

## Language and mathematics teaching/ learning in multicultural classrooms in Europe: Exploring problems and difficulties \*

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### ABSTRACT

*In the framework of the Comenius action of the LLP programme of the European Commission, we are developing a project focusing on the role of the language in mathematics learning for non-mainstream students. We are in the first stage, exploring teachers' needs in order to respond more effectively to teaching mathematics. Here we briefly present the project objectives and the first findings from the analysis of a questionnaire answered by lower secondary school teachers in the partners' countries (Austria, Czech Republic, France, Greece, Italy and Norway). Questions were about teachers' experience on teaching in multicultural classes, their pre-service and in-service training, material used or needed in order to facilitate their teaching.*

### Theoretical framework

In the last two decades several scholars, acknowledging the role of the language in the mathematics teaching/learning, above all for students that are not taught in their first language, have focused their researches on this topic. Through the research, it has been recognized that various factors related to language affect children's learning (e.g. Ellerton & Clarkson,

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1996; César & Favilli, 2005; Setati, 2008, Barwell 2009). Much of the literature focuses on differences between bi- or multi-lingual and monolingual children. In the past, bilingualism was thought to have a negative effect on thinking (Saer, 1923). However, in recent research bilingualism appears as an advantage more than as a disadvantage. For example, bilingualism: increases meta-linguistic awareness (Cummins, 1978; 2000), is related to creativity (Kessler & Quinn, 1987; Leikin, 2012) and the formation of ideas (Liedke & Nelson, 1968), and leads to superior performance (Clarkson, 2007). Meanwhile, a significant number of researches focuses on what happens in linguistically diverse mathematics classrooms, investigating the role of language in acquiring mathematics as system of meaning (Pimm, 2004; Barwell, 2009) and in understanding the mathematical processes through teacher's pedagogical discourse (Khisty 2002). In a recent work Barwell (2012) identifies four types of tensions around language issues when teaching mathematics in multilingual classroom environments: tensions between school and home languages; between formal and informal language in mathematics; between language policy and mathematics classroom practice; between the language for learning mathematics and the language for getting on in the world.

A question that emerges is how far teachers are aware of the role of the language in mathematics teaching. Khisty (2006), exploring the kind of knowledge and skill that are required from mathematics educators and teachers, stresses the need for: finding ways to use the multimodal nature of mathematics into constructing effective learning environments; alerting or altering teachers' beliefs into combining language and content teaching; orienting them to use multilingualism as a tool to benefit learning.

## **The M<sup>3</sup>EaL project**

### ***Rationale and aims***

Although multiculturalism in schools is a widespread phenomenon in all European countries, much still needs to be done to identify teaching strategies which enable different disciplines to be taught effectively to pupils from minority cultures as well as to the rest of the class. It is of vital necessity to define and experiment teaching materials which do not discriminate against pupils from different cultures and languages. This is particularly true for maths, a subject which – according to comparison results of several international studies – proves by far more difficult to learn than any other.

This project aims to collect information about experiments carried out in the partner countries and teaching materials for maths in multicultural contexts which have proved effective or worthy of further study and piloting. The project aims also to produce teaching materials that take into consideration specific local factors such as the cultural and linguistic context of the classroom, the social environment outside the school, the school system and tradition, the majority culture of the country in question as well as several minority cultures present in the European schools, etc. One of the aims of the project is to create, on the basis of national and international experiences, examples of teaching materials to be adapted to the different contexts and cultural-linguistic factors present in European schools. These materials, piloted in different partner countries, will represent a synthesis of various national experiences and a tool for reflection on teaching methods which secondary school maths teachers will be able to use throughout Europe.

The cooperation among mathematics and language educators from six European countries quite significantly different in cultures and languages represent a valid instrument to create in the partnership the awareness of the importance of cultural and linguistic diversity. This awareness will be reflected in the proposals for teaching materials, thus allowing maths teachers and their pupils to benefit from the new cultural environment in the classroom.

### ***Expected impact***

The main target groups are mathematics in-service teachers and student teachers (pre-service teachers) in secondary schools. The main dissemination tools will be represented by continuous contacts with and information to teacher professional organisations, associations working with minorities, local authorities that will be invited to attend and contribute meetings, seminars and conferences.

The dissemination of the experiences obtained through the piloting of the teaching materials will increase teachers' confidence in their ability to cope with the multiculturalism in the classroom. The courses and workshops for teachers and trainees organised, in each partner country, to pilot the teaching materials will allow teachers with pupils from different cultures to pay greater attention to communication in maths classes. The careful and precise use of the language, and better acknowledgment and valuation of the cultural differences in classrooms represent key factors for mathematics teachers' development. The consequent new approach to mathematics

teaching should represent the methodological change, which minority pupils and the whole class could benefit from in their learning process.

Pupils – specifically, but not only, those from different cultures and with different languages – will benefit from the possible changes in the teachers' didactical approach.

Video recordings, teaching materials, reports, etc. will be an additional resource for teacher trainers and represent possibilities for change in their educational approach.

To measure the impact and the results of the project activities on the different target groups, specific evaluation and assessment instruments will be produced, making mainly use of questionnaires, individual reports and classroom observation sheets.

### **First findings from a questionnaires analysis**

In the first stage of our research a questionnaire for lower secondary school mathematics teachers was designed and disseminated in the partner countries. The questions basically aimed to get from the teachers information about their training to teach in multicultural classrooms, their teaching experience in such contexts, the encountered problematic issues, the way they had confronted them, the educational needs they had identified.

Through a first analysis of about one hundred and fifty questionnaires, it clearly emerged that, in all the project partner countries, teachers had no adequate training, if they had it at all. Only a few young teachers had attended initial teacher training courses regarding intercultural education, although just under a pedagogical perspective. The majority of the teachers had attended no training programmes, seminars or conferences at all, even though 60% of them experienced teaching pupils from different cultural and linguistic background.

The majority of the respondents encountered different kinds of difficulties when teaching in multicultural classes. In order to overcome them, teachers looked for adequate materials (such as books, papers, teaching units, ICT supported didactic resources) produced by mathematics educators and presented at mathematics teacher training programmes, organised by different educational authorities or local entities.

Teachers in all the project partner countries consider that the language is an obstacle for mathematics teaching. Some of them suggest the use of a lexicon with mathematics terminology.

Some teachers emphasise that it can be hard to know if the pupils' sometimes poor achievement is caused by the lack of maths knowledge from earlier studies or the new language. Respondents say also that it is hard to find teaching materials that do not demand good knowledge of the mainstream language.

### **Summarizing**

Although the European educational context is or tends to be multicultural/multilingual, at higher or lower degree depending of the country, teachers seem to be unprepared to cope with this educational reality.

The first analysis of the questionnaires completed from secondary mathematics teachers in the six European partner countries reveals that the great majority of the teachers had no adequate (pre-service or in-service) training on issues related to the educational management of learning mathematics in multilingual classrooms. The issues of language appear to be of the most important factor for teaching in classes with pupils whose family language is different from the vehicular language. Also the lack of appropriate teaching material as well as schools' support were designated by the teachers as factors that influence their work.

So, in order to make teachers able to create suitable pedagogical environments in classroom (using multilingual and multimodal mathematics communication, being aware of what learning in two languages means and how to teach effectively in these classroom contexts) they need much more education and support in general.

The information of the first step of our project as well as the corresponding theory will guide our next steps to design and pilot suitable didactical materials.

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