MATHS TEACHERS IN MULTICULTURAL CLASSES: FINDINGS FROM A SOUTHERN EUROPEAN PROJECT

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Abstract Faced with an ever-increasing number of immigrant or minority culture pupils in their classes, many maths teachers have to confront a completely new didactic situation. Research underway within a European project initiated in Italy, Portugal and Spain is already providing interesting findings on conceptions, attitudes, strategies and needs manifested by teachers both regarding their pupils and their own practices. This paper presents some of these empirical evidences, obtained from a first analysis of a questionnaire submitted to maths teachers in lower secondary schools. In particular, we can say that teachers have shown interest in teaching in multicultural contexts, but they ask for specific in-service courses and support both in terms of experts and didactic material.

Introduction

The phenomenon of immigration is relatively recent for Southern European countries such as Italy, Portugal and Spain. If we exclude the migratory flow towards Portugal of citizens from its ex-African colonies after their independence in 1975, it is only in the last ten years that these countries have started to attract the attention of many people from North Africa, Sub-Saharan Africa, South America, Asia, East Europe and the Middle East. Today, the main causes of these movements, as it is often the case when talking about immigration, are wars, lack of job prospects and a dignified standard of living in the country of origin, or even absolute poverty. The relatively easy access by sea to Italy and Spain and even Portugal (often illegally), pushes more and more people to look for a better life in countries, which, up till a few years ago, were only considered a stopping point towards Northern and Central Europe.

Faced with this flow of immigrants, a large debate is developing in our society at various levels: political, sociological, humanitarian etc. It is now easy to observe an increasing degree of sensitivity on the part of a large number of people towards the phenomenon, with different evaluations and attitudes.

Nearly everyone recognises the problems that this significant level of immigration brings with it at various levels. Nearly everyone also recognises that there is a significant lack of programming and planning at a political-administrative level. Even today, the emergency situation seems to be the factor that shapes each decision and initiative. Among the social problems linked to immigration, education is certainly a feature. This can find a medium term solution by placing adequate attention on multiculturalism, and thus posing didactical type problems.

The presence of immigrant pupils in primary and lower secondary schools of the three countries is increasing consistently. In Italy, for example, foreign pupils in primary and lower secondary schools only represent 2% of the school population, but this percentage is expected to double in less than ten years (MIUR, 2001). However, in Portugal this percentage is much higher. Notwithstanding the size of the phenomenon, it is clear that in many classes there is now more than one macro-culture represented. In Spain, in fact, and maybe even more so in Italy, this experience is absolutely new; in Portugal this is not the case, given the presence over many years of pupils with origins in the ex-African colonies. For this reason, here one does not have simply immigrant pupils but also pupils from minority cultures (already Portuguese citizens).

Even within single countries, there is anyway a wide difference in situations due to the tendency of immigrant citizens coming from the same area to group together in the new country: this is often because there is a higher availability of work in these zones, but sometimes it is in an attempt to recreate a social fabric similar to that they have at home. An example of this is the Chinese community in Tuscany.

But this inhomogenity is also temporal, because the structure of immigrant groups changes over the years within the three countries: over time, there is in fact a great variation in the percentage of immigrant pupils originating from different countries.

Theoretical framework

The IDMAMIM theoretical background are the intercultural didactics, Mathematics teaching in non homogenous cultural contexts, Ethnomathematics (D'Ambrosio, 1995/96), teachers education for an intercultural teaching of mathematics and didactic planning considering different real situations.

Mathematics is conceived as a situated activity being a social achievement (Abreu, 1995). Therefore it is under the influence of several social and cultural elements which shape mathematical activities and performances (Bishop, 1988; Saxe, 1996). Considering Mathematics as a social and cultural activity stresses its collaborative character and the need to promote collaborative practices within the educational community, namely among teachers (César, 2000). According to these epistemological principles teachers should be educated taking into account the ideals of the ethnomathematics programme (D'Ambrosio, 1995/96) and facilitating them the development of the competencies needed to operationalize those ideals in their practice in multicultural contexts (Favilli, 2000; Shirley, 1998).

In order to achieve this development teachers should introduce in their classrooms learning situations rising from daily life practices in different cultures which involve implicit and explicit mathematical activities (Oliveras, 1996). These didactical proposals could include microprojects based in handcrafts activities in which pupils explore mathematical knowledge related to the elaboration of the considered artifacts (Favilli, Oliveras and César, submitted). In (Oliveras, Favilli and César, 2002) there is a detailed analysis of the objectives of the project and its theoretical background.

The IDMAMIM European Project and the instruments used

In our countries there have been several demands of primary and secondary school teachers – worried and often unprepared to deal with this totally new experience – in order to have the opportunity to do pre-service and in-service education related to multicultural education. But, as we will see better later, the teacher in-service education offered was not considered adequate since it was essentially based just on promoting higher sensitivity and a positive attitude in approaching the teaching experience in an intercultural context.

Very little attention was given in fact to the teaching of the various disciplines, except for that of the local language as a second language. In this way, teachers indirectly appropriated the idea that teaching other subjects should/could not be influenced by the presence of immigrant or minority culture pupils in the class. The school system seems yet now to consider the teacher's positive attitude and teaching of the local language the only elements to be tackled.

What seems to be missing in most situations are responses from the various disciplines to a general educative problem. This means that up till now, there has been practically no specific planning for the single disciplines taking into account the cultural context of a class that is no longer homogenous (at least at a macro level) but varied (Favilli, in press). As regards mathematics, this point clearly emerged in Italy from the analysis of a questionnaire set in 1996 to some middle school teachers with foreign pupils in their classes in the Province of Pisa. Analogous findings also emerged in Spain through theoretical study initiatives (Oliveras, 1997) and practical projects (Gorgoriò, 1998).

This is the context that provided the idea in October 1998 to set up ***IDMAMIM***[(1)] **–** ***Innovazione in Didattica della MAtematica in contesti Multiculturali con alunni Immigrati e di Minoranze*** - *Innovation in the Didactics of MAthematics in Multicultural contexts with Immigrant and Minority culture pupils*, a research project aimed at mathematics teachers working with the 11-14 age group, the partners being the Universities of Pisa, Lisbon and Granada.

In short, there are five main themes of the IDMAMIM research: (a) Culturally contextualised didactics of mathematics; (b) Attention given to different mathematical cultures: creating a climate of reciprocal respect between different cultures; (c) Exchange and use of different mathematical knowledge; (d) In-service education of mathematics teachers and (e) Subsidies for the intercultural teaching of mathematics.

The procedure we used was: (a) The analysis of the state of the art; (b) Questionnaires for teachers; (c) Semi-structured and audio taped interviews for some selected teachers; (d) Introductory seminars on the teaching of multicultural mathematics and ethnomathematics; (e) Planning proposals (micro-projects) for interdisciplinary and intercultural curricula; (f) Experimentation and validation in

classes; (g) Revision, external evaluation and transfer onto a CD-Rom. In this paper we are going to present data from the questionnaires.

Structure of the questionnaire

The questionnaire, prepared in 2000, was aimed at maths teachers and distributed in the Provinces of Pisa and Granada and in Lisbon. It was divided into three sections that could be entitled as follows: (I) Information on the *curriculum vitae et studiorum* of the immigrant or cultural minority pupil; (II) How his/her mathematics teacher sees this pupil; and (III) How the mathematics teacher sees him/herself in his/her activity in multicultural classes. Each teacher had to compile sections I and II for each of his/her immigrant or minority culture pupils, and compile a single section III.

Section I of the questionnaire

One of the aims of this section was *to push the teacher into:* (a) appropriating more information on the scholastic experience of the pupil before his/her arrival at the school; (b) trying to understand the curricular content already presented to the pupil and at what level it had been appropriated (Favilli and Villani, 1993).

Section II of the questionnaire

Some of the main scopes of this section of the questionnaire were *to make the teachers aware, in general,*

a) of the necessity that the immigrant or minority culture pupils are effectively included into the class, as a starting point for their active participation in the school and society (César, 2000) ;

and, in particular,

b) of the difficulties these pupils face in learning mathematics.

These problems are strictly linked to each other and require positive and effective responses that are individual rather than global, relating to the individual pupil and his cultural background and that of the class. In fact, for the pupil to reach a real inclusion in the school and society, he/she must reach an adequate level of culture.

For this reason, the first group of questions in section II is dedicated to inclusion, with questions aimed at knowing pupil's level of knowledge of the local language, the child's inclusion in the class, relationship with companions etc.; the second group is dedicated to the pupil's preparation and, in particular, mathematical preparation, with questions on any specific difficulties in this field of learning.

Section III of the questionnaire

Some of the main aims of section III of the questionnaire included *to bring to the forefront*: a) the teacher's beliefs with respect to the relationship between culture and mathematics; b) the professional attitude of mathematics teachers in multicultural contexts; c) their needs for specific in-service education; d) the didactic strategies and

methods used by them in this context; e) any requests for specific didactical subsidies. All these aspects will be illuminated by some of their answers.

Results

The analysis was performed in I – Pisa (Italy), 106 section IIs and 68 section IIIs (some teachers had more than one immigrant pupil per class); in P – Lisbon (Portugal), 109 section IIs and 69 section IIIs (see above); in S – Granada (Spain), 40 section IIs and 40 section IIIs.

We will try in the following to summarise some of the most interesting indications that emerged from a quantitative analysis of the questionnaires. These empirical evidences were judged worthy of further investigation, which was performed through interviews, performed later, with some teachers who had filled in the questionnaire (César, Oliveras and Favilli, in press). It is clear that the data reported below cannot be considered *a priori* as representative of a general situation for the countries of interest, even though they do have their own significance, considering, for example, the fact that the sample used in Pisa corresponds to 18% of the immigrant and minority culture scholastic population:

II. a)

1. *What difficulty did the pupil find in inserting him/herself into the class?*

	significant	medium	little	no answer
I	26%	35%	39%	
P	12%	40%	47%	1%
S	30%	42%	28%	

2. *Does this difficulty still exist?*

	yes	no	no answer/don't know
I	31%	69%	
P	14%	62%	24%
S	38%	56%	6%

3. *Does the pupil only have contact with his/her companions within the school?*

	yes	no	no answer/don't know
I	21%	79%	
P	32%	59%	9%
S	48%	26%	26%

4. *Are the parents interested in the pupil's schooling?*

	yes	no	no answer/don't know
I	42%	58%	
P	64%	19%	17%
S	60%	30%	10%

II. b)

1. *The subject the pupil has most problems with learning is*:

I	Mathematics 37% Italian language 32%, etc.

2. *When compared to the rest of the class, his/her difficulty in learning mathematics is*:

	less	equal	greater
I	5.5%	46.5%	48.5%

P	Mathematics 36% Portuguese language 50% , etc.	**P**	33%	45%	21%
S	Mathematics 12% Spanish language 47.5% , etc.	**S**	13%	51%	36%

3. *What are the topics proving most difficult*?

I – problems 41%, calculations 19%, geometry 7% etc.

P – operations and calculations 43% , geometry 17% , algebra 5%

S – calculations or arithmetic 19% , problems 15% , geometry 13% etc.

The evident greater difficulty revealed by immigrant or minority culture pupils in learning mathematics made it necessary to perform an accurate investigation as to how the mathematics teachers had managed to get into a clear situation of cultural conflict. Section III of the questionnaire dealt entirely with this investigation.

A more refined research would also be useful to better understand whether and for what reason cultural differences correspond, even at a macro level, to a greater or lesser difficulty in appropriating specific topics in mathematics.

III. a) – 1. *From a professional viewpoint, the teachers have towards foreign or cultural minority pupils an attitude of:*

I – interest 79% , indifference 9% , irritation 2% etc.

P – interest 70% , indifference 17% , discouragement 7% etc.

S - interest 70% , indifference 7% , irritation 7% etc.

III. b)

1. *Teachers are prepared for the experience of teaching in a class with foreign or minority culture pupils:*				**2.** *Do you think it is useful to participate in in-service education for teachers who work with foreign or cultural minority pupils?*			
	not at all	**by following courses**	**by studying texts**		**yes**	**no**	**no answer/don't know**
I	48%	15%	2%	**I**	64%	16%	20%
P	44%	3%	1%	**P**	65%	4%	31%
S	52%	8%	22%	**S**	60%	10%	30%

III. c)

1. *As a result of the presence of immigrant or cultural minority pupils, have teachers changed their didactic methods?*				**2.** *Did teachers perform a different type of work with these pupils?*				**3.** *Did teachers use different didactic materials from that traditionally used, in some way connected to the culture of these pupils?*			
	yes	**no**	**no answer**		**yes**	**no**	**no answer**		**yes**	**no**	**no answer**
I	49%	35%	16%	**I**	60%	37%	3%	**I**	25%	75%	
P	31%	65%	4%	**P**	27%	70%	3%	**P**	20%	71%	9%
S	36%	52%	12%	**S**	45%	35%	20%	**S**	12%	62%	26%

III. d)

1. *Do teachers think it is important to interact with a person who has knowledge about the culture of these pupils?*				**2.** *Do teachers think that the didactical resources available are adequate for a multicultural scholastic context?*			
	yes	**no**	**no answer/ don't know**		**yes**	**no**	**no answer/ don't know**
I	75%	6%	19%	**I**	13%	65%	22%
P	84%	3%	13%	**P**	42%	45%	13%
S	70%	12%	18%	**S**	42%	46%	12%

III. e)

1. *Do teachers consider that a different mother tongue language influences learning in mathematics?*				**2.** *Do teachers think that the original culture of the immigrant or minority culture pupils influences their mathematics learning?*			
	not at all/ little	**significantly**	**no answer/ don't know**		**not at all/ little**	**significantly**	**no answer/ don't know**
I	34%	39%	27%	**I**	27%	44%	29%
P	32%	42%	16%	**P**	25%	49%	26%
S	42%	35%	23%	**S**	5%	58%	37%

Discussion

There is certainly a clear interest on the part of mathematics teachers in the three countries regarding the experience of teaching in a multicultural context, and there is a need for in-service courses with this scope [14]. However, it also emerges that there is a certain degree of passivity in taking private study initiatives. Therefore the CD-rom, which will be final project output, will include not only an introduction on the maths teaching in multicultural contexts and the ethnomathematics, but also a wide bibliography, so easing the in-service education of the teachers.

As regards teaching, apart from a common recognition of the peculiarity of the situation, from the analysis of the questionnaires it seems that there is a satisfactory degree of flexibility shown by the teachers (see questions III. c)-1,2 and 3), who seem fairly inclined to consider the cultural context of the classroom (Bishop, 1988).

The great need of the teachers for support in this activity is, again, common in the three countries: a support both in terms of experts (Favilli, 2000) and didactic material. This seems to be a consequence of the lack of knowledge of didactic subsidies based on different cultures.

To that, as already said above, the proposal for interdisciplinary and intercultural didactic modules is a part of the IDMAMIM project work-plan. Three modules have been prepared and are under experimentation and validation in a few classes. The modules have been proposed in the form of *microprojects* (Oliveras, 1996), which main aim is to introduce mathematical concepts, from a socio-constructivist approach, to pupils in multicultural classrooms, starting out with activities in one or several of the cultures present in the class.

The chosen activities relate to culturally relevant handicrafts, such as the Andean flute (South American culture), the batik tissues (Sub-Sahara African culture) and the woven carpets (North African culture). Each module could be developed according to the following schema:

- watching a video-tape showing the handicraftsman working out his product;
- deeply analysing the artefact production, pointing out the single activities;
- replying in the classroom the whole procedure, so to have the same artefact made up by the pupils;acknowledging the explicit and implicit mathematical concepts required in the construction;
- investigating the further mathematical knowledge necessary to make up a similar artefact, with different patterns or dimensions;
- continuously pointing out and developing the possible connections to other school disciplines and, therefore, involving different teachers in the module activities.

By the suggested methodology, all pupils should learn to work co-operatively, in a interdisciplinary way, valuing the contributions from different cultures and taking

advantage from their concern to a real problem. Further, in this way pupils from minorities, who very often suffer a kind of cultural inferiority complex, should improve their self-esteem. The cultural diversity in the classroom should then become a powerful educational tool from which the whole class could benefit thanks to a real intercultural form of education (Bishop, 1988; Vygostsky, 1962, 1978).

With respect to the possible causes of greater difficulty found in learning mathematics by immigrant or minority culture pupils, it is not possible to extract clear findings from the questionnaires as to the opinions of the teachers: Portugal is the only exception for the linguistic factor (highly determinant) (Ellerton and Clarkson, 1996) and Spain for the cultural effect (which appears to be absolutely insignificant). A better analysis will be possible after a more detailed study is performed on the answers to the questionnaires and the replies in the recorded interviews.

Final remarks

The implementation in the mathematics curriculum of microprojects involving different disciplines and rooted on different cultures could be a first answer to the need for making less difficult the learning of a subject which is worldwide regarded as a difficult one *per se* and which clearly appears too much difficult for most pupils from minorities.

Furthermore, as the first experiences [or: microprojects piloting] are showing, the introduction in the classrooms, not in a folkloric way but as educational choice, of contributions to the mathematical knowledge from different cultures, should strengthen the teachers belief (which is starting to emerge) that there is a link, to be studied with great attention, between mathematical education and the culture of origin of the immigrant or minority culture child.

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