

TSG 40 Agenda (Updated July 10th)

TSG 40: RESEARCH AND DEVELOPMENT ON MATHEMATICS CURRICULUM

Class: **B** (Class A for TSGs with odd numbers; Class B for TSGs with even numbers)

****Please prioritize the sessions in “core-time” (from 19:30-23:00, Beijing time, i.e. Session 2, 3 for Class A and session 1, 2 for Class B) as they are friendly to most of the time zones in the world.**

The Organizing Team

Chair: **Masataka Koyama**, Hiroshima University, Japan

Cochair: **Jeremy Hodgen**, University College London, UK

Members:

Gulseren Karagoz Akar, Bogazici University, Turkey

Shelly Dole, University of the Sunshine Coast, Australia

Ruilin Wang, Capital Normal University, China

TSG 40 Description

Mathematics curriculum and its impact on teaching and learning have received increasing attention around the world. The aim of the Topic Study Group 40 (TSG 40) is to share and discuss the recent results of research and development on mathematics curriculum at all levels, and to identify perspectives for future research and development. Recent mathematics curriculum study has expanded to explore a range of important topics, including policy issues, curriculum development and analysis, and curricular impact on teachers' teaching and students' learning. TSG 40 welcomes researchers, teacher educators, teachers, curriculum developers, test developers, and policy makers with research interests in research and development on mathematics curriculum. We invite both theoretical and empirical research contributions that address one or more of the following topics in the research and development on mathematics curriculum.

Topic 1: Mathematics Curriculum Policy

This topic includes policy issues related to mathematics curriculum in different education systems, and the process of curriculum decision-making, curriculum changes, curriculum policy, and education changes viewed from a historical perspective.

Topic 2: Mathematics Curriculum Development and Analysis

This topic includes curriculum design and development in different education systems; explicating and comparison of diverse ideas and practices in curriculum development, textbook design, and changes in curriculum development in different system contexts.

Topic 3: Mathematics Curriculum, Teacher, and Teaching

This topic includes perspectives on the process of improving mathematics education by reform of curriculum and teaching, and the challenges of developing, implementing, and evaluating change in the content objectives and teaching of mathematics.

Topic 4: Mathematics Curriculum and Student Learning

This topic includes curricular impact on students' learning and the challenges of reforming the curriculum in order to improve students' learning.

TSG 40 contributions will include regular presentations of invited and selected papers, short presentations of selected papers, and posters.

TSG 40 Time Allocation

TSG 40 is in Class B and has three sessions with 90-90-120 minutes' timeslots for papers.

- TSG Class B, Session 1 (Tuesday July 13th) 19:30~21:00 Beijing time (90 minutes)
- TSG Class B, Session 2 (Friday July 16th) 21:30~23:00 Beijing time (90 minutes)
- TSG Class B, Session 3 (Saturday July 17th) 14:30~16:30 Beijing time (120 minutes)

Two additional 60-minutes' timeslots for posters, shared by all TSGs.

- Poster Session 1 (Saturday July 17th) 13:00~14:00 Beijing time (60 minutes)
- Poster Session 2 (Sunday July 18th) 13:30~14:30 Beijing time (60 minutes)

TSG 40 Detailed Time Allocation Program

SP: A short paper (4 pages) has a total of 15 minutes (10-minutes' oral presentation and 5-minutes' discussion)

Session 1 (Tuesday July 13th) 19:30~20:30 Beijing time (60 minutes)

- 19:30~20:30 **Opening Session of TSG 40**
Chair: **Masataka Koyama**, Hiroshima University, Japan
Cochair: **Jeremy Hodgen**, University College London, UK
Members: **Gulseren Karagoz Akar**, Bogazici University, Turkey
Shelly Dole, University of the Sunshine Coast, Australia
Ruilin Wang, Capital Normal University, China

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Session 2 (Friday July 16th) 21:30~23:00 Beijing time (90 minutes)

- 21:30~21:45 SP1
COMPARATIVE STUDY ON STATISTICAL CONTENTS IN CHINESE AND JAPANESE MATHEMATICS TEXTBOOKS

Xinqi Zhang¹ & Masataka Koyama²

¹Graduate School of Education, Hiroshima University, Japan.

²Graduate School of Humanities and Social Sciences, Hiroshima University, Japan.

In this paper, we compare the statistical contents in Chinese and Japanese mathematics textbooks as a part of intended mathematics curriculum. The similarity and difference are reflected on the structure of statistical contents and means of data analysis. There are deficiencies in problems, plans and conclusions of the statistical investigative cycle in China and Japan. Therefore, we think that we can use mathematical history materials of statistics to help students promote statistical thinking process.

- 21:45~22:00 SP2
THE IMPLEMENTATION OF A REFORMED MATHEMATICS CURRICULUM:
MATHEMATICAL PROCESSES IN PRACTICE

Anna Klothou¹ & Charalampos Sakonidis²

¹Department of Primary Education, Greece

²Democritus University of Thrace, Greece

The recontextualizations that are taking place during the implementation of a reformed curriculum are identified through different knowledge fields teachers draw on to attribute meaning to the ideas and the teaching practices promoted. The paper examines six primary school teachers' practices concerning four mathematical processes adopted after their involvement with piloting a reformed Mathematics curriculum in Greece. Analysis of the data revealed contradictions in teachers' teaching practices which can be attributed to local recontextualization procedures activated during the implementation of the reformed curriculum.

● 22:00~22:15 SP3

THE MATHEMATICAL LITERACY IN KOREAN MATHEMATICS CURRICULA

Eun Young Cho¹ & Rae Young Kim²

¹Graduate School, Ewha Womans University, South Korea

²Ewha Womans University, South Korea

In this study, we analyzed the nature of mathematics and the goals of mathematics education represented in 10 Korean mathematics curricula (from the 1st to the 2015 revised curriculum) to find out how the concept and meaning of mathematics have changed over time. We conducted semantic network analysis by keywords of each curriculum to identify the word change trend by extracting the frequency and degree centrality of each word, and matrix charts among words.

The results from the analysis showed that the meaning of mathematics has changed to meet social needs across curricula. The first curriculum reflected the needs for the reconstruction of the nation and education for citizens after the Korean War so that "life" emerged as a keyword in the mathematics curriculum. The 2007 revised curriculum stressed student-centered instruction focusing on problem-solving skills to enhance students' ability. The term 'ability' in the 2009 and the 2015 revised curriculum has been differently used from the previous curricula in terms of the correlation with other words. It was related to the terms such as problem-solving, society, creativity, and ideas and their correlation was almost 0.9 in the 2009 and 1.0 in the 2015 revised curricula respectively, which were related to preparing for the 4th industrial revolution. It led us to reconsider the meaning of mathematics as mathematical literacy. Mathematical literacy denotes a student's ability to understand and use mathematical knowledge and skills to meet his or her needs in various contexts as a well-being citizen (OECD, 2018). This calls us to the need for a conceptualization of mathematical literacy in the upcoming curriculum considering social needs such as lifelong learning.

● 22:15~22:30 SP4

FINANCIAL EDUCATION IN THE ROMANIAN MATHEMATICS CURRICULUM: POLICY AND IMPLEMENTATION IN ELEMENTARY TEXTBOOKS

Daniela Căprioară¹, Annie Savard², & Alexandre Cavalcante²

¹Ovidius University of Constanța, Romania

²McGill University, Montreal, Canada

Introduction of financial education in the school curriculum occurs in many different ways depending on educational policies and systems. Research shows that mathematics is necessary in order to modelize financial contexts and support financial decision making (Savard, 2018; Sawatzki & Sullivan, 2017). In Romania, an European emerging country in a post-communism area (1990), the challenge to financially educate students is particularly important because the country is still adapting to a capitalist economy. In this study we will show to what extent the Romanian mathematical curriculum for the primary level corresponds to the concepts derived from the definitions of financial education. The recent mathematics curriculum requires teaching a lot of financial concepts (e.g. money and budgeting, earning and spending, cost and profit etc. So, the elementary school teachers play an important role though they have not been trained to teach FL, even if they are currently being asked to do so (Way & Holden, 2009).

● 22:30~22:45 SP5

FORMATIVE EVALUATION OF A TOOL FOR REPRESENTING IDEAS IN MATHEMATICS CURRICULUM DESIGN: A DELOHI STUDY EXAMPLE

Ellen Jameson & Lynne McClure

Cambridge Mathematics, Cambridge Assessment, University of Cambridge, UK

Formative evaluation of curriculum frameworks can take place before they have been implemented and can contribute data in time to inform continuing design and development. In this paper we discuss some contributions of a Delphi study conducted for the formative evaluation of such a tool, the Cambridge Mathematics Framework. A panel of curriculum researchers responded to questions arising from our design, theoretical framework and methodology. This paper focuses on the panel's responses regarding the contributions of motivation to mathematical thinking and doing. The panel assigned motivation lower priority in total for consideration in our design work, but also expressed the highest levels of professional disagreement about it. This centred around the degree of integration they perceived motivation to have with the development of conceptual understanding in mathematics.

● 22:45~23:00 SP6

IMAGES OF MATHEMATICS CURRICULUM AND PEDAGOGICAL INFLUENCES

Laxman Luitel & Bal Chandra Luitel

Kathmandu University School of Education, Department of STEAM Education, Nepal

I (first author) spent a significant time to search for better ideas, tricks, as well as pedagogies for teaching mathematics in better ways. For this, I realized that curriculum of mathematics plays an important role. The ever-changing beliefs about the mathematics curriculum informed to seek better alternative in teaching it. Keeping those meaningful moments and contexts in the center, I conducted critical research using autoethnography as methodology under multi-paradigmatic research design. The purpose of this study was to assess the beliefs about the mathematics curriculum and its pedagogical influences in classroom aiming to improve the teaching and learning environment. I followed metaphorical approach to represent my beliefs of its curriculum rather than definitional approach. For which the Knowledge Constitutive Interest (Habermas, 1972), Transformative Learning Theory (Mezirow, 1991) and Social Constructivism were considered the major theoretical lenses. The moments and situations I experienced during my teaching and learning activities has represented through multiple genres (story, narrative, poem, etc.)

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Session 3 (Saturday July 17th) 14:30~16:00 Beijing time (90 minutes)

- 14:30~14:45 SP7

A PARTICIPATIVE APPROACH TO DESIGNING A NEW MATHEMATICS COURSE FOR ALL COLLEGE AND UNIVERSITY STUDENTS IN THE PHILIPPINES

Catherine P. Vistro-Yu

Mathematics Department, Ateneo de Manila University, Philippines

This paper aims to describe and analyze the design process that went into the development of the new mathematics course for the general education curriculum (GEC) required of all students of colleges and universities in the Philippines, beginning SY 2018-2019. The new GEC was conceptualized in 2013 to accompany the new K-12 mathematics curriculum offered under the banner of the Enhanced Basic Education Act of 2013. Entitled “Mathematics in the Modern World” (MMW), this new course was envisioned to help provide for the holistic development of the Filipino student in tandem with courses from other disciplines. The process followed in designing MMW is a departure from the traditional top-down approach, allowing for greater participation among educators and subject specialists. Refinement and revisions to the initial course syllabus were based on consultations among different experts and on perspectives of future course instructors during the orientation and training programs held nationwide. Proposals for a more systematic curriculum development process are offered.

● 14:45~15:00 SP8

A COMPARISON OF U.S. AND CHINESE GEOMETRY STRANDS THROUGH THE LENS OF VAN HIELE

Lili Zhou, Jinqing Liu, & Jane-Jane Lo

Curriculum & Instruction, Purdue University, USA

The present study aims to compare the geometry standards in *U.S. Common Core State Standards of Mathematics (CCSSM)* and *Chinese Compulsory Education Mathematics Curriculum Standards (CMCS)* through the lens of van Hiele levels. The study considered a standard unit as one or multiple learning expectation(s) and placed each learning expectation into van Hiele levels. By examining the van Hiele level distributions of the learning expectations and major topics, this study investigated how CCSSM and CMCS propose the development of the geometric thoughts of students. The findings reveal different emphases in geometry learning goals of CCSSM and CMCS. Specifically, i) CMCS shows more consistent progression through grade bands than CCSSM. ii) CCSSM makes more connections between various aspects of the same topics or between different topics than CMCS. iii) While CCSSM highlights Dynamic Geometry Environments (DGEs), CMCS underscores abstract and rigor at the upper level. Implications of this study and suggestions for future revisions for both standards are discussed.

● 15:00~15:15 SP9

CURRICULUM PROPOSAL FROM EL SALVADOR FOR IMPROVING MATH LEARNING, DESCRIPTION, STRUCTURE, FIRST RESULTS AND EFFECTIVENESS

Francisco Antonio Mejia Ramos

Ministry of Education of El Salvador

Low performance in mathematics is a common issue in Latin American countries, and El Salvador is not an exception, from international evaluations, school visit experiences, and teachers' perspectives, the low academic performance in Mathematic has been confirmed. Since 2016, El Salvador in cooperation with JICA has developed a new Mathematics Education Policy, rearranging the National course of study from Primary to Secondary Education, elaborating textbooks, and developing teachers' understanding and classroom implementation of textbooks strategy. The proofreading strategy based on El Salvador students' needs, the rearrangement of contents in the courses of study, and the approach to specific classes are essentially explained in this presentation. The implementation based on a 'student-centered approach' and a suitable 'teacher support' based on some specific formative assessment statements are briefly presented as well. Finally, some findings of the first years of implementation and apparent success are shown at the end of the presentation based on research implementations.

● 15:15~15:30 SP10

A COURSE DESIGN FOR MATHEMATICAL MODELING IN HIGH SCHOOL BASED ON STEM EDUCATION

Su Shengkui^{1,2}, Miao Lin^{1,3}, & Chen Qinghua¹

¹College of Mathematics and Informatics, Fujian Normal University, China.

²Xiamen No.6 Middle School of Fujian, China.

³Shanghai Hongkou Experimental School, China.

With the globalization of STEM education, mathematical modeling courses in high school are increasingly important. Drawing on the concepts of course design in the objective model and process model, this study focuses on the strong correlation of mathematical modeling literacy among multiple disciplines in high school. We have built a progressive course system including mathematical modeling basic courses (M), innovation practice courses based on school-enterprise cooperation (I), research-based learning advanced courses (R) and STEM higher-order courses (S), jointly constituting the MIRS course. On this basis, this study illustrates the implementation of the MIRS course through four course cases.

● 15:30~16:00 **Closing Session of TSG 40**

Chair: **Masataka Koyama**, Hiroshima University, Japan

Cochair: **Jeremy Hodgen**, University College London, UK

Members: **Gulseren Karagoz Akar**, Bogazici University, Turkey

Shelly Dole, University of the Sunshine Coast, Australia

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Poster Session 1 (Saturday July 17th) 13:00~14:00 Beijing time (60 minutes)

● PP1

INVESTIGATING THIRD LEVEL LECTURERS AWARENESS OF SECOND LEVEL CURRICULUM REFORM FOUR YEARS ON

Fiona Faulkner, Cormac Breen, Michael Carr, & Mark Prendergast

Technological University Dublin, Ireland (Fiona Faulkner, Cormac Breen, Michael Carr),
University College Cork, Ireland (Mark Prendergast)

● PP2
MATHEMATICAL CURRICULUMS FOR FIVE-YEAR JUNIOR COLLEGE
PROGRAMS IN TAIWAN

Yu Jr Tsai & Shao Ying Li

Taitung College, Taiwan, China.

This article introduces the arrangement of mathematical curriculum in five-year junior college programs which combines with compulsory education and higher education in Taiwan. Nevertheless, no matter what schools are, achievement gap caused by the system of mathematical curriculum in compulsory education can be clarified effectively after we analyze mathematical curriculum guidelines. This may help teachers to understand the contents students are learning in class, and moreover, teachers can find some proper strategies to assist interdisciplinary students to learn mathematics effectively.

● PP3
THE CURRICULAR STATUTE OF THE DISCRETE MATHEMATICS DISCIPLINE IN
THE BRAZILIAN SYSTEMS ANALYSIS AND DEVELOPMENT PUBLIC
TECHNOLOGICAL COURSE

Jefferson Biajone¹ & Vinicio de Macedo Santos²

¹Itapetininga College of Technology, Brazil

²University of Sao Paulo, Brazil

This poster presents a post-doctoral research (Biajone & Santos, 2019) on the statute of the Discrete Mathematics (DM) course curriculum production in terms of objectives and contents for the System Analysis and Development (SAD) undergraduate course offered by 134 public technological colleges and universities in Brazil. Developed in 2018, this research investigated the DM discipline constitution at the undergraduate level according to what contents and purposes are needed for the SAD course and its prescribed curriculum under the perspective of curriculum policy cycle (Ball et al, 1992) and history of disciplines (Goodson,1997).

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