

WHAT ARE THE REASONS BEHIND THE SUCCESS OF FINLAND IN PISA?

George Malaty, University of Joensuu, Finland,
george.malaty@joensuu.fi

The success of Finland in PISA has surprised mathematicians and mathematics educators both in and outside Finland, myself among them. Nevertheless, because of my background and experience, it was easy for me to understand the reasons behind this success. The five main reasons are the success of pre-service teacher education, the culture of the teaching profession, the success of in-service teacher education, the different efforts which have been made to develop mathematics education and the daily traditions of school life in Finland.

0. A direct answer to the question

As a direct answer to the title question, I think that the main reasons for Finland's success in PISA are as follows:

1. the success of pre-service teacher education
2. the culture of the teaching profession
3. the success of in-service teacher education
4. the different efforts which have been made to develop mathematics education
5. the daily traditions of school life in Finland.

These reasons are discussed in more detail below, including in 4. the work of my own university, the University of Joensuu, as a case study.

1. The success of pre-service teacher education

The success of pre-service teacher education in Finland has mainly two aspects:

- keeping the level of teacher education qualification high
- being able to recruit motivated students.

As regards the teaching qualification, every schoolteacher must achieve a Masters degree: an M. Ed. for a primary school teacher (Grades 1 - 6) and an M.A. or M.Sc. for a secondary school teacher (Grades 7 - 12). Regarding the recruitment of teachers, although entry to secondary mathematics teacher education in Finland is at a satisfactory level, primary teacher education (Grades 1-6) is one of the most popular studies in higher education. Whereas we are able to recruit enough students to fill most of the places available for secondary mathematics teacher education, the number of applicants for primary teacher education is 5-6 times the number of places available. Those who fail to obtain a place normally apply again one or more times in the following years. Note that in Finland primary teachers are known as class teachers because they must be able to teach all subjects to a class.

1.1 Why is primary teacher education so popular?

One of the main reasons is the special status of primary school teachers in Finnish society. For about 150 years, the teaching of reading and writing has been the responsibility of primary school teachers, a task previously undertaken by a holy organisation, the church. Because of the *1921 Primary School Compulsory Education Act*, a primary school was established in every village and the Primary teacher became an 'enlightening candle' for the community. After that time, beside each Church Street, there was a School Street in each town. By 1974, primary school teacher education had been completely transferred to universities, generating further interest in primary teacher education.

From an affective point of view, Finnish youth remembers their time spent in Primary school, especially the early years, with great warmth. During these years, it is quite common to end the school day by shaking hands with the teacher and not uncommon to give the teacher a hug.

1.2. What about secondary teacher education?

The main reason for the relative popularity of secondary teacher education is related to more general factors beyond secondary school. These factors can be divided into four inter-related groups:

- a) the welfare of schools
- b) the pleasant work environment in schools
- c) the daily traditions of school life
- d) the school principles of care, comfort and equality.

These factors add a special meaning to our discussions but I will deal with them towards the end of this paper.

2. The Culture of the Teaching Profession

For the majority of Finnish teachers, teaching is a mission in which there has been a long tradition of teachers' interest in students' learning. This can be seen from two aspects: one is the interest of teachers in developing themselves, and the other is their intimate approach to helping individual students, for instance in solving a mathematical problem. It is common to see the teacher sitting on his or her knees in front of a student's desk in order to have a face to face quiet discussion. In Finnish schools there are no inspections. This not only saves money but also makes each teacher feel free and responsible. Every teacher can develop his or her own curriculum, building on the basic curriculum published by the National Board of Education and the more detailed curriculum accepted by the school, in which every teacher has played a part in developing. Teachers are also involved in writing the core National Curriculum. In addition, every teacher has the freedom to choose the textbooks needed for his or her class from those made available by different publishers. All this freedom gives every teacher an active role in the profession, making them highly interested in their work and offering them an opportunity to develop their experiences.

3. The Success of In-service Teacher Education

The in-service education of teachers is well organized in Finland, with different organisations providing different types of courses. For example, the National Board of Education provides

different types of in-service education in mathematics teaching and local education authorities provide in-service courses for primary and secondary school teachers.

Teachers' associations also provide in-service education on mathematics teaching both locally and nationally. The main associations are Mathematical Subjects Teachers Association, Class Teachers Association, Teachers of Early School Grades Association (Grades 1 and 2) and Specialist Teachers Association. Each university has a centre for continuing education and each province has a Summer University. Both provide different types of education, including in-service education for teachers. Also, 'Free Institutes' and 'Civil Institutes' can provide in-service education for teachers.

In this brief survey, I have mentioned the main organisations providing in-service education for teachers but this is not a complete list of providers. In-service education is sometimes provided free, otherwise teachers have to obtain funding from their schools. It is remarkable that in some cases teachers themselves pay for participation on in-service courses of interest to them – an indication of how interested teachers in Finland are in their profession and its development. I must also mention that in some cases teachers can have an influence on the content of in-service courses, increasing teachers' motivation to attend such programmes.

4. The Different Efforts Made to Develop Mathematics Education

Case study: the role of the University of Joensuu

We have made different efforts to develop mathematics education in Finland, especially during the 1990s when different organisations were involved. Let me now tell you about the role of the University of Joensuu.

One of the main problems we had in mathematics education was the lack of primary school teachers who were mathematics specialists. Although as a minimum, half of the programme of study for an M.Ed. is devoted to education, a modest obligatory part is allocated to mathematics and mathematics education. The study programme for primary teacher education consisted of 160 credits while the minimum part of educational studies was 75 credits. The obligatory part of mathematics and mathematics education together was 3-4 credits. A credit relates to 20 teaching hours and each teaching hour is 45 minutes (Malaty 2004). As a result of the Bologna Declaration, changes have taken place in teacher education programmes for the 2005 quota but these changes have not affected the structure or the content of teacher education programmes so there have been no changes to mathematics and mathematics education programmes.

Indeed, there had always been an opportunity to choose one or two school subjects in which to specialise or to choose elective educational studies, but mathematics had not been a popular choice.

Less than 2% of students chose mathematics as a specialisation and this remained the case until 1992, when the work done at the University of Joensuu led to radical changes. At the moment, mathematics is one of the most popular specialist subjects on the Primary teacher education course at the University of Joensuu, with more than 80% of students specialising in

mathematics (15 credits) and half of them continuing their studies to 35 credits. The study for 35 credits offers a secondary school mathematics teacher qualification.

4.1 The story of the University of Joensuu

What follows is personal experience and therefore I have some reservations in writing about it but nevertheless this experience may indicate, for some readers, a possible approach for trialling such developments in mathematics education in their own institutions.

In Finland, each department of teacher education has a practice school, in most cases within the University campus. This school is called a 'Normal School'. During mathematics teaching practice, supervision is provided in the primary school of the Normal School by class teacher and the mathematics educator from the university.

Our efforts in Joensuu to improve mathematics education started mainly from this supervision. In the year 1986-1987, I had a chance to observe 135 lessons of 45 students. This supervision included supervision of lesson planning. In this supervision, I asked my students to teach more systematic mathematical content than that provided by textbooks. In addition, I asked them to put emphasis on understanding and to use discovery strategies. These guidelines reflect some of our main teaching principles. In addition, to assist my students in lesson planning, I took part in teaching school classes. The success we gained from this work led us to propose setting up Mathematics Clubs in the Normal School and the first mathematics club was established in autumn 1988. Five teachers from the Normal School joined me in working in these clubs.

In 1989, in response to a request from my university students, I established an evening mathematics club just for them. More than 50 students attended this club, which took place once a week between 18.00 and 19.30. The following year, 1990, this club was changed to an elective course 'Mathematical Thinking' (2 credits). Since 1993, this course has been split into two courses, 'Geometric Thinking' (1 credit) and 'Algebraic Thinking' (1 credit).

In 1993, more than 50 students chose mathematics as their specialist subject. This number represented more than half of the yearly quota of primary teacher students and was more than triple the number of students specialising in mathematics in all the other 10 Finnish teacher education departments. Since that time, this success has continued and the number of students specialising in mathematics has increased to more than 80% of the quota.

In 1994, the Higher Education Evaluation Council nominated the University of Joensuu as the 'Centre of Excellence in Mathematics Teacher Education'. In the same year the international committee, which evaluated the faculties of education of Helsinki, Joensuu and Oulu Universities, wrote in its report that "... The University of Joensuu has been successful in developing a study program for teachers specialising in mathematics education, that can serve as a model for other faculties and other content domains . . . the program seems to help in freeing future teachers from the frequently observed anxiety for (the teaching of) mathematics." (Buchberger 1994, 13). Personally, that same year I was nominated 'Teacher of the year', which was offered by the Finnish Summer Universities.

4.2. Details of some other activities undertaken by my university

In 1990, the Joensuu Board of Education asked me to organise a mathematics club for those teachers who were interested in establishing their own mathematics clubs. 39 teachers attended this club. Most of them were class teachers or specialist teachers and some were Junior (Grades 7-9) or Senior (Grades 10 - 12) secondary school teachers. Because of this group of teachers, mathematics clubs spread to all the primary schools and to some secondary schools in Joensuu.

In the first half of the 1990s, mathematics clubs spread all over the country through in-service education of teachers. The publishing of some of the clubs' materials and a teacher book gave support to teachers' work (Malaty 1992, Malaty 1993, Malaty 1994).

During the 1990s, I was involved in more than 300 in-service education programmes in more than 75 municipalities, including all the major cities, reaching more than 12 000 teachers from kindergartens to senior secondary schools. The content of these in-service programmes was not always related to mathematics clubs but the success of mathematical clubs brought credibility to these programmes. Some colleagues who are mathematics educators attended some of these in-service education programmes.

Since 1992, similar activities to those of spreading mathematics clubs have been done to bring mathematics teaching to kindergartens. This has given a relevant grounding for the preschool education act of 1998.

Different teachers' associations have invited me to give talks at their conferences, especially the Association of Mathematical Subjects Teachers. At their 1993 conference I gave a talk on the need for developing Geometric Teaching. Two years later, in 1995, after there had been no textbooks in geometry for more than 20 years, a geometry textbook was published for senior secondary schools.

Finally, may I mention that our work has attracted the interest of different people, among them politicians and the media. Mathematics clubs became a topic for daily newspapers and weekly magazines. One of the magazines was distributed to every home in the country (1989). Also the TV channels 1 and 3 showed an interest in mathematics clubs and it was an item of the main news of the most popular channel: Channel 3. In 1994, I had the chance to speak directly to the public in a lecture for Channel 3 MTV-akatemia. The topic of the lecture was 'Developing Mathematics Teaching: What? Why? And How?' This publicity has supported other official efforts to develop mathematics education, including *The National Joint Action Programme for Developing Science and Mathematics*, 1996 - 2002 (The Ministry of Education 1999).

4.3. The University of Joensuu and PISA results

One of the most important achievements we can mention is that our region (Eastern Finland) now has more qualified teachers of mathematics. This we can see from the PISA results and also from our National Assessment Studies. Our efforts in developing teacher education in our region are not only related to class teacher education. In conjunction with the efforts made in class teacher education mentioned earlier, similar efforts have been made in special teacher education. At the University of Joensuu, there is a Department of Specialist Teacher

Education, where mathematics and mathematics education is just the same as that for class teacher education. Lectures on mathematics and mathematics education have been provided for both types of students combined in one group. This gave specialist teacher education students the chance to attend class teacher students' mathematics clubs in 1989. Since 1993 the majority of specialist teacher education students in our university have attended the same mathematics specialised programmes of the class teacher education students (15/35 credits.) This education has provided Primary Schools (Grades 1–6), and Junior Secondary Schools (Grades 7–9) in Eastern Finland with more qualified special teachers in mathematics teaching. In addition, some of the kindergarten teacher education students in our university have received the same education in mathematics and mathematics education as that for primary school teachers and specialist teachers, including the specialised courses mentioned above (15/35 credits).

5. Back to the Background for Success

At the beginning of our discussion we mentioned general factors related to the success in teacher recruitment. These were:

- The welfare of schools
- The pleasant work environment in schools
- The daily traditions of school life
- The school principles of care, comfort and equality.

In fact, these are the main factors without which all the efforts made in Finland to develop mathematics education could not succeed.

5.1. The welfare of schools

Traditionally, children and young people have special status in Finnish society. As Finland represents a type of welfare state, the government offers, mostly free of charge, all types of services, particularly to children and young people.

This interest in children's and young people's development brings to teachers a remarkable respect. All types of education in Finland are not only free but also well supported: schools offer free healthcare; students and teachers receive free daily hot meals; there is free access to computers and printers, with all computers linked to the internet; students from Grade 1 onwards have the opportunity to access computers for e-mail and other uses; comprehensive school students (grades 1-9) are provided with free textbooks, notebooks, pencils, etc.; for school journeys exceeding five kilometres, taxis are provided free of charge.

5.2. The pleasant work environment in schools

Finnish schools are well furnished and well equipped. Schools are open places, both physically and socially. On the one hand, schools are open so that visitors can enter through any open door. On the other hand, teachers' work is not subject to any type of regular inspection. In Finnish schools, there is no formality in either clothing or in teachers' and students' communications. Nevertheless, respect for teachers, especially in the case of primary schools, is obvious.

Every morning the teacher finds the blackboard and/or other type of boards well cleaned. Finnish schools are relatively quiet, especially inside the classrooms. This gives the teacher a chance to take care of students and their learning, and in return it increases the teacher's interest in his or her work. There are no restrictions on the number of photocopies a teacher can make for distribution to children as learning materials. These materials and others like them are given out freely. Each classroom has a washbasin and paper towels for washing hands and other purposes. Classrooms, corridors, auditoriums, halls and bathrooms are always clean and warm and that is why most children walk about in socks or slippers inside school, giving them the feeling of being at home.

5.2. The traditions of daily school life

Every teaching hour is 45 minutes. In the 15 minutes break between lessons, the teacher opens a classroom window to refresh the air, even in winter. At break time students, especially those in Grades 1-6, must leave the classroom and go into the school yard. Teachers take it in turns to observe the children while they are outside.

Each class and its teacher go to the dining room together for their daily hot meal. Rectors of schools are able to contact all children and teachers through loudspeakers in each classroom. This means that from time to time the rector can ask children and teachers to stop their activities for a while to hear to some urgent information but this happens rarely.

5.3. School principles of care, comfort and equality

The care of each student in Finnish schools is obvious and can be seen from the relatively low number of students in a class, normally between 15 and 25. This has an impact on social relations in the class and on the learning of each individual child.

From the social aspect, the low number of students ensures an intimacy between the teacher and students. The class lunch with the teacher is like having lunch as a large family and the food provided is similar to an ordinary family lunch, consisting of a hot dish and bread, salads, dessert and drinks, especially milk. The food is always fresh and served with care in a pleasant dining room. That is why students like school lunches.

From the learning aspect, the low number of class students offers teachers the opportunity to take care of each learner. When a student shows some weakness, for example in mathematics, both the student's teacher and a specialist teacher (M.Ed) soon take care of him or her. This care includes, among others, organising 'support classes' and providing individual support. The results of this support care can be seen from PISA results. The small number of class students allows everyone to know each other better: therefore some students also receive help in their learning from other students in the class.

Schools arrange parents' evenings to discuss general issues. These evenings are normally organised so that each student's parents can meet, in private, their child's teacher but some teachers, especially those teaching the first two grades, visit each child's home at least once a year.

What about comfort? In Finnish schools, there is no need to think about punishing students. Physical punishment does not enter a teacher's head, even shouting is unnecessary. Punishment and control are not characteristics of the Finnish teaching profession; the aim of a teacher's work is to support students' development. For example, if a student in a comprehensive school leaves his exercise book at home, the teacher offers him a new one without any blame.

What about the principle of equality? The dispersion of Finnish students is less than in other countries, as has been shown not only in the PISA studies but also in other earlier comparative studies. This can be seen as the result of implementing the principle of equality accepted by comprehensive schools, but the equality of the comprehensive school law of 1998 is just a reflection of traditions in Finnish society. The results of PISA show that there is no significant effect of different socio-economical backgrounds on students' learning. This is not an unexpected result as in Finland there is no interest in so-called private schools and private lessons are unknown. This is because there has been a long tradition of trust in public schools and in teachers.

Parents send their children to school so that they will not only learn but also receive support in their development. Homework is not stressed and no homework is set before holidays or weekends. The limited amount of homework means that students are able to participate in hobbies and activities which interest them, especially music and sport, at the end of school day. Students are grateful to schools for offering delicious lunches and a place to meet their friends.

Schools not only prepare children for the future but ensure that they have a good life in the present. Learning subjects is not the main objective of schooling and that is one of the reasons why it is difficult to see cheating in examinations in Finnish schools. Parents trust teachers to take care of their children and teachers are indeed interested in assisting the growth of every student, especially those who have weaknesses. That is why the dispersion of Finnish students' performance is less than in other countries. On the other hand, this also reflects one of our main problems in mathematics education, the need for more care of gifted students.

6. General Information on Higher Education

Higher education is free and well supported. For 9 months each can student receives a monthly bursary, currently 259 euros. He or she receives a monthly housing support of about 170 euros. Students are allowed to earn up to 505 euros per month and this sum is tripled to 1 515 euros in the three months summer holiday. In addition, a student can get a monthly loan of up to 220 euros per month. All course books are freely available on loan from university libraries along with access to on-line electronic literature.

References

- Buchberger, F. et al. 1994, Educational studies and teacher education in Finnish universities. Helsinki. Ministry of Education, Department for Higher Education and Research.
- Malaty, G. 1992. Geometrinen ajattelu I [Geometric Thinking I]. Porvoo: Weilin+Göös.
- Malaty, G. 1993. Geometrinen ajattelu I [Geometric Thinking I]. Didaktikka [Didactics]. Porvoo: Weilin+ Göös.
- Malaty, G. 1994. Algebrallinen ajattelu I [Algebraic Thinking I]. Porvoo: Weilin+Göös.
- Malaty, G. 2004. Mathematics Teacher Training in Finland. In: Series of International Monographs on Mathematics Teaching Worldwide. Monograph 2. TeacherTraining. Budapest: Müszaki Könyvkiadó, A WoltersKluwer Company.
- Ministry of Education 1999. Finnish Knowledge in Mathematics and Sciences in 2002. Revision of the National Joint Programme (LUMA). Helsinki: Ministry of Education.