

# An experience in multilingual mathematics teaching

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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 will provide a short outline of a short teaching experiment in a high school in a bilingual area (Friulian-Italian), in which we sought to explore some of the opportunities offered 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 “challenging” subject. If we wish to improve 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 language of teaching at school, the gap between their own socio-emotional world and the school world is even

wider. For minority language, since it requires a formalized and sophisticated use of the language, mathematics can become 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 was no such a problem. The reasons for such a choice are manifold, complex and diversified, and this is surely no place to explore them in depth. One of the basic assumptions is however that, at the bottom, the only serious approach is a monolingual teaching (obviously in the “majority” language).

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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 in 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 self-esteem and refusal in many students? Is there really no other path we can thread? Is it possible to exploit a bilingual approach as additional tool for teaching mathematics? And, conversely, can the use of the “minority” language in mathematics modify the way it is felt? 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 pages does not 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 framework of CIRD (Centro Interdipartimentale per la Ricerca Didattica) at Udine University is developing on such topics. In particular, a series of experimental activities on probability teaching in 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 to better understand how 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 communication, far from being a mean duplication of the communication channels, the use of two languages in mathematics is rather an opportunity to address several questions from different viewpoints.

Our experiment has taken place as part of teaching training at SSIS (Scuola di Specializzazione per l’Insegnamento Secondario – a Specialization School for Teaching) at Liceo Scientifico (science-oriented high school) in Gemona del Friuli, in the school year 2002/2003. During this training, student teachers introduce a particular topic to the class under the supervision of the senior teacher. It was agreed with the host teacher (Prof. Santina De Monte) to use a partially trilingual (Italian-Friulian-English) approach and study how the class would react.

**3. Our class and its reaction to our teaching proposal.** Our experimental class was in the fourth grade of an experimental “Liceo scientifico” (age 17). Approximately 50% of the pupils speak Friulian as their first language, while the others speak Italian as first language. A girl was an English speaker. Each student was able to understand Friulian. Initially, our class reacted with worry at the idea of our experiment. It was necessary to

organize a meeting and explain them the way we intended to carry out our multilingual experiment. The class reacted with noticeable tension and appeared to be quite divided. Some students (mostly Italian-speaking) stated that they did not believe in this experiment, in particular regarding use of Friulian as the language of teaching. However, after clarification of the “rule of the game”, all the students agreed in writing to participate in the experiment.

**4. Our experiment: mathematical contents.** We will now shortly outline the mathematical contents proposed in our experiment. We tackled discrete symmetry groups in the plane. This topic fitted well both the needs of our class (it is a topic which is not usually dealt with in this grade and offered an opportunity for cross-references 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 presented the following: classification of the isometries of the plane, introduction of the notion of a 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 us consider in more detail the language contents of our experiment. The “language policy” we used in our class can be summed up as follows:

- a) all terminology was given in three languages (Italian, Friulian, English) and was always written on the blackboard. The aim was to allow students to be precise while using “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 they wished when talking, regardless of the language used by the teacher for explanations. The teacher always replied in the language used by the student;
- c) all lectures were given in Italian, 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 handed out 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 rewrote the configuration file to set up an interface in Friulian as well;
- f) the final test was given in Italian. Teaching was strongly biased in favour of the use of the Italian lan-

guage. This was due to several contingencies (limited time, situation of the class, etc.) However, partial use of the “minority” language provided us with a few useful hints.

### 6. The reactions of our class during the experiment.

During the experiment the class were not particularly tense and accepted the use of the “minority” language in an overall positive and constructive way. No student, however, seized the opportunity to talk in Friulian until lectures were held in Italian. Friulian was spoken only during the only lecture completely rendered in Friulian. This is probably due to the psychological pressure of the other students, the tension at the beginning of the experiment (which remained however latent) and 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 predict if and how use of the Friulian language

helped and stimulated our students in their activities. It certainly brought in some novelty and an area of curiosity which was appreciated by several students (for instance, some of them chose to use the Friulian version of “Cabri”).

**7. Results.** The disciplinary results of our experiment are summed up in Figure 1. Due to the lack of a control group and the limited extension of our experiment it is not possible to quantify the impact of the “minority” language on mathematics learning.

However, it is possible to look in more detail at the results of the anonymous set of questions we gave the students before and after the experiment. The students were asked to state their agreement or disagreement with 5 statements using an integer between +5 (full agreement) and -5 (full disagreement). The mean agreement indices for the various statements were as follows:

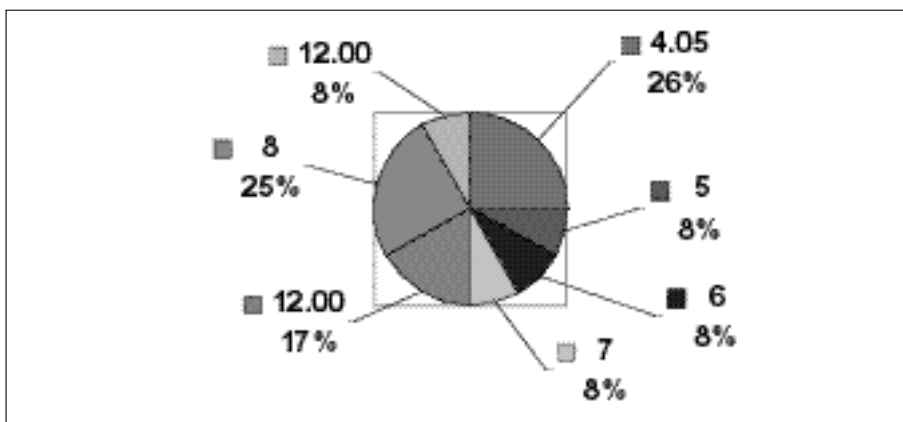


Figure 1. Final test results.

Statement	Agreement index before our experiment	Agreement index after our experiment	Change in the agreement index
1. Linguistic variety is an important cultural asset	+ 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 acquire a more open and tolerant attitude	0.00	+ 0.29	0.29

First of all, it can be noted that the agreement indices for statements 1,2 and 5 changed minimally, and this may depend only on the experimental error in our test. The agreement indices for statements 3 and 4 changed quite remarkably. Let us now look in detail the various statements.

1. *Linguistic variety is an important cultural asset*: our class seemed to agree with this statement. Our experiment did not noticeably change 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 was a slight disagreement with this statement in our class. No significant changes after our experiment. There is a clear doubt on the contribution a “minority” language can make to a

high level communication. This is due to the fact that it is almost never used in formal and official settings. 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) seemed to agree with this statement. After our experiment, the agreement decreased by almost one point. Deeply rooted prejudices cannot be eradicated in a short time; it is however clear that 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 remarkably increased (3/4 points). Our class seemed to believe that

multilingualism provides no additional difficulties to mathematical understanding. It is probably so based on their own direct experience.

5. *Multilingualism at school helps acquire a more open and tolerant attitude.* Our class had 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 already stated, such a partial and limited experience does not allow to draw general and absolute conclusions. Yet, our experiment seems to point out that an interplay between teaching of mathematics and the “minority” language can prove beneficial to both. To set up such an interplay, it is necessary to provide teachers with both cultural and didactic tools for sound bilingual teaching practices.

## References/ Bibliografie

- Weyl H. (1952). *Symmetry*. Princeton: Princeton University Press.
- Hilbert, Cohn-Vossen (1972). *Geometria intuitiva*. Torino: Boringhieri.
- Gallian J. (1998). *Contemporary Abstract Algebra*. Boston: Houghton Mifflin.
- Dedò M. (1997). Trasformazioni geometriche: a cosa possono servire? In *Geometria Tradizione e rinnovamento*. Bologna: Convegno Nazionale di Studio.
- Lamuela X. (1991). Su la codificazion e il completament dal vocabolari furlan. *La Patrie dal Friûl*.
- Pittana A., Mitri G., De Clara L. (1997). *La nomencladure des matematichis*. Codroip: I.L.F. Pre Checo Placerean.
- Fogale M., Paolini E. (2001). *Une introduzion ae analisi matematiche*. Codroip: I.L.F. Pre Checo Placerean.
- Pittana A., Toffoli D., Spizzamiglio V., Roiatti V., Lamuela X., Ceschia A., Croattini L., Fantini S. (1990-1992). Lenghe 2000: Algjebre, Analisi, Gjeometrie. *La Patrie dal Friûl*.
- Cummings J. (2000). *Language, power and pedagogy. Bilingual children in the crossfire*. Clevedon: England Multilingual Matters.
- Altran E. (2002). *Un esperimento di didattica della probabilità nelle scuole elementari*. Udin: Università di Udine.