

An experience in multilingual teaching in mathematics.

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Abstract

Can a multilingual approach help mathematical teaching? And can mathematical language be helpful in modifying our feelings about a “minority” language? We shall give a short outline of a short teaching experiment in a high school in a bilingual area (Friulian - Italian), in which we have sought to explore some of the opportunities opened by a multilingual approach to mathematical teaching.

Key-words: bilingual teaching, language policy, mathematical terminology.

1. Can a multilingual approach to mathematics be profitable?

One of the main problems in mathematical teaching is that mathematics is often felt to be abstract, formal, far from everyday's life, and therefore it is considered to be the typical “hard” subject. If we wish to better the learning of mathematics at any level and make this subject enjoyable it is necessary to overcome this prejudice. For students whose first language is not the same as the teaching language at school the gap between their own socio-emotional world and the school world is even wider. Mathematics then, since it requires a formalized and sophisticated use of the language, can become for minority language pupils the typical instance of this gap and acquire therefore further negative implications. Up to now the most used strategy in this situation was just to pretend there is no such a problem. The reasons of such a choice are many, complex and diversified, and this is surely no place to explore them in depth. One of the basis assumptions is however that, at the bottom, the only serious approach is a monolingual teaching (obviously in the “majority” language). But is it really so? If the message we convey (explicitly or implicitly) to our pupils is: “our school does not care about your language and your cultural world” shouldn't it be reasonable to expect from them a less active participation to all school activities? Are we sure there is no danger such a school policy can lead to alienation, uneasiness and lack of integration, contributing therefore to the rise of a feeling of estrangement, lack of selfesteem and refusal in many students? Is there really no other path we can tread? Is it possible to exploit a bilingual approach as an additional tool in teaching mathematics? And, conversely, can the the way one's “minority” language is felt be modified as the mathematical language is made one's own by using

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it? Can this help to reduce the gap between the official school world and the cultural frame within which its action takes place?

2. Our experiment: our teaching proposal and frame.

The proposal we present in the following has no claim to give a full and comprehensive answer to all our questions. It is part of a wider research program which a research center in the frame of the CIRD (Centro Interdipartimentale per la Ricerca Didattica) at the Udine University is developing on such topics. In particular a series of experimental activities on probability teaching in the elementary school has been carried out in several elementary schools in the Udine province. The Friulian or Slovene languages were used together with the Italian language in order to better understand how best to exploit the wealth of multilingualism in teaching. The results of those experiments (detailed in Altran (2002)) seem to suggest that the use of several languages increases the opportunities to stimulate the pupil's intuition. Since each language is not only a rational but also an emotional way of communicating, the use of two languages in doing mathematics far from being a mean duplication of the communicational channels, is rather an opportunity to see the several questions from different viewpoints.

Our experiment we here describe has taken place as part of a teaching training of the SSIS (scuola di specializzazione per l' insegnamento secondario – a school for specializing in teaching) at the Liceo Scientifico (sciences oriented high school) in Gemona del Friuli, in the schoolyear 2002/2003. This training foresees the treatment of a particular topic by the specialisee in a class, with the simultaneous presence of the official teacher. It has been agreed with the host teacher (prof. Santina De Monte) to use a partially trilingual (Italian-Friulian-English) approach and to study how the class would react.

3. Our class and its reaction to our teaching proposal.

Our class where our experimental work is a fourth in an experimental "liceo scientifico" (age 17). Approximately 50% of the pupils speak friulian as their first language, while the others speak italian as their first language. A girl was an english speaker. Anyway each student was able to understand Friulian. At the beginning our class reacted with worry at the idea of our experiment. It proved necessary to explain at once in a meeting the way our multilingual experiment was planned to be preformed. Remarkable tensions emerged in connection with this kind of topics in our meeting. Our class appeared to be quite divided. Some students (mostly speaking Italian as their first language) declared openly they didn't believe in this experiment, with particular regard to the use of the

Friulian language as a teaching language. However, after clarifying and specifying the “rule of the game” of our experiment all the students made it possible by stating in written their willingness to take part.

4. Our experiment: mathematical contents.

We shall now shortly outline the mathematical contents proposed in our experiment. We have tackled discrete symmetry groups in the plane. This topic fitted well both with the needs of our class (as being a topic different from those usually treated during the year, and giving an opportunity for connections with other subjects) and with the purposes of our experiment (since it offered a chance to discuss multiculturalism when discussing Alhambra mosaics). In particular we have dealt with: classification of the isometries of the plane, introduction of the notion of symmetry group, cyclic and dihedral groups as symmetry groups for finite figures and the results of the classification of symmetry groups for mosaics and linear decorations.

5. Our experiment: language contents.

Let's look in more detail to the language contents of our experiment. The “language policy” we used in our class can be summed up as follows:

- a) all terminology has been given in three languages (italian, friulian, english) and has always been written on the blackboard. The aim was to allow the students to be precise in their expressions in the “minority” language as well and to stimulate them to understand the exact meaning of the specific words we used (for a reference to mathematical terminology in Friulian language see Pittana- Mitri-De Clara (1997) and Fogale-Paolini (2001));
- b) each student was free to choose the language he wished to use when talking, regardless of the language used by the teacher for his explanations. The teacher always replied in the language used by the student;
- c) all lectures were given in Italian language, except for the lecture on linear decorations, which was given fully in Friulian.
- d) lecture notes distributed to the class were written in Italian. Diagrams for the classifications of symmetry groups were left in English, historical notes on the Alhambra fortress were distributed in Friulian, while a paper on the philosophy of the artists decorating the fortress was given in its original English version;
- e) the “Cabri” software we used in our class at an early stage of our teaching training is available in several languages. For our experiment we have rewritten the configuration file, in order to give the students a chance of using a version of the program with interface in Friulian as well;

f) the final test was given in Italian.

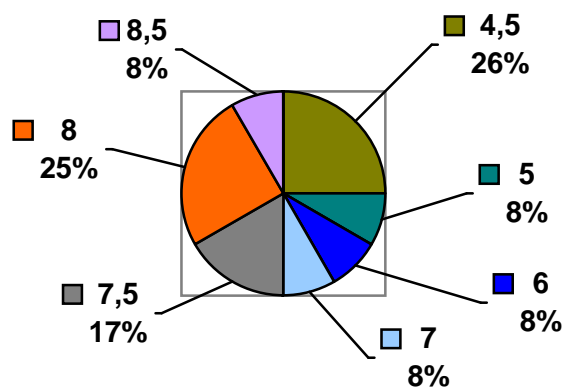
We start by remarking that the teaching activity was strongly biased in favour of the use of the Italian language. This choice has been determined by several contingencies (limited time, situation of the class ...) Anyway also a partial use of the “minority” language could help us with a few precious hints.

6. The reactions of our class during the experiment

No particular tensions occurred during the experiment and our class has accepted in an overall positive and constructive way the use of the “minority” language. No student however has used the opportunity to talk in Friulian until the lectures have been held in Italian. Only during the only lecture completely given in Friulian there have been interventions in Friulian. This is probably due to the psychological pressure of the other students, to the tensions occurred at the beginning of the experiment (which remained however latent) and to the usual behaviour learned at school (the “minority” language is very seldom used in formal settings), which cannot be overcome in a short time. It is difficult to say if and how using the Friulian language has helped and stimulated our students in their activities. It certainly has been an element of novelty and an object of curiosity several students have appreciated (for instance some of them have chosen to use the Friulian version of “Cabri “).

7. Our results

The disciplinary results of our experiment are summed up in picture 1. Due to the lack of a control group and the limited extension of our experiment it seems impossible to quantify the impact the use of the “minority” language has had on the learning of mathematics.



Picture 1: results of our final test

It is possible instead to analyze in more detail the results of our anonymous set of questions we gave the students before the beginning and after the end of our experiment. The students were asked to declare the degree with which they agreed or disagreed with 5 statements. This was to be expressed with an integer between +5 (full agreement) and -5 (full disagreement). The mean agreement indices for the various statements were

Statement	Agreement index before our experiment	Agreement index after our experiment	Change in the agreement index
1. Linguistic variety is an important cultural assett	+ 3,46	+ 3,21	0,25
2. It is impossible to express sophisticated notions in a “minority “ language	- 0,38	- 0,50	0,22
3. “Minority” languages are not suitable for school use	+ 2,00	+ 1,14	0,86
4. Multilingualism may cause difficulties in learning.	- 0,46	- 1,21	0,75
5. Multilingualism at school helps in acquiring a more open and tolerant attitude	0,00	+0,29	0,29

We can first remark that the agreement indices for statements 1,2 and 5 have changed so little that the changes can depend only on the experimental error in our test. The agreement indices for statements 3 and 4 have changed quite remarkably. Let us now look in detail the various statements.

1. *Linguistic variety is an important cultural assett*: our class seems to agree with this statement. Our experiment has not changed in a noticeable way our agreement index. Our statement is so general that most of the students can make it their own.
2. *It is impossible to express sophisticated notions in a “minority “ language*. There is a slight disagreement with this statement in our class. No significant changes after our experiment. There is a clear doubt on how much the “minority” language is really up to a fruitful use in high

level communication. This is due to the fact that it is almost never used in a formal and official frame. There is no bias, however against the fact that it can also convey elaborated notions.

3. *“Minority” languages are not suitable for school use:* before our experiment our class (on the whole) seems rather to agree with this statement. After our experiment the agreement degree decreases by almost one point. Deeply rooted prejudices cannot be eradicated in a short time; it is anyway clear that a school use of the “minority” language undermines them at their very roots.
4. *Multilingualism may cause difficulties in learning:* before our experiment our class slightly disagreed with this statement. After our experiment the disagreement has remarkably increased (3/4 points). Our class seems more convinced multilingualism provides no additional difficulties to mathematical understanding. It is probably so due to their own direct experience.
5. *Multilingualism at school helps in acquiring a more open and tolerant attitude.* Our class keeps a neutral attitude both before and after our experiment. It is probably too strong a statement to get a more marked agreement.

8. Summing up.

As we have already said such a partial and limited experience doesn't allow us to draw general and absolute conclusions. Anyway our experiment seems to point out that an interplay between teaching of mathematics and the “minority” language can prove beneficial to both. We must however underline that in order to set up such an interplay we must provide teachers with both cultural and didactic tools such as to enable them to organize a serious bilingual teaching.

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