CIEAEM71

Braga, Portugal 22 - 26 July 2019

THEME

Connections and understanding in mathematics education: Making sense of a complex world

INTERNATIONAL PROGRAMME COMMITTEE

LOCAL ORGANIZATION COMMITTEE

CONFERENCE VENUE

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THEME OF THE CONFERENCE

Phrases like “mathematics is the language in which God has written the universe” (Galileo Galilei) or “all things in nature occur mathematically” (René Descartes) express the idea that if we want to understand the world, then we need to use mathematics. But can we use mathematics without understanding? John von Neumann once said “Young man, in mathematics you don't understand things. You just get used to them.” One way to interpret this statement would be to say you could use mathematics (with success) without understanding it. Or, perhaps we can speak of a kind of understanding that is merely instrumental instead of relational (Skemp, 1976) or intuitive, or formal (Byers & Herscovics, 1977). Another different way to read von Neumann’s statement is to take it as a clarification that understanding is not a black and white issue. There may be degrees of understanding. And there may also be a form of understanding that impedes better understanding. In the words of Richard Skemp, “to understand something means to assimilate it into an appropriate schema. This explains the subjective nature of understanding, and also makes clear that this is not usually an all-or-nothing state” (Skemp, 1971, p. 46). Pragmatically, the power of adaptability of a schema results from its connection to a greater number of concepts, but it may happen

that what is an appropriate schema at one particular time may be obsolete and turn into an obstacle later on (Brousseau, 1997).
Let's get back to René Descartes: "All things in nature occur mathematically". A different idea implied by this saying would be that to understand mathematics we need to connect our mathematical understandings with our understandings of the world we live in (natural, psychological and socio-cultural; see also Skemp, 1979). This idea is at the base of the concept of mathematization, or, more precisely, horizontal mathematization (Freudenthal, 1991). Concurring with this idea is the belief many have that Mathematics is a cultural product based on human experiences, such as counting, measuring, locating, designing, explaining, and playing (Bishop, 1988). Nevertheless, mathematical understanding has to do with both the learning of invariants and the acquisition of cultural tools in which children can represent mathematical ideas, in a dynamic and interconnected process (Nunes & Bryant, 1997). This idea is in line with a recent formulation of understanding in epistemology, in which understanding of a given phenomenon has to be maximally well-connected and it may have degrees of approximation (Kelp, 2015). Concerning the learning and teaching of mathematics in the complexity of our world, we can revalue the ideas of Galileo, Descartes and Von Neumann on the central role of mathematics in the context of the genetic approach of epistemology proposed by Piaget to the logical-mathematical dimension of the construction of scientific knowledge. Piaget proposed replacing the positivist hierarchization of science with an interdisciplinary cyclic epistemology. This approach to epistemological interrelationships in the context of learning, conceived in the digital environment of education, calls into question not only the connections of mathematics as a scientific discipline, but also the connections of mathematics as an academic subject. How is it possible to make the presence of mathematics visible in the understanding of other school subjects? How to collaborate with other teachers of mathematics and of other courses? This question of interdisciplinarity is in close interaction with the learning and teaching of the complexity and variety of the natural and social phenomena of our era.

SUBTHEMES

1. Learning in an increasingly complex world

- **How can we re-conceptualise learning with understanding in a complex world?**
- **How can we promote learning with understanding in an increasingly complex world?**
- **What features should a task have in order to promote learning with understanding? How to research the complex dynamic of learning with understanding promoted by such tasks? What can we learn from this research to use within the classroom and in designing lessons/tasks?**
- **How can we establish connections in mathematics learning: Between different areas of mathematics? Between mathematics and other subjects? Between mathematics and everyday life?**
- **What implications does the increasingly complex world have in terms of numeracy or mathematics literacy? How does this inform our practices within the classroom and in designing lessons/tasks?**

2. Mathematics Teacher Education

- **What kind of mathematics training should teachers have in order to be able to promote learning with understanding?**
- **How can teacher training contribute to establishing connections between the various areas of Mathematics?**
- **How can teacher training contribute to establishing connections between Mathematics and other subjects?**
- **How to promote connections between school mathematics and academic mathematics, in teacher training?**
- **What type of competences do we need to include in professional training programs for mathematics teachers to cope with the increasingly complex world challenges?**

3. Teaching for connections and understanding

- **In relation to connections and understanding, what kind of teaching methods are more appropriate?**
- **How do we evaluate and/or research the resources from the perspective of the connections and the understanding they try to promote?**
- **How can we promote mathematics education as a means to explore environmental issues?**
- **How can we promote mathematics as a means to reflect on the sustainability of the world?**
- **How can mathematics promote "living together"?**

4. Mathematics Education with Technology

- **How can ICTs contribute to learning rich in connections, in an increasingly complex world?**
- **How can ICT be used in teacher training to promote understanding in mathematics?**
- **How can we use ICT as teaching-learning tools, rather than instruments that replace students' cognitive efforts?**

5. Connections with culture

- **Is it possible to understand peoples' lives from an ethnomathematics perspective?**
- **How can school mathematics take into account the culture developed by young people in their everyday lives?**
- **How to take advantage of cultural aspects to enrich the teaching and learning of mathematics?**
- **How can we create hybrid spaces linking school-mathematics to mathematics situated in cultural, everyday contexts?**
- **What does it mean to develop a critical approach to mathematics and culture in an increasingly complex world?**

REFERENCES

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PROGRAM OF THE CONFERENCE

The program of the conference includes several activities: plenaries, semi-plenaries, working groups, oral presentations and lectures, and a forum of ideas.

Plenaries

The program includes plenary and semi-plenary sessions where invited speakers will focus on aspects of the conference theme. The plenaries and semi-plenaries provide a shared input to the conference and form a basis for discussions in the working groups.

Plenary speakers

- Terezinha Nunes, Department of Educational Studies, University of Oxford
- Carmen Batanero, Departamento de Didáctica de la Matemática, Universidad de Granada
- Joaquin Giménez Rodriguez, Departament d'Educació Lingüística i Literària, i Didàctica de les Ciències Experimentals i la Matemàtica, Universitat de Barcelona
- João Filipe Lacerda de Matos, Instituto de Educação da Universidade de Lisboa
- Kay Owens, School of Teacher Education, Charles Sturt University.

Working groups

Each participant is invited to be a member of one of the working groups that will meet several times. Working groups will focus on a specific sub-theme or on a number of interrelated themes. This will provide opportunities both for in- depth discussions and for the linking of experiences. These are planned as interactive sessions and are the heart of the conference. Some presentations may be included in these sessions but discussions and exchange of experiences and ideas are the essential aspects of this activity. Each group will be coordinated by two "animators".

Oral presentations and lectures

Individuals or small groups of participants are encouraged to contribute to the conference through an oral presentation, thus communicating and sharing with others their ideas, research work or experiences. Relevant case studies are particularly welcome. Presentations should be related to the theme of the conference in general or to the sub-themes. The time allocated to each presentation and discussion will depend on the organization of the working group. There may also be some invited lectures and presentations.

Workshops

Individuals or small groups of participants are also encouraged to prepare and organize workshops. These are a more extended type of contribution which should focus on concrete activities and encourage the active involvement of the participants through working on materials, problems or questions relating to the sub-themes. A workshop will last for about 90 min.

Forum of ideas

The Forum of Ideas offers an opportunity to present case studies, learning materials and research projects, as well as ideas that are not directly related to the theme. Participants are encouraged to display their work in the exhibition hall. There will be a specific time for contributors to explain and discuss their work with fellow participants.

Special sessions

There will be some special sessions that will enrich the discussion by presentations of country-specific views on recent developments in mathematics education.

Official languages of the conference

The official languages of the conference are French and English. Everyone is asked to speak slowly and clearly so that all participants can understand and contribute to discussions. All speakers must prepare their slides or diorama in both languages. We rely on and appreciate the help of those who can translate, to assist their colleagues within each working group.
Animators in most cases are able to help in both languages.

CALL FOR PAPERS

We hope that all participants will contribute "actively" to the conference by sharing with others their experiences and views in the various sessions, particularly in the working groups. Moreover, you are encouraged to send a proposal for an oral presentation or a workshop, or to bring a contribution to the Forum of Ideas.

Proposals for ORAL PRESENTATIONS and WORKSHOPS can be made by sending a FOUR PAGE text (about 1800 words or 12000 characters with spaces), BEFORE MARCH, 3, 2019, including:

- Title, authors' names and affiliations,
- Aim and main idea of the reported study, methodology and the expected conclusions,
- Related essential references.

The language of the proposal should be the same as that of the oral presentation (English or French). Once your proposal is accepted you will need to prepare an abstract or summary in the other official language together with slides in both languages. Members of the Commission can assist the participants in translating their slides if they ask for help ahead of time.

Three types of presentations can be proposed:

1) Study of mathematics education practice or pedagogic innovation
2) Research on current issues in the teaching/learning of mathematics
3) Theoretical papers or literature reviews.

Proposals for the FORUM OF IDEAS, can be made by sending a ONE PAGE text (about 450 words or 3000 characters with spaces), BEFORE MARCH, 31, 2019, including:

- Title, authors' names and affiliations,
- Short description of the content, including information about the type of material to be presented (poster, models, video).

The language of the proposal should be the same as that of the oral presentation (English or French). Once your proposal is accepted you will need to prepare an abstract or summary in the other official language together with one single Power Point or other presentation in both languages. Members of the Commission can assist the participants with translations if they ask for help.

The Conference Proceedings will be edited by the electronic typesetting of the submitted papers. For uniformity and the good quality of the edition, it is necessary to keep to the following specifications:

1. The page size will be A4 with margins 4cm right and left, 5.3cm top and down. The text alignment will be justified, except the title and the author's byline that will be aligned center.
2. The first page will contain in order:

- The title of the paper, in bold font and size 16,
- One blank line,
- The author's name, with a full post address and email, in font size 12,
- Two blank lines,
- Abstract of the paper: this will not exceed 15 lines, in font size 12. The main text, in font size 12.

The paper will be written in the word processor Word for Windows. All text fonts will be Times New Roman. Pictures, tables, graphs, that are included in the text, must also be saved in separate files submitted with the paper.

Please send us your computer file by using Microsoft Word or compatible (saved as SURNAME.doc or SURNAME.rtf) with your proposal to the following E-mail address: cieaem71@gmail.com (send a copy also to palhares@ie.uminho.pt).

REGISTRATION

Please register on line on the conference website.

CONFERENCE FEE

Before April 30, 2019, Participant	300 Euro
Before April 30, 2019, Accompanying person, Student, Preschool Educator, Elementary or Secondary Teacher	160 Euro
After April 30, 2019, Participant	360 Euro
After April 30, 2019, Accompanying person, Student, Preschool Educator, Elementary or Secondary Teacher	220 Euro
Quality Class with lodgment (ten nights)	300 Euro

Quality Class without lodgment 160 Euro

The fee includes all documents for the Conference (except for accompanying persons), coffee breaks, social activities, lunches, excursion and conference dinner.
You may offer extra 10 euro (or more) for the Braithwaite Fund (In order to support participants in difficult circumstances).
You can pay the conference fee by money transfer to the following bank account entitled to

AEME (Associação para a Educação Matemática Elementar)
PT50 0035 0171 0019 6909 5303 8
BIC SWIFT CGDIPTPL

All bank charges must be covered by the participant.
When you have paid by money transfer, please immediately send a copy of the transaction document with your name on it to the Conference Secretariat
cieaem71@gmail.com and palhares@ie.uminho.pt

IMPORTANT DATES

Proposals for ORAL PRESENTATIONS and WORKSHOPS	MARCH, 3, 2019
Contributions to the FORUM OF IDEAS	MARCH, 31, 2019
Reply from the International Program Committee	APRIL, 15, 2019
Conference Fee	APRIL, 30, 2019
Submission of the final paper	MAY, 15, 2019
Third Announcement (Final Program)	MAY, 31, 2019

ACCOMMODATION

Participants must book hotel or other accommodation by themselves. Please book your hotel in advance if you wish to have a nice place! You will be able to travel by bus from the center of Braga to the conference venue, so the city center will be a good place to stay.

INFORMATION FOR VISITORS

Time - Portugal is on Greenwich Mean Time (GMT).
Currency - The official currency in Portugal is EURO (€). Major credit cards are widely accepted, although cash is preferred in most shops, especially the smaller ones.
Banks - Banks in Braga are open between 08.30 – 15.00 during working days.
Smoking - The conference is a non-smoking event. In Portugal smoking is not allowed in public buildings, restaurants, liquor establishments (bars) and cafeterias.
Liability & Insurance - The organizers cannot be held responsible for accidents to conference participants or accompanying persons, for damage, or loss of their personal property, or for cancellation expenses, regardless of cause. Participants are advised to carry out their own insurance arrangements during their stay in Portugal.
Special Needs - Participants and accompanying persons with disabilities are invited to advise the Conference Secretariat of any special requirements.
Phones & mobile phones - The international dialing code of Portugal is +351. Please consult your cell provider about roaming rates for Portugal.
Electrical Plugs 220V ~ 50Hz

HOW TO REACH BRAGA

By airplane
The closest airport to Braga is Airport Francisco Sá Carneiro in Porto. There are direct buses from the airport to the center of Braga, it is a 50 minutes' journey. Information on timetable and prices can be found in https://www.getbus.eu/en/braga-airport-braga/

It is also possible to come via Airport General Humberto Delgado in Lisbon, but be aware that it is a 3h30m journey by train or 4h30m by bus to reach Braga.