

# TSG 41 Agenda

## TSG 41: Research and development on textbooks and resources for learning and teaching mathematics (Class A TSG times)

### Session 1

1. Time: 14:30–14:40 (Opening and Introduction)

2. Time: 14:40–15:00 (Discussant)

Title: TEXTBOOKS AS TEACHER SUPPORT FOR ENGAGING STUDENTS IN ACTIVE KNOWLEDGE ORGANIZATION

Discussant: **Susanne Prediger**

Institution: Technical University Dortmund / IPN Kiel, Germany

Abstract: Engaging students in processes of mathematizing and active knowledge organization (instead of telling and rehearsing ready-made mathematics) is a key demand for high quality mathematics instruction. Although many mathematically rich context problems have been designed and published in textbooks, their impact on regular mathematics classrooms remains limited, as teachers face challenges in shaping and enacting the important phase of knowledge organization. In the talk, I present an approach how textbooks can also support this second phase.

3. Time: 15:05–15:10 (Presentation of short oral group discussion)

Xiang Gao, Gergely Balazs Wintsche, Wenbin Xu, Marc van Zanten, Jana Visnovska

Report on the discussion of the following contributions

Title: AN ANALYSIS OF DATA AND PROBABILITY TASKS IN US AND CHINESE ELEMENTARY MATHEMATICS TEXTBOOKS

Authors: Xiang Gao

Institution: East China Normal University, China

Title: LEARNING TO DESIGN RESOURCES FOR TEACHERS

Authors: Jana Visnovska, José Luis Cortina, Pamela Vale

Institution: The University of Queensland, Australia; Universidad Pedagógica Nacional, Colombia; Rhodes University, South Africa

Title: THE EFFECT OF THE CURRICULA ON TEXTBOOKS FOR THE TEACHING OF PROBABILITY AND STATISTICS

Author: Gergely Balazs Wintsche

Institution: Eötvös Loránd University, Budapest, Hungary

Title: CONSTRUCTING A TEXTBOOK ANALYSIS FRAMEWORK OF STATISTICS AND PROBABILITY AREAS IN ELEMENTARY MATH

Authors: Shiqi Lu, Wenbin Xu

Institution: Nanjing Normal University, China

Title: MATHEMATICS EDUCATION ACCORDING TO THE TEXTBOOK: OPPORTUNITIES TO LEARN INVESTIGATED

Author: Marc van Zanten, Marja van den Heuvel-Panhuizen

Institution Utrecht University, The Netherlands; Nord University, Norway

4. Time: 15:15—15:25 (long oral)

Title: IDENTIFYING EDUCATIVE FEATURES IN SCRIPTED MATHEMATICS LESSON PLANS

Author: **Moneoang Leshota**

Institution: University of the Witwatersrand, South Africa

Abstract: Literature shows that educative curriculum resources can support teacher learning as teachers use them in their practice. With the institution of scripted lesson plans in underperforming schools in South Africa comes the question of whether or not these lessons can support teachers' learning. Content analysis of the scripted lesson plans in this paper identifies their potentially educative features to show that it is possible to transform the lessons into educative resources for teachers.

5. Time: 15:30—15:35 (Presentation of short oral group discussions)

Anatoli Kouropatov, Moneoang Leshota, Shuhui Li, Yang Shen, Fulin Liu

Report on the discussion of the following contributions

Title: DIDACTIC CONSIDERATIONS REGARDING THE ITERATIVE DEVELOPMENT DDESIGN OF DYNAMIC DIGITAL TOOLS

Authors: Anatoli Kouropatov, Regina Ovodenko, Michal Fraenkel, Maureen Hoch,  
Institutions: Levinsky College of Education, Israel; Shenkar College of Engineering and Design & Center for Educational Technology, Israel; Center for Educational Technology, Israel

Title: IDENTIFYING EDUCATIVE FEATURES IN SCRIPTED MATHEMATICS LESSON PLANS

Author: Moneoang Leshota

Institution: University of the Witwatersrand, South Africa

Title: A COMPARATIVE STUDY OF BIDIRECTIONAL CONNECTIONS IN U.S. AND CHINESE HIGH SCHOOL MATHEMATICS TEXTBOOK PROBLEMS

Author: Shuhui Li

Institution: Columbia University, USA

Title: TRANSLATIONS OF FUNCTION REPRESENTATION IN DIFFERENT TEXTBOOKS

Author: Yang Shen, Bao Jiansheng

Institution: East China Normal University, China

Title: A COMPARATIVE STUDY ON FRACTIONS IN PRIMARY SCHOOLS  
MATHEMATICS TEXTBOOKS OF CHINA AND THE UNITED STATES

Authors: Fulin Liu, Yiming Cao, Dengfeng Liang

Institutions: People's Education Press, Beijing Normal University, Beijing  
Technology Business University, China

6. Time: 15:40—15:50 (long oral)

Title: LEARNING TO DESIGN RESOURCES FOR TEACHERS

Authors: **Jana Visnovska**, José Luis Cortina, Pamela Vale

Institution: The University of Queensland, Australia; Universidad Pedagógica Nacional,  
Colombia; Rhodes University, South Africa

Abstract: Mathematics instructional practices that result in ambitious and equitable classroom learning are learnable, but not intuitive, and the adoption of such practices have been shown to require sustained systemic and professional development support. The instructional (curriculum) resources that could aid both teachers' initial explorations of such practices (i.e. educative curriculum resources), and teacher educators' work as supporters of required teacher learning could provide a substantial advance to the instructional improvement efforts. The design of such resources presents a host of worthwhile research questions. We focus on how specific features of materials designed in classroom design experiments, that reliably led to notable developments in students' mathematical reasoning, were used in different contexts, supported changes in teachers' views and practices of teaching, and in others' views of the professional capacities of these teachers. We are in particular interested in design features of resources that would contribute to teachers' re-claiming the agency over both the meanings and decisions associated with mathematics teaching profession.

7. Time: 15:55—16:00 (Presentation of short oral group discussion)

Suijun Jia, Yao Li, Hongwei Ran, Sebastian Rezat

Report on the discussion of the following contributions

Title: A COMPARATIVE STUDY OF PROBLEM SOLVING IN CHINESE AND  
U.S. PRIMARY MATHEMATICS TEXTBOOK

Author: Suijun Jia

Institution: Zhejiang International Studies University, China

Title: A COMPARATIVE ANALYSIS OF TASKS CONTEXTS IN  
MATHEMATICS TEXTBOOKS IN CHINA AND SINGAPORE

Author: Yao Li, Lianchun Dong

Institution: Minzu University of China, China

Title: A COMPARATIVE OF MATHEMATICAL INQUIRY ACTIVITIES IN  
TEXTBOOKS IN CHINA AND SINGAPORE

Author: Hongwei Ran, Lianchun Dong

Institution: Minzu University of China, China

Title: ELEMENTS OF A THEORY OF TEXTBOOK DESIGN

Author: Sebastian Rezat

Institution: Paderborn University, Germany

8. Time: 16:05—16:15 (long oral presentation)

Title: ELEMENTS OF A THEORY OF TEXTBOOK DESIGN

Author: **Sebastian Rezat**

Institution: Paderborn University, Germany

Abstract: Research on mathematics textbooks and curriculum materials is a research domain which still needs more solid methodological and theoretical foundations. On the one hand, there are several normative theories about how mathematics textbooks and curriculum materials ought to be designed, on the other hand, there is a growing body of empirical research on their use and effects on teaching and learning mathematics. A possible outcome of this body of empirical research is that it could inform the design of mathematics textbooks and curriculum materials in order to produce more effective and influential materials on a scientific basis. However, the results are fragmentary and rarely related to each other. The aim of this paper is to contribute to the requirement of theoretical foundation by ordering the results of research on mathematics textbooks and curriculum resources which could be useful to inform design. As a result, I am drawing a first and preliminary outline of a structural theory of textbook and curriculum material design, which is grounded in empirical research on mathematics textbooks and curriculum materials.

9. Time: 16:20—16:30 (Discussion)

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## Session 2

1. Time: 19:35—19:55 (Discussant)

Title: DIGITAL MATHEMATICS CURRICULUM RESOURCES:  
TOWARDS DESIGN PRINCIPLES OF EDUCATIVE MATERIALS FOR STUDENTS  
AND TEACHERS

Discussant: **Birgit Pepin**

Institution: Eindhoven University of Technology, The Netherlands

Abstract: In this presentation, I first provide a brief review of the role and effect of print and digital curriculum resources (e.g. textbooks) in mathematics classrooms. Subsequently, I start from the notion of connectivity to develop an argument for design principles of educative curriculum resources for students and teachers. In my view this line of research has not been sufficiently developed: Whilst curriculum resources have been examined in terms of their quality and support for student learning, less research has focused on teacher learning with educative curriculum materials, and even less on educative digital curriculum resources that consider and foster the (co-)learning of

teachers and students. This is particularly relevant, as schools and universities trial out innovative online and blended teaching and learning approaches, for which they require particular resources. In this presentation, I discuss design criteria and suggest selected design specifications, including their functions, for educative curriculum materials that are likely to be educative for teachers and students. With new and innovative education approaches, it appears that teachers as well as students have to develop particular design capacities: teachers for designing their own materials for the innovative learning, students for selecting and combining curriculum resources and designing their own learning paths.

2. Time: 20:00–20:10 (long oral presentation)

Title: DIDACTIC CONSIDERATIONS REGARDING THE ITERATIVE DEVELOPMENT DDESIGN OF DYNAMIC DIGITAL TOOLS

Authors: **Anatoli Kouropatov**, Regina Ovodenko, Michal Fraenkel, Maureen Hoch,

Institutions: Levinsky College of Education, Israel; Shenkar College of Engineering and Design & Center for Educational Technology, Israel; Center for Educational Technology, Israel

Abstract: This paper reports on the iterative design and development of three dynamic digital tools that focus on the linear transformations of a function's graph, with reference to didactical and mathematical considerations (in the current paper we discuss horizontal translations only).

3. Time: 20:15–20:20 (Presentation of short oral group discussion)

Saba Gerami, Dewi Rahimah, Yi Wang, Lynda M. Wynn

Report on the discussion of the following contributions

Title: TEACHING AND LEARNING WITH DYNAMIC TEXTBOOKS: STUDYING STUDENT USES AT SCALE

Authors: Vilma Mesa, Saba Gerami

Institution: University of Michigan, USA

Title: THE ELEMENTS OF TEXTBOOKS THAT INDONESIAN MATHEMATICS TEACHERS USE ...

Author: Dewi Rahimah, Jana Visnovska

Institution: The University of Queensland, Australia

Title: INVESTIGATING THE USE OF MATHEMATICS TEXTBOOKS BY STUDENTS IN SHANGHAI AND ENGLAND: A COMPARATIVE STUDY

Authors: Yi Wang, Lianghuo Fan

Institution: Beijing Normal University, China; East China Normal University, China; University of Southampton, UK

Title: EXAMINING CURRICULUM AND TEACHER SUPPORTS FOR ENGAGING SECOND. EMERGENT BILINGUAL STDS IN MATHEM. PRACTICE

Author: Lynda M. Wynn

Institution: California State University, USA

4. Time: 20:25—20:35 (long oral presentation)

Title: TEACHING AND LEARNING WITH DYNAMIC TEXTBOOKS: STUDYING STUDENT USES AT SCALE

Authors: Vilma Mesa, **Saba Gerami**

Institution: University of Michigan, USA

Abstract: Dynamic textbooks are created in PreTeXt, a markup language that gives structure to the textbooks' content and facilitates their viewing in any device (phone, tablet, computer). The textbooks have interactive features such as Sage computational cells, GeoGebra explorations, and WeBWork. In addition, users can hide or make visible definitions, examples, and proofs at will. We are interested in learning how these textbooks are used by the students in a large-scale project that reaches many students from different parts of the United States every semester. We are able to track their viewing of the textbooks in real time and collect student narrations of how they use the textbooks and responses to content-related questions posed in the HTML format of the textbooks. We discuss steps and challenges we have encountered as we integrate these two kinds of data, with the goal to corroborate patterns of use of dynamic textbooks by students.

5. Time: 20:40—20:45 (presentation of short oral group discussions)

Karima Sayah, Dominic R. Oakes, Hendrik Van Steenbrugge, Maryna Rafalska

Report on the discussion of the following contributions

Title: SESAMATH RESOURCES AND COLLECTIVE WORK FROM MATHEMATICAL LABORATORY TO CLASSES IN ARABIC ENVIRONMENT

Author: Karima Sayah

Institution: Al AWAEL School of Education and Learning Annaba, Algeria

Title: PROMOTING THE TEACHING AND LEARNING OF MATHEMATICS THROUGH VISUALISING CONNECTIONS IN POST-16 RESOURCES

Author: Dominic R. Oakes, Sofya Lyakhova

Institution: Swansea University, UK

Title: A METHOD TO ANALYZE TEACHERS' COLLECTIVE WORK AROUND RESOURCES IN THE CONTEXT OF PD

Author: Hendrik Van Steenbrugge, Andreas Ryve

Institution: Stockholm University, Sweden; Mälardalen University, Sweden

Title: COMPARING NAMING SYSTEMS USED BY CHINESE AND UKRAINIAN TEACHERS: EXPLORING T'S RESOURCE SYSTEM

Author: Maryna Rafalska, Chongyang Wang, Luc Trouche

Institution: Université Côte d'Azur, France; Beijing Normal University, China; ENS de Lyon, France

6. Time: 20:45—21:00 (Discussion)

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### Session 3

1. Time: 21:35—21:45 (long oral presentation)

Title: INVESTIGATING THE USE OF MATHEMATICS TEXTBOOKS BY STUDENTS IN SHANGHAI AND ENGLAND: A COMPARATIVE STUDY

Authors: **Yi Wang**, Lianghuo Fan

Institution: Beijing Normal University, China; East China Normal University, China; University of Southampton, UK

Abstract: This paper reports a survey study aiming to investigate students' use of mathematics textbooks in Shanghai and England and explore their beliefs about textbooks. Quantitative approaches dominated the processes of data collection and analysis, which were triangulated and complemented by qualitative methods. Three research instruments, including a student questionnaire, student focus group interview, and classroom observation, were designed and developed to collect data. 161 Shanghai seventh- and eighth-grade students from three state-funded schools and 206 England year seven and eight students from three maintained schools participated in the study. The results revealed that Shanghai students relied heavily on textbooks and used them in various situations, had a strong sense of self-regulation behind the use, and thought highly of textbooks in their learning of mathematics. While England students seldom incorporated textbooks in mathematics learning, used them mainly depending on teachers' instructions, and held a relatively critical view of textbooks.

2. Time: 21:50—21:55 (presentation of short oral group discussion)

Guorui Yan, Ok-Kyeong Kim, Katiane de Moraes Rocha, Everaldo Silveira

Report on the discussion of the following contributions

Title: HOW EXPERT MATHEMATICS TEACHER DESIGN CURRICULUM BASED ON TEXTBOOK USE: A CASE STUDY IN BEIJING

Author: Guorui Yan

Institution: The University of Hong Kong, China

Title: TOWARD SYSTEMATIC SUPPORT FOR PRESERVICE TEACHERS LEARNING OF PRODUCTIVE RESOURCE USE

Author: Ok-Kyeong Kim

Institution: Western Michigan University, USA

Title: ANALYSING TEACHERS INDIV. AND COLL. RESOURCES THROUGH THE LENS OF THEIR DIGITAL RESOURCES

Author: Katiane de Moraes Rocha

Institution: University Center Anhanguera of Campo Grande, Brazil

Title: STUDENT UNDERSTANDING OF TEXTBOOK VISUAL REPRESENTATIONS OF NATURAL AND FRACTIONAL NUMBERS

Author: Everaldo Silveira, Arthur B. Powell

Institution: Federal University of Santa Catarina, Brazil; Rutgers University-Newark, USA

3. Time: 22:00–22:05 (Presentation of short oral group discussion)

Maxim Brnic, Lisnet Mwadzaangati, Niamh O’Meara, Hilary Tanck

Report on the discussion of the following contributions

Title: LONG-TERM USE OF A DIGITAL MATHEMATICS TEXTBOOK WITH INTEGRATED DIGITAL TOOLS: INVESTIGATING THE INFLUENCE ON STUDENTS’ ACHIEVEMENT AND SELF-EFFICACY

Author: Maxim Brnic

Institution: University of Münster, Germany

Title: THE RELATIONSHIP BETWEEN MATHEMATICAL EXAMPLES IN MALAWIAN GRADE 1 PRIMARY SCHOOL MATHEMATICS TEACHERS’ GUIDE AND THE GOALS OF OUTCOME BASED EDUCATION.

Author: Lisnet Mwadzaangati

Institution: University of Malawi, Malawi

Title: CAREER MATHWAYS: A TEACHING & LEARNING INTERVENTION TO SHOW THE RELEVANCE OF MATHEMATICS IN CAREERS

Author: Niamh O’Meara, Olivia Fitzmaurice, Patrick Johnson

Institution: University of Limerick, Ireland

Title: UNBOUNDING CURRICULUM RESOURCES

Author: Hilary Tanck

Institution: Clemson University, USA

4. Time: 22:10–22:30 Title: INSTRUCTIONAL MATERIALS AS TOOLS FOR INSTRUCTIONAL IMPROVEMENT (Discussant)

Authors: Erin Henrick, **Paul Cobb**

Institution: Vanderbilt University, USA

Abstract: In this presentation, we focus on the role of instructional materials in supporting instructional improvement in mathematics. Unsurprisingly, mathematics instructional materials are not all created equal, but vary significantly in terms of the rigor of their learning goals and opportunities they provide for students to attain those goals. High-quality instructional materials provide greater opportunities to attain rigorous goals and include high-cognitive demand tasks that are sequenced to support students’ development of significant mathematical ideas. We know from prior research that teachers’ use of high-quality instructional materials can also support their own learning. In the paper, we first describe the instructional materials used in the four school districts with which we partnered and then we clarify the issues we investigated before sharing our findings. We conclude with recommendations for school system leaders seeking to support teachers to use high-quality instructional materials effectively, and with recommendations for future research in this area.

5. Time: 22:30–22:50 (Discussion)

6. Time: 22:50–23:00 (closing remarks)



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**Note:**

Class A:

- Session 1: 14:30-16:30 Beijing time, July 13<sup>th</sup>
- Session 2: 19:30-21:00 Beijing time, July 14<sup>th</sup>
- Session 3: 21:30-23:00 Beijing time, July 17<sup>th</sup>