Classroom settings, self-regulated learning skills and grades in mathematics

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The overall purpose of this study is to present plausible influences on students' self-regulated learning skills. This study concentrates on the contextual aspects of the educational preconditions. The group climate seems to be the most influential factor to students' self-regulated learning skills in mathematics. A supportive climate is related to the view of mathematics as something important, while a non-supportive climate is related to difficulties in mathematics. Students with difficulties in mathematics are affected by classroom settings that they perceive as demanding in terms of objectives, and in teacher centred instructions. To some students, high demands, distinct information and invitations to participate can result in positive relationships with mathematics. However, the same conditions can create difficulties in mathematics among other students.

Cuban (1993), has in a very interesting overview of the American school system including descriptions of how teachers taught during the period of 1890–1990, concludes that there is a lot of research on teachers, their work and their work conditions. However, he holds the opinion that one perspective is missing: "I have pointed out what is missing from the study: information about classroom climate, the impact upon students of different forms of instructions, teacher-student relationships, and the students' perspective on teaching" (p. 286). Certainly, it is not quite correct to say the students' perspectives are totally missing in research concerning classroom climate and impact of different forms of instruction. As I will show below, there are studies with reference to forms of instruction; some of them also take into account the students' opinions (cf. Granström,

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Samuelsson, J. (2008). Classroom settings, self-regulated learning skills and grades in mathematics. *Nordic Studies in Mathematics Education*, 13 (1), 51–69.

2006). However, I agree with Cuban when he states that it is important to get information from students about their experiences and perspectives on teaching. In this study the aim is to interpret students' experiences and perceptions of different aspects of classroom settings related to their perception of mathematics as a school subject.

Self-regulated learning skills and mathematics achievement

There is a substantial amount of research that shows how negative relationships with mathematics affect students' achievement (Wigfield & Meece, 1990; Gierl & Bisanz, 1995; Foire, 1999). It is also well known that students' self-perception and interests and the value they place on doing well are critical predictors of academic success (Conell, Spencer & Aber, 1994; Eccles, 1993; Fuligni, 1997; Guay, Marrsh & Boivin, 2003; Valentine, DuBois & Cooper, 2004; OECD, 2004). Within the framework of PISA 2003 (OECD, 2004), affective factors are related to the area of self-regulated learning skills. In PISA, self-regulated learning skills include the motivation to learn and the ability to select appropriate goals and strategies for learning. The factors investigated in PISA were categorized as students' interest in and enjoyment of mathematics, instrumental motivation in mathematics, self-concept in mathematics, and anxiety in mathematics. One main assumption is that these factors correlate to students' performances in mathematics. This assumption is based on empirical evidence (see OECD, 2004). Students' interest in and enjoyment of mathematics and students' instrumental motivation in mathematics are aspects of motivation (OECD, 2004). The former factors are related to internal characteristics while the latter is related to external rewards. Students' self-concept in mathematics define students' beliefs about their mathematical competencies. These beliefs have influence on the goals students set for themselves and on their choices of learning strategies.

In the discussion about teaching mathematics effectively, the cognitive outcomes of schooling often receive most attention. These outcomes, however, represent just one important factor in math education. Another important facet of the above referred studies is the affective outcomes (Konu, Linton & Autio, 2002; Opdenakker & Van Damme, 2006). Thereby a student's relationship to mathematics is both a prerequisite for learning math as well as a result of the classroom interaction. In this study I will investigate to what extent classroom settings are related to students' self-regulated learning skills and to what extent these self-regulated learning skills predict students' grades in mathematics.

Self-regulated learning skills are in this study defined as student's relation with mathematics, e.g. their view of the subject's importance, self-perception, interests (see table 1).

Classroom settings and learning outcomes

Cobb (1998) stresses that the activities in the classroom, the repeated actions in which students and teachers engage as they learn, are important because they come to constitute the knowledge that is produced. The teacher, the one choosing learning methods, has a strong influence on the learning context and on creating successful experiences for students. There is some evidence that different teaching styles can have different impact on student achievement (Aitkin & Zukovsky, 1994) and that the choice of teaching approaches can make an important difference in a student's learning (Wentzel, 2002). Granström (2006) shows that different teaching approaches in classrooms affect students' benefits from the lessons. Settings where students are allowed and encouraged to co-operate with classmates and teachers give the students better opportunities to understand and succeed. Boaler (1999, 2002) finds that practices such as working through textbook exercises or discussing and using mathematical ideas were important vehicles for the development of flexible mathematical knowledge. One outcome of Boaler's research was that students who had worked in textbooks performed well in similar textbook situations. However, they found it difficult to use mathematics in open, applied or discussion-based situations. The students who had learned mathematics through group-based projects were more able to apply their knowledge in a range of situations. Behets (1997) finds that effective teachers spend more time with student activities, less time in teacher instruction and more time observing pupils. According to Crocker (1986) achievement is reinforced when teachers create classrooms that include (a) substantial emphasis on academic instruction and students' engagement in academic tasks, (b) whole-class instruction, (c) effective question-answer and seatwork practices, (d) minimal disruptive behaviour and (e) prompt feedback to students. Clarke (1997) argues that successful teachers engage in and focus on students' thinking in whole-class activities. In interactions with students, teachers use questions in order to challenge the children's thinking and reasoning. They do not give the right answers immediately; instead, they encourage students to describe their thoughts and ideas about mathematics, and to listen to and evaluate their classmates' reflections and ideas. Clarke's (1997) ideas about successful teaching differ from Crocker's

(1986) results. They also differ from how Swedish mathematics lessons are generally conducted. A common method in Swedish classrooms is for the teacher to instruct by imparting knowledge and then have the students practice their skills (NU, 2004). One explanation for differences in research results might be the researchers' definition of mathematics knowledge. Today's definition is broader and more multifaceted than ever before. Kilpatrick, Swafford and Findell (2001) expand the definition to include aspects such as conceptual understanding, procedural understanding, strategic competence, adaptive reasoning, and productive disposition. Case (1996) and Samuelsson (2006) argue that a variation in teaching methods is important because different teaching methods draw attention to different competencies in mathematics (cf. Boaler, 2002). Thus, the choice of teaching method in mathematics seems to be important for students' performance.

Different teaching methods also seem to influence student's self-regulated learning skills (interest, view of the subject's importance, self-perception, and attribution) (Boaler, 2002). Students who were expected to cram for examinations describe their attitudes in passive and negative terms. Those who were invited to contribute with ideas and methods describe their attitude in active and positive terms that are inconsistent with the identities they had previously developed in their lives. A negative relationship with mathematics, for instance, can be influenced by too much individual practice (Tobias, 1987) and teachers who expose students' inabilities (Samuelsson, 2006). Students who do well in school demonstrate an appropriate task-focused behaviour (Chapman & Tunmer, 1997; Onatsu-Arvillomi & Nurmi, 2000); they have positive learning strategies. If the students are reluctant in learning situations and avoid challenges, they show low achievement (Midgley & Urdan, 1995; Zuckerman, Kieffer & Knee, 1998).

Results from research on effective schools frequently point to the importance of teachers' and students' interactions in the classroom (Andersson, 1991). Oppendekker and Van Damme (2006) stress that good teaching involves communication and building relationships with students. The synthesis of meta-analysis and reviews of Teddlie and Reynolds (2000) gives evidence for positive relationships between achievement and varied classroom settings. Educational research has often shown that 'time on task', effective learning time, classroom management, classroom climate, and relationships within the classroom are significant factors for effective teaching. It is also stressed in research on effective schools that classroom climate is related to non-cognitive outcomes such as well-being, working attitudes and interests (Konu, Linton & Autio, 2002; Opdenakker & Van Damme, 2006).

As can be seen, several studies point to the fact that factors within the classroom setting, such as *teaching methods*, *group climate*, *students' participation* and *classroom behaviour* seem to influence students' achievement, with respect to cognitive as well as non-cognitive outcomes. However, to what extent different classroom settings predict self-regulated learning outcomes is not fully investigated.

Research on effective teaching has been criticised on the grounds that correlations between teaching parameters and students' achievements usually are low (Dunkin & Biddle, 1984). However, even weak correlations can make important differences as the impact of different variables may be compounding. Small improvements in a specific area may combine with small improvements in other areas to create a total change in students' achievements (Davis & Thomas, 1989). In this study the goal is to investigate the students' perceptions of different classroom settings relating to their perceptions of mathematics as a school subject, as well as to their actual success. Classroom settings are defined as the activities in the classroom, the repeated actions in which students and teachers engage as they learn (see table 2).

The aim of the study

The overall purpose of this study is to convey some important prerequisites for students' success in mathematics. I assume that the classroom settings are important for their achievements. Certainly, there are individual differences with respect to intellectual qualifications. In this study, however, I concentrate on contextual aspects of the educational preconditions. A basic assumption is that these aspects are related to the students' self-regulated learning skills in mathematics, which in turn may influence their performance (grades). Thus, the hypotheses, formulated as two research statements, are as follows:

1. There is a relationship between students' success in mathematics (in terms of grades) and their self-regulated learning skills in mathematics. To what extent do different factors predict learning outcomes in mathematics grades?

2. Students' self-regulated learning skills in mathematics are related to variations in the classroom setting. To what extent do different classroom settings predict learning outcomes related to students' self-regulated learning skills?

Method

In order to verify or falsify the hypotheses formulated above, I looked for information about students' self-regulated learning skills in mathematics, their perception of classroom settings, as well as their actual achievement. The National Agency of Education has by order of the Swedish Department of Education collected a lot of data about Swedish schools. The purpose of this is to create a general picture of primary and secondary school and its outcomes. A similar evaluation took place in 1992. One argument for a new evaluation in 2002 was changes in the society including the school system and teacher education. To get a wide scope of school cultures in the Swedish system, a survey study with students, teachers and parents as informants was carried out. The questions covered areas such as attitudes toward different subjects, organisation, time use, and teaching methods. Results from this national survey that includes 120 different comprehensive schools and data from 6 758 students (school year nine, approximately age 16) were utilised in this study. The data were selected from the larger national questionnaire study administered by the National agency for education. However, this study is restricted to the students' attitudes and opinions of self-regulated learning skills and classroom settings.

Component analysis

Furthermore, although the entire questionnaire is composed of about one hundred statements, I just used items relevant to my research questions. Twelve questions concern the students' self-regulated learning skills. Items giving information about the students' perception of the classroom settings, the activities in classroom, amount to 35. All items in the questionnaire are presented as statements, to which the students had to respond on a four-point scale (don't agree = 1; totally agree = 4). Students' grades were collected from *Statistics Sweden*. Reliability test (Cronbach α) was carried out on each factor.

There is a common procedure to use factors with eigenvalue > 1 in a factor analyse (Thurstone, 1947; Magnusson, 2003). The criteria to select the number of factors in this study was eigenvalue > 1.

Students' self-regulated learning skills in mathematics

An entire section of the questionnaire deals with students' relationships to mathematics as a school subject, composed of 12 items in all (table 1). Principle component analysis completed by a Varimax rotation factor analysis resulted in two factors (49,2 % of the variance was explained, eigenvalues were 3,9 and 2,0). Six items could be grouped under the label I*mportance of mathematics* (α = 0,83). This factor contains both internal and external aspect of motivation (cf. OECD, 2004). Six items comprise a factor called *Difficulty of mathematics* (α = 0,69). These items point to difficulties with mathematics. This factor contains questions about students' choice of learning strategies (cf. OECD, 2004).

There are different ways of producing factor names. The usual procedure is that the researcher looks for highest loadings, in order to produce the factor name (Magnusson, 2003). This procedure is used in the present study.

Table 1. *Items related to student's self-regulated learning skills in mathematics*

Components	Question	Loading
Importance of mathematics	1) I'm interested in mathematics	0,592
	2) Math knowledge is important	0,805
	3) Adults think maths is important	0,695
	4) Math knowledge is important in future education	0,793
	5) Math knowledge is important in future work	0,737
	6) I am going to use the math I learn in school	0,747
Difficulty of mathematics	1) I only work with math to prepare for the tests	0,630
	2) I spend too much time learning math	0,507
	3) Math is a difficult subject	0,652
	4) I give up if the task is too difficult	0,735
	5) I could have been better in math if I had tried more	0,574
	6) I've learned a lot of unnecessary things in math	0,590

Classroom settings

Teachers arrange the classroom setting in different ways in order to facilitate learning and practice. This can be seen as part of the learning environment. The questionnaire accounted for the students' perceptions of such learning conditions. As many as 35 items were relevant to this study. Principal component analysis followed by Varimax rotation on all 35 items revealed seven factors (54.3 % of variance explained; eigenvalues = 8,1; 3,3; 1,8; 1,6; 1,4; 1,1; 1,1). The seven factors were labelled as shown below. The 35 items and the factor loadings are displayed in table 2.

Table 2. *Items related to Classroom settings*

Components	Question	Loading
Group climate	1 I am pleased with the support I've received in grades 7-9	0,665
	2 We have a nice, positive classroom climate	0,445
	3 My suggestions are taken seriously	0,493
	4 I speak to the teacher if I have a problem with math	0,522
	5 I receive the support I need	0,761
	6 The teacher has time to help me if I need help	0,727
	7 Math is a subject where students help each other	0,487
	8 The teacher supports and encourages me	0,699
	9 It is possible to show my skills in math	0,653
	10 The teacher gives me correct grades	0,608
	11 I've learned most of my math skills in school	0,404
Participation	1 The teacher plans the activities with students	0,607
	2 The students influence the selection of content	0,808
	3 The students influence the selection of method	0,782
	4 The students influence how long they will work with a task	0,803
	5 The students influence the math tests	0,669
Informing students	1 The teacher investigates students' math skills before he/she starts to teach a new topic	0,452
	2 The students are informed of what they should learn according to the national curriculum	0,753
	3 The teacher communicates his/her expectations to students	0,744
	4 The students are informed of what they should do to earn different grades	0,734
	5 The teacher and student communicate about the student's achievement in math	0,357
Students working together	1 The students work in groups	0,726
	2 The students work with individual tasks	-0,411
	3 The students work on projects	0,725
	4 The student work on tasks out of the textbook	0,517
Order in class	1 The students do not listen when teacher talks	0,777
	2 Our classroom is noisy and disorderly	0,840
	3 It takes a long time to start working during lessons	0,793
Teacher centred instructions	1 The teacher talks, and the students listen	0,835
	2 The teacher talks and asks questions, and the students answer	0,845
	3 Teachers and students discuss math problems	0,543
Demands	1 I've been working with too many easy tasks in grades 7-9	-0,280
	2 I have been working with too many difficult tasks in grades 7-9	0,625
	3 The teacher places demands that are too high on me	0,589

1. *Group climate*: This factor is defined as a perception of supportive classroom conditions where students help each other and the teacher encourages ($\alpha = 0{,}84$).
2. *Participation*: This indicates that the students are invited to influence their work conditions ($\alpha = 0{,}87$).
3. *Informing students*: High values show that the teacher evidently informs students on objectives and expectations ($\alpha = 0{,}75$).
4. *Students working together*: High values indicate that the teacher uses work methods such as projects, group tasks, and low values show that students are mainly practicing individually ($\alpha = 0{,}63$).
5. *Order in class*: This concerns 'off task behaviour' in the classroom ($\alpha = 0{,}76$).
6. *Teacher centred instructions*: High values show that the teacher makes use of whole class lessons to talk and discuss with the students ($\alpha = 0{,}72$).
7. *Demands*: High values mean high demands and pronounced expectations from the teacher ($\alpha = 0{,}54$).

Students' achievement

The Swedish school system is goal-directed, which means that the education is governed by objectives. The students' grades are to be related to these objectives, which are competencies important in mathematics. My data accounted for the students' grades in mathematics, which are divided into four categories, failed (1), passed (2), passed with distinction (3), and superior (4).

Data analysis

The analysis was carried out with use of the above presented components. To be able to verify our hypothesis, a number of multiple regression analyses were carried out. These analyses made it possible to estimate the relationship between multiple independent variables and one dependent variable. Each of the factors, *perceived classroom settings and self-regulated learning skills*, was used as an independent variable in the regression equations. The dependent variable was *grades in mathematics*. The data analyses were made in two steps: (a) Students' self-regulated learning skills was related to students' grades, and (b) students' perceptions of the classroom settings were related to their self-regulated learning skills. Thereby the relationships between different classroom settings and self-regulated learning skills can be scrutinised.

Because of a large number of tests made in the regression analyses and a large number of students, quite small correlations may be statistically significant ($p<.05$). Therefore, Bonferroni's correction for setting the alpha level of $p<.05$ was used. The outcome of Bonferroni's test suggested an alpha level lower than $p<.007$. With reference to Bonferroni I only comment on correlations at a significance level of $p<.001$ (Abdi, 2007).

Results

Students' self-regulated learning skills and grades

The first hypothesis predicted a relationship between the students' self-regulated learning skills and their grades. This is not a drastic assumption; nevertheless, it has to be proven. All standardized regression coefficients for the equation are shown in table 3. The multiple regression coefficient is $R=0.46$, $F(2, 5566)=736{,}5$, $p<.001$.

Table 3. *Relationship between self-regulated learning skills and grades*

Self-regulated learning skills	Standardized Coefficient	*t*-value
Importance of mathematics	,203	16,4***
Difficulty in mathematics	-,357	-28,8***

Notes. *p<,05; ** p<,01, ***p<,001

The result very clearly shows that there is a relationship between students' grades and the factors, importance of mathematics and difficulty of mathematics. Students' interest in and view of mathematics as an important subject seem to affect their grades in mathematics in a positive way, while difficulties affect students' performance in mathematics in a negative way. It is also obvious that difficulties of mathematics predicts a student's grade in mathematics twice as much as the factor importance of mathematics. Thus, the first hypothesis, stating that there is a relationship between students' success in mathematics (defined as grades) and their self-regulated learning skills, is supported. Thereby, the following research question becomes still more interesting: What conditions may influence the students' self-regulated-learning skills, importance of mathematics and difficulty of mathematics? This question is dealt with in the next section.

Classroom settings and students' self-regulated learning skills

The statistical analyses concerned the relationship between the above classroom settings and the students' self-regulated learning skills. In table 4 the results are presented with respect to importance of mathematics and difficulty of mathematics.

Table 4. *Relationship between classroom settings and self-regulated learning skills*

Classroom settings	Importance of mathematics		Difficulty of mathematics	
	Standardized coefficient	*t*-value	Standardized coefficient	*t*-value
Group climate	.30	17.47***	-.18	-11.04***
Participation	.01	.45	.08	5.25***
Informing students	.04	2.12*	.06	3.35***
Students working together	-.09	-5.86***	.02	.19
Order in class	-.01	-.57	.16	12.26***
Teacher centred instructions	.06	3.99***	.06	4.14***
Demands	-.24	-16.98***	.39	30.86***

Notes. *p<,05; ** p<,01, ***p<,001

Classroom settings related to importance of mathematics

The multiple regression coefficient was significant: $R = 0.44$, $F(7, 4909) = 173$, $p < .001$. This implies that there is a relationship between classroom settings and students' view of the importance of mathematics. This relationship seems to be explained by four of the factors. A view of mathematics as important is predicted by *supportive group climate*, and *teacher centred instructions*. However *high demands* and *students working together* seem not to support student's view of mathematics as important, but, rather, seem to promote the opposite. A noisy classroom and participation have no relationship to motivation.

Classroom settings related to difficulty of mathematics

The multiple regression coefficient was also significant in this case: $R = 0.51$, $F(7, 4903) = 243.8$, $p < .001$. The relationship between contextual factors and students' difficulties in mathematics is explained by a *lack of supportive group climate*, *disruptions*, *high demands* and *informing students*.

Request for or invitation to *participation* is also related to students' difficulties of mathematics and so are *teacher centred instructions*. *Students working together* do not seem to affect difficulties of mathematics.

Summary

The group climate in the classroom seems to be important to the students' self-regulated learning skills. A supportive climate is related to a view of mathematics as something important, while a non-supportive climate is related to difficulties in mathematics. Students with difficulties in mathematics are affected by requirements they perceive as demanding in terms of information to students, and expectations of being active in whole-class lessons. They are also disturbed by disorder in the classroom. Students who see mathematics as something important do not seem to be disturbed by disorder, but they take advantage of traditional teacher centred lessons more than group work.

Discussion

The purpose of the present study was to scrutinise how students' perceptions of classroom settings may influence the students' self-regulated learning skills, which in turn is influencial for their achievement in this subject (in terms of grades). Even though there are critics who argue that there is usually a low correlation between teaching conditions and students' achievement (Dunkin & Biddle, 1984), I found a number of rather evident relationships. The variance explained by the classroom settings ranged from 20 % to 26 % with reference to students' self-regulated learning skills. Factors that affect students' achievement are considered to be cumulative (Davies & Thomas, 1989), which means that a change in one or several aspects can be important for improvement in the students' relationships with mathematics and their learning. The present study is based on statistical correlations; it does not account for *causal* relationships. However, the results can be used for tentative causal interpretations. When these kinds of model descriptions are presented, the interpretation of the results is at least as important as the description of the model. Thus, the following interpretations seem to be plausible and a possible starting point for further studies.

Self-regulated learning skills and grades in mathematics

The findings in this study are in line with other researchers (e.g., Wigfield & Meece, 1990; Gierl & Bisanz, 1995; Foire, 1999, Boaler, 1999; 2002) who argue that a negative relationship with mathematics affects a student's achievement in a negative way. If students are not persistent in learning situations and avoid challenges in mathematics (cf. Midgley & Urdan, 1995; Zuckerman, Kieffer & Knee, 1998) it will cause low grades in mathematics. There is no doubt that a view of mathematics as something important affects students' grades in a positive way and that difficulties in mathematics affects students' grades in a negative way. Interestingly, difficulties in mathematics predicts grades almost twice as much as student's view of mathematics as something important. In OECD (2004) studies it is clear that self-concept has the strongest connection to performance. One explanation as to why the factor, importance of mathematics, doesn't predict grades as much as difficulty of mathematics is that many students who think mathematics is easy do not think the subject is important. On the other hand, some students think it is very important but have great difficulty learning it. The connection between self-regulated learning skills and learning outcome helps us to identify some plausible explanation for low grades in mathematics. Teachers need to help students who think they have difficulties in mathematics to see the intrigue and importance of mathematics in our world. In this study it is possible to see how different classroom settings affect these self-regulated learning skills.

Classroom settings related to self-regulated learning skills

Cobb (1998) argues that the repeated actions in classroom are important because they constitute the knowledge that is produced. In this study it is also proven that the activities in the classroom have an effect on self-regulated learning skills, i.e. students' relation with mathematics.

The results of this study show that a supportive *group climate* gives a small but statistically significant positive contribution to students' view of mathematics as important and interesting (cf. Andersson, 1991; Teddlie & Reynolds, 2000; Konu, Linton & Autio, 2002; Oppendekker & Van Damme, 2006). Clarke (1997) as well as Boaler (1999, 2002) show that teachers who encourage students to listen to each other and express their thoughts have a positive effect on students' mathematics achievement. This study also presents a statistically significant relationship between peer support and students' self-regulated learning skill, i.e. their relationships with mathematics. Supportive group climate is the strongest predictor to students' view of mathematics as something important. A learning environment that includes high *demands* seems to affect students' view of mathematics as important and and their view of mathematics as difficult in a negative way. From this point of view it is obvious that a teacher's way of arranging the classroom setting makes a difference (cf. Behets, 1997; Cobb, 1998; Boaler, 1999; 2002). Therefore, it is most significant for teachers to be aware of and have skills to arrange a positive group climate with reasonable demands when they teach mathematics.

The factor *teacher centred instruction* seems to predict views of mathematics as important as well as difficulties in mathematics. One interpretation is that students who think they have difficulties in mathematics seem to be uncomfortable when they have to participate in whole class discussions, an aspect of teacher centred instruction. A plausible explanation for this could be that their weakness in mathematics will be exposed in such situations. Students with low confidence in their mathematical abilities will probably perceive their difficulties as embarrassing in whole-class lessons. This could be attributed to factors like home environment, where they may not be used to carry on conversations like those in the classroom. As has been shown, students who see mathematics as important seem to prefer whole-class teaching and discussions to working together. One explanation could be that these students with good mathematical ability get positive feedback in a whole-class discussion. In such situations their performance becomes visible and reinforced.

The relationship between *students working together* on the one hand and self-regulated learning skills on the other hand indicates the importance of working procedures. This means that a student who works alone with skill training, rather than participating in group work, seems to be motivated in such arrangement. This outcome is contrary to that of Tobias (1987) and Boaler (1999), who argues that too much individual practice could result in negative attitudes toward mathematics. It is possible to find one explanation for these results in earlier investigations about teaching mathematics in Sweden: Swedish mathematics education has been marked by skill practice. When students practice, they become motivated because they think they are learning mathematics, and mathematics is an important subject. If teachers teach with group work, they draw attention to qualities in mathematics other than skill practice (Case, 1996). Students who think mathematics is skill practicing will therefore not be motivated when they work in groups on projects. Therefore, it is of great importance for teachers to discuss with their students what mathematics is.

Apparently, difficulties are also related to perceived demands to p*articipate in decisions regarding working methods in the classroom and the learning content*. The result of the study illustrates the importance of having a professional teacher able to argue for specific content and reasonable methods rather than imposing demands on the students, especially students with low self-concept. If a teacher has knowledge about mathematics as a subject and also knowledge about how to teach it and how to choose content and working methods, it is reasonable that he or she may draw the students' attention to objectives without dictating to the students. This study points to the importance of a teacher who can support students taking part in discussions concerning method and content. Therefore, this result is consistent with many previous findings (cf. Behets, 1997) arguing for the importance of qualified teachers in mathematics.

A confusing result in this study is how *teacher's information* affects students' difficulties in mathematics. Earlier research has shown the importance of knowing the goals of an activity to be successful. It is also reasonable to believe that if we know what we are looking for, it should be easier to find it. The results of this study show a negative relationship between the factor *informing students* and difficulties in mathematics. One explanation is that it is difficult to communicate qualities of knowledge. Another interpretation is that students with low cognitive ability feel uncomfortable or overwhelmed when they understand what objectives they need to reach. They may feel that the objectives of mathematics are too demanding. As it has been seen before in this study, the demands are strongly correlated to students' difficulties.

Disruptive behaviour has a negative effect on students' achievement (Crocker, 1986). In this study it is also clear that *disorder in classroom* is related to *difficulty of mathematics*.

Different strategies are needed for different students

As a consequence of the results presented above, one classroom strategy may have a different impact on different students. With some students, high demands, formulated objectives and invitations to participation can result in a positive relationship with mathematics. However, the same conditions can result in a negative relationship for other students. The explanation for these differences is probably to be found in the language used in the classroom (Bernstein 1971). Teachers may easily transmit objectives and tasks to students from well educated homes, while they have problems communicating expectations and objectives and struggle to arrange discussions that engage students from homes with a low interest in school matters or from different cultural backgrounds. Thus, increasing the demands and requests for participation will probably stimulate the already empowered students but will increase the resistance among students with negative relationships with mathematics. Surely, there is no problem motivating those already motivated with well tried strategies. However, since such strategies can be counter-productive for students with low self-concept, other strategies have to be chosen. Thus, 'traditional mathematics lessons' seem to reinforce those already succeeding, while such lessons seem to increase the resistance to mathematics among those who are struggling. Consequently, it seems reasonable to create classroom settings that promote not just the already empowered, but also those in need of support.

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Sammanfattning

Det övergripande syftet med denna studie är att studera hur elevers upplevelser av olika klassrumspraktiker predicerar vad elever tänker om och känner för matematik.

Den viktigaste faktorn för att eleverna ska uppleva matematik som värdefullt och överkomligt är gruppklimatet. Ett stöttande klimat påverkar elevernas uppfattning om matematik som ett viktigt ämne som inte är särskilt svårt att lära. Motsatsen dvs. elever som upplever ett icke stöttande klassrumsklimat uppfattar skolmatematiken som svår och oviktig. Studenter som erfar att de har svårigheter i matematik påverkas negativt när de känner att kraven är alltför höga. Det kan handla för högt ställda mål såväl som att lärarens undervisning är på en alltför hög nivå. För vissa studenter är dock dessa krav positiva.