Eighth Symposium on the Study of Mathematical Work

Second call for contributions

Dates: From 21 to 25 October 2024

Location: Castro Urdiales, Cantabria, Spain

Languages of the symposium: English, Spanish, French

Organizing institution: Universidad de Cantabria

Symposium website: https://etm8.unican.es/

ÉTM8

CIEM
Centro Internacional de Encuentros Matemáticos

EXCMO. AYUNTAMIENTO DE CASTRO URDIALES

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Functioning of the Symposium

ETM meetings are international symposia organized in the form of thematic working groups based on contributions from participants. The symposium format encourages exchanges between participants and helps build a community of researchers with common interests.

The number of participants per theme is limited to facilitate interaction and discussion. Each theme of the symposium will be introduced by a plenary presentation, recalling in particular the achievements of previous symposia.

The four thematic working groups are set out below. We propose to discuss and develop the theoretical perspectives in didactics on mathematical work as well as aspects relating to signs, tools, discourse, control and necessity in mathematical work, thus highlighting the key elements that influence mathematical practice, in particular AI and the digital. In the context of learning, we will look at the genesis and development of mathematical work, focusing on the central role of teachers, trainers, collectives and interactions in this process. We will analyze how projects, situations and tasks contribute to the construction and development of mathematical work, highlighting their importance in the evolution of this fundamental discipline.

The four topics of the symposium focus on certain issues which are developed below, but it is clear that these issues are not isolated. Inter-theme meetings will be organised on issues that concern more than one theme, with a grouping of contributions providing food for thought for all.

The symposium will last 5 days and, like its predecessors, will be trilingual (English, Spanish and French). Contributions (oral and poster presentations) may be made in any of these three languages; oral presentations will be accompanied by an electronic slide show in one of the other two languages of the symposium.

Call for Contributions

Proposals for oral or poster contributions will be accepted by the Scientific Committee on the basis of a short abstract including bibliographical references (three pages) which explicitly mention at least one of the symposium topics. The paper must be based on research and fit in with at least one of the symposium's scientific themes. The submission of this abstract is to be done through the online electronic form, accessible at the following link: https://forms.gle/Qsi5t2CNAH65KSe97 .

Each accepted proposal must then be completed, in CERME style (14 pt), in the form of an article and submitted under one of the symposium topics. Papers should not exceed 12 pages for an oral contribution and 3 pages for a poster. All selected contributions will be pre-published online and made available during the Symposium. They will be revised after the symposium for publication in the proceedings[1].

Important dates

- Submission of a 3-page abstract by **March 1, 2024** using the electronic abstract form (above)
- Scientific Committee's comments sent before **1 April 2024**
- Submission of the contribution before **30 June 2024** on the symposium website at: https://etm8.unican.es/
- Registration for the symposium: **June-July 2024**
- The Symposium will take place from **21 to 25 October 2024**
- Return of papers for publication in the proceedings on **31 January 2025**

➲ For more information, visit the ÉTM8 website at https://etm8.unican.es/.

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[1] The symposium proceedings are available at https://etm7.sciencesconf.org/resource/page/id/8.

Topic 1. Theoretical perspectives and approaches on mathematical work

Responsibles: Assia Nechache (France) & Patrick Gibel (France)

This theme is concerned with the theoretical and methodological aspects of mathematical work related to the definition, construction and implementation of mathematical knowledge. It also aims to deepen the perspectives specific to the theory of Mathematical Working Spaces (MWS theory), in particular through the comparison with other theoretical approaches. The main objectives of the theme are as follows:

- To delve deeper into the theoretical and methodological elements defined and used in MWS theory.
- To analyze, with different theoretical approaches, the different theoretical aspects related to the construction of mathematical knowledge;
- To allow comparative and complementary perspectives on issues related to the identification, implementation and construction of the mathematical work.

This general theme will be addressed by means of specific questions that may be formulated and dealt with in the MWS theory or in other theoretical perspectives.

- From a didactical perspective, what do we call mathematical work in a school context? How can it be identified? What are the methods of analysis and study of the mathematical work? How are the ideas of genesis and circulation defined and employed in the MWS theory? Do these concepts have equivalents in other theories?
- The MWS theory intends to closely combine epistemological and cognitive aspects in the construction of mathematical work. How are these two aspects taken into account in different theories? How can differences and commonalities be characterized? What are the new insights offered by this study of differences and similarities?
- A didactical perspective on mathematical work implies a reflection on the implementation of this work and on the construction of mathematical knowledge. How, then, can mathematical work and the process of knowledge construction be initiated for a subject? Is it a construction of knowledge in a given time or in the long term and in constant evolution? How is an individual's mathematical work organised and developed? How to guide and facilitate the control of mathematical work? How can the social and emotional factors be taken into account? What is the relationship with learning theories?
- The expected mathematical work is not independent of the mathematical domains that are taught. How to characterize, in different mathematical fields, the process of construction of mathematical knowledge and the resulting specific mathematical work?

In the MWS theory, paradigms are used to account for the rules, practices, and properties that are accepted in a school community around the mathematical domains being taught. What is the specificity of the notion of paradigms in the school context? How are they taken into account in specific studies related to mathematical or pluridisciplinary domains? How do paradigms intervene in other theoretical frameworks?

Topic 2. Study of signs, tools and discourse, and the dynamic evolution of their interactions in the mathematical work

Responsibles: Michela Maschietto (Italy), Ferdinando Arzarello (Italy), Jorge Gaona (Chile), Rosa Elvira Páez Murillo (Mexico)

Topic 2 is devoted to the study of the tools of mathematical work, the associated signs and their relationship to discourse. Attention is paid to their evolution and interactions in the mathematical work, together with the questions already addressed in the previous symposia, concerning the three geneses and their relationships.

In particular, the contributions may focus on the following points:

- Interactions and didactical situations. We question the potential offered jointly by technological environments and sign systems to develop the student's mathematical work. Particular attention may be given to the discursive, semiotic and instrumental geneses and their relationships.
- Mutual control of signs, tools and discourse. We will focus on the introduction and use of artifacts, both material and digital, in relation to the manipulations and associated gestures, the semiotic aspects present in the artifact and the different forms of discourse.
- Design of material or digital artifacts. New artifacts can be designed for educational use, some of which are based on historical sources. What are the characteristics that promote specific mathematical work? How to explain the students' cognitive processes in analyzing mathematical work? How to study and analyze the link between the use of material and digital artifacts?
- Specificities of online education. What are the different uses of digital platforms, online exercise collections, and video conferencing? What signs arise from technological instrumentalization and the way of communication?
- Mathematical work and artificial intelligence (AI). What mathematical work can be developed in contexts where AI is used? In relation to Theme 4, what tasks can be designed taking into account the different AI that answer (often incorrectly) mathematical questions using various discourses and signs?
- Proof and reasoning. The question here relates to the types of proof and reasoning that occur during mathematical work, at different levels of primary, secondary and higher education. How do the analyses focusing on semiotic aspects play an essential role in the analysis of the different forms of reasoning that appear in the student's mathematical work? What are the relationships among the geneses?

Topic 3. Genesis and development of mathematical work: role of the teacher, the trainer, the group and interactions

Responsibles: Inés Mª Gómez-Chacón (Spain), Fabienne Venant (Québec) & Laurent Vivier (France)

This third theme focuses on the progress of the reflection on the role of teachers and interactions in the construction, or training, of an adapted and efficient mathematical work.

We encourage authors participating in topic 3 to pay particular attention to the methodological aspects. We also encourage the establishment of relations between the Topic 3 and the others topic of the symposium. The underlying theoretical aspects may, for example, coincide with those studied in topic 1. Similarly, analyses of interactions in the classroom, or of the implementation of didactic situations in the classroom, may cross over with the study of tools, signs and discourse specific to topic 2. Finally, the role of teachers is largely based on the design of tasks, which is at the heart of the discussions in topic 4.

In particular, contributions may focus on the following points:

- The design and implementation of didactic situations to develop mathematical work in class are the responsibility of the teacher. What are the didactic choices made by the teacher in designing these situations?
- The effective implementation of these situations in the classroom requires the establishment of interactions between the pupils and the teacher in order to develop mathematical work. These interactions can occur during the collective phases, or during group work. How does the teacher anticipate and manage these interactions? How does the teacher organise the different phases, individual, group, collective?
- Analyses of the interactions produced in class become necessary to understand the way in which mathematical work is developed. How do these analyses take into account different interdependent dimensions, such as: epistemological, cognitive, didactic, technical, affective, cultural?
- In order to design and implement their teaching, teachers also rely on their knowledge, particularly mathematical and didactic knowledge. Several questions can be asked on this subject: how can we identify the various types of knowledge on which the teacher relies? Does this knowledge allow the teacher to design a coherent and efficient teaching?
- The above questions underline the importance of teachers' knowledge for teaching and therefore raise the issue of teacher training. How can this knowledge be taken into account and developed in the framework of prospective and in-service teacher training? What training methods, particularly distance and group training, should be used? What is the role of the trainer? What place for interaction in training?

Topic 4. Role of tasks and didactic situations in the construction of mathematical work

Responsibles: Alain Kuzniak (France), Jesús Flores Salazar (Peru), Elizabeth Montoya Delgadillo (Chile) and Konstantinos Nikolantonakis (Greece)

This theme examines the use of tasks and didactic situations in observing, analyzing, and developing mathematical work throughout the curriculum. It involves an interest in the type of tasks developed by teachers according to the mathematical knowledge involved. It also prompts reflection on the design, implementation, and observation of didactic situations developed to enhance students' mathematical work. The theme, formulated within the framework of MWS theory, focuses on creating idoine MWSs by concentrating the study on the design and implementation of tasks and didactic situations that ensure a dynamic interaction between reference work and personal work. Of course, other didactical approaches are welcome.

On the conception of tasks related to the expected mathematical work.

Tasks are essential to guide or orient students' work and, beyond that, to structure their mathematical work.

- What are the essential characteristics of mathematical tasks? What connection do they propose between the different epistemological and cognitive components of work?
- What are the specific tools and methods that allow to account for the conception and adaptation of tasks to a particular mathematical work?

On didactical situations and idoine mathematical work.

Numerous studies have focused on the objectives and choices made by teachers when implementing tasks in a classroom.

- How mathematical tasks are designed and used?
- How mathematical work depends on didactic situations?

Furthermore, observing and analysing didactic situations developed in the classroom and individual problem-solving approaches provide a basis for examining and characterising tasks and their evolution in a school context.

- How does the teacher take into account the mathematical work of their students to modify or adapt the given tasks?
- How can we report on these transformations based on observations or experiments related to the resolution of a task or problem?

On the decisive role of certain specific tasks.

Research in mathematics didactics has highlighted particular tasks that are decisive in the development of coherent mathematical work: emblematic tasks in ETM theory, fundamental situations in TSD, assessment tasks, etc.

- How can these particular tasks be recognised and developed?
- What study plan should be developed for their experimentation and analysis?

On modelling tasks.

Increasingly, the legitimacy of mathematics at school is based on close interaction with real-world problems and technologies. As a result, modelling tasks in conjunction with a multidisciplinary approach to teaching have become increasingly important, and their implementation in the classroom is raising questions about the nature of the mathematics involved.

- How can we think about and study these modelling tasks in the context of mathematics teaching to find a balance between mathematical and non-mathematical activities?