracy appears to be a concern in all of the educational contexts represented at the Discussion Group; however, there were diverse interpretations of the meaning of numeracy. While there seems to be recognition that numeracy is cross-curricular in most of these educational contexts, the implementation of "across the curriculum" approaches is limited. Other concerns included the impact of international testing on classroom practices, the importance of pre-service education to challenge existing notions of numeracy and the need to support professional development for teachers.

Nine participants from six countries attended the second 90 minute session. We summarised the themes that emerged from the first session and posed critical questions for further discussion. New groups were created, each centred on either a theoretical perspective or approach to researching with teachers, to formulate questions to guide future research. While the issue of numeracy is relevant across educational contexts represented at the Discussion Group, a major issue is the lack of a shared language and a common definition of numeracy. Also of concern was the lack of impact that qualitative research appears to have with policymakers; thereby suggesting a need to investigate alternative forms of assessment for numeracy.

Most participants indicated interest in continuing discussions by providing their contact details at the end of the second session and two participants indicated an interest in contributing to a forthcoming issue of ZDM focussing on numeracy that is being edited by the Discussion Group coordinators.

1 We gratefully acknowledge the contribution of Anne Bennison to facilitating the Discussion Group and preparing this report.

Discussion Group 6: Observing Teachers Observing Mathematics Teaching: Researching the Unobservable

Submitted by David A. Reid (Universität Bremen, Germany), Richard Barwell (University of Ottawa, Canada), Lisa Lunney Borden (St. Francis Xavier University, Canada), Dominic Manuel (McGill University, Canada) Elaine Simmt (University of Alberta, Canada), Christine Suurtamm (University of Ottawa, Canada)

The goal of the discussion group was to address two interrelated methodological questions:

- How can we research the unobservable (e.g., reasoning, beliefs, etc.)?
- How can our research acknowledge and make use of the fact that "everything said is said by an observer" (Maturana, 1987)?

Participants in the discussion group offered examples from their own experience of specific research studies where these questions mattered and how they are/were addressed.

We then turned to examples from the Observing Teachers study to provoke deeper discussion of the key questions. The Observing Teachers study seeks to explore how middle school mathematics pedagogy differs across regions of Canada. "Pedagogy" is used to refer to the implicit cultural practices of teachers, including cultural beliefs about how children learn and how teachers should teach, that guide teaching practice. Because pedagogy is implicit, it is not directly observable, and so the methodology of the research programme had to address the first key question: How can we research the unobservable? The research team chose to confront this challenge by making use of the fact that "everything said is said by an observer". Rather than attempting to observe and analyse teachers' practice in the hopes of revealing their pedagogy, which would say as much about the researchers as observers as anything, the researchers instead observe and analyse teachers' observations of their own teaching and others' teaching. They recognise that their observations of the teachers' observations are also observations, and so they compare analyses within the research team in order to observe themselves as researchers, as they observe the teachers' observations.

Examples of two analyses from the Observing Teachers study were shared (see Manuel, Savard, & Reid, 2014, and Reid, Savard, Manuel & Lin, 2015). The participants then engaged in a comparative analysis of two short pieces of data from the study. The second day began with reports of the observations of the participants, which served to illustrate well the observer dependence of data analysis.

The second session closed with an extensive and vigorous discussion of the guiding questions.

The two sessions were attended by over twenty participants with considerable overlap in the two sessions.

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Discussion Group 6: Observing Teachers Observing Mathematics Teaching: Researching the Unobservable (continued)

Tobin, J., Wu, D., & Davidson, D. (1989). *Preschool in three cultures: Japan, China, and the United States*. New Haven:Yale University Press.

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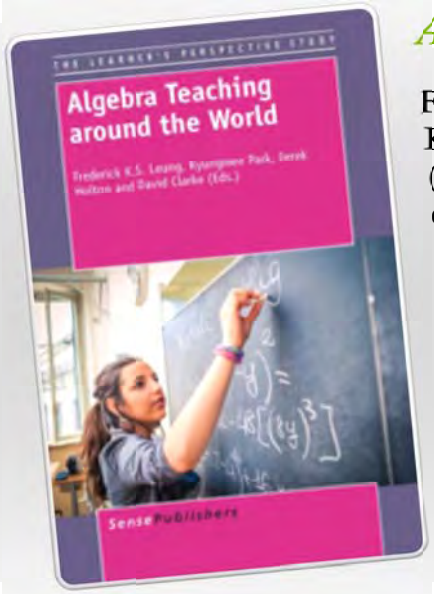
Book Announcement



Algebra Teaching around the World

Frederick Koon Shing Leung (The University of Hong Kong, Hong Kong), Kyungmee Park (Hongik University, Korea), Derek Holton (University of Melbourne, Australia) & David Clarke (University of Melbourne, Australia) (Eds.) 2014

Utilizing the LPS dataset, this book documents eighth grade algebra teaching across a variety of countries that differ geographically and culturally. Different issues in algebra teaching are reported, and different theories are used to characterize algebra lessons or to compare algebra teaching in different countries. Many commonalities in algebra teaching around the world are identified, but there are also striking and deep-rooted differences.

ISBN Paperback: 9789462097056
ISBN Hardcover: 9789462097063
ISBN E-Book: 9789462097070
https://www.sensepublishers.com/catalogs/bookseries/the-learneras-perspective-study/algebra-teaching-around-the-world/

Discussion Group 7: Preparing and Supporting Mathematics Teacher Educators: Opportunities and Challenges

Submitted by Rachael M. Welder

Discussion Group #7 was organized by Rachael M. Welder, Hunter College of the City University of New York (USA) and Amanda Jansen, University of Delaware (USA). Andrea McCloskey, Penn State University (USA) also contributed to the planning of the group, but was unable to attend the conference.

The goals of our discussion group were to: (a) explore challenges faced by Mathematics Teacher Educators (MTEs) in their work with prospective elementary teachers (ePTs) and (b) consider opportunities to address these challenges. Our interest in this topic was driven by the fact that most instructors of mathematics courses for ePTs in the USA do not themselves have elementary/primary school teaching experience (Masingila, Olanoff, & Kwaka, 2012). The attendees of our two group meetings included doctoral students and faculty who are MTEs; many teach courses for and/or conduct research surrounding the development of ePTs and MTEs. The following countries were represented in our group: Australia, Canada, France, Germany, Israel, Malawi, and the USA.

The first session (7/16/14) opened with a short introduction providing the rationale for the group and the goals of both the group organizers and the attendees. Rachael Welder presented findings from her collaborative research with Andrea McCloskey exploring the educational and teaching experiences of early-career MTEs and the challenges they face in preparing ePTs. The participants reflected on this work and engaged in subgroup discussions of the dilemmas they perceive as they work to become or prepare MTEs. Concerns that were raised ranged from building trust between ePTs and MTEs who lack teaching experience to considering the balance between teaching and scholarship when adjusting to new roles as MTEs.

Throughout our discussions, the participants shared information regarding the contexts surrounding elementary teacher preparation in their countries—as this varied across nations, so did the work of MTEs. Out of these discussions arose a valuable outcome: an expanded view of the similarities and differences occurring in the preparation of elementary teachers and MTEs spanning five continents. For instance, our participant from Malawi shared an example where new MTEs without prior teaching experience will teach in primary school settings before conducting work as MTEs. Additionally, our participant from France shared a model where early MTEs are charged with constructing their own professional development experiences, some of which include observing or co-teaching with other MTEs, working in local primary schools, or attending conferences.

The second session (7/18/14) began with Rachael Welder sharing additional results from her work with Andrea McCloskey, highlighting professional learning opportunities reported to contribute to the work of early-career MTEs, in

Discussion Group 7: Preparing and Supporting Mathematics Teacher Educators: Opportunities and Challenges (continued)

lieu of elementary teaching experience. This was following by a presentation by Amanda Jansen, in which she shared her university's model for mentoring doctoral students (future MTEs) as they begin teaching courses for ePTs. These ideas served as a springboard for the participants to start conceptualizing strategies for supporting MTEs within the context of their own countries.

The second group meeting continued to focus on identifying various dilemmas the attendees were facing in their own work and opportunities to address them. Amanda Jansen introduced a proposal to address the challenge of balancing teaching and scholarship: integrating teaching responsibilities with conducting research on teacher education and teachers' learning. It is part of the culture in Amanda's workplace to integrate research and teaching. However, new challenges were also explored as a consequence of considering this opportunity, such as potentially diverging from one's original research area to do so.

Participants reflected on a collective challenge to identify specific learning goals for the ePTs with whom they work. An overarching concern was how they, as current and future MTEs, decide upon the specific content and instructional methods to teach in their classes and how to know if they are making the best choices in terms of what their ePTs need to learn. This led to an interesting exchange of ideas about the ways in which goals for teacher learning are being and might be defined, within and across nations, and the socio-political context of establishing such goals for teachers' learning.

The participants who shared contact information with the group organizers will be contacted during the fall of 2014 to discuss potential research collaborations and the continuation of discussions surrounding the group's goals at PME 39 and/or PME-NA 36.

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Masingila, J., Olanoff, D., & Kwaka, D. (2012). Who teaches mathematics content courses for prospective elementary teachers in the United States? Results of a national survey. *Journal of Mathematics Teacher Education, 15*(5), 347-358.

Discussion Group 8: Researching Thinking Classrooms

Submitted by Gaye Williams (Deakin University, Australia) and Peter Liljedahl (Simon Fraser University, Canada)

These organisers began their conversations about '*Thinking Classrooms*' in Morelia, Mexico in 2008 and organised PME37 DG5 *Building Thinking Classrooms* as a result. *Researching Thinking Classrooms* is a sequel to this previous DG. It was organised in response to participant interest in exploring research questions arising from the *Building Thinking Classrooms* DG.

Research designs previously employed to study Thinking Classrooms from various theoretical perspectives include cognitive, social, affective, emotional, psychological, and volitional perspectives on student learning, and teachers' practices and beliefs. Research designs employed have included: self-reports of affective experiences (Liljedahl, 2013), video analysis in a 'reform classroom' (Cobb, Yackel, & Wood, 2011), video of own classroom practice (Lampert, 2001), video-stimulated student interviews (Williams, 2014), and study of the "entanglement of subject and object, mind and world" (sensuous cognition, Radford, 2014, p. 352) which employs video as an analysis tool. In addition, networking of theoretical frameworks has been a productive way to find out more about student and teacher activity in 'thinking classrooms' (Hershkowitz, Tabach, Rasmussen, & Dreyfus, 2014). Teacher guidance of student thinking has also been studied through video data (Funahashi & Hino, 2014).

The two DG sessions were focused in the following ways:

Session 1 (35-45 participants): Evidence-based stimulation of discussion through focus on a Wordle <http://www.wordle.net> that captured frequently used words in the participant responses to the *Building Thinking Classrooms* (DG5 PME37). Groups then formulated their own definitions of *Thinking Classrooms* and generated more researchable questions about such classrooms. A Gallery Walk followed in which participants considered researchable questions generated by other groups and selected the three questions they would most like to explore.

Day 2 Included 35-45 participants, many from Session 1 and some new participants. Session 1 activity was reviewed in a Wordle representing the frequency of term usage in definitions of *Thinking Classroom* produced in Session 1 (see Figure 1). Differences between this Wordle and the one displayed in Session 1 (to captured terms used in discussing *Thinking Classrooms*) were discussed.

Categories of research questions formulated in Session 1 were then presented. An example question from each category is included herein: "What type of content (e.g., tasks etc.) promote a *Thinking Classroom*?" "How are mathematical structures introduced into discourse and does it matter whether students or the teacher bring them in?" "What are the tools (including competencies) that enable teachers to transition to a *Thinking Classroom*?" "How do teachers initiate and sustain *Thinking Classrooms*?" "How does thinking stop in a classroom and why does it stop?" "What techniques give the most

Discussion Group 8: Researching Thinking Classrooms (continued)

engagement?" "Given a *Thinking Classroom*, what are the outcomes?" Participants who wanted to focus on the same research question then formed groups and began to develop a research design that would help investigate their question. Various methodologies were considered and ideas were shared. At least one group decided to continue to research their question throughout the subsequent year. The interest stimulated through these questions suggests a Working Group on *Designing Research to Explore Thinking Classrooms* is warranted at PME39. The DG organisers intend to submit this WG.

Cobb, P., Yackel, E., & Wood, T. (2011). Young children's emotional acts while engaged in mathematical problem solving. In A. Sfard, K. Gravemeijer & E. Yackel (Eds.), *A Journey in Mathematics Education Research* (Vol. 48 pp. 41-71). Netherlands: Springer.

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Liljedahl, P. (2013). Illumination: an affective experience? *ZDM, 45*(2), 253-265. doi: 10.1007/s11858-012-0473-3.

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Radford, L. (2014). Towards an embodied, cultural, and material conception of mathematics cognition. *ZDM, 46*(3), 349-361. doi: 10.1007/s11858-014-0591-1.

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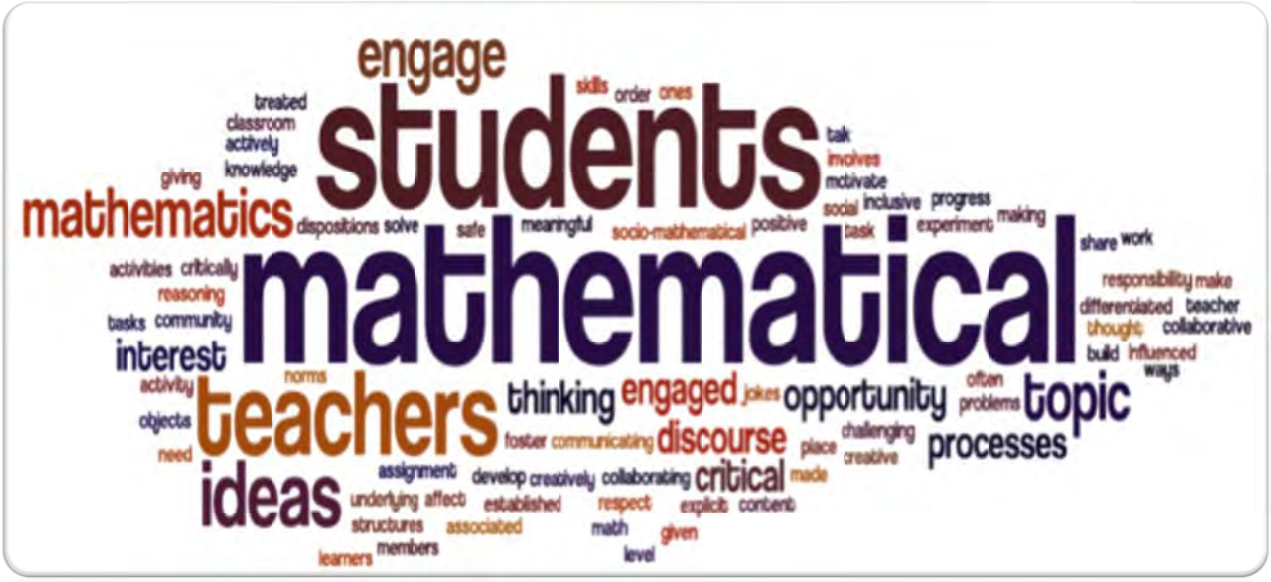

Figure 1. Wordle of terms used by participants in defining Thinking Classrooms

Discussion Group 12: What is Quality Mathematics Teaching-Research?

Submitted by Bronislaw Czarnocha and Hannes Stoppel

There were two meetings of the DG 12. During the first meeting there were 8 participants, primarily PhD candidates in Mathematics Education. The discussion started by reading excerpts from reading materials to come at the adequate idea about the quality of the presented there teaching-research aims and methodologies. It centred on the differences between quantitative and qualitative approaches to classroom investigations. Raised questions were:

1. When each of the methodologies is appropriate?
2. Can one create mixed approaches?
3. What is the aim of teaching experiments?
4. How should the teaching-research reports be written?
5. What exactly is the difference between research and teaching-research?

The discussion revealed that one of the most pertinent issues was the design and assessment of a teaching experiment. There were significant differences of opinion as to what is teaching experiment; some of these differences were motivated by the differences in experiences between PhD candidates and rank and file teachers (decisive minority amongst participants). These differences suggested that the second meeting of the DG 12 should focused on the detailed discussion of several teaching experiments, preferably one designed by a teacher and one designed by a researcher.

Hannes discussed the design and conduct of his multi-cyclical teaching experiment in Freshman calculus. His description revealed large dose of the intuitive teaching craft knowledge governing the sequence of refinements, which was applied on the "just-in-time" basis. As compared with teaching experiments designed and conducted by researchers, his, teacher's design was not fully conceived apriori as the researcher's design. At the same time, the design and conduct was successful in terms of finding the effective "real world" based pedagogy in 3 cycles of the TE.

The discussions during both meetings of the DG 12 suggested that the future TR discussion groups at PME's should be focused on the "nuts and bolts" of designing, conducting and assessing classroom teaching experiments.

Working Session 1: Teacher Noticing: A Hidden Skill of Teaching

Submitted by Molly H. Fisher, Edna O. Schack, Jennifer Wilhelm, Jonathan Thomas, Cindy Jong, and Rebecca McNall-Krall

This working group was divided into three sub-groups to continue the work of PME-NA 2013 working group of the same name. The sub-groups had three main outcomes: A monograph on teacher noticing, a conference on teacher noticing, and a strong internet presence of the topic of teacher noticing.

The group formed to strengthen the internet presence discussed strategies such as a website on teacher noticing, social media groups for discussion, blogs or wikis to post information, and email listservs. At this point, the email listserv has been established that combines the 2013 working group attendees with the 2014 working group attendees and communication has begun with those groups. Additionally, a facebook page has been created to bolster teacher noticing discussions and this will begin to be used and advertised more as the other two sub-groups have more information to share regarding the monograph and the conference.

The sub-group that discussed a teacher noticing conference decided to apply for funding to support a conference centered around teacher noticing research. They plan to apply for an AERA conference grant to fund the conference and the goal is to hold the conference in the days prior to the next PME-NA conference, much like a pre-session to the main conference. The idea would be that attendees could combine travel efforts and attend both conferences in one visit.

The other sub-group formed is a group focusing on discussions to extend mathematical teacher noticing to science, ultimately leading to a monograph. The facilitators of the working session had the good fortune to meet with Jinfa Cai, co-editor, with James Middleton, of the Springer series, *Research in Mathematics Education*. During this meeting we discussed with Dr. Cai the purpose of the monograph as defined by the Working Group participants. From this we developed an outline to propose for the monograph. The proposed monograph will build upon the work of Sherin, Jacobs, and Philipp's *Mathematics Teacher Noticing: Seeing Through Teachers' Eyes* (2011).

At the suggestion of Dr. Cai, we will strive to include both seasoned and promising researchers/authors for the chapters of the monograph. Additionally, the chapter authors will include international mathematics and science education researchers. The sections of the book will include a commentary on the chapters within that section. We have sent an initial invitation to some of the top researchers in this field, receiving a number of positive responses for chapter writing.

Our next step will be to send a call for chapter proposals from the participants in the working sessions at both the 2013 and 2014 conferences. Following this, a broader call for chapters will be released. We expect to submit the monograph proposal to the Springer series, *Research in Mathematics Education* by early summer 2015.

Working Session 1: Teaching Noticing: A Hidden Skill of Teaching

The three sub-groups forms will work synergistically as the authors in the monograph will be invited to speak at the conference and presenters from the conference (that weren't already invited to write for the monograph) could be invited to submit for the monograph. All of these efforts will be advertised using social media outlets, email listservs, and websites that will be administered by the technology sub-group.

Working Session 2: Developing Preservice Elementary Teachers' Mathematical Knowledge for Teaching

This working session was organized by Lynn C. Hart, Georgia State University, USA, and Susan Oesterle, Douglas College, Canada. The purpose of the working session in Vancouver was to finish the work started in two previous meetings of the working group in Chicago and Kalamazoo in which members of the group identified and examined significant cognitive and non-cognitive factors influencing the mathematics content preparation of preservice teachers from multiple, diverse perspectives, including those of mathematicians and mathematics educators.

Identifying factors that impact the development of appropriate and adequate mathematical content knowledge in preservice elementary teachers is a complex issue in mathematics education research. In the first session, each subgroup shared their work, as follows.

Mathematical Tasks: This subgroup's work is grounded in a task development cycle of *design, enact, reflect*, and *modify/re-design* phases. The group shared their research on task development using tasks originally designed for children.

Children's Thinking: Based upon earlier research from Cognitively Guided Instruction and more current studies focused on interpreting children's mathematical thinking, this subgroup shared how artefacts of children's thinking can promote mathematical understanding with preservice elementary teachers.

Mathematical Habits of Mind: This subgroup unpacked the notion of mathematical habits of mind. Building from the literature, they provided example tasks for developing mathematical habits of mind and discussed how these tasks can be used to both raise awareness of and foster ways of thinking in preservice elementary teachers.

Affect: Another influential factor in the preparation of preservice teachers is the affect (e.g., attitudes, beliefs, emotions) they bring to and acquire during university mathematics

Working Session 2: Develop Preservice Elementary Teachers' Mathematical Knowledge for Teaching

content courses. This group reviewed and summarized the state of research in this area to reveal implications for preservice elementary teachers' learning of mathematics content.

Three International Perspectives: This subgroup provided examples from three countries on mathematics content courses for preservice teachers.

On the second day newcomers and prior working group members were invited to respond, first in plenary and then in themed subgroups. The last hour was dedicated to discussing compilation of the final papers into an edited book to support mathematics instructors of preservice elementary teachers.

Check your PME contribution before submission!

Submitted by Stefan Ufer for the Vice-President Portfolio Group (Csaba Csikos, Masakazu Okazaki, Wim van Dooren)

To give PME authors some guidance on the details of preparing a PME contribution for submission, the Vice-President Portfolio Group has prepared a *Submission Check List*. This provides a concise list for a "last-minute-check" of things like the length of submission, the formatting, the need for a blinded version for review, details of references, copyright, and so on. The lists are on the IGPME web site (links see below) and it is also planned to include them in the conference announcements and in the Conftool system for future conferences. We hope that the lists will be helpful for PME authors (since all the formal details can be found in one place without searching in long documents or web sites) and will also reduce the workload of the conference organizers.

So, please take some minutes and Check your Contribution with the new lists!
For Research Reports: http://www.igpme.org/index.php/annual-conference/session-types/research-report?id=121

For Short Oral or Poster Presentations: http://www.igpme.org/index.php/annual-conference/session-types/short-oral?id=122

For Poster Presentations: http://www.igpme.org/index.php/annual-conference/session-types/poster-presentation?id=122

PME39, 2015

Mathematics Education: Climbing Mountains, Building Bridges

The local organising committee is pleased to invite you to attend the *39th Meeting of the International Group for the Psychology of Mathematics Education* (PME39) to be held in Hobart, Tasmania, Australia from July 13 to July 18, 2015.

Mathematics Education: Climbing Mountains, Building Bridges has been chosen as the theme of the conference. This theme provides opportunities to highlight and examine research that considers the challenges, obstacles, links, and connections in mathematics education, with a view to progressing what is known and valuable in the area. The theme *Mathematics Education: Climbing Mountains, Building Bridges* reflects two of the notable features of the landscape of Hobart: Mount Wellington (or kunanyi, to give it its Aboriginal name), which provides a

Figure 1. Aerial view of Hobart City, Tourism Tasmania and Alastair Brett

PME39, 2015: Mathematics Education: Climbing Mountains, Building Bridges (continued)

striking backdrop to the city, and the Tasman Bridge, which crosses the wide Derwent River estuary.

Four plenary speakers will address aspects of the theme: Lyn English (Australia) who has expertise in data modelling and statistical reasoning particularly in early childhood; Johan Lithner (Sweden) who will bring a mathematicians perspective to the problems of teaching mathematics meaningfully; Oh Nam Kwon (Korea) who specialises in the teaching and learning of senior mathematics; and Marty Simon (USA) whose research focuses on the development of conceptual understanding in mathematics and how mathematics teachers learn to teach in ways that foster this. A plenary panel will also engage with the theme.

We are proud to be hosting the conference in Hobart, the capital city of the Australian island state of Tasmania (home to many animals and plants found nowhere else in the world). Hobart is small city with a population of around 200 000. Located at 42°S, Hobart is one of the most beautiful cities in the world, situated on the wide Derwent River, and with the 1271m high kunanyi/Mount Wellington as a dramatic backdrop. It has a cool but not cold winter climate with average daily maximum July temperatures of around 12°C. Scenic in its own right, Hobart is also a springboard to many of Tasmania's world-renowned natural and wilderness areas. Another of its famous attractions is the privately owned Museum of Old and New Art (MONA), and there are numerous galleries, parks, and an excellent restaurant scene.

Figure 2. *Tasmanian devil (Sarcophilus harrisii) - Bonorong Wildlife Park, Tourism Tasmania and Rob Burnett*

The main campus of the University of Tasmania is located in Hobart and as Australia's fourth oldest university will be celebrating its 125th birthday in 2015.

The venue for the conference is Hobart College, one of the Tasmanian government senior secondary schools (Years 11 and 12), and is situated in the bush on Mt Nelson 6km from Hobart's CBD. It offers a variety of conference spaces and has a commanding view of Mt Wellington. Transport to and from the CBD will be organised for participants. There is a range of accommodation options in the CBD all within easy walking distance of the waterfront with its many restaurants.

For more information about PME39, please visit the website at www.pme39.com

PME39, 2015: Mathematics Education: Climbing Mountains, Building Bridges (continued)

PME39 13-18 July 2015 Hobart, Australia

Important Dates:

Research Reports (RR)	January 15, 2015
Short Oral (SO)	March 6, 2015
Poster Presentation (PP)	March 6, 2015

Figure 3. Tasmanian seafood: Tourism Tasmania & Peter Aitchison

Colloquium – A new presentation format, piloted at PME 39!

Submitted by Wim Van Dooren, PME IC

Besides the exchange of research findings, PME has the goal to stimulate genuine collaboration and incremental understanding. For that reason, PME will adopt a new presentation format in addition to the individual presentations in research reports, short orals, and posters.

Starting at PME 39 in Hobart, it will be possible to submit a group activity called "colloquium". A colloquium consists of 3 related individual research reports, which will be scheduled together in one time slot in the programme, and which are followed by a discussion initiated by a discussant who has prepared his/her contribution beforehand.

Several other organizations (e.g. EARLI, AERA, BERA) have used this presentation format at their conference for a very long time, and with great success. There are several possible advantages of this new format. It enhances collaboration among researchers, and may stimulate the inclusion of new researchers in a particular domain. For conference participants, the program becomes more structured and coherent, and discussion during sessions can be enhanced.

If you can think of colleagues who could submit research reports that in some way are related to each other (e.g. they depart from related or contrasting theoretical stances, use identical instruments or methods or investigate the same question using different methods, focus on closely related research questions, etcetera), we would like to invite you to submit these research reports in the form of a colloquium for the next PME conference.

A colloquium proposal consists of a set of (exactly) three research reports, to be presented by members from at least two different countries, and includes in addition a one page summary by an organizer, indicating a specific pre-determined focus that is present in each research report.

The deadline for proposals of colloquia is the same as that of research reports. The three separate research reports that comprise the colloquium have to be submitted via the normal procedure, and the organizer additionally submits a one page summary of the theme and the goals of the Colloquium, including mentioning the person who agreed to be discussant. The research reports included in a colloquium proposal are reviewed in the usual way, and if the colloquium is not accepted as such, the individual research reports can still be accepted in the usual way. Thus, there is no risk involved in trying to submit in this new format as compared to submitting an individual research report.

We hope to see many positive reactions, and many interesting colloquia presented at PME in Hobart.