

Topic Study Group 59

Mathematics and Creativity

TSG-59 Organising Team¹

1. Introduction

The major goal of this TSG was to gather educational researchers, research mathematicians, mathematics teachers, teacher educators, instructional designers and other congress participants for the international exchange of ideas directed at better understanding of creativity in mathematics and mathematics education. The TSG gathering was framed by the discussion of the two contrasting perspectives on the nature and nurture of creativity: individualistic vs. social.

The following issues were discussed:

- Does it make sense to perceive creativity?
 1. as emerging from the individual or from dialog, brainstorming and co-construction?
 2. as yielding grand intellectual feats or as an everyday occurrence in each of us?
- How is it best to design situations with dense potential for creativity emergence:
 3. by orchestrating diversity or homogeneity in educational settings?
 4. by focusing within the discipline or promoting interdisciplinary?
- How can we best understand and support creativity in teachers, teacher designs and the teaching process? by addressing the mathematics teacher:
 5. as an individual;
 6. as an actor in a homogeneous community of practice;
 7. as an actor in a diverse community of interest including members from outside mathematics education.

2. Organisation of ICME-59

The TSG activities were organised based upon the theme individualistic versus social perspectives of creativity and the 30 papers and short orals received. Four sessions are designed, among them two sessions (session 1 and session 4) are simulated (due to the on-line nature of the meeting) “round table” activities, and the other two are oral presentations (Tab. 1).

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Tab. 1. The list of papers presented

Paper and author(s)	
Session 1: Opening and Round Tables	
<i>Introductory Talks</i>	
[1]	Introduction: Different faces of creativity: on the program and participants of the TSG-59 ICME-14. Roza Leikin (Israel).
[2]	Opening: Individual vs social perspectives of mathematical creativity. Chronis Kynigos (Greece).
<i>Round Table 1: Cognitive Perspective of Creativity</i>	
[3]	Exploring primary students' creativity in hands-on mathematical activities. Jiali Xing, Qiaoping Zhang, and Xuanzhu Jin (China).
[4]	A leap from in school to our school: possibility is creativity development. Shin Watanabe (Japan).
[5]	Creativity in linear algebra through interactions. Aditya Adiredja and Michelle Zandieh (USA).
[6]	Students make interactive exhibition experimental mathematics for the museum of entertaining sciences. Mariia Pavlova and Maria Shabanova (Russia)
<i>Round Table 2: Creativity in the World</i>	
[7]	Mathematical creativity of Filipino and Japanese students: a comparative study. Lady Angela Mico Rocena, Ma. Nympha B. Joaquin (Philippine), and Manabu Sumida, Naomichi Yoshimira (Japan).
[8]	An exploration into Chinese high school students' consciousness of enquiring and innovation. Yi Chu and Haiyue Jin (China).
[9]	Promoting creativity in the international baccalaureate diploma programme mathematics. Deborah Sarah Sutch and Helen Thomas (The Netherlands).
[10]	A survey of mathematics teachers' perceptions on mathematically gifted learners in Thaba Nchu primary schools in South Africa. Motshidisi Gertrude van Wyk (South Africa).
Session 2: Collaborative Creativity	
[11]	Social creativity in a constructionist classroom context. Chronis Kynigos and Dimitris Diamantidis (Greece)
[12]	Fostering creativity in a diverse classroom of a community college. Malgorzata Aneta Marciniak (USA).
[13]	Collaborative creation between university students from mathematics and music. M. Alicia Venegas-Thayer (Chile)
[14]	Understanding students everyday play experiences when designing games in the mathematics classroom. Erik Ottar Jensen (Denmark).
[15]	Creative design of digital tools for teaching in a mathematics' teachers' community. Chronis Kynigos and Dimitris Diamantidis (Greece).
[16]	Creative art processes to deepen geometrical thinking of middle school mathematics teachers. Irina Lyublinskaya and Marta Cadral (USA).
[17]	Beyond Sudoku: creating a course for developing deductive and creative skills. Jeffrey J. Wanko (USA).
[18]	Designing games to foster creativity thinking about randomness. Theodosia Prodromou (Australia) and Chronis Kynigos (Greece).
Session 3: Cognitive abilities and development in connection to creativity	
[19]	Creativity varies from task to task, doesn't it? — a qualitative view on first graders' individual creativity. Svenja Bruhn (Germany).
[20]	“Rethinking the World” with mathematics: the geometric chess from bauhaus as a basis for creating mathematical ideas and materials. Torsten Fritzlar and Karin Richter (Germany).
[21]	Inventing growing patterns by primary school students — a creativity provoking task. Daniela Assmus and Torsten Fritzlar (Germany)
[22]	The relation between spatial ability and creativity in geometry in primary school. Anastasia Datsogianni (Germany), and Pantelitsa Eleftheriou, Nektaria Panagi-Louka, and Athanasios Gagatsis (Cyprus).
[23]	How long is half a piece of string — the journey continues. Bruce Stuart Ferrington (Australia).
[24]	Strategy-related and outcome-related mathematical creativity in all as compared to that in gifted. Roza Leikin and Haim Elgrably (Israel).

Session 4: Round tables
Round Table 3: Collaborative and Interactive creativity

- [25] Inquiry dialogues in mathematics classroom and mathematical representations and their role in learning mathematics. *Hanna Zdziarska Slabikowska* (Norway).
- [26] Mathematical creativity workshop to review elements of geometry with high school students. *Matheus Delaine Teixeira Zanetti, Mateus G. Fonseca, and Cleyton H. Gontijo* (Brazil).
- [27] Comparing social creativity among designers with creativity of mathematical digital resources produced. *Nataly Essonnier* (Switzerland), *Mohamed El-Demerdash* (Egypt), and *Jana Trgalová* (France).
- [28] Expanding possibilities: a metaphor for the co-construction of students' creative acts. *Ayman Eleyan Aljarrah and Jo Towers* (Canada).
- [29] Developing mathematical group creativity through mathematical modelling. *Hye-Yun Jung and Kyeong-Hwa Lee* (South Korea).

Round Table 4: Evaluation of Creativity

- [30] Students and their effects on motivation and performance in mathematics. *Mateus Gianni Fonseca and Cleyton H. Gontijo* (Brazil).
 - [31] Research problems and assessment by students. *Noriko Tanaka* (Japan).
 - [32] Establishment of evaluation index system for primary school students' mathematical innovation competency: investigation and analysis based on Delphi method. *Yanzhi Wang* (China).
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The first session's activities comprised of two "round table" activities respectively grouping the presentations into the following themes: a) cognitive perspectives of creativity, b) creativity in the world. The round tables were preceded by an introductory talk by Roza Leikin^[1] outlining the structure of the meetings followed by another by Chronis Kynigos^[2] laying out the frame for the discussions with respect to the TSG-59 theme for the ICME-14 conference.

The activities of the second session comprised of paper presentations grouped around the theme "collaborative creativity". Eight papers were presented and discussed focusing on creativity emerging in a classroom context, stimulated by transdisciplinary approaches to mathematics education and manifested during students' design and tinkering with constructionist digital media and games. To stimulate discussion the session was chaired by Suhy.

The activities of the third session involved paper presentations addressing the cognitive abilities and development in connection to creativity. The papers yielded research on mathematical creativity in individuals' grappling with diverse tasks including patterns, spatial ability, iterative halving of a piece of string. To stimulate discussion, the session was chaired by Kynigos.

The fourth session activities comprised of two simulated (due to the on-line nature of the meeting) "round table" activities respectively grouping the presentations into the following themes: c) collaborative and interactive creativity and d) evaluation of creativity.

The TSG concluded in a discussion around the value and the diversity of the two approaches to creativity concluding that it is worthwhile and necessary to pursue both the individualistic and the collaborative perspectives, to employ research and creativity perspectives outside mathematics education to the extent that they inform and enrich the study of creativity in both the teaching and learning of mathematics, both for high-end performers and in an inclusive spirit as a trait inherent in every student. The group agreed more work is needed especially regarding the nature of every-day mathematical

creativity in connection to student activity including the understanding of the role of situational and social context. It was also agreed that more work is needed to understand creativity in teacher classroom activity and with respect to their design of resources as tools to inspire and liberate mathematical creativity in students.

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