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DG 15: Ethnomathematics

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Aims and focus

According to the discussion document the DG 15 mostly aimed to provide a forum of participants to exchange their ideas and experiences in ethnomathematical research, particularly, those related to research on cultural aspects of mathematics education. Thus, the activities of DG 15 at ICME-10 aimed to discuss the following issues in the area of ethnomathematics:

1. What is the relationship between ethnomathematics, mathematics and anthropology, and the politics of mathematics education?
2. What evidence is there, and how do we get more, that school programmes incorporating ethnomathematical ideas succeed in achieving their (ethnomathematical) aims?
3. What are the implications of existing ethnomathematical studies for mathematics and mathematics education?
4. What is the relationship of different languages (or other cultural features) to the production of different sorts of mathematics?

The Organising Team was able to mobilise contributed papers from all five continents. More than 50 people from more than 30 countries participated in the DG activities. The discussion was mainly based on the 15 papers accepted by the Organising Team and made available to the public at www.icme-organisers.dk/dg15/. The papers can be roughly grouped, with respect to the above issues, in this way:

1. Maria Cecilia de Castello Branco Fantinato (Brasil): *Quantitative and spatial representations among working-class adults from Rio de Janeiro*.
Gelsa Knijnik and Fernanda Wanderer (Brasil): *The art of tiles in Portugal and Brazil: Ethnomathematics and traveling cultures*.
Hsiu-fei Sophie Lee (Taiwan): *Ethnomathematics in Taiwan – A Review*.
Charoula Stathopoulou (Greece): *Mathematical cognition in and out of school for Romany students*.
2. Franco Favilli and Stefania Tintori (Italy): *Intercultural mathematical education: Comments about a didactic proposal*.
Giuseppe Fiorentino and Franco Favilli (Italy): *The electronic Yupana: A didactical resource from an ancient mathematical tool*.
Laura Maffei and Franco Favilli (Italy): *Piloting the software SonaPolygons_1.0: A didactical proposal for the GCD*.
Mogege Mosimege (South Africa) and Abdulcarimo Ismael (Mozambique): *Ethnomathematical studies on indigenous games: examples from Southern Africa*.

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3. Pierre Clanché and Bernard Sarrazy (France): *Occurrence of typical cultural behaviors in an arithmetic lesson: how to cope?*
Philip Clarkson (Australia): *Multicultural classrooms: contexts for much mathematics teaching and learning.*
Maria do Carmo Santos Domite (Brasil): *Notes on teacher education: An ethnomathematical perspective.*
Issic K.C. Leung, Siu-hing Ling and Regina M.F. Wong (Hong Kong): *Students' Mathematics Performance in Authentic Problems.*
Jerry Lipka and Barbara L. Adams (USA): *Some Evidence of Ethnomathematics: Quantitative and Qualitative Data from Alaska.*
Rex Matang and Kay Owens (Papua New Guinea): *Rich Transitions from indigenous counting systems to English arithmetic strategies: Implications for Mathematics Education in Papua New Guinea.*
Daniel Clark Orey and Milton Rosa (USA): *Ethnomathematics and the teaching and learning mathematics from a multicultural perspective.*

Even if no papers were completely or mostly related to issue 4, in some of them the relationship between different languages and different mathematics was clearly pointed out.

Based on the assumption that the participants had made themselves familiar with the papers before the congress, the DG 15 activities were carried on as follows:

- As only the two Team Chairs of the Organising Team were present at the first session, it was decided to split the session in two subgroups. It was also decided to give an opportunity for the participants who had submitted a paper and were present at the session, to give a very short oral presentation of their paper, in order to initiate and enhance the discussion. The participants joined the subgroups in accordance with their specific interests. In these parallel sub-sessions and in the second one (see below), papers from each of the three groups of papers, mentioned above, were made available for the discussion.
- In the second session, the two subgroups met together and there were some more short oral presentations followed by a short discussion on each paper and finally the general discussion.
- The final session was completely devoted to reporting and general discussion.

The accepted papers for the DG and their short presentations raised a large variety of issues within the area of ethnomathematics, in general, and the issues set out by the Organising Team for the discussion, in particular, as shown by their summaries:

First group of papers

Fantinato's paper reports some of the results of a piece of ethnomathematics research developed with a group of low-educated adults, living in a poor neighbourhood of Rio de Janeiro. The research aims to understand quantitative and spatial representations built and used in different life contexts, as well as relationships between these representations and school mathematical knowledge. Results show a strong association between

the use of mathematical skills in daily life and survival strategies to satisfy basic needs such as managing a reduced budget. This appears to be related also to emotional factors like protecting one's identity.

Knijnik & Wanderer's paper discusses some aspects of the relationship between Mathematics Education and art, focusing mainly on the study of Portuguese tiles, which were brought to Brazil in the colonial times. In Brazil they were re-appropriated in a special way and later on came back to Portugal influenced by that hybridized form. The paper shows the curricular implications that can be established through the links between pedagogical processes involving isometries and the fruition of art.

Lee's review paper argues that multiculturalism having been a trend in educational reform around the world, Taiwan is not exempted from this trend. Indeed, multicultural curricula have been implemented in Taiwan from the elementary to college level of education. However, when compared to the concept and implementation of multicultural curricula, ethnomathematics appears to be an emerging new concept and has not been extensively studied yet.

Stathopoulou's paper presents a study in which first hand material, collected on the spot in a multicultural community in Athens, is used to demonstrate the relation between the mathematical cognition acquired by Romany people within their community and mathematics learning of Romany students in school context. The fact that the formal education contemns or ignores the special cognition with which Romany students come to school is connected not only with their low school aptitude but also with the preservation of their marginal role in school as well as in the society.

Second group of papers

In their paper, *Favilli* and *Tintori* argue that the practical implementation of the theories developed in the area of ethnomathematics research and culturally contextualized mathematics education does not seem to have been devoted much attention in some countries where multiculturalism is a relatively recent educational requirement. This paper presents some considerations made by mathematics teachers and their pupils after piloting an intercultural and interdisciplinary didactic proposal related to the construction of a *zampoña* (the Andean flute) and elaborated in the context of a European project.

Fiorentino and *Favilli's* paper introduces an electronic version of the *yupana*, the Inka abacus. One of the paper aims is to show that it is possible to make ancient mathematical artefacts attractive and usable, thus proving their present didactical utility. The electronic yupana represents an attempt to link tradition and modernity, indigenous and scientific knowledge, poor and rich cultures. It represents an educational environment, a friendly tool through which pupils can achieve the notion of natural number, compute basic operations, familiarise with positional notation and base change, and develop personal "algorithms".

The paper by *Maffei* and *Favilli* presents a didactical unit designed within a research project on arithmetic. The unit objective is to introduce the notion of the Greatest Common Divisor through *sona*, sand drawings from African culture, and their representation by an appropriate software. A brief description of the project framework, the practice of the *sona* and the guidelines of the didactical proposal, as well as a sketch of the main characteristics of the *SonaPolygons_1.0* software are presented. The first findings of a pilot project at a few lower secondary schools are also discussed.



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In their paper, *Mosimege* and *Ismael* present studies on a variety of indigenous games carried out in regions of South Africa and Mozambique. It studies the use of these games in the classroom, with a variety of activities for the purpose of learning mathematics. Such games are usually viewed from the narrow perspective of play, enjoyment and recreation. However, analyses of games reveal complexities, such as their origins, socio-cultural contributions to societal and national activities, mathematical concepts associated with the games, general classroom related curriculum development possibilities and implications.

Third group of papers

Clanché and *Sarrazz's* paper offers a topic for discussion. They present a reflection based on observations of an arithmetic lesson, in which certain typical cultural behaviours occurred. The study is based on the assumption that mathematics must now be understood as a kind of cultural knowledge, which all cultures generate but which need not necessarily look the same from one cultural group to another.

Clarkson's discussions paper calls for attention, particularly, to the issue that many if not most mathematics classrooms are micro-sites of multiculturalism. Hence notions of ethnomathematics are in play whether it is acknowledged or not. However, the fact that there are often multiple cultures and languages represented means that the learning and teaching carried out in these classrooms is more complicated than in mono-cultural classrooms. The notion of multiple contexts of classrooms, because of the variety of possible combinations of cultures and languages present, is emphasised as a potentially important factor that has not been recognised in research so far.

Domite's paper presents a reflection on an ethnomathematical perspective of teacher education. Based on one example of a teaching situation with a teacher in which a different approach to division was presented by a child, based on out-of-school experience. The aspect underlined in this paper might help student teachers to get inside the world of the students, thus indicating how student teachers could be educated in order to become aware of the mathematical background of their students.

Leung, Ling and *Wong's* paper on a preliminary research project carried out in Hong Kong, refers to a distinction between ethnomathematics and the formal way of learning mathematics in schools, stressing the richness of ethnomathematical activities. It presents the idea of linking mathematics and the real world through what the authors call authentic problems. Their result suggests that authentic problems could lead to a better learning environment in mathematics.

The paper by *Lipka* and *Adams* presents the first results of a project aimed at improving the academic performance of Yup'ik and other Alaskan students, and to alter the politics of exclusion by including elders' knowledge in the school math's curriculum. Quantitative data derived from a research design shows that the Alaska native students who engage in this culturally-based curriculum outperform comparably matched groups of students who use their school mainstream curriculum only. Further, qualitative data shows some of the teacher-student, student-student and school-community effects of this curricular effort. The study also shows that the culturally-based mathematics modules appear to motivate and increase students' interest.

Matang and *Owens'* paper explores the possibility of utilising and building on the counting and arithmetic strategies embedded in the country's 800-plus traditional counting systems. This is based on the commonly accepted educational assumption that

learning of mathematics is more effective and meaningful if it begins from the more familiar mathematical practices found in the learner's own socio-cultural environment. Based on the basic number structures and operative patterns of the respective counting systems from selected language groups, the paper briefly describes how the rich diversity among these language groups can be used as the basis to teach basic English arithmetic strategies.

Orey and *Rosa* argue for a distinction between ethnomathematics and multicultural mathematics. They warn against using ethnomathematics as a lead into Western mathematics. Taking into account that the basic tenant of ethnomathematics is the sincere belief that all people use mathematics in their daily life, not just academic mathematicians. Yet, globally speaking, not all people have regular access to or attend school. Ethnomathematics as a program of study offers one possibility – allowing researchers to examine what and how mathematics is taught in the context of school, culture, and society.

The discussions gave the DG participants the opportunity to reflect upon additional issues related to those dealt with in the papers. These issues include:

- the relation between mathematics education in its cultural context and the theory of didactic situations;
- the relevance of using indigenous mathematics in the classrooms;
- the role of different counting systems in basic arithmetic;
- the importance of making cultural and historical mathematical activities, tools and artefacts available to the classroom in a modern way, respectful of the tradition;
- the interaction between the various languages used in an increasing number of classrooms (language of education, different mother tongues, mathematical language).

As a conclusion, it must be stressed that the richness of the contributions and the variety of issues provide evidence of the great vivacity of the international community of ethnomathematics, a field of study that keeps attracting an increasing number of scholars.

This report was written by Franco Favilli and Abdulcarimo Ismael. They are happy to be contacted at favilli@dm.unipi.it and ismael@teledata.mz for further information on the works of this DG.



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