THE MATHEMATICS INITIATIVE: UNEQUAL ACCESS TO EDUCATIONAL IMPROVEMENT

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The Mathematics Initiative is a Swedish government initiative to develop mathematics teaching in order to improve student achievement. In an application procedure, a municipality can suggest one or more development projects and get financial support from the Swedish National Agency of Education. About half of the municipalities that participate are successful with their applications. In this paper, I will report an investigation of how economic resources and student mathematics achievement in groups of municipalities relate to their submission of a competitive project application in the Mathematics Initiative. Data from official statistics have been used for this investigation.

Keywords: mathematics achievement, school reform initiative, unequal distribution

INTRODUCTION

Within a recent broad educational reform in Sweden, there is a particular focus on mathematics, reflecting the fact that the educational authorities are concerned about the students' performances in both national and international tests (TIMSS and PISA). The outcome on the latest national test was that almost one fifth of the students, in their ninth and final year of compulsory school, did not pass in mathematics. By using additional data, the National Agency of Education (Skolverket) can distinguish the results for specific groups of students. The survey reveals that a high proportion of the students who do not pass are children whose parents have a low level of education (lower than upper secondary). Disparities between groups of students are also described in earlier reports from the educational authorities [1].

Students with foreign background (first or second generation immigrants) and students whose parents have only *pre-secondary education* appear to be disadvantaged in comparison with *students with Swedish background* and students whose parents have *upper secondary* or *post-secondary education* [2]. In general, student performance is 'falling' relative to earlier cohorts and relative to other countries, and the achievement gap between specific groups of students is increasing in mathematics (and other school subjects as well). The second issue is not in accordance with the Education Act (Skollagen) sanctioned by the Swedish parliament and government:

> All children and young persons shall irrespective of gender, geographic residence and social and financial circumstances have equal access to education in the national school

> system for children and young persons. The education shall be of equal standard within each type of school, wherever in the country it is provided. (Education Act, 2§, 1985)

The previous government decided, in 2003, to set up a Mathematics Delegation (Matematikdelegationen) whose task it was to propose measures to strengthen mathematics education and performance. The current reform effort in mathematics education could, to some extent, be seen as resulting from the proposal of that committee [3].

Schools today operate under many circumstances that make it difficult to implement reforms and carry out development work. Darling-Hammond (2005) identifies three: a) the growing importance of educational success which provokes a need to create much more productive schools quickly, b) the explosion of knowledge and the rapid pace of technological change, and c) “dealing well with diversity, a task that twentieth century bureaucracies are ill-equipped to handle” (p. 362). So, implementing reform and facilitating school development are very complex issues that can be studied from different perspectives. In accordance with the overall principles of the educational system in Sweden, it is important to evaluate reform initiatives in relation to how they deal with diversity.

The current reform in mathematics education in Sweden is multi-faceted and comprises a mix of strategies that include incentives, support, resources, accountability and pressure (for an overview of the reform initiatives, see Johansson, 2010). The multi-faceted nature of the reform may be grounded in the fact that a shared understanding of *how* mathematics teaching should be developed cannot be assumed. In this paper, I will focus on one part of the reform, *The Mathematics Initiative* (Matematiksatsningen). For this part of the educational reform, there exist a range of official data that can be used for an analysis, such as data about student achievement in each municipality (even available at school level) and data about participation of municipalities in the Mathematics Initiative. Consequently, it seem appropriate to use these data for an evaluation of the first round in terms of success of applications in relation to economic resources and student achievement in Swedish municipalities.

THE MATHEMATICS INITIATIVE IN SWEDEN

At the end of the spring semester 2009, the National Agency of Education announced the guidelines for grant application for development of the teaching of mathematics in compulsory school.

> Local, state and independent school organisers can apply for grants for the development of mathematics teaching in their schools. Individual schools or teachers who wish to undertake a development project are invited to apply to their school organiser. The organiser is responsible for the application. (Skolverket, Dnr 2009:406, author translation)

The local school authority can apply once, using a special application form, but the application may consist of more than one project. A project idea can be initiated by a group of teachers, a principal or any other professional. Information on background, aims and objectives must be submitted for each project. The syllabus in mathematics is expected to be the starting point in the suggested development projects, but the schools may choose among diverse types of activities. Grants are given to projects aiming to develop teaching methods, pedagogical developmental work, further studies in mathematics and "other initiatives intended to improve the teaching of mathematics and designed to increase student achievement in the subject" (Skolverket, Dnr 2009:406, author translation).

The mathematics initiative not only requires voluntary and active participation from school developers, but also that they possess the ability to formulate project ideas in a formal application procedure. The responsibility for the initiative, design and evaluation of projects is at the school or district level - but the decision on which projects will receive funding takes place at the national level, and is made by the National Agency of Education. This type of application procedure is relatively new for most teachers and principals. There are guidelines that govern who receives the funds, but not all of them are explicitly stated. Therefore, it was of interest to examine which municipalities chose to participate in the application procedure and which did not chose to do so in the first round of application, in addition to investigating the successful municipalities. The investigation was guided by a theoretical perspective based on the work of the sociologist Basil Bernstein.

THE MATHEMATICS INITIATIVE AS A COMPETENCE MODEL

In his later work, Bernstein (2000) describes two types of pedagogical model: the *performance model* and the *competence model*. These are contrasting models of practice and context in terms of: discourse, space, time, evaluation, control, pedagogic text, autonomy, and economy. In the performance model, the rules for legitimate texts are explicit. The emphasis is on "a specific output of the acquirer, upon a particular text the acquirer is expected to construct and upon the specialised skills necessary to the production of this specific output, text or product" (Bernstein, 2000, p. 44). There are structures for external control and economy and acquirers have relatively little control over the selection of content, order and pace. The criteria for evaluation are explicit and specific; the focus is "upon what is *missing* in the product" (p. 46, italics in the original text) and assessment and evaluation "gives rise to a potential repair service and its diagnostic theory, practice and distribution of blame" (p. 48).

In the competence model, the rules for legitimate texts are implicit. The acquirers have considerable control over the selection of content, order and pace. The emphasis is on "the realisation of competences that acquirers already possess, or are thought to possess" (Bernstein, 2000, p. 45). This means that the learner's potential is more important than the product itself. The emphasis is upon what is obtained in the final result, not what is missing. The criteria for evaluation could be implicit and diffuse; however, there is often an ‘ideal’ to be compared with. The characteristics of the ‘ideal’ are often implicit; the acquirer could need some special ability to ‘see’ the important values. The implicitness of the competence model could make it more expensive than the performance model. There are hidden costs which are time based; planning and monitoring, constructing pedagogic resources and finding ways to evaluate practice takes more time. Because of this range of hidden costs, personal involvement and commitment are crucial if a competence model is to be successful (Bernstein, 2000).

The performance model and competence model was originally used for an analysis of the pedagogic practices in primary and pre-school. However, I also found the work helpful as a conceptual framework for the analysis of reform efforts in education. Bernstein’s language of description offers a way to reflect upon how knowledge is reproduced and legitimised. This also applies to the knowledge distributed and expected to be developed through educational reforms on a systemic level. The contrasting characteristics of the models provide a sociological perspective on school improvement. Even though both models have their weakness and strengths, following the ideas of Bernstein, we can assume that municipalities with different demographic patterns have differential access to a competence model, or to a performance model respectively.

An example of a performance model of educational change is the nation-wide state program *National Numeracy Strategy,* NNS, conducted during 1997-2001 in England. Almost all primary schools were involved. The program was built on clear instructions, support materials and financial support. The directives were aimed at all levels: regional strategy-leaders, local school administrations (Local Educational Agency, LEA), school management, and teachers (for an evaluation of the project, see Earl, Watson, Levin, Leithwood, Fullan & Torrance, 2003). These characteristics represent a performance model because of the explicitness of expected outcomes and hierarchical control structures.

On the other hand, the project *Learning Communities in Practice* (LCP) can be characterised as a competence model of educational change. Jaworski (2004) describes how teachers can learn to look critically at their own teaching and develop through ‘communities of inquiry’. In this model, individual teachers develop inquiry approaches to their own practice. They are “encouraged to look critically at their own practices and to modify these through their own learning-in-practice” (Jaworski, 2004, p. 26). This means that there is no set of explicit and shared criteria for what constitutes success of the learning community as well as no external control structures.

The Swedish Mathematics Initiative also represents a competence model. This is because the criteria for application to participate as well as for the evaluation of the outcomes are vague. Also, self-evaluation is suggested by the authority. Further, the participants are free to choose any focus or set of activities they like, as long as these are linked to the goals of mathematics education as represented in the official curriculum. Altogether, the implicitness of criteria at all stages from application, through activities and evaluation, clearly represent a competence model.

DATA AND METHOD

In order to investigate the relationship between the municipalities' participation and success in the application procedure and in student achievement, I conducted a secondary data analysis of public data available from the National Agency of Education. In two different databases, there are data about mathematics achievement at school and municipality level, and about participation and success in the Mathematics Initiative. In the database about student achievement, municipalities are divided into nine categories on the basis of structural parameters such as population, commuting patterns and economic structure [4]. The categories of municipalities are:

- Big cities (metropolitan municipalities),
- Suburban municipalities,
- Larger towns,
- Commuter municipalities,
- Sparsely-populated municipalities,
- Manufacturing municipalities,
- Other municipalities, more than 25,000 population,
- Other municipalities, 12,500–25,000 population,
- Other municipalities, less than 12,500 population.

I explored each group by looking at three different aspects:

a) 'participation' in the application procedure (the proportion of municipalities that submitted),
b) 'success' in the application procedure (the proportion of municipalities that got a grant), and
c) student achievement.

In this study, municipalities were regarded as 'high-performing' or 'low-performing' depending on what proportion of their students reached the objectives of the compulsory school (getting *leaving certificates*) or passed the national test in mathematics for the year 2009. Municipalities were compared in each municipality group based on the mean value in the group. The municipalities were regarded as *high-performing in general* if the proportion of students getting leaving certificates was above (or equal to) the average of the group and *low-performing in general* if it was below the average. The municipalities were regarded as *high-performing in mathematics* or *low-performing in mathematics* if the proportion of students achieving the goal for grading marks on the national test in mathematics was above (or equal to) or below the average of the group, respectively.

PARTICIPATION, SUCCESS AND PERFORMANCE

In this section I present the results of the analysis for each municipality group. A summary is presented in a table at the end of this section.

Big cities: This group consists of the Swedish metropolitan municipalities, all three of which participated in the application procedure and were awarded grants for some of their projects. There was a positive correlation between student achievement and municipality participation (the higher the achievement, the higher number of project plans). It is noteworthy to mention that in Sweden the inner-city schools usually cater students with high socio-economic background.

Suburban municipalities: All except three of the 38 municipalities participated in the application procedure; two of these three were high-performing, both in general and in mathematics. The third was low-performing in both aspects. The municipalities that were granted financial support for their projects were, on average, high-performing and those who were not granted were low-performing, both in general and in mathematics. The lowest-performing municipality in the group submitted two applications, neither of which was granted.

Larger towns: In this group, all 27 municipalities participated in the application procedure with one or more applications. There was a relatively high proportion of the municipalities, 67 percent, that was granted financial support for some of their projects. The municipalities that were granted financial support for their projects were, on average, high-performing and those who were not were low-performing, both in general and in mathematics. The lowest-performing (in general) in the group submitted four applications for funding, none of which was granted. Among all municipalities in Sweden, this municipality has the second highest proportion of students of foreign background. Two other municipalities, low-performing in mathematics, submitted a total of eight project plans. Neither of them received any financial support for their projects.

Commuter municipalities: This is the group of municipalities with the second-lowest success rate in the application procedure; 62 percent of the 41 municipalities did not get any financial support for their projects. The ones who were granted funding were, on average, high-performing. Seven municipalities did not participate in the application procedure. These were low-performing, both in general and in mathematics.

Sparsely-populated municipalities: This is the group with the lowest proportion of participation; 44 percent of the 39 municipalities did not submit any application. These were, on average, low-performing in general and high-performing in mathematics, which was the same pattern as for the municipalities that were not getting any financial support for their projects. Municipalities that were granted funds were high-performing in general and low-performing in mathematics.

Manufacturing municipalities: This is the only group were the municipalities that received financial support for their projects were, on average, low-performing in general, and the ones that were not granted money were high-performing in general. The lowest-performing municipality in mathematics, however, did not succeed with their application. The four municipalities (out of 40) that did not participate in application procedure were low-performing, both in general and in mathematics.

Other municipalities (>25,000 pop.): The municipalities that were granted financial support for their projects were, on average, high-performing, and those who were not granted were low-performing, both in general and in mathematics. The municipality with the lowest results in mathematics (out of 34) submitted four applications, none of which was granted.

Other municipalities (12,500–25,000 pop.): The municipalities that were granted financial support for their projects were, on average, high-performing and those who were not granted were low-performing, both in general and in mathematics. Among the five lowest-performing in mathematics (out of 37), four applied and one was granted funds. The lowest-performing municipality, in general and in mathematics, submitted three applications but did not get any financial support.

Other municipalities (<12,500 pop.): Municipalities in this group were the least successful in the application procedure; only five of them got grants for their projects. The participation rate was also the lowest among the groups; 13 out of 31 did not participate in the application procedure. The achievement gap is large between the five municipalities that were granted funds and the thirteen that were not.

The table below shows a summary of the results. For each group, the x indicates if the municipalities that received financial support (or not) were, on average, both in general and in mathematics, high-performing (+), low-performing (–); or if the municipalities were high-performing in one aspect and low-performing in the other (+/–). The column to the right shows the background of the municipalities that did not participate. It shows that there is no obvious pattern in this last aspect.

Table 1: Municipality groups: participation, success and performance.

	Project application						No project application		
	grant			no grant					
Groups of municipalities	+	+/–	–	+	+/–	–	+	+/–	–
suburban municipalities	x					x	x		
larger towns	x					x			
commuter municipalities	x				x				x
sparsely-populated municipalities		x			x			x	
manufacturing municipalities		x		x					x
other municipalities (>25,000)	x					x	x		
other municipalities (12,500–25,000)	x					x	x		
other municipalities (<12,500)	x					x		x	

DISCUSSION

There is a clear pattern visible in the distribution of financial support; in almost all groups of municipalities, those who got grants are on average the ones that are relative high performing. In each group there are many examples of low-performing municipalities that do not participate or participate without success. The participation rate differs on a group level; municipalities with relative few inhabitants participate to a lesser extent in the Mathematics Initiative and have a low award rate for their project applications.

Bernstein's model now offers a way to interpret these distributions in terms of the explicitness of the criteria and advantages/disadvantages of the municipalities involved. In the same way as students appear to be disadvantaged in a competency model of education in relation to their social and economic background, one can interpret the lack of success of groups of municipalities through their common "background". This interpretation views municipalities as social conglomerated consisting of schools, in the same way as schools consisting of classrooms, and classrooms consisting of students.

Many low-performing schools are located in low socio-economic school areas, and some municipalities have more of these areas than others. Resulting difficulties in the teachers' working environment may be an obstacle in their professional development and therefore an obstacle for school-development projects (e.g. Kensington-Miller, 2004). Schools with less favourable backgrounds may not have the experience of the type of development projects that are awarded in the Mathematics Initiative, a knowledge that make it easier to interpret and adjust to the expectations. On the other hand, experiences of developmental work could make it more straightforward to ‘read’ what the National Agency of Education expects from the schools in order to give financial support for a project. Experience with developmental work is more likely to be located at schools within more wealthy municipalities. Altogether, this might lead to the perpetuation of unequal attainment and continued inequality in education.

Since personal involvement and commitment are crucial if a competence model is to be successful (Bernstein, 2000), smaller municipalities may be disadvantaged in the Mathematics Initiative due to their economic conditions. If there are no organisation around school improvement, for example a ‘mathematics change agents’, individual school principals or teachers not only have to keep themselves informed but must also take the initiative to apply for project funding. This could be one reason behind the relative low participation and success rate among the smaller municipalities.

Finally, municipalities’ access to the initiative seems to be related to some implicitness of criteria in the Mathematics Initiative. Whether Bernstein’s (1975) interpretation of the problems of an “invisible pedagogy” linked to a competency model in education also can be transferred to the systemic level needs further attention.

NOTES

1. See for example: Skolverket. (2004). *Elever med utländsk bakgrund.* (Report 2004:545). Stockholm: Skolverket.

2. See *Educational results National level*: *Sweden’s Official Statistics on pre-school activities, school-age child-care, schools and adult education Part 1.* (Report 2009:325). Stockholm: Swedish National Agency for Education.

3. The report of Matematikdelegationen is published 2004: *Att lyfta matematiken: intresse, lärande, kompetens* (No. SOU 2004:97).

4. The classification of municipalities is made by the Swedish Association of Local Authorities and used for statistical reports, comparisons and analysis work. The grouping of municipalities is well known and widely used by agencies and universities, for example by researchers and students in the selection-procedure when a representative sample of municipalities for a study is chosen.

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