TSG 30 Agenda

TSG 30: **In-Service Mathematical Teacher Education and Mathematical Teacher Professional Development at Primary Level**

Class: B

Session 1 (19:30-21:00 Beijing time, July 13th) Moderator: Leonor Santos

1. Time: 19:32─19:54

   Title of the Paper: CHINESE TEACHERS' LEARNING AS TRANSFORMATION OF DIDACTIC PRAXEOLOGIES IN A CROSS-CULTURAL TEACHER EXCHANGE PROGRAMME

   Author(s): **Xingfeng Huang** & Yunji Zhang

   Institution(s): Shanghai Normal University, China

   Abstract: *The UK-China Mathematics Teacher Exchange Programme (MTE) funded by the Department for Education in the UK in 2014, which aims at improving teachers' professional competence in and for practice. In this study, we have researched 2 primary school teachers who participated in the Programme to teach mathematics in Britain. Obviously, there is a clear contradiction between Chinese teachers' teaching and students' learning according to various cultures and different educational contexts. How do these two teachers prepare for and polish their mathematics lesson? How do they try their best to let students understand the true meaning of mathematics? How do they turn those challenges into a learning opportunity for their professional development? This study is of great significance in finding out the answers of these questions above.*

2. Time: 19:54─20:16

   Title of the Paper: DEVELOPING TEACHERS' CLASSROOM ACTIONS AND PEDAGOGICAL KNOWLEDGE THROUGH THE FACILITATION OF TEACHING A CHALLENGING TASK

   Author(s): **Sharyn Livy**[1], Janette Bobis[2], Ann Downton[1], Sally Hughes[1], Maggie Feng[2], Melody McCormick[1], James Russo[1] & Peter Sullivan[1]

   Institution(s): Monash University[1], University of Sydney[2], Australia

   Abstract: *Supporting teachers in the Early Years to extend their classroom actions and pedagogical knowledge is important for eliciting students' mathematical thinking. Qualitative data were collected from a Year 2 teacher participating in a larger project designed to explore the potential of mathematical sequences of connected, cumulative and challenging tasks. The lesson structure prompted the teacher to consider changes to her pedagogical approaches. In launching the lesson without explaining the process for finding the answer, she supported students in the Summarise Phase by deliberately selecting and sequencing three students to share their responses to the task with the whole class. Her planning informed important pedagogical and mathematical decisions during the lesson that not only acted as a purposeful professional learning experience but*

also transformed her classroom actions for advancing student thinking from the concrete to abstract.

3. Time: 20:16─20:38

   Title of the Paper: CHANGES IN MATHEMATICAL KNOWLEDGE FOR TEACHING AND BELIEF ON PRACTICES THROUGH PROFESSIONAL DEVELOPMENT BASED ON REASONING-MODELING APPROACH

   Author(s): **Kyong Mi Choi**[1], Jihyun Hwang[2], Jessica Jensen[3], Dae Hong[2] & Wesley Cox[1]

   Institution(s): University of Virginia[1], University of Iowa[2], California Polytechnic University[3], USA

   Abstract: *Teacher's understanding of content knowledge and pedagogical practices, and their instructional practices are very important for student learning. In this study, as a part of a larger study, participating teachers attended a professional development for two years that promote teachers' implementation of mathematical reasoning and modeling in their instructions. Teachers' mathematical knowledge for teaching (MKT) and belief on instructions (reasoning-based or rule-based) have shown changes. A general trend is that MKT scores increased, and rule-based belief is decreased. However, a relation between MKT and belief on instruction was not detected. The significant decrease of teachers' belief on rule-based instruction is particularly important as it is related to teachers' instructional practices toward more reasoning-based teaching styles.*

4. Time: 20:38─21:00

   Title of the Paper: ARE ELEMENTARY IN-SERVICE TEACHERS CONFIDENT AND WELL PREPARED IN MATHEMATICS THEY TEACH? – THE CASE OF FRACTION DIVISION

   Author(s): **Yeping Li**[1], Huirong Zhang[2], & Naiqing Song[2]

   Institution(s): Texas A&M University[1], USA; Southwest University[2], China

   Abstract: *We focused on both in-service Chinese teachers' (ITs) confidence about their knowledge and the extent of their knowledge on the topic of fraction division. The results revealed how these ITs' confidence may or may not be supported by their knowledge for teaching fraction division, an important topic they need to teach as part of the curriculum standards in China. The results also illustrated the importance of specifying knowledge components in mathematics instruction in order to help build and support ITs' confidence for classroom instruction.*

Session 2 (21:30-23:00 Beijing time, July 16th) Moderator: Munira Amirali

1. Time: 21:30─21:42

   Title of the Paper: MATHEMATICAL REASONING AND TEACHER EDUCATION

   Author(s): **Leonor Santos**, Ana Henriques, Joana Mata-Pereira, & Lurdes Serrazina

   Institution(s): Instituto de Educação, Universidade de Lisboa, Escola Superior de Educação, Instituto Politécnico de Lisboa, Portugal

Abstract: *The project REASON, aims to investigate ways to support primary and secondary prospective and practicing teachers' development of mathematical and didactical knowledge to promote students' mathematical reasoning. The project adopted a design-based methodology, informed by research on mathematical reasoning, to plan and conduct four teacher education experiments. Its development will give new elements to reflect about the adequacy and potentialities of these experiments on teachers' learning. At the Congress we will present some development and first results of the project.*

2. Time: 21:43─21:55

   Title of the Paper: IN-SERVICE TEACHER EDUCATION FOR PROMOTING MATHEMATICS REASONING IN PRIMARY SCHOOL

   Author(s): **Lurdes Serrazina**[1] & Joana Brocardo[2]

   Institution(s): Escola Superior de Educação, Instituto Politécnico de Lisboa[1], Escola Superior de Educação, Instituto Politécnico de Setúbal[2], UIDEF[1, 2], Instituto de Educação, Universidade de Lisboa[1, 2], Portugal

   Abstract: *This paper reports part of the research developed by the project REASON (Mathematical Reasoning and Teacher Education). The main objective of the project is to study the mathematical and didactical knowledge teachers need to carry out a practice that promotes students' mathematical reasoning and to study ways to foster its development in prospective and practicing teachers of primary, middle and secondary school. We present the in-service teacher education experiment for primary teachers (grades 1-6), namely its organization and the principles for designing learning tasks to identify and deepen the understanding of the mathematical and didactical knowledge that primary teachers need to develop to promote students' mathematical reasoning. We also present an example of training materials. At the Congress we will report results of the teaching experiment meanwhile carried out.*

3. Time: 21:56─22:08

   Title of the Paper: GROWING THROUGH INQUIRY: A STORY OF THREE PRIMARY TEACHERS INVESTIGATING THEIR PRACTICE

   Author(s): **Derek J. Sturgill**

   Institution(s): University of Wisconsin-Stout, U.S.A.

   Abstract: *Professional development plays a critical role in teacher growth. Unfortunately, not all professional development programs support such growth because of a disconnect between program goals and teachers' practice. Teacher inquiry, teachers engaged in research about their own teaching and students' learning establishes a firm connection between professional growth and practice. A summary is presented on three Grades 4–6 teachers of mathematics who teach in Midwestern United States and their enactment and outcomes of classroom inquiry projects. Project outcomes relate to these three teachers' pedagogy, knowledge of student learning, knowledge of inquiry, and future school plans.*

4. Time: 22:09─22:21

Title of the Paper: MATH TEACHERS COMPETENCE ASSESSMENT TO DEVELOP PERSONALIZED PROFESSIONAL LEARNING

Author(s): **Ilze France**, Dace Namsone, Liga Cakane, & Ilze Saleniece

Institution(s): University of Latvia, Letonia

Abstract: *The aim of the study was to examine competencies of mathematics teachers in the context of Latvia's curriculum reform in general education, with a particular focus on teachers' preparedness to develop student cognitive skills and ways to stimulate more appropriate and individualized teacher professional development. In total, the study involved 25 mathematics teachers from one selected municipality. Research methods included analysis of large-scale assessment data, lesson observations and analysis, teacher testing, and expert focus group discussion. As a result, researchers identified four groups of teachers, each requiring different professional development activities; and arrived at the conclusion that mathematics teachers require individualized professional development to ensure implementation of reform-relevant ideas into the school practice.*

5. Time: 22:22─22:34

   Title of the Paper: ASSESSING THE EFFICACY OF THE MATH FOR ALL PROFESSIONAL DEVELOPMENT PROGRAM FOR PRIMARY TEACHERS AND THEIR STUDENTS

   Author(s): **Babette Moeller**[1], Matt McLeod[1], Teresa Duncan, & Jason Schoeneberger[3], John Hitchcock[4] & Marvin Cohen[5]

   Institution(s): Education Development Center[1], Deacon Hill Research Associates[2], ICF[3], Abt Associates[4], Bank Street College of Education[5], USA

   Abstract: *Math for All (MFA) is an intensive professional development (PD) program for in-service teachers. It consists of five one-day workshops and classroom-based assignments, providing a total of 50 hours of PD. The program shows teams of general and special education teachers how to collaboratively plan and adapt math lessons to help all students achieve high-quality learning outcomes in mathematics, including students with disabilities. This paper reports on a randomized controlled trial (RCT) of MFA. The study involved 32 schools, 98 4th and 5th grade general and special education teachers, and approximately 1,500 4th and 5th grade students. The researchers found that MFA had statistically significant, positive effects on teachers' self-reports of their preparedness and comfort with teaching, and a school-level analysis found a moderate MFA effect on student achievement. Quasi-experimental analyses of a subgroup of teachers who agreed to be observed showed initial evidence of MFA impacts on their classroom practices.*

6. Time: 22:35─22:47

   Title of the Paper: DRAWING ON THE DIDACTICAL SUITABILITY CRITERIA TO ANALYSE A LESSON STUDY ENHANCING TEACHERS COMPETENCE OF DIDACTICAL REFLECTION

   Author(s): **Viviane Hummes**[1], Adriana Breda[1], Elvira García-Mora[1], Vicenç Font[1], Javier Díez-Palomar[1], & Maria José Seckel[2]

   Institution(s): University of Barcelona[1], Spain; Universidad Católica del Maule[2], Chile

Abstract: *This paper discusses the combination of two major instruments for professional mathematics teachers' development: the lesson study (LS) and the didactical suitability criteria (DSC). One of the main competences that teachers of mathematics must develop when they participate in teacher training programs is their ability to do didactical analysis. Teachers will must be able to review critically their lessons (planning, implementation, review and re-design) in order to cope with students' requirements and necessities. Drawing on a literature review, in this paper we argue that combining LS and DSC offers teachers the opportunity to draw on a consensual structured approach covering the main educational dimensions embedded within their classroom practice.*

7. Time: 22:48─23:00

   Title of the Paper: INSIGHTS ON SHANGHAI IN-SERVICE PRIMARY MATHEMATICS TEACHERS' ACQUISITION OF PEDAGOGICAL CONTENT KNOWLEDGE THROUGH TEACHING RESEARCH GROUP ACTIVITIES: A CASE STUDY

   Author(s): **Hong Yuan**

   Institution(s): The City University of New York, USA

   Abstract: *This study examined shanghai in-service primary mathematics teachers' acquisition of pedagogical content knowledge (PCK) through participating in Teaching Research Group (TRG) activities. It used the qualitative case study with a survey research approach with one teacher in one public primary school started as a small rural school in Shanghai. The study shows that Shanghai in-service primary mathematics teachers acquire and develop their PCK by creating supplementary teaching materials, studying students' thinking, and teaching mathematical thinking through active participation and communication with their colleagues, the school, district, and city teaching research coordinators during TRG activities; and writing reflection reports afterward. The study has implications for teachers' community of practice, in that teachers grow their PCK through sustained job-embedded and expert-assisted professional development. This growth, in turn, improves students' learning of mathematics.*

Session 3 (14:30-16:30 Beijing time, July 17th) Moderators: Xingfeng Huang & Masakazu Okazaki

1. Time: 14:30─14:44

   Title of the Paper: KYOZAIKENKYU AS WELL-FORMED STORY MAKING FOR DEVELOPING QUALITY MATHEMATICS LESSONS

   Author(s): **Masakazu Okazaki**, Keiko Kimura, & Keiko Watanabe

   Institution(s): Okayama University, Hiroshima-Shudo University, and Shiga University, Japan

   Abstract: *Many researchers and educationalists have suggested that a quality mathematics lesson in Japan can be achieved using kyozaikenkyu—the teacher's in-depth study of instructional materials for successful teaching. However, a framework for analyzing the quality of kyozaikenkyu has yet to be adequately clarified. The present study*

proposes a theoretical approach for examining the levels of kyozaikenkyu from a narrative coherence perspective. We undertook this study by means of a qualitative analysis of mathematics lessons conducted by three types of teacher. We conclude that there are four levels of kyozaikenkyu: (1) mathematical investigation of the problem situation; (2) mathematical investigation of the problem situation in terms of accessibility by students; (3) mathematical investigation of the problem situation in terms of understanding the processes that students can follow; and (4) mathematical investigation of the problem situation in terms of a coherent classroom narrative through teacher-student interactions.

2. Time: 14:45─14:59

   Title of the Paper: TEACHING AS PROFESSIONAL LEARNING: SMALL STEPS TOWARDS SUSTAINABLE MATHEMATICS TEACHER PROFESSIONAL DEVELOPMENT

   Author(s): **Ban Heng Choy** & Jaguthsing Dindyal

   Institution(s): National Institute of Education, Nanyang Technological University, Singapore

   Abstract: *Continual professional development for teachers is a key lever for honing mathematics teaching expertise. Although there have been efforts to focus on improving teachers' mathematical knowledge for teaching, empowering teacher change through collaboration, and using inquiry-based approaches to improve teaching, many challenges remain. In this paper, we present our ideas based on a needs analysis conducted in three Singapore primary schools, involving a total of 39 teachers. In response to the challenges identified, we propose a way of thinking about professional learning—teaching as professional learning—and argue for a focus on pedagogical reasoning as one of the crucial steps towards a more sustainable mathematics teacher professional development.*

3. Time: 15:00─15:14

   Title of the Paper: IMPROVEMENT OF A PRESCHOOL TEACHER'S REFLECTION ON PEDAGOGICAL CONTENT KNOWLEDGE DURING A PROFESSIONAL DEVELOPMENT PROGRAMME IN JAPAN

   Author(s): **Nagisa Nakawa** & Nanae Matsuo

   Institution(s): Kanto Gakuin University, Chiba University, Japan

   Abstract: *This paper will analyse and discuss how a Japanese preschool teacher with insufficient mathematical training improved and developed her reflection on her pedagogical content knowledge through a ten-month intervention programme in Japan. The authors utilised the three components of PCK (pedagogical content knowledge) to analyse the teacher's reflections. In addition, methodologically, the ALACT (Action, Looking back on the action, Awareness of essential aspects, Creating alternative methods of action, and Trial) model was applied during the programme. The authors compared the teacher's reflection at the very beginning and end of the programme to see what kinds of changes had occurred in the three elements of PCK, through interpretative phenomenological analysis. The results showed that the teacher's knowledge of content and teaching (KCT) and knowledge of content and curriculum (KCC) had greatly improved by the end of the programme.*

4. Time: 15:15─15:29

   Title of the Paper: TEACHERS VIEWS OF THE EFFECTS OF THE FOSTERING INQUIRY IN MATHEMATICS PROJECT

   Author(s): **Jill Cheeseman**

   Institution(s): Monash University, Australia

   Abstract: *A research-based professional development project Fostering Inquiry in Mathematics (FIiM) was conducted for one year in three schools in Australia with 24 teachers of children in the first two years of formal schooling. This paper reports teachers' views of the effects of the project on their practice. Teachers' responses to online survey questions indicated the effects of the project relate to building knowledge for teaching, experimenting with practice, using resources for lessons, and developing knowledge of children. Teachers quantified their views on their: pedagogical skills, knowledge, and enthusiasm for teaching mathematics with young children. Results showed significant changes in teachers' views about the curiosity children have about mathematics, teachers' confidence in teaching mathematics, and their commitment to teaching inquiry/problem solving with young children.*

5. Time: 15:30─15:44

   Title of the Paper: DEVELOPING TEACHERS' KNOWLEDGE OF FRACTIONS: A CASE FROM KARACHI, PAKISTAN

   Authors: **Munira Amirali**

   Institutions: Aga Khan University Institute for Educational Development, Karachi, Pakistan

   Abstract: *Almost all the countries including Pakistan try to promote mathematics education by emphasizing learning for conceptual understanding (National Curriculum for Mathematics, 2006). However, in Pakistan at the primary level, teachers struggle to teach basic math concepts they are being recruited as 'primary school teachers and not as subject specialist teachers. Nevertheless, in grades IV and V schools try to assign mathematics teaching to those whom they think can teach mathematics. This selection procedure implies that very often teachers teaching mathematics have themselves done very little mathematics after their schooling.*

6. Time: 15:45─15:59

   Title of the Paper: CONTINGENCIES AS MOMENTS OF COLLABORATION: A REPORT ON INVESTIGATING AND SUPPORTING MATHEMATICS TEACHERS' KNOWLEDGE

   Authors: **Shikha Takker** & K. Subramaniam

   Institutions: Homi Bhabha Centre for Science Education, TIFR, Mumbai, India

   Abstract: *In this paper, we argue that 'contingencies' arising in the context of teaching practice are significant moments in the teacher-teacher educator collaboration. Such moments require teacher educators to revisit their goals, and utilise these moments as*

'learning opportunities' for all participants. Developing on the construct of 'boundary crossing' used in Wenger's framework, this paper reports findings of the study where mathematics teachers' knowledge was investigated and supported in the context of practice. We argue that contingent moments (a) helped in identifying the mathematical challenges faced by teachers while teaching mathematics, and (b) created opportunities for challenging their existing knowledge and beliefs. Noticing and responding to such contingent situations has the potential to design responsive professional development experiences.

7. Time: 16:00─16:14

   Title of the Paper: RE-CONCEPTUALIZING PRIMARY MATHEMATICS IN-SERVICE TEACHER PROFESSIONAL DEVELOPMENT IN NIGERIAN CONTEXT

   Authors: **Lawan Abdulhamid**[1] & Balarabe Yushau[2]

   Institutions: University of the Witwatersrand, Johannesburg, South Africa[1]; Abubakar Tafawa Balewa University, Bauchi, Nigeria[2]

   Abstract: *This paper contributes to research on the design of mathematics teacher professional development (PD) that is responsive to the current realities in primary mathematics teaching landscape. Using a finding from the analysis of a group of 98 primary school teachers' content knowledge, we argue for a reconceptualisation of the current PDs in Nigeria. In this re-conceptualisation, we call for the need to disaggregate the levels at which in-service mathematics teacher professional development interventions could usefully start across lower (grade 1-3), middle (grade 4-6) and upper (grade 7-9) basic teachers, and the need for a longer period of PD, with interim assessments.*

8. Time: 16:15─16:29

   Title of the Paper: DEVELOPMENT OF CRITICAL LENSES AMONG TEACHERS IN LESSON STUDY

   Authors: **Tan Saw Fen**

   Institution: Wawasan Open University, Bayan Lepas, Malaysia

   Abstract: *This study aims to explore the development of teachers' critical lenses when they were conducting lesson study. Two lesson study groups comprised of 6 teachers and 3 teachers respectively conducted five lesson study cycles. The planning research lesson sessions and post-lesson discussions were observed and audio-recorded. The audios were transcribed verbatim and analysed to explore the teachers' development of critical lenses. Teachers from both lesson study groups developed student and curriculum developer lenses. However, group A teachers developed richer student lens if compared with the group B teachers. All the teachers did not adopt the researcher lens when they were conducting the lesson study cycles. The possible factors affecting the teachers' development of critical lenses could be the knowledgeable others, the preparation of detailed lesson plan and the difference of seniority and experience among the teachers.*

9. Time: 16:29─16:30

Wrap-up (Xingfeng Huang, Masakazu Okazaki, & Munira Amirali)