

Topic Study Group 18

Students' Identity, Motivation, and Attitudes towards Mathematics and Its Study

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ABSTRACT This report provides a short summary of the work of TSG-18 on “Students’ Identity, Motivation, and Attitudes towards Mathematics and Its Study”. We begin with a characterization of the field of students’ affect before we provide information on the review process, the participants, sessions, proceedings, and the mode of publication of papers after the conference.

Keywords: Students’ affect.

1. TSG Description

In TSG-18, we focused on students’ affect with a special focus on students’ identity, motivation, and attitudes towards mathematics and its study. There was a parallel Topic Study Group on teachers’ affect (TSG-34: Affect, beliefs, and identity of mathematics teachers).

Affective variables can be seen as either hidden or explicit factors that influence learning processes and outcomes. The different research perspectives used in the study of students’ affect include psychological, sociological, philosophical, and linguistic, and all these as well as other perspectives were welcome. In addition to the general domain “affect”, the title of this Topic Study Group highlighted three concepts that have been popular in the field of mathematics education: identity, motivation, and attitudes. This was not seen as restrictive. On the contrary, we invited discussion on all areas of affect, encompassing anxiety, attitude, beliefs, emotion, flow, goals, identity,

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interest, meaning, motivation, needs, norms, self-concept, values etc. All of them play a crucial role in students' learning of mathematics and there are also subtle differences among them. In addition, we welcomed the analysis of the mutual relationship between affective constructs and their connection to cognition and other constructs studied in mathematics education as well as the description of programs for promoting aspects of affect.

According to the call for papers, the activities of the working group were aimed at

- clarification of the dimensions of affective constructs and their relationships;
- development of measurement instruments (questionnaires, rubrics for qualitative analysis etc.) and other methodological tools for research on affect;
- role of the different affective concepts (see the list given above) in learning of mathematics, problem solving, proof, etc.;
- developmental aspects of affect, e. g. development of interest, anxiety etc.;
- intervention or comparative studies aimed at changes in affective variables;
- relationships between students' and teachers' affect, role of affect in communication among students or between students and teachers;
- affect as sociocultural phenomenon and lifelong learning;
- development of learning communities that foster positive affective climate;
- relationships between affect and gender/ethnicity/mathematical activity etc.

2. Participants

The participation in the Topic Study Group highlights the growing interest in research on affective issues. At ICME-13, there was only one affect related TSG in which 86 researchers were involved and 22 papers were presented on both students' and teachers' affect (Hannula et al., 2017). For TSG-18 in 2021, that focused on students' affect only, we had 2.5 times as many papers. In total, 57 contributions were considered in the review process. Based on the reviews as well as gender and regional balance, the TSG organizing committee decided to welcome 38 short oral presentations, and eleven authors were invited to hand in an extended version of their paper. In addition, eight posters were accepted for presentation.

The COVID-19 pandemic caused the shift from an on-site conference in 2020 to an online-conference format in 2021. Therefore, some authors were not able to attend the conference, and we finally had 35 presentations in our topic study group in which 80 researchers from all around the world were involved. Most of the researchers participated online, but in addition there was always a significant number of participants in the room in Shanghai.

3. Sessions

As TSG was the biggest TSG at ICME-14, we were allowed an additional time slot for the organization of our program. Thus, we had two sessions of 120 minutes and two sessions of 90 minutes time for the work in our TSG. Still, we had a very strict time limitation due to the very high number of presentations. There were 20 minutes time for presentation and discussion of a long paper, 10 minutes for a short paper, and five minutes for a poster (Tab. 1).

Tab. 1. List of papers presented

Paper, poster and author(s) in order of presentation	
Session 1	
[1]	Mathematics-anxiety students reasons and feelings when choosing to solve particular problems. Kai Kow Joseph Yeo (Singapore).
[2]	Mathematical problem-solving beliefs of Filipino seventh graders. Katrina Grace Q. Sumagit and Nympha B. Joaquin (Philippines).
[3]	Understanding the intentions of shadow education in Brunei Darussalam. Masitah Shahrill and Ai Len Gan (Brunei).
[4]	Developing and validating a scale for measuring students' critical thinking disposition in mathematics education. Changgen Pei and Jiancheng Fan (China).
[5]	Exploration of math mindset changes over time in an urban sample of elementary and secondary school students in the United States. Beijia Tan, Jenee Love, Leigh M. Harrell-Williams, and Christian E. Mueller (USA).
[6]	Classroom goal structures, Chinese students' goal orientations and mathematics achievement. Meng Guo and Xiang Hu (Hong Kong SAR, China).
[7]	Applying the Theory of Planned Behaviour to 2012 Australian PISA data. Mun Yee Lai and Pauline Wong Wing Man Kohlhoff (Australia).
[8]	The non-intellectual level of efficient mathematics learning of junior high school students and their influence pathways on mathematics learning performance. Rui Yang, Guangming Wang, and Shuang Li (China).
[9]	Different contributions of parental expectations and teacher's behaviors to students' mathematics-related beliefs. Sheng Zhang and Guangming Wang (China).
[10]	Does parents' attitude towards math matter to young adolescents' math achievement in China? Meditating effects of math anxiety. Mingxuan Pang and Xiaorui Huang (China).
[11]	Mathematical identities of a high school mathematics learner in landscapes of mathematical practice. Wellington Munetsi Hokonya and Pamela Vale Mellony Graven (South Africa).
Session 2	
[12]	Make a tutorial! The impact of a classroom video project on emotions, motivations and achievement. Daniel Barton (Germany).
[13]	Perceived difficulty in answering mathematical task: reflections on metacognitive factors. Marta Saccoletto and Camilla Spagnolo (Italy).
[14]	Affective issues in the learning of abstract algebra. Marios Ioannou (Canada).
[15]	A framework of learners' mathematical identities. Aarifah Gardee and Karin Brodie (South Africa).
[16]	A conceptual framework relating mathematics clubs and mathematical identities. Lovejoy Comfort Gweshe and Karin Brodi (Zimbabwe).
[17]	Influence of collaborative learning on student attitudes toward mathematical problem solving. Farzaneh Saadati (Chile).

Session 3

- [18] A quantitative analysis of six aspects of student identity and creativity-fostering instruction. **Paul Regier, Miloš Savić, and Houssein El Turkey** (USA).
- [19] Does types of problem influence on interest? A replication of a German study in the Spanish context. **Clara García-Cerdá and Irene Ferrado** (Spain).
- [20] Attitudes, beliefs and emotions towards graph theory. **Claudia Vargas-Díaz and Victoria Núñez-Henríquez** (Italy).
- [21] Predicting college major choice in STEM with students data at grades 9 and 11. **Jihyun Hwang and Kyong Mi Choi** (USA).
- [22] The role of interpersonal discourse in small-group collaboration in developing mathematical arguments and student identity. **Shande King** (USA), **Lynn Hodge** (USA), and **Qintong Hu** (China).
- [23] Exploring pre-service teachers persistence through multiple strategies tasks. **Amanda Meiners, Kyong Mi Choi, and Dae Hong** (USA).
- [24] Meaningful reasons for learning mathematics. **Maike Vollstedt** (Germany).
- [25] Positive emotions in early algebra learning. **Yewon Sung, Ana Stephens, Ranza Veltri Torres, Susanne Strachota, Karisma Morton, Maria Blanton, Angela Murphy Gardiner, Eric Knuth, and Rena Stroud** (USA).

Session 4

- [26] Stereotype on female's success boosts female's math learning. **Xiaorui Huang and Bo Dong** (China).
 - [27] Peer pressure effect on student teachers' affective relationship with problem posing. **Bozena Maj-Tatis** (Poland), **Konstantinos Tatsis** (Greece), and **Andreas Moutsios-Rentzos** (Greece).
 - [28] Questionnaire of attitudes toward statistics for junior high school students in Japan. **Yoshinori Fujii and Koji Watanabe** (Japan).
 - [29] "Dear Kingos, it's all right to be noisy!" why is it so hard to get them talking? **Natanael Karjanto** (South Korea).
 - [30] The character of students mathematical values in learning mathematics. **Miho Yamazaki and Wee Tiong Seah** (Japan).
 - [31] A case study of mathematical research presentation in a public junior high school: focus on the relationship of assumption of others and the quality of learning. **Tomoaki Shinobu** (Japan).
 - [32] Mathematics anxiety: a Portuguese study in higher education. **Vanda Santos, Anabela Pereira, Teresa Neto, and Margarida M. Pinheiro** (Portugal).
 - [33] The transition from school to university mathematics: which roles do students interest and beliefs play? **Sebastian Geisler** (Germany).
 - [34] Exploring 11th grade students' attitudes towards mathematics. **Jiraporn Wongkanya, Naruon Changsri, Kiat Sangaroon, and Maitree Inprasitha** (Thailand).
 - [35] High school students images, anxieties and attitudes toward mathematics. **Shashidhar Belbase** (United Arab Emirates).
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Presentation times were primarily organized according to the time zones of the presenters to enable every presenter to give their presentation at their daytime. In addition, we also tried to group presentations on similar topics wherever possible.

The first session started with an opening and welcome message by the TSG organization committee. Each session was then chaired by a different member of the committee. They paid special attention to making sure that contributions came both from the online participants and from the room in Shanghai. The discussions prove to be fruitful for the presenters.

The closing at the end of our last session provided some information with respect to the proceedings of our TSG and a very heartfelt summary of our work: The word cloud in Fig. 1 was created from all papers that were presented in TSG-18.

