Bilingual Teaching in Mathematics:
Experiences from the Teaching Practice School of The University of Tampere

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Abstract: The teachers at the Teaching Practice School of the University of Tampere have been working on bilingual teaching at lower secondary school (age 13 – 15) during the period 2000 – 2005. The project differs from many other bilingual projects because only some 20 – 25 % of the teaching is given in English. The teachers use English material or they can use English in their speech, or do both. The pupils who wish to attend a bilingual class must undergo a test including an interview in English and a written test in Finnish. I have taught bilingual classes and my subjects have been mathematics, chemistry and physics. During the last three years I have developed my teaching practices in mathematics. When I started my investigation I had two main goals: I wanted to encourage my colleagues to use English in their teaching and I wished to find arguments to assure the teachers in our school of the positive effects that bilingual teaching has on the pupils’ learning. In my study I have concentrated on my own work as a teacher and evaluated it as objectively as I can. I conducted an investigation, which explored the meta-cognitive skills that bilingual teaching encourages, and their usefulness in learning mathematics. I made an inquiry into these skills with 11 open questions. I got 16 answers. The pupils who answered were just ending their last schoolyear at the age of 15 or 16. After the inquiry I interviewed the pupils who volunteered to an interview and held 11 interviews. In my paper I comment on the theory behind my investigation with reference to the pupils’ experiences, based on their interviews.

Key Words: mathematics teaching, bilingual

1. Introduction
During the past five years, 2000 – 2005, the teachers at the Teaching Practice School of the University of Tampere have been working on bilingual teaching. The bilingual project has been joined by one new class in lower secondary school (age 13 – 15) every autumn. The curriculum of this class is the same as the curriculum of the other classes, but the teachers have used English in their teaching in every subject. However, the practices vary a lot between the teachers. Our project differs from many other bilingual projects because only some 20 – 25 % of the teaching is given in English. The teachers can use English material or they can use English in their speech, or do both. The books that are used in a bilingual class are all in Finnish and the teachers must put a serious work into finding suitable English material for their purposes. In our curriculum the pupils have some voluntary subjects, which they can choose for the 8th class and 9th class. Two courses have been designed for the bilingual classes only. They are an advanced course in English and a course in Finnish literature.

The pupils who wish to attend a bilingual class must undergo a test including an interview in English and a written test in Finnish. The tests are organized during the previous spring term and the teachers who are involved with the testing are the English teachers and the Finnish teachers.

The pupils also have recommendations from their lower secondary school teachers.

What then is important in this study? When choosing the pupils the teachers look for active and socially talented children, who are gifted in their mother tongue and also interested in reading books. The teachers also try to find pupils who are truly interested in learning in English. Most of the pupils who attend a bilingual class have a Finnish family
background, but a few of them have attended an English playschool or even studied in English during their first schoolyears. The teachers who are involved with this project can weekly attend an English course, which improves their ability to use English in their teaching.

I have taught these classes for three years and my subjects have been mathematics, chemistry and physics. At the time I collected my data I also taught mathematics to my own bilingual class. They were in the 7th grade and during those two years I tried to develop my teaching practices. In my study I conducted an investigation, which explored the meta-cognitive skills that bilingual teaching encourages, and their usefulness in learning mathematics.

The first bilingual class graduated, in the 9th grade, in spring 2003 and are continuing their studying at various schools in Tampere. My data consists of their answers to my inquiry and their interviews.

2. Short Review of the Background

The goals

When I started my investigation I had two main goals in my mind: I wanted to encourage my colleagues to use English in their teaching and on the other hand I wished to find arguments to assure the teachers in our school of the positive effects that bilingual teaching has on the pupils’ learning.

When the first bilingual class started at the Teaching Practice School of the University of Tampere there were intentions from the perspective of the two languages: to find out what affect an active effort to improve the Finnish skills has on the pupils’ English skills. Another important goal was, and still is, to help the pupils to appreciate their own culture while
they learn another language. The project is naturally a possibility to encourage the linguistically talented children in their studies. As a Teaching Practice School our school has to develop different teaching methods and let the teacher trainer students test them. We have also maintained discussion about what kind of language proficiency is adequate or essential for a teacher when teaching different subjects in English.

**Positive influences and restrictions**

In our project we have found that there are many positive influences and also restrictions. The bilingual classes are small and selected, there are only 17 to 18 pupils per class. Because of the tests the pupils are talented in many subjects, they are active in various groupwork and they are interested in learning. Their parents are also interested in schoolwork and they participate actively in different school activities. Another positive influence is that not only the pupils and their parents are interested in bilingual learning but the teachers are interested, too. They attend courses in English and develop their teaching practices. All these possibilities can turn into restrictions, because the results we get are not comparable to any other bilingual project. That will be also a difficult point of view when I continue with my study.

**Teaching mathematics in English**

During this bilingual project I have taught classes in mathematics, physics and chemistry, but I am not the only mathematics teacher who is involved with this. In the beginning of my study I decided not to investigate other teachers’ work and so I have developed my own work and evaluated it as truly as I can. In this stage of my study I have listed the different methods I have used.
Mostly, I have searched for material or problems that are in English. They can be close to the topic the class has just learned or they can be something extra like problem solving. Sometimes I do all the teaching in both English and Finnish and we also write notes in English. Sometimes we can start in Finnish and then do the review in English. Occasionally I have made up a mathematical story in English and I have asked the pupils to draw the story or invent mathematics exercises about it. Another way to speak English is to play a game. That can be a method to get the pupils to talk and use English in their speech.

To improve text comprehension we have written a dictionary of the mathematical concepts in English. In tests we normally have one exercise in English. The pupils also produce material in English. We have had examinations or investigations which the pupils design by themselves and then write the report in English.

Every week we have had a lesson in computer classroom. We have used Internet, studied new topics via Internet sites and had some groupwork like ‘Weather in Europe’ or ‘Currencies’. I have also sent weekly problems via email. The problems have been in English and I have got the answers in English too.

Some recent research

Among the abilities in which bilingual children seem to be superior is metalinguistic ability. They seem to think flexibly and abstractly about language. (Hakuta, 1990, 49.) Also, Michael Sharwood Smith refers to metalinguistic skills and to the superior abilities of bilinguals with a notion that in the process of acquiring and using different languages they
may have more occasion to reflect consciously upon the ways languages differ. (Sharwood Smith, 1992, 21.) Bilingual children solve metalinguistic problems, in the same way that many monolingual children do, but bilingual children approach these problems with different initial levels of mastery of analysis and control than do their monolingual peers. (Bialystok, 1991, 134.) Janice Johnson refers to Ben-Zeev’s investigations (1977), and explains that bilingual children performed better than monolinguals on classification tasks. (Johnson, 1992, 209.) Comparing the bilingual teaching and mathematics, Dawe (1983) found that, on tests of mathematical reasoning, as competency in two languages increased, so did deductive reasoning skills in mathematics. Limited competence in both languages appears to result in negative cognitive outcomes. (Baker, 1993, 137.)

### 3. Materials and methods

In my study I had an inquiry containing 11 questions. I had designed the questions so that they consisted of the views that I had found from the previous research. I wanted to find out what the pupils think about the analysing and reasoning skills and if they see the development or maturation, what they remember of the mathematics lessons and what they think about their social skills, and whether these skills affect their learning and studying mathematics. After the inquiry I asked the pupils for volunteers for an interview. There were 17 pupils in that class and I got 16 answers to my inquiry and 11 pupils volunteered for an interview. In every interview I had questions that were meant to collect more information about the answers I got from the inquiry and one special question about the reason why the respondents had attended to this special class and were they satisfied of having qualified. Afterwards I dictated all the data, classified it and found some themes:
4. Results

My investigation turned out to be too short and small to answer the questions I had in my mind. The reliability and validity of the study suffers because of the number of the participants. Also the whole bilingual project is quite restricted and it is not possible to make generalizations.

The first theme was about the analysing and reasoning skills. It turned out, that the informants were too young to evaluate these skills and I did not have a proper method to make conclusions about them.

The second theme was about the mathematics teaching and here the pupils did not want to evaluate their own teacher. I found that there was only one mathematics project, that the pupils could remember, but it had been so remarkable that they all remembered it. Most of the informants were satisfied with this mathematics-english combination, and they thought it was very useful to know all the mathematical concepts in both languages. The most important thing was to learn the issues first in Finnish and after that in English.

The third theme was about this bilingual project and the reason the pupils decided to attend the tests. The main reason was that they wanted to make sure of getting into the Teaching Practice School of the University of
Tampere. Some respondents stated that they expected to have a special class with very talented pupils and a good atmosphere. Some wanted to have their best friends in the same class, and there were a few pupils who told that they were very good in English and they wanted to learn more of it.

The fourth theme was about the parents and their influence on their childrens’ schooling. It appeared that the parents of the bilingual class were very attentive and interested about their children. A few of the respondents told that they get help for their homework from their parents and the parents often asked about school and how it is going. The informants told that to be a pupil in a bilingual class is not very easy. The teachers expect more, they give more homework and the atmosphere can be challenging but also too demanding. The best way to success is to have good relationships with the other pupils. As a researcher I think it will be necessary to keep in mind that a special class needs also special attention and it would be important to look after the class atmosphere.

5. Discussion
There are two questions I have asked myself: can bilingual teaching increase interest in mathematics among linguistically talented children and can the learning strategies they use in English lessons transfer to mathematics lessons. Thus far I have noticed that many mathematical concepts are much clearer in English than in Finnish. For example concepts like powers and equations are easier to understand in English. The words describe the concept better. And of course abbreviations like V when talking about volume and A when talking about area are clearer. The Finnish words ‘tilavuus’ and ‘pinta-ala’ do not even begin with the right letter.
Another interesting point is the relationship between Mathematics and culture. When I have browsed through some mathematic books in English I have found material and good examples that are based on the cultural tradition to some extent. I think I can enrich my teaching with this kind of material.

What are the expectations the pupils have when they find their way to a bilingual class? What are the expectations their parents have? How do their expectations change during the lower secondary school? So far, I have noticed that my bilingual class has more groupwork, we talk more both in Finnish and in English, and the pupils use the mathematical language more than pupils I have taught before. My teaching has also changed in ways I did not expect, but that is very understandable. Because we learn everything in two languages I have to plan my teaching so that we have enough time to do things a bit differently. Often I find myself thinking of what is relevant, essential or fundamental?

6. References


