Topic Study Group 24

The Role and the Use of Technology in the Teaching and Learning of Mathematics at Primary Level

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1. Aims and Themes

The aim of TSG-24 at ICME-14 was to share, discuss and advance knowledge and understanding of key aspects of research and practices related to the role and use of technology in the teaching and learning of mathematics at the primary school level.

For these aims, we invited contributions within four sub-themes.

1.1. Sub-theme 1: student interaction

In the ICME-13 Monograph Uses of Technology in Primary and Secondary Mathematics Education, several contributions concern students' learning. Some research suggests that digital technologies have the potential to support the learning of mathematics, giving a unique experience. At the same time, contributions highlight that few works focus on student interaction with digital media, and why and how these technologies have an impact on learning. Therefore, in this TSG, we are interested in continuing to deal with this theme:

- How does the use of apps enhance students' learning?
- What kinds of activities/tasks are proposed for students?
- What are the differences, if any, in the use of touchscreen apps (mobile or not) from the perspective of learning processes of specific mathematical content?
- What is the potentiality of coding activities for exploring mathematical concepts?

1.2. Sub-theme 2: digital and analog tools

Digital technologies are not considered alone. In many primary schools, depending on the culture of each country, there are physical manipulatives also in use. This is taken into account in some projects, focusing on digital and analog tools, from different perspectives (e.g., artefacts, coding to model mathematical relations, DGS simulations). We solicited contributions on this aspect:

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- How do analog and digital technologies support students'learning?
- In which specific situations do digital and physical tools display advantages for overcoming students' difficulties?

1.3. Subtheme 3: new technologies

From the discussion on technology, it emerges that many kinds of technology (e.g., tablets, IWB, and personal computers) are available for primary education. Nevertheless, their diffusion and how they are used at school are different from one country to another one (one-to-one tablet, BYOD, IWB). At the same time, new technologies are available and experimented in the classroom (e.g. VR, AR). In this sense, we would discuss:

- Which types of technology use are emerging to enrich and foster mathematics learning in kindergarten and primary school?
- Which digital technology for education do enable primary children to inquire, problem solve and think mathematically and share their learning?
- Which are the most spread technologies at kindergarten and primary school? Which mathematical contents do they concern about?

1.4. Subtheme 1: teacher's role

We were also interested in questions about teacher evaluation of apps. We aim to investigate the different aspects of this question. In particular, which criteria could be suggested to teachers for choosing apps in their teaching.

The spread of digital technologies at school depends on teachers' engagement (training and practice). A pedagogical approach taken by the teacher is complementary to the potential of the affordance of the apps to influence students' learning. The tasks given to students and the classroom culture the teacher develops are key elements of the learning. So, we aim to deepen the discussion about the teacher's role:

- How do schools and teachers use technology to enrich mathematics learning at the primary level?
- How do teachers choose the technology they use in their classrooms?
- A specific question is addressed to each participant, in order to know the state of the art: What are the typical digital technologies in used in kindergarten and primary school classrooms in your country?

2. The Sessions

Due to the global pandemic caused by coronavirus disease (COVID-19), only 9 out of 21 contributors participated in this conference. Therefore, the work of TSG-24 was organized into three main TSG Sessions, and these were supplemented by oral communication and poster presentation (Tab. 1). The three sessions were chaired by Sitti Patahuddin and supported by George Gadanidis.

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The contributors of this TSG were from seven countries: China (including Hong Kong, SAR), Malaysia, Japan, Australia, USA, India, and Canada. The nine contributions are as follow:

Tab. 1. List of papers presented

Paper and author(s)
Session 1
[1] Impact of computer-mediated sharing on classroom activities. ***Shaikh Sashid Rafikh****, Harita Raval, Harshit Agrawal, and Nagarjuna Gadiraju* (India).
[2] ELPSA framework uses in designing lessons with web-based resources: A case of equivalent fractions. ***Sitti Patahuddin*** *and Jonathan Adam* (Australia).
Session 2
[3] Using mathematically-focused text messages to connect families with their childs learning. ***Mollie Helen Appelgate****, Christa DeAnn Jackson, and Kari Nicole Jurgenson* (USA).
[4] Exploring the use of digital platforms in supporting dialogue in primary mathematics classrooms. ***Qian Liu*** (China). (Poster)
[5] Computational modelling in Grades 1-3 mathematics. ***George Gadanidis****, Janette Hughes, Immaculate Namukasa, and Ricardo Scucuglia* (Canada).
[6] Building computational thinking (CT) readiness: a self-assessment framework and tools for integrating CT in primary math classrooms. ***Heater Sherwood*** (USA). (Poster)
Session 3
[7] Proposal on how to use digital textbooks at primary level and research directions. ***Manabu Goto*** (Japan).
[8] Coding in elementary mathematics lessons. ***King-Man Leung*** *and P. Y. Tang* (Hong Kong SAR, China).
[9] Effectiveness of digital game-based learning (DGBL) in enhancing fraction skills among primary four pupils. ***Jia Yi Boo*** *and Kwan Eu Leong* (Malasya).

The TSG-24 started with a short introduction from each participant followed up by an overview of the TSG-24 programs by Sitti and George. The TSG sessions progressed well and we did not face any technological issues. All contributors did a live presentation and followed up by discussions. They shared their screen without a need to send their pre-recorded video or slide presentation.

TSG-24 also had an additional discussion forum led by George Gadanidis. George shared practices related to "Coding in the Ontario Mathematics Curriculum for Grade 1-8". This session stimulated great discussion among the participants. George invited the participants to share in what ways coding was a part of the school curriculum in their countries. George emphasised that despite the fact that coding is not a new thing, being an explicit part of the curriculum offered opportunities to show the relevance and the value of mathematical thinking in this digital world.

In conclusion, TSG-24 was a learning space where various topics were shared and discussed, including digital game-based learning, theoretical frameworks in designing mathematics lessons with technology, digital textbooks, computational thinking and coding. The challenge of this TSG was mainly a lack of connections among the participants due to the online setting and the time zones as some participants had to join the session in the middle of the night and very early in the morning.

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