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TWG22: Curricular resources and task design in mathematics education

Introduction to the papers of TWG22: Curricular resources and task design in mathematics education

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In this report the themes and points for discussion of the Thematic Working Group 22 on Curricular Resources and Task design are briefly explained and summarized. These related to design principles and task characteristics, also of digital curriculum resources, and perspectives on the development of digital resources were identified. At the same time the role of teachers in task design, whether as “designers” or “partners in task design” or as mediators of tasks designed by others, and of course the role of students working with the tasks/resources, were acknowledged as crucial issues. Concerning teachers, pre-service or in-service teacher education, and generally teachers’ work in collectives, were perceived as stimulating contexts for the design of and work with curriculum resources: how can teachers develop design capacity and knowledge when working with curriculum resources, and which affordances (and constraints) are provided by digital resources? Concerning students, discussions evolved around issues related to how digital resources can provide feedback for enhanced student learning.

Keywords: Curriculum resources; task/curriculum design; design principles; teacher collective work; design capacity.

Background

The TWG 22 received 25 paper and poster submissions: 17 submissions were accepted as papers, 6 as posters, and 2 were withdrawn (for various reasons: lack of funding; lack of time). The contributing authors came from 17 different countries.

The sessions were organised into five paper sessions organised under four themes, one poster session, and one report & discussion session. For each session we now briefly present the authors and titles of the individual presentations, followed by a summary of themes discussed in the sessions.

Session 1 & 2

Theme: Issues linked to the design of tasks and resources

- Gijssbers & Pepin: Context based tasks on differential equations to improve students' beliefs about the relevance of mathematics
- Nagari Haddif: Principles of redesigning an e-task based on a paper-and-pencil task: The case of parametric functions
- Borys & Choppin: Tensions between resource perspectives and trends in the design and dissemination of digital resources

- Brocardo, et al.: Tasks to develop flexible multiplicative reasoning
- Seidouvy & Eckert: Designing for Responsibility and Authority in experiment based instruction in mathematics
- Cohen-Eliyahu: The role of design in conceptual change: The case of proportional reasoning

The issues identified in these two sessions related to four main themes. First, participants discussed the relationships between design principles and task characteristics. This is particularly important, if the design is expected, for example, to afford conceptual change (see Cohen-Eliyahu), or to support student reasoning competency involving aspects of authority and responsibility (see Seidouvy & Eckert) or to enhance students' beliefs about the relevance of mathematics (see Gijssberg & Pepin), or to facilitate noticing and visualization when developing flexible multiplicative reasoning skills (see Brocardo, et al.). It is also pertinent for tasks that were re-designed from paper and pencil to e-tasks (see Nagari Haddif). Second, perspectives on the development of digital resources were identified, and tensions between conceptions of teachers' interactions with digital resources and the ways other actors (e.g. policy makers, curriculum developers) frame the purpose for and development of digital curriculum resources (see Borys & Choppin). A third point of discussion was the role of teachers in task design, whether as "designers" or "partners in task design" or as mediators of tasks designed by others. In fact, it was concluded that often teachers were left out, or insufficiently considered, in relation to their role of mediating tasks. A fourth point of discussion was related to the role of students working with the tasks/resources, which was addressed in the majority of the papers presented in these two sessions.

Session 3 (poster session)

In this session all posters were presented in order to provide additional opportunities for contributors to participate in this TWG.

- Noll, et al.: How to design educational material for inclusive classes
- Jukic Matic: Teachers' pedagogical design capacity and mobilisation of textbook
- Wynne & Harbison: Task design within the Universal Design for Learning Framework to support inclusion in the mathematics classroom
- Llanos & Otero: Changes in the images and arguing from mathematics textbooks for the secondary school in Argentina along 67 years
- Dooley & Aysel: Using variation theory to explore the re-teaching phase of lesson study
- Cizmesija et al.: Asymptotes and asymptotic behaviour in graphing functions and curves: an analysis of the Croation upper secondary education within the anthropological theory of didactics

Session 4

Theme: Issues linked to prospective teachers' work with tasks and resources

- Dempsey & O'Shea: Critical Evaluation and Design of Mathematics Tasks: Pre-Service Teachers
- Kilic, et al.: Pre-service teachers' reflections on task design and implementation

- Stylianides & Stylianides: Promoting prospective elementary teachers' knowledge about the role of assumptions in mathematical activity

The issues identified in this session related to four main themes. First, although not directly addressed in the three papers, the issue of design capacity building was raised: what teacher design might mean (see also sessions 1 & 2), who is designing what (see also sessions 1 & 2), and how design capacity building relates to teacher education. Linked to latter, a second point was discussed: the relationship between teacher knowledge (see Stylianides & Stylianides) and design capacity. As a third point for discussion, participants reflected on the implementation process in terms of pre-service teacher learning/knowledge development (see Kilic, et al.). Under a fourth issue it was discussed how teacher knowledge (in teacher education) could be enhanced through task design (Dempsey & O'Shea).

Session 5

Theme: Issues linked to design and use of resources in professional development and collective work

- Eckert: Agency as a tool in design research collaborations
- Essonnier, et al.: Factors impacting on the collaborative design of digital resources
- Gueudet & Parra: Teachers' collective documentation work: a case study on tolerance intervals
- De Moraes Rocha & Trouche: Documentational trajectory: a tool for analysing the genesis of a teacher's resource system across her collective work

The issues identified in this session related to three main themes. First, it was emphasised that teachers' learning trajectories of professional learning are typically not short-term, and hence that there is a need to research them longitudinally (see De Moraes Rocha & Trouche). Second, the dynamics in collaborative task design of teachers and teachers working/designing collaboratively with curriculum resources, were highlighted (see Eckert; Gueudet & Parra): in terms of lesson preparation, design of learning trajectories, and/or teacher re-design in class. Linked to that a third point was raised: the cultural aspects of teachers working with curriculum resources (see Essonnier et al.).

Session 6

Theme: Issues linked to teacher and student use of resources/curriculum materials at primary level

- Daina: From textbook to classroom: a research on teachers' use of pedagogical resources in the context of primary school in the French
- Delaney: Children's performance on a mathematics task they were not taught to solve: A case study
- Gaio: Programming for 3rd graders, Scratch-based or Unplugged?
- Rezat: Students' utilization of feedback by an interactive mathematics e-textbook for primary level

The issues identified in this session related to four main themes. First, although not directly addressed in all papers of this session, the choice, design and use of digital as compared to non-digital curriculum resources were discussed. This was seen as particularly relevant, as often digital curriculum resources are combined with traditional materials (see Gaio), such as textbooks. Second, participants discussed the use of mathematical tasks/curriculum resources to promote particular learning goals (see Diana), in particular as textbooks often do not provide information on how to organize the teaching of particular activities. This links to the third point, the enactment/implementation of tasks depending on teacher goals (see Delaney). A fourth point related to task design and feedback, that is ways in which teachers or curriculum developers can provide effective feedback, i.e. feedback that actually influences the development of mathematical concepts (see Rezat).

Session 7

In session 7 the following themes were identified as overarching issues:

- Task design: what does task mean; what does design mean?
- Teacher design capacity & the role of the teacher in “design” (incl. implementation)
- Digital resources/tasks/curriculum materials
- Plurality of theoretical frameworks & clarity
- Operationalization of theoretical frames
- High inference claims & evidence

Whilst the first three have been addressed under previous sections, the last three deserve a special mention. It was noted that a plurality of theoretical frames was used. This is not an issue in itself, but it becomes a problem, when the diversity of theoretical frameworks diverts from, and sometimes covers, the problem addressed, that is obscures the clarity of the research. Linked to that selected participants would have wanted a better, or clearer, description of how the theoretical frames were actually operationalized. Moreover, it was mentioned that too often the researchers made high inference claims based on insufficient evidence. This was seen as a shortcoming of such research. Overall, participants emphasized the positive and constructive atmosphere in the group, where criticism was welcomed as a vehicle for developing deeper insights and sharpening up of ideas.