10

Student Perspectives on Learning Mathematics

Introduction

In this chapter, student perspectives on the learning and teaching of mathematics are analysed. Accounts of the students' attitudes and experiences are based on questionnaire and focus group data. The students' general attitude and self-image in relation to mathematics, their experience in the classroom, and their expectations in relation to the Junior Certificate and later education, were examined in the questionnaires. These issues were explored in depth in the focus groups with a number of targeted students within each of the classes.

As there is considerable international evidence to show that students' attitudes towards, and performance in, mathematics are strongly influenced by their mathematical experiences, and in particular by the way mathematics is taught in school (Dick and Rallis, 1991; Johnston, 1994; Ma, 1997; Reynolds and Walberg, 1992; Boaler, 1997a, 1997b), we examined students' perspectives on mathematics, and in particular their experience of learning mathematics in class. Our focus on gender is informed by the considerable research evidence regarding gender differences in both attitudes to, and experience of, mathematics (Beaton et al., 1996; Jones and Smart, 1995a, 1995b, including recent evidence that these may be changing and not as stereotyped as formerly perceived – Forgasz and Leder, 2001; Leder and Forgasz, 2000).

In the analysis, we also devoted attention to the differences in attitude and experience between students in different tracks and from different social class backgrounds given the evidence that both impact on students' experience of learning mathematics (Boaler, 1997a, 1997c, 1997e; Zevenbergen, 2000; Dunne, 1999).

What is required for success in school mathematics?

Students were asked to indicate their level of agreement or disagreement with six statements about what is required for success in school mathe-

matics. Figure 10.1 shows the level of students' agreement with each of the statements. 'Having a good maths teacher' received the highest level of agreement among the students. Most students also agreed that 'study at home' was important for success in mathematics, while somewhat fewer believed that success was contingent on 'liking the subject' (Figure 10.1).

With the exception of one school, few students regarded 'good luck' as a requirement for success. Similarly, students in the majority of the classes (six out of ten) did not agree that success in mathematics necessitates 'learning the textbook off by heart'. However, good memorisation was considered to be important by the students in the remaining four classes. All but one of the classes that believed 'luck' or 'learning off' was crucial for success were low streams, while the fourth was a top stream in a school where most students took Ordinary or Foundation level mathematics (Figure 10.1).

While teachers considered 'innate ability' as important for succeeding in mathematics, students were more divided in their views and no particular pattern is discernible. Students tended to regard success in mathematics as being an outcome of good teaching and study, rather than any of a given mathematical ability.

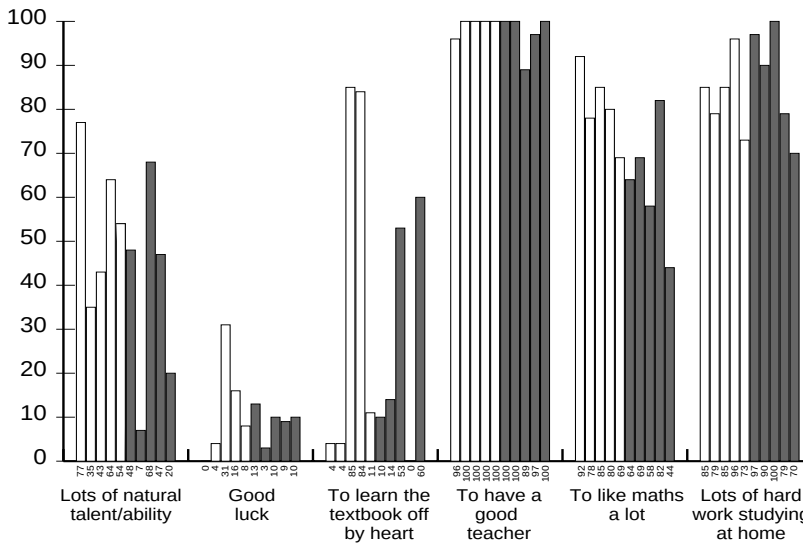
However, there were gender differences between students regarding what was considered important for success at mathematics. Boys were more likely than girls to consider natural talent and memorisation as prerequisites for success, and to a statistically significant degree. Within three of the five coeducational classes, the tendency for boys to attribute more importance to natural talent also held true (Lagan (SC Fr); Errigal (CS Fr); and Blackstairs (VCC Fr D)).

Importance of doing well in school mathematics

Students were asked to indicate the extent of their agreement or disagreement with a number of statements as to 'why you need to do well in mathematics'. The findings would suggest that the students are quite positive about the value and importance of mathematics. A majority believed that mathematics is required for everyday life, for employment and for further education purposes; they regarded mathematics as an important subject that had both a short and long term value. This contrasts with the small proportion of students who only viewed success in mathematics as necessary because it was compulsory and/or because it would please their parents (Appendix 1, Figure A10.1).

Figure 10.1: Students' views of requirements for success in school mathematics

(Base: 237)



Key: Single sex schools: (white bars) and **Coeducational schools:** (grey bars)

1. Barrow (SSG F)
2. Nore (SSG Fr)
3. Suir (SSG Fr D)
4. Liffey (SSB Fr D)
5. Lee (SSB F)
6. Lagan (SC Fr)
7. Errigal (CS Fr)
8. Mourne (VCC Fr D)
9. Blackstairs (VCC Fr D)
10. Nephin (VCC Fr)

Note: Same key applies to all six statements.

Gender differences in attitudes to mathematics, classroom experience and academic expectations

Having observed students in classes, we wanted to explore their own views on their classroom experience of learning. We wanted to understand their subjective experience of mathematics, and in particular to explore gender differences in perceptions of mathematics learning. To achieve this objective, we administered questionnaires to all of the students present in the observed classes using Likert type scales (Oppenheim, 1966, pp.120-159). Five areas were examined:

1. **Attitude to mathematics**: perceptions of school mathematics, that is, how difficult, useful, interesting, enjoyable or boring mathematics is perceived to be and whether it is listed as a first or second favourite or least favourite subject (MATHATT scale);

2. **Academic image in relation to mathematics**: self-assessed 'ability' in school mathematics in the context of the particular class and wider peer group (MATHIMG scale);
3. **Positive classroom interaction with teacher**: perceptions of frequency of interaction with the mathematics teacher and the level of reward for achievement in this class (MATHPTI scale);
4. **Negative classroom interaction with teacher**: perceptions of correction/sanctioning in mathematics class – mainly for work poorly done or bad behaviour (MATHNTI scale);
5. **Academic expectations**: perception of likely performance in the Junior Certificate Examination and in future education[1] (EXPECT Scale). [2]

The mean scores for each gender group on each of the scales are presented in Table 10.1 below, while differences between girls and boys in single sex and coeducational schools are outlined in Tables 10.2 to 10.6. A more detailed analysis of the findings for each school is presented in Appendix 3 of Chapter 10, Tables A10.3 –A10.7.

Table 10.1: Gender differences in attitudes to mathematics, mathematics self-image, classroom experience of mathematics and educational expectations

	Girls	Boys	Total
1. MATHATT	1.26	1.33*	1.29
2. MATHIMG	.98	.94	.96
3. MATHPTI	1.27	1.67*	1.45
4. MATHNTI	.53	.71*	.61
5. EXPECT	1.87	1.99*	1.93

* Significant, $p < 0.01$

What is clear from Table 10.1 is that girls have more positive views of mathematics, more positive views of their classroom experiences in mathematics, and higher educational self expectations than boys generally. In four of the five areas (Scales 1,3,4,5) the differences were statistically significant. The only area in which boys had a more positive perspective was in terms of mathematics self-image. However, the difference between girls' and boys' self image was not significant.

Girls within coeducational schools also had more positive classroom experiences than boys and higher educational expectations; however, they had a lower mathematics self-image, and slightly less positive attitude

towards the subject. The only significant difference between girls and boys in coeducational schools was in the more positive classroom interaction experiences reported by the girls (Table A10.3).

Both social class background and track or stream position also appeared to impact on attitudes and experiences. There were statistically significant differences between middle-class and working class students in terms of educational expectations, and between higher and lower streams in terms of both expectations and mathematics self-image. Both middle-class and higher stream students reported more positive attitudes on four of the five scales (the exception in both cases was classroom sanctioning which was reported to be higher among the top tracks and among middle-class students: Tables A10.2 and A10.5).

Attitude to mathematics

*Table 10.2: Gender differences in attitudes to mathematics (the MATHATT scale: overall average = 1.29**)*

Overall scores by gender	Girls: 1.26	Boys: 1.33
Gender differences within coeducational classes and between single sex classes	SS Girls: 1.21 SS Boys: 1.38*	Coed girls: 1.32 Coed Boys: 1.28

*p < .001

**The lower the score the higher the liking for mathematics.

What is evident from Table 10.2 is that girls have a more positive attitude toward mathematics than boys overall. Girls in the single sex schools held the most favourable views of mathematics, followed by boys, and then girls, in the coeducational schools. The boys in the two single-sex secondary schools were the least likely to express positive attitudes towards the subject. Yet the boys in question were not in low tracks (where students generally held more negative attitudes and lower expectations, see Table A10.6). One of the classes was mixed in a fee paying school (Lee (SSB F)) while the other was a top stream class in a school of designated disadvantage status (Liffey (SSB Fr D)).

Turning to gender differences within the schools, boys held more favourable attitudes towards mathematics in two of the five classes. These are both bottom stream classes in community colleges; the first comprises equal numbers of girls and boys (Mourne (VCC Fr D)) while the second has an over-representation of boys (Nephin (VCC Fr)). In one of the five coeducational schools, girls had more favourable attitudes toward mathematics; this was a top band in a secondary school with equal

numbers of boys and girls (Lagan (SC Fr)). In the remaining two schools, there were no differences in the mean scores (Table A10.8).

Overall therefore, while girls generally held more positive attitudes to mathematics than boys, such views are mediated by social class, stream/track position and, as we will see later in this chapter, the style and attitude of the teacher.

Mathematics self-image

In general, boys had a slightly higher mathematical self-image compared with girls, although the differences were not significant (Table 10.3). Boys in the coeducational schools had the highest self-image followed by the girls in the single sex schools. The girls in the coeducational schools had the lowest self-image in relation to mathematics.

*Table 10.3: Gender differences in mathematics self-image (the MATHIMG scale: overall average = 1.04**)*

Overall scores by gender	Girls: 0.98	Boys: 0.94
Gender differences within coeducational classes, and between single sex classes	SS Girls: 0.95 SS Boys: 0.97*	Coed Girls: 1.01 Coed Boys: 0.92

*p < .001
**The lower the score the higher their academic self-image in relation to mathematics.

Within the coeducational schools, boys had a higher self-image in four out of the five schools. Gender differences were statistically significant in two of these schools (Mourne (VCC Fr D) and Nephin (VCC Fr), Table A10.9). In the remaining coeducational school, girls were shown to have a higher self-image relative to both boys and to their peers in the other four schools; this is a top-stream class in a community college (Blackstairs (VCC Fr D), Table A10.9).

Classroom experience: positive reinforcement and negative sanctioning

Two scales were constructed to examine positive and negative aspects of classroom interaction. The positive scale measured students' perceptions of the frequency of their interaction with their mathematics teacher and the level of reward/praise for their achievements in class. The negative scale indexed negative interaction with the teacher. It specifically referred to

sanctioning/correction for particular behaviour, including work-related and non-work related behaviour.

Girls reported more positive interactions with teachers in their mathematics classes compared with boys, and to a statistically significant degree. Girls in the single sex schools reported substantially more positive classroom experience than boys in single sex schools in particular (Table 10.4).

*Table 10.4: Positive interaction in mathematics classrooms: (the MATHPTI scale: overall average = 1.60**)*

Overall scores by gender	Girls: 1.27	Boys: 1.67*
Gender differences within coeducational classes and between single sex classes	SS Girls: 1.15 SS Boys: 1.76*	Coed Girls: 1.38 Coed Boys: 1.59

*p < .001

**The scale ranges between 0 and 3. The lower the score the greater the level of perceived positive interaction/reward.

Within the five coeducational schools, girls reported higher levels of positive interaction with their mathematics teachers than boys although the differences are not statistically significant. The differences between girls and boys were statistically significant in only one of the five schools; this was a middle stream class in a community school (Errigal (CS Fr), Table A10.10).

Given gender differences in the reporting of positive interactions, it is not surprising to find that girls also reported receiving less negative attention than boys, and to a statistically significant degree. In this case, it was girls in the coeducational classes that reported the lowest level of sanctioning in mathematics classes, while boys in single sex schools reported the highest levels of negative attention (Table 10.5).

*Table 10.5: Negative interaction in the mathematics classroom (MATHNTI scale: overall average = 0.62**)*

Overall scores by gender	Girls: 0.53	Boys: 0. 71*
Gender differences within coeducational classes, and between single sex classes	SS Girls: 0.55 SS Boys: 0.84*	Coed Girls: 0.51 Coed Boys: 0.60

*p < .001

**The scale ranges between 0 and 3. The lower the score the lower the level of perceived negative interaction/sanction.

Within the five coeducational schools the findings were mixed. In two of the five schools, the girls reported receiving low levels of negative attention; one was a middle band in a community school (Errigal (CS Fr)) while the other was a bottom band in a community college (Mourne (VCC Fr D)). The opposite applied in two other schools, both of which were community colleges; the first involved a top band (Blackstairs (VCC Fr D)) while the second involved a bottom band (Nephin (VCC Fr)). Finally, in one of the schools there were no gender differences in the mean scores with both boys and girls reporting high levels of negative interaction. The class involved was a top band in a secondary school (Lagan (SC Fr), Table A10.11).

Although girls generally reported most positive interaction, the variability in the character of classes in which interaction was most positively perceived, suggests that individual teachers play an important role in determining classroom climate as well. This hypothesis found support in the interview data which we discuss later in this chapter.

Academic expectations

Students were also asked to comment on their educational expectations for themselves, and on those of their parents and teachers. Girls held higher academic expectations for themselves, to a statistically significant degree, compared with boys. Girls in the single sex schools had the highest academic expectations, followed by boys in the single sex schools. Boys in the coeducational schools had the lowest expectations.

Differences in expectations between single sex and coeducational schools must be interpreted however in the light of the differences in the types of schools in the study. While there was an equal number (two out of five) of designated disadvantaged schools in both the single sex and coeducational groups, there were more middle-class students in the single sex sector (79 per cent of the students in single sex schools were middle-class compared with 52 per cent in coeducational schools (see Table 7.2, Chapter 7)). The differences between coeducational and single-sex schools may, therefore, have much to do with the social class background and related track expectations of students in different types of schools, rather than with the gender composition of the schools.

Within the coeducational schools, girls had consistently higher educational expectations than boys. The difference was greatest in the designated coeducational school involving a bottom stream class (Nephin (VCC Fr), Table A10.12).

*Table 10.6: Gender differences in educational expectations (the EXPECT scale: overall average = 1.9**)*

Overall scores by gender	Girls: 1.87	Boys: 1.99*
Gender differences within coeducational classes, and between single sex classes	SS Girls: 1.98 SS Boys: 2.10*	Coed Girls: 2.14 Coed Boys: 2.23

*p < .001

**The scale ranges between 0 and 3. The lower the score the higher the self-expectation.

Discussion

The data indicates that girls generally had more positive attitudes to mathematics, had higher expectations of themselves, and more positive classroom experience of learning the subject than boys. These findings suggest that girls' attitudes to mathematics and their learning experiences of the subject may be more positive than originally perceived (Leder and Forgasz, 2000). It also concurs with findings by McDonnell (1995) demonstrating girls' generally more positive attitude to schooling. However, boys had a slightly higher mathematics self-image than girls, a finding that concurs with that of Hannan et al., (1996).

The attitudinal differences between girls and boys generally towards mathematics were reversed in the coeducational schools where girls had slightly less positive attitudes. Girls in coeducational schools also had the lowest self-image in relation to mathematics compared with girls in single sex schools and boys in coeducational, or single sex schools.

Girls in coeducational classes had significantly more positive classroom experiences than boys, however, and somewhat higher expectations. Girls in coeducational classes also had far fewer negative interactions than boys in their own class, and than boys in single sex classes (the group with the highest level of negative interaction). It was girls in single sex classes that had the highest expectations and the most positive interactions of all groups. However, they had somewhat more negative interactions than girls in coeducational classes.

Differences between students were not confined to gender however. They were also related to both social class background and track placement. While there were no significant social class differences between students in their attitudes, self-images or positive interactive experiences of mathematics, middle-class students reported more positive attitudes and experiences in all three areas. Middle class students also had significantly higher educational expectations although they reported significantly more negative experiences of mathematics (Table A10.2).

Differences across streams mirrored those across classes, with the top streams reporting more positive attitudes, self-images, classroom experiences and expectations. The differences between the social classes were significant in relation to both self-image and expectations, with middle-class students having the higher mathematics self-image and expectations (Table A10.2 and Table A10.5).

Overall, therefore, the data indicates that the relationship between gender and attitudes to, and experience of, mathematics, is complex and is mediated by social class and track position. As we will see below, it also lends support to Ma's (1997) claims that perspectives on mathematics are influenced by the way in which the subject is taught by individual teachers.

Profiling mathematics learning: 'positive' or 'negative' experience

While there was a general tendency for girls, top stream classes, and middle-class students to hold the most positive views of mathematics overall, the profile of the schools with the most positive perspectives shows that teacher practices also impact on attitudes to the subject (Figure 10.1 and Table 10.7). Although students in the three bottom streams (Suir (SSG Fr D); Nephin (VCC Fr); Mourne (VCC Fr D)) did not have positive attitudes to mathematics or positive self-images, expectations or learning experiences, students in one of these, Nephin, had more positive attitudes to mathematics than the boys in the mixed class in Lee (a socially select, feepaying boys' school). Even their mathematics self-image was only marginally lower than that of the boys in Lee. The students in Nephin also had more positive attitudes and self-images than the top stream in Liffey (SSB Fr D). The classes in which low levels of negative interactions with teachers were reported (Barrow (SSG F) and Errigal (CS Fr)) were also those where attitudes and self-image were most positive.

A profile of positive mathematical experience

One of the most striking findings from the focus group material is that the majority of the students did not have the necessary vocabulary to discuss mathematics as a subject and had little interest in discussing it. These findings concur with cross-national data from Picker and Berry (2001) suggesting that mathematicians were 'largely invisible' to lower secondary school students, and that they held quite stereotyped and negative views of mathematics. When students did discuss the subject, most of their experiences were expressed in terms of particular teachers rather than mathematics per se. This finding also concurs with international research (Dick and Rallis, 1991; Johnston, 1994; Ma, 1997) which suggests that

Table 10.7: Ranking of schools in relation to attitudes to mathematics and experience in class

Case Study Schools – Rank order	Perceptions of Mathematics		Experience with the Class Teacher		Academic Expectations	Maths JC Level (Majority)	TIMMS-related Test % Grade C or above (School Rank)	Streamed (s)/ Mixed (mix)	
	Attitude to (1 –2)	Self Image (0-2)	Positive Interaction (Rewards) (0-3)	Negative Interaction (Correction)* (0-3)					
	Rank of School out of 10 (1 = most positive)								
Barrow (SSG F)	1	1	1	2	1	Higher	1	S	Top
Nore (SSG Fr)	4	8	3	5	3	Higher	6	Mix	
Suir (SSG Fr D)	9	10	5	7	8	Ordinary	9	S	Bottom
Liffey (SSB Fr D)	8	6	6	6	9	Ordinary	5	S	Top
Lee (SSB F)	7	4	10	9	2	Higher	4	Mix	
Lagan (SC Fr)	10	9	9	10	4	Higher	2	S	Top
Errigal (CS Fr)	2	2	2	1	6	Ordinary	7	S	Middle
Mourne (VCC Fr D)	6	7	4	8	7	Ordinary	9	S	Bottom
Blackstairs (VCC Fr D)	3	3	7	3	5	Higher	3	S	Top
Nephin (VCC Fr)	5	5	8	4	10	Ordinary	8	S	Bottom
	Mean Score	Mean Score	Mean Score	Mean Score	Mean Score	Level subject is taken by Majority	TIMMS-related Test % Grade C or above		
Barrow (SSG F)	1.05	0.67	0.89	0.47	1.64	Higher	96	S	Top
Nore (SSG Fr)	1.24	1.08	1.14	2.40	1.75	Higher	38	Mix	
Suir (SSG Fr D)	1.50	1.25	1.22	0.64	2.18	Ordinary	0	S	Bottom
Liffey (SSB Fr D)	1.40	1.02	1.32	0.61	2.21	Ordinary	48	S	Top
Lee (SSB F)	1.35	0.92	1.52	1.06	1.67	Higher	62	Mix	
Lagan (SC Fr)	1.56	1.09	1.58	0.77	1.79	Higher	87	S	Top
Errigal (CS Fr)	1.14	0.87	1.60	0.26	2.02	Ordinary	18	S	Middle
Mourne (VCC Fr D)	1.29	1.05	1.63	0.69	2.17	Ordinary	0	S	Bottom
Blackstairs (VCC Fr D)	1.20	0.90	1.70	0.49	1.92	Higher	81	S	Top
Nephin (VCC Fr)	1.28	0.99	1.93	0.57	2.42	Ordinary	10	S	Bottom
Overall average	**1.29**	**0.96**	**1.45**	**0.61**	**2.11**				

*In relation to teacher correction, rank order 1 implies students report receiving the highest level of negative interaction while rank order 10 implies the lowest level.

Key: SSG F: Secondary girls', fee-paying; SSG Fr: Secondary girls', free scheme; SSG Fr D: Secondary girls', free scheme designated disadvantaged; SSB Fr D: Secondary boys', free scheme designated disadvantaged; SSB F: Secondary boys', fee paying; SC Fr: Secondary coed, free scheme; CS Fr: Community school, free scheme; VCC Fr D: Vocational/Community college, free scheme designated disadvantaged; VCC Fr: Vocational/Community college, free scheme (where free-scheme represents non fee-paying status).

students' views of the subject are strongly influenced by their classroom experience of learning it. Although students were able to identify particular areas of mathematics where they experienced a difficulty, they were generally unable to pinpoint the reason for the problem: problems were often described in terms of something 'not clicking' or 'not getting it'. While interviews with students provided some insight into their feelings about mathematics, they were limited at times by an inability to name issues of concern.

Introduction

Of the ten case-study classes, three were largely 'positive' about learning mathematics.[3] The schools in question included an urban fee paying all girls' secondary school (Barrow (SSG F)) and two mixed community colleges in a large and a small town respectively (Blackstairs (VCC Fr D) and Errigal (CS Fr)). Blackstairs was also a designated disadvantaged school.

There were a number of similarities between the students in Barrow (SSG F) and Blackstairs (VCC Fr D): both were top stream classes (with a majority assigned to the Higher level Junior Certificate course in mathematics) and students in both achieved high scores in the TIMSS-related test. In terms of social background however, the students were very different: Barrow is a socially selective school while Blackstairs has students from diverse social backgrounds. However, in Blackstairs the particular top stream class has an over-representation of students from a middle-class background compared with all students in the school (see Chapter 4). By contrast with the other two schools, the students in Errigal are in a middle stream class, with the majority assigned to the Ordinary course in mathematics for the Junior Certificate. As the data in Table 10.6 show, less than 20 per cent of these students achieved a grade C or above in the TIMSS-related test, compared to 96 and 81 per cent respectively, for Barrow and Blackstairs.

Students in the class in Barrow were the most positive about their mathematics classes and education generally. Of the ten schools, they rank highest in terms of attitude to mathematics, experience of learning mathematics and academic expectations for the Junior Certificate and their future education. In addition, of the ten classes in this study they achieved the highest mean score in the TIMSS test. As we will see below, interviews with the students confirmed findings from the questionnaire data regarding their positive perspective.

In Errigal, the students were extremely positive despite a relatively low average achievement in the TIMSS-related test, and their placement in the

Ordinary level mathematics class (Table 10.7). From the focus group discussions, it was clear that the 'teacher factor' was critical in shaping their current attitude to, and experience of, learning the subject. Finally, the students in Blackstairs were very positive about mathematics (in terms of attitude and self-image) and reported a low level of negative interaction with their teacher. Of the three schools in the 'positive' experience category, their score on the level of reward received for achievements in class was lower than both the average score and that recorded for the other two schools.

Using material from focus group discussions, the reasons why students in these classes are positive about mathematics, and their schooling generally, are explored.

The 'good teacher': 'clear', 'patient', 'good-humoured' and 'fair'

When asked about their current experience of learning mathematics, the students in the focus group in Barrow (SSG F) were very positive. As is the case generally for the students in this study, responses about learning are articulated in terms of the teacher rather than in terms of curricular content, learning resources or the forthcoming Junior Certificate Examination.

> *Interviewer:* How do you find maths this year?
> *Liz:* Ms Brennan makes maths interesting. She adds little funny things. It is her sense of humour. She keeps you interested. (Barrow SSG F)

> *Barbara:* I just think she is very good at teaching and explaining. I think it also helps when you are graded on ability. It makes it easier when you don't have people who need it to be explained millions of times. (Barrow SSG F)

In Blackstairs (VCC Fr D), all six students in the focus groups[4] had a very positive view of their mathematics teacher. The following extract indicates that the girls liked the teacher, Mr Butler, (and the subject) not solely due to his skilled teaching but also because he treated the students with sensitivity and respect.

> *Interviewer:* So how are you finding maths this year?
> *Jackie:* I think Mr Butler is a good teacher. He goes fast but then he really explains things. I suppose you have to get a certain amount done by the end of the year.
> *Patricia:* When we came into his class first, the way he would bring people up to do questions on the board and that, that was quite unnerving at first. But he explains it really well so most people know how to do it when they are called up.
> *Jackie:* Yeah, like you feel that everybody is watching you. And then he would say: 'Is that right?' and you are hoping they will say 'yes'. And then if nobody does, it's: 'Oh no!'.

Interviewer: So it is unnerving?
Aine: If you got it wrong, he would say: 'Are you sure that is right?' and usually you would look at it again and then you would usually realise where you have gone wrong, like say with just a minus or plus. Then if you still can't do it he will come up and show you – like he will rub out the bit you got wrong and show you how to do it.
Interviewer: So you think it is a good or bad method, overall then?
Jackie: I think it makes you concentrate more. If you are not concentrating and you are called up you feel really stupid. So when he says: 'You are going up to the board', everyone is thinking: 'That might be me'. So I think you definitely listen and take in more.
Interviewer: So what else do you think about maths class with Mr Butler?
Jackie: While he doesn't really praise or go on if you got it right, he will just kind of say that you got it right. You kind of feel good because of the way he says it.
Interviewer: What about if you hadn't your homework done or that – would he give out to you?
Patricia: You would bring in a note if you hadn't it done or you couldn't do it or something. You wouldn't just not do it. But usually he wouldn't embarrass you. He would probably speak to you on your own. But he never says names to embarrass you. Like sometimes he says that the class is so big he would say that there are a few in the class who are not paying full attention, or something like that. And it would unnerve you in case it was you and you would pay more attention. But he would never say names.
Interviewer: What about how he explains things – how do you find that?
Patricia: He would show you the hard way and then he would show you the easy way. He would show you the easy way from the hard way – like you take that from that. Then he will go into why you do that. You know like quadratic functions and why you do that is that and then he would go into a big long explanation of it. Then he would say: 'Now you don't have to do it that way, just do it this way because it is a shorter and easier way'. (Girls group)

This excerpt revealed aspects of skilled teaching from the point of view of the students, including thorough explanation and involvement of students through board work. In addition, the responses implied a rapport and mutual respect between teacher and students. Turning to the responses of the three boys in Blackstairs (VCC Fr D), it is evident that there are many similarities between the two accounts.

Interviewer: So how do you find maths this year with Mr Butler?
Robert: Good. I think the way he does it really brings you out of yourself. He did it the very first day. He says it helps each other to know each other. And in the class nobody has a grudge against him or anything so it is far easier to learn. He has a good way of teaching. It gets through to you. And it makes the class more enjoyable.
Interviewer: And would you say that the boys and the girls both think like this in the class?

Robert: Yeah – they are both the same. Much the same anyway. Like there are the same kind of grades coming out from both.
Interviewer: So in general you think Mr Butler's way of teaching maths is good?
Brian: Yeah – sometimes he shows us two ways of doing maths – but he shows us what he thinks is the better way.
Christopher (interrupts): He normally goes away from the book like. Normally the book has harder ways and he shows us an easier way.
Brian: Yeah. He would show us two ways and he would ask: 'Which do you find easier, which would you prefer?' and then we would do it that way. He never takes an example out of the book – like he never just reads it out. He takes things out of his head. Actually he would tell us to close the books while he is explaining something and he wouldn't let us write it down until afterwards so that we can pay attention and understand what he is doing.
Robert: It's good then – we have these hardback copies and we take down the explanation of a sum and an example and that. We use these for revision – like it is hard to revise maths, it's hard to study maths. But he directs how we do our written work and then it is easy to find things and it is not confusing. Like it can be confusing otherwise. You would get to know what was in the copy, you would learn it off and usually it would stick to you. You usually get it into your head anyway because usually when you are doing a topic it is usually for a week and you would stick at it and by the end of the week you sort of have it. (Boys group)

The views that emerged in the course of the two focus group discussions are largely consistent with the positive picture that emerged from the quantitative data. Other data from Blackstairs (VCC Fr D) show that the students' rating of the level of reward for achievements in mathematics class was below the average: 1.70 compared to the overall average of 1.45 (Table 10.7). This finding may relate to the students' description of the teacher's style; achievements were acknowledged at a whole class rather than individual level. In all other aspects, however, the students in Blackstairs (VCC Fr D) were very favourably disposed toward the mathematics teacher.

In Errigal (CS Fr), the boys reported that they had made a lot of progress in mathematics since they came into the post-primary school. They reported that this happened since they came into Ms Ennis' class in second year.

Gerard: She explains it more. She puts really good notes on the board.
Interviewer: Do you find the notes helpful?
Gerard: Yeah, they are really good because you can go back on it again and it is really clear to understand how she did it.
Sean: Anytime you do it the wrong way in your copy you write in the right way beside it in red pen and you can see exactly what you are doing.
Declan: It's easy to spot then where you went wrong. Anyway she always explains it again if you go wrong and then it is easy to understand.

Interviewer: When you get it right does she praise you?
Gerard: No, not really. She might say: 'That's good'. But nothing more than that really.
Interviewer: What about then if you don't get it right – would she ever give out?
Gerard: No she wouldn't make fun of you. She's nice like that – fair like.
Interviewer: Do any of you mind when you are asked to answer questions out loud in front of the class?
Boys all answer: No. (Boys group)

The girls in Errigal (CS Fr) have had the same mathematics teacher since they came into post-primary school. In the following excerpt, they describe how they came to like Ms Ennis' teaching style.

Interviewer: So how do you find maths this year?
Geraldine: I was scared of Ms Ennis in the beginning.
Interviewer: Why was that?
Geraldine: Oh, I don't know. In first year we were put outside for looking out the window and if you got something wrong you had to say where you went wrong and my mind would go blank. But this year she is really nice.
Agnes interrupts: I liked her last year.
Geraldine: I liked her but it took me a while to get used to her.
Rose: I really liked her too.

The girls went on to explain how Ms Ennis is considered to be an effective mathematics teacher in their school.

Agnes interrupts: She is a very good teacher. You see, I'm not too good at maths and I was afraid that I wouldn't get a great teacher that wouldn't explain it very well but I was delighted that I got Ms Ennis. So were my parents.
Geraldine: I know a girl in third year and she was put in another class (not Ms Ennis' class) and her mother asked that she be moved in with Ms Ennis because she is a better teacher.
Rose: She is a brilliant teacher.
Interviewer: It sounds from what you say that she has really developed a reputation in the school as a 'good' maths teacher?
Students: Yeah. Definitely. (Girls group)

The girls explain that the teacher monitors their progress closely, asking frequently about homework and work set in class if anyone 'got it wrong'.

Interviewer: How do you feel then if you have to explain what you got wrong?
Geraldine: OK, yes, fine! Like she is really good, she doesn't make you feel bad just because you made a mistake.
Rose: She'll do something until you understand it. She won't mind like.
Marjorie: She's not a teacher that would make you nervous.
Rose: She'll spend the whole class. She will just make sure that you get it right.

Agnes: I got something wrong there a while ago and she asked me did I understand it. I was afraid to say no but she kept us in for 10 minutes until I understood it. Like she is very good like that.
Geraldine: At the end of first year we were supposed to be divided into Higher level and Lower level but whatever happened it wasn't done. Anyway I didn't care if I didn't do the Higher level. I just prefer to stay with Ms Ennis than to [move to another teacher and] do the Higher level.
Students: General agreement with Geraldine's last point.
Rose: Everyone wants to stay in her class. A lot of people come begging at her door to be taken into her class. Like my sister now, she's in fifth year, she was in with another teacher and then she changed to her class and she says she really understands her better than she did the other teacher.

The girls continued in their praise of the teacher. Rose volunteered an example of why they like the teacher: 'If someone didn't do their homework she will just say that homework is for your own benefit but that it is your life' but 'she won't show you up'. They agreed that she was 'fair' and not 'sexist', by comparing her with another teacher.

Interviewer: What do you mean exactly when you say she is fair and that she is not sexist?
Geraldine: Last year we had this woodwork teacher. If you went up with a piece of woodwork and said 'Look' or whatever, he'd go: 'Well that's good *for a girl'*. We were treated different to the boys.
Rose: Yeah, I left woodwork just because of him. (Girls group)

Mathematics as a subject seemed to be defined and interpreted in terms of the person who taught it. The students who were most positive about mathematics were also very positive about their teachers describing them as 'good teachers', clear in their explanations, patient in their approach, good-humoured, not sarcastic, and fair to all students.

Fear of being wrong

Despite the overall positive experience, an issue that arose spontaneously in the focus group discussions related to help seeking. Students were reluctant, even fearful, to ask for help in mathematics class. This issue was raised by the students themselves, in the context of a discussion about their experience of learning mathematics throughout their primary and post-primary education. Students said they generally preferred to ask their parents and/or other siblings for help at home, or alternatively to ask one of their friends or classmates. Help from home or friends appeared to be less threatening than the prospect of asking the teacher in front of the entire class. Students were fearful of being wrong and looking 'stupid' in class.

The fear of asking for help in class was expressed in the two top stream classes (namely Barrow (SSG F) and Blackstairs (VCC Fr D)) but not in the middle band class in Errigal. In Blackstairs it was only the girls who referred to their need for outside help. The competitive atmosphere in the top stream classes, something we observed in the video analysis, did not seem to lend itself to any display of weakness or inadequacy, and the girls appeared to be somewhat more sensitive to this.

The following excerpt from a class in Barrow illustrates the point:

Catherine: Sometimes if I didn't understand I wouldn't ask her. I would feel it was a stupid question. I would ask my Dad instead.

Barbara: Well if I had a problem I would wait until maybe towards the end of the class because usually she does the sum out on the board and she would do it step by step, so you understood. If I had a problem I would probably ask her, but it would depend. I would say to the girl beside me: 'Do you understand that?' and if she says 'Yes' then I wouldn't ask.
Interviewer: So you would go by the person beside you?
Barbara: Yeah. Everyone in the class is amazing at maths. There is a lot of pressure as well, there are some people who are just amazing. You feel that you have to keep up and everything – there is a lot of pressure to do really well.
Liz: I think Ms Brennan tries to take some of that pressure off. But then sometimes she would say also: 'You are all meant to gain As' all the time!' (Barrow SSG F)

This same issue arose in the discussions with the girls in Blackstairs (VCC Fr D). Although the girls were comfortable in asking the teacher for help, in that he invited and welcomed questions, they did not like to feel embarrassed in front of everyone in the class. In the context of this particular class, most of the help was likely to come from friends or classmates rather than family:

Interviewer: Do you always ask Mr Butler questions when you don't understand what is going on?
Aine: We *can* ask him. But the thing is you wouldn't want to ask him because the class is so big. If everyone else understands it you would be embarrassed to ask.
Jackie: He always encourages us to ask. And like if you ask a question he will always answer it. But you can feel a bit weird asking.
Interviewer: Was this the case in primary as well?
All three girls: Yes!
Interviewer: Was it just maths or did it happen in other subjects as well?
Patricia: In every subject. If you needed help your friends would usually show you.
Interviewer: And what would happen if all your friends were stuck as well.
Aine: That wouldn't usually happen. If a lot of people got stuck, then someone was bound to say: 'I don't understand it' and then others would join in and say: 'Me too'. And then he would go over the lot again.

The most positive views on learning mathematics were expressed in two top streams and in one mixed class. In each class the teacher's competence in explaining mathematical material, and their caring, non-critical and supportive approach to student learning, led to a positive response to the subject overall. Although students were positive, students in the top stream classes were also quite fearful in class, partly of the teacher, but mostly of being seen as 'stupid' by their peers if they asked an inappropriate question. Fear of being 'wrong' was part of the sub-text of the top set mathematics classes. It led certain students (especially girls) to seek help outside of class rather than within it.

A profile of negative mathematical experience

Introduction

Students in three of the case-study classes were mostly negative about their experience of learning mathematics. Of these three, one was exceptionally negative. The class in question was in Lagan, a coeducational secondary school located in a large town. It was a top track group assigned to the Higher course for the Junior Certificate. Most of the students (87 per cent) achieved a grade C or higher in the TIMSS-related test; overall in the TIMSS-related test, the class achieved second place relative to the ten schools in this study.

The second school where there was considerable negativity, Lee (SSB F), is a fee paying, all boys' secondary school located in an urban area. The school is socially selective in its intake with the vast majority of the students from an upper middle-class background. All students are assigned to the Higher course for the Junior Certificate and are taught in mixed 'ability' classes. Most of the boys in the class (62 per cent) achieved a grade C or higher in the TIMSS-related test, putting them in fourth rank-order place overall (Table 10.7).

The third class in this 'negative' category is the top stream in a boys' secondary school located in an urban area (Liffey SC Fr D). The school is designated disadvantage and a majority (76 per cent) of students are from a working class background. The principal and the teacher both described the school as having an over-representation of students with low levels of academic achievement, and they attributed this mostly to unsupportive family backgrounds. In addition, the principal made reference to a particularly high incidence of 'social problems' in the geographical area in which the school was located. The norm in this school was for *none* of the Junior cycle students to follow the Higher course in mathematics for the Junior Certificate. The observed top stream class was an exception and the

teacher expected that a number of the students were likely to take the Higher paper in the Junior Certificate Examination. However, this did not happen and the Junior Certificate results were disappointing in the teacher's view. In the observed class, almost half (48 per cent) of the students achieved a grade C or above in the TIMSS-related test, placing them fifth among the ten schools in the study (Table 10.7).

The class in Lagan (SC Fr) had the most 'negative' reports of mathematics, which seemed surprising in the context of their high achievement. Yet this negativity was expressed, by a large proportion of the students in the class, in response to an open ended question in the questionnaire.

In this question we asked students to record any opinions or experiences they felt were not catered for in the questions asked. Approximately one third took the opportunity to do so and the negative comments were divided between dissatisfaction with the principal and with the mathematics teacher. While most students in the other nine schools in the study took the opportunity to include some positive comments about various aspects of their school, or their mathematics teacher, this did not happen in Lagan. Two reasons emerged for overall student negativity, the attitudes of the principal which were regarded as being too controlling, and the approach of the mathematics teacher which was not regarded as being sufficiently attentive to the students' learning needs. It was not related to the subject per se.

> I don't like the principal or some other teachers in this school. They are too strict on things like uniform and they are unfair to some students. The vice-principal is sound. (Male student)
>
> I don't like the principal because he gives out and doesn't listen to your side. Also generally girls are treated differently to boys in most subjects including maths. (Female student)
>
> The school is okay but the principal is too strict. Maths sometimes is really boring and difficult. (Female student)
>
> I think that despite us learning all the time in CSPE and other classes that we should listen, and be listened to, it is funny how the most important person in the school [i.e., the principal] doesn't! (Male student)
>
> The maths teacher today put on an act. Also I think she explains things too quickly. And why on earth do we have to do algebra? (Female student)

Critical teachers, competition, speed and fear of being wrong

What emerged most strongly from the focus group with the mathematics class in Lagan (SC Fr), was an experience of 'pressure' and 'competition'.

Although both girls and boys expressed such concerns, it was the girls who articulated it most clearly.

Interviewer: How do you find maths this year?
Anne: I like maths this year when I can do it. It often happens that I cannot … then I get kind of down about it.
Pauline interrupts: Yeah. Exactly, I feel like that too…
Anne: I think Ms Leydon explains it but she goes *too fast.* There is a lot of pressure to do well.
Pauline: I like maths but this year it has been a real challenge. Ms Leydon is a good teacher. Like she knows her stuff and she is good at keeping control. Like last year our teacher did not explain things very well. But then we were in a mixed class and it was easier to get top of the class. Because we were doing easier stuff that everyone is expected to know it was easier to get it. Ms Leydon's class is very competitive and you are expected to know it first time. You are almost *afraid* to say that you got the answer wrong and that you will look stupid in front of everyone else.
Interviewer: Where did the competition thing come from do you think?
Pauline: Some people in the class are awful brainy. Some of the boys, but some of the girls too. Like there is one girl and she is really brainy and very determined as well. It makes it more *competitive* because it feels like if you don't know it you shouldn't be there – actually Ms. Leydon often reminds us about that and she will say: 'You better pay attention and keep up because you may not see this again until the Junior Cert'.
Anne interrupts: If you got something wrong she will keep on at you until you do …
Pauline: Yeah, like I remember that happened to me. I didn't know something or I got something wrong and I honestly didn't have a clue. She just kept asking me about it. She kept on at me and *I was nearly reduced to tears* about it in the end. And *I rarely ask questions* since.
Interviewer: That must be difficult?
Pauline: Well it has improved a bit. Since the parent teacher meeting it is easier to ask questions. I think a lot of parents told her that we were finding it tough and that she goes *too fast*. She has slowed down *a bit* since. She also says a lot more now: 'If you don't understand, ask me.'
Sinead: She goes *too fast*. Even though she had slowed down lately she still goes too fast I think. There is so much to cover in maths. Like even if you revise it will never be as thorough an explanation again – so if you don't get it as you go along it is a problem really.
Interviewer: Do you ask questions if she is going too fast for you and you need more explanation?
Sinead: I don't really like asking questions. If I don't understand I usually ask a friend to help me.

This 'pressure to perform' was emphasised further when the issue of praise for work well done was raised:

Pauline: Ms Leydon wouldn't, I wouldn't say she would *praise* you as such. If you are doing well it is just expected. If you have a record of being good then you know that she will automatically think: 'Oh she is good at that'. With those people she might say 'Good' but nothing more really.
Anne: Sometimes when she gives back tests she might say 'Good'. But she will also say 'That was bad' or 'You should have done much better'.
Interviewer: Is that privately or in public?
Anne: In front of everyone. If you don't do well she will say that you should have asked her if you didn't understand it. I don't think she should say it like that in front of the class.

When asked about criticism, all of the girls agreed that she wouldn't 'give out' but she would say that they should have asked for help:

Pauline: When you get something wrong she tells you that you should have asked a question. Sometimes she will say: 'Ah come on, you can do this' and then everyone turns around and has a look at you. That is why people are *afraid* – they are afraid they will be put on the spot if they ask a question. (Girls group, Lagan (SC Fr))

The responses by the boys are consistent with the latter reports, albeit somewhat attenuated. The fast pace of the lesson was mentioned but was not associated with 'pressure' and 'competition' to the same degree.

Interviewer: How do you find maths this year?
Vincent: I think she explains it quite well. She keeps your interest like. Having said that *she goes fast* enough alright. I'd say that sometimes people are slow to ask a question or ask for help because *you wouldn't want to be seen as the one who would ask*.

Peter: It's OK. Well it's OK as long as you keep up with what is going on. If you don't understand then it's tough, like I would say most *people don't like to ask questions*. Then if you get it wrong she gives out and says you should have asked the question. I'd mostly ask somebody at home or sometimes I'd be able to figure it out myself.

Joe: I usually understand what she is doing at the time. But then sometimes I forget how to do it or I get mixed up. Like in algebra some of the equations look the same and I can't see what way to do it.
Interviewer: Is there anything that would help you to remember?
Joe: Just to go back over it a lot. Like lots of practice and revision as well. But we go through things *so fast* that – just say with an equation, I think that if you knew why you were doing it that way you would probably remember it better.

An indirect reference to pressure was made when talking about the teacher's use of praise.

Fergal with a laugh: No she wouldn't praise you. *You are just expected to get it right.* She may say 'Good' but that's all.

When the issue of the teacher's use of criticism was raised only one of the four boys responded.

Peter: People don't usually mess in her class. Like she has good control.
Interviewer: Apart from messing, what about if you get something wrong?
Peter: Well she might look sort of annoyed or tell you that you should know it. She would try and get you to work out the problem there and then.
Interviewer: What is that like?
Peter: I don't know – you feel under a bit of *pressure* I suppose. (Boys group, Lagan (SC Fr))

The discussion became much more animated when we moved on from the issue of maths to the boys' general attitude to the school. All four boys reported that they did not like the principal because he was too strict and unfair. Three of the four boys related particular incidents with the principal; the general feeling was of 'being blamed in the wrong' and that 'he would not listen to your side'. Similarly, the girls also identified that the principal was 'very strict' in relation to uniform and rules about how to walk in the school.

Although the students in Lagan (SC Fr) were high achievers in a top stream class, the data from the questionnaires and the focus group discussions suggest that the 'teacher factor' was instrumental in generating negativity about mathematics. Negative feelings were explained in terms of being afraid to ask a question or give a wrong answer. Students felt they were under pressure, and that the material was being presented too quickly. At its strongest, the negativity was described as feeling that one was not entitled to be in the class if one was unable to keep up.

An interesting comparison can be made between this school and Barrow (SSG F) (discussed under 'positive experience' above) where the work ethic, pace and competitive atmosphere are similar. While the core ethos in each mathematics class is similar, the difference appears to be in the teacher's teaching style or delivery. In Barrow (SSG F) the use of humour is mentioned by the teacher and students, while this is noticeably absent in the accounts given by the students in Lagan (SC Fr). In addition, negative comments or sanctioning for mistakes were mentioned frequently by the students in Lagan (SC Fr) only. Lagan (SC Fr) provides a good illustration of the co-existence of high achievement and negative attitude and experience, while Barrow (SSG F) demonstrates almost the opposite. Although students in Barrow (SSG F) also felt under pressure, this was counterbalanced by a combination of teacher support, good humour and praise.

While overall attitudes to mathematics were quite negative in Lee (SSB F), they were a good deal more negative among the low achieving boys in the class. The low achieving students involved in the first group articulated quite negative views about mathematics.

Interviewer: How are you finding maths this year?
Conor: She really knows her stuff. And she says if you don't understand something to put up your hand. But then if you do she says: 'There is the example on the board' even if you don't get it!
Interviewer: So you would like more help?
Conor: Yes. Definitely. She really flies through it on the board. I think it would be better if she just came down to you. I find it easier to understand when she talks to you directly yourself.
Interviewer: What about asking your neighbour? Would you ever do that?
Conor: No.
Jonathan: I think she is good. She comes down to you the odd time to explain something. Like she would do it if there was time. But she is going *really fast* trying to get the course covered. Like it is a really long course for honours and you have to go fast. I suppose it would be better if she could go into more detail in explaining things but it is probably not possible to do that and still get everything finished.
Stephen: She is a good teacher. But as Jonathan said she tries to get the chapters done *as fast* as she can so she can finish the whole course on time. She should slow down really and spend a bit more time helping people that have problems. Sometimes she will ask who doesn't understand and she will say that she will come back and help them, like say at the end of class or when we are doing work or started our homework, but then she often forgets or doesn't get around to it and that. Like I think there is no point going on unless you understand it.
Interviewer: And would any of you ask for help at home or from someone other than the teacher?
Conor: My Dad, he's reasonable at maths, but he doesn't really explain it that well. He goes too fast. My mum's not good at all. I don't like asking my Dad for help.
Jonathan: I usually ask in class so I don't really need to ask anyone. The odd time my Dad but he does things a different way sometimes.
Stephen: I ask my Dad. Not often though. Like you are taught one way in school and when you go home he'll probably show me a different way. Then in class the next day I won't have a clue.
Jonathan: I think our parents were taught a different way. In maths class too I hate the way she always shows us the harder way. She says that it is so we can understand it better. Then she might show us an easier way. Then in the tests I get mixed up about what way to do it.

In our discussion about the use of praise and criticism by the teacher, the boys convey further negative attitudes. Overall, they report little or no praise for achievement or successes but a considerable amount of criticism for mistakes or misdemeanours.

Turning to the high achieving students in the second focus group from

Lee (SSB F), our analysis revealed fairly positive views about their experience of learning mathematics this year. The excerpt shows that while they are positive about the teacher's pedagogical approach there is little evidence of a rapport between students and teacher. In fact, students reported being ridiculed if they did not understand. Opportunities to ask for help are not always taken, with evidence that the choice is sometimes made to ask someone else or work it out on their own.

Interviewer: So what do you think of maths this year?
Dermot: It's enjoyable. The subject is good. So I don't mind it. The teacher is good.
Shane: Yeah, she is.
Larry: She knows her stuff.
Interviewer: Do you find maths challenging?
Dermot: It's not challenging, just fun to do. I just like doing maths.
Shane: Yeah. It's easy so you just do it!
Interviewer: So is that the way then? If you can do it you like the subject?
Larry: No. I can do Irish but I hate Irish.
Dermot: It's more the teacher than the subject.
Interviewer: So getting back to your maths teacher – do you think she is a good teacher then? You like her?
Laughter from the three boys
Dermot: No, we're not saying she's likeable!
Interviewer: So why do you think she is a good teacher?
Dermot: Well if someone has a problem she explains it. She will spend more time with those that didn't get it and be more patient. But if you were capable to put in the work and you didn't get it, she'd push you a bit further because she knows what you are capable of. There are other teachers in the school in other subjects and if you ask them what way to go about something they wouldn't explain it as thoroughly. She has a better method.

While students praised the teacher's method for explaining mathematics, they were cautious about asking questions.

Shane: Normally *I'd ask people in my class* to explain something before I'd ask the teacher or else I would just look at the answer and try and figure it out. Sometimes if you do ask the teacher she makes a big deal of it and sometimes she spends too long on it.
Dermot interrupts: It's a quicker process to ask someone else or just figure it out yourself.
Interviewer: One thing we noticed from being in the class is that you don't seem to mind putting up your hands to say you have a problem or you got something wrong?
Dermot: It's a good class. So no one takes it personally.
Shane interrupts: If you asked a question because you didn't understand, there might be someone who was jealous of you. There was a guy in my old school and if I asked a question he'd be saying: 'Why are you asking questions? You're supposed to be a brain, you're stupid'.

Larry: Most people in the class now are fairly good. So if only a few people don't understand she'll go down to them but if nearly everyone doesn't understand she will do it all over again.

When asked about positive reinforcement, the boys unanimously agreed that the teacher did not praise them for work well done.

Larry: She only praises people who are not good at maths but the people who are good at maths she would never praise. There are some people who are really bad at maths and she might praise them. I suppose this is to build a bit of confidence, you know. (Group 2, Lee (SSB F))

The students in Mr Little's class in Liffey (SSB Fr D) convey a general satisfaction with their teacher in terms of his pedagogical approach. Notwithstanding this, the students appeared quite alienated from learning, mainly articulated in terms of 'hating maths' and 'not being any good at it'. This applies particularly to the low achieving boys in the group: they spontaneously refer to, and are quite focused on, having performed badly in the Christmas test and are quite open about their low self-image in relation to maths. This is the only school where a 'disruptive' student participated in the focus group discussions.

Interviewer: How are you finding maths this year?
Ian: It's good. Mr Little is good. If you don't understand something he will explain it. He also goes around and helps you if you need it.
John: Yeah, we had this teacher last year and he used to make us go up to the blackboard.
Interviewer: And how did you find that?
John: Embarrassing! Especially when you got things wrong.
Robbie: He used to call me up to the blackboard and I would have just gone back to my seat and he would call me up again.
Interviewer: Why did he do that?
Other boys in the group interrupt saying that Robbie was always messing. Robbie laughs and looks proud.
Liam: I think Mr Little is good. Like if we get a question, a hard question, you know like an honours question, and we get it right he will say: 'Ask who got it right'. If a lot of people got it right he looks happy not like some of the others who just want to give out and get at you. When he is going around the class, when he looks at our homework, or if he gives us stuff to do in class, he will put a big smiley face on your copy if you did it right.
Robbie: Sometimes he starts roaring and shouting and bangs the desk.
Boys start chatting and laughing about a classmate that got thrown out of the class.
Interviewer: Getting back to maths. Is there any topic or part of the course you are having any difficulty with?
Robbie (with Liam joining in): All of it is hard. Like when it comes to the test.

I know it while we are doing it but then I forget. He starts a new thing every few days and it is hard to remember. You learn how to do it one way and then you get told to do the sum and then there's always a new way added in.

Liam: And you don't even know how to do one sum and he moves on to another one.

Interviewer: Do you do a test after finishing a topic or just at Christmas and summer?

John: I done bad at the Christmas test.

Robbie: I failed my Christmas test.

Ian: I did bad too.

Interviewer: Was it the same for you Sean?

Sean: Yes. I did bad. I knew all the sums and then at Christmas I don't know what it was. I knew some of the sums but I was just sitting there looking at it. Like we got a lot of formulas for the sums and I wouldn't know which ones to use.

John: I thought I did good in it but when I got the results back I failed it.

Interviewer: And did you get a chance to discuss it with Mr Little?

Ian: Yes. We went over it in class.

Robbie: I'm dreading the summer test. We're after doing loads this year. We have only started revision and we are starting the tests next week. I hate maths.

Liam: I hate it too. I'm crap at it.

Interviewer: Which comes first do you think, hating it or not being good at it?

Robbie: Hating it.

Liam: I'm not good at it. That's why I hate it.

Interviewer: So maybe you are not giving it a chance if you are hating it so much?

Robbie: It's just hard to take in everything.

Interviewer: So maybe more attention would help or more explanation?

Pat: I don't think so. I think that if you're not good at maths, you're not good at maths and you can't do anything to make yourself good at it.

Interviewer: You think that?

Boys all agreeing: Yes.

John: I hate when the teacher comes down.

Interviewer: Why is that?

John: I just do. I hate the whole thing about maths. I can't do them. I prefer to ask the fella beside me. I hate the way he comes down all the time.

Some of the other boys seem to agree with this.

The reasons why students were negative about mathematics varied across the three classes. In both Lee (SSB F), and especially Lagan (SC Fr), the approach of the teacher to the subject was the key factor. When the teacher moved too fast without adequate explanation, used ridicule or got annoyed when the student had difficulties, or if s/he was not positive in orientation, students tended to be negative about the subject. In the class in Liffey (SSB Fr D), however, it was the students' sense of failure in mathematics that led them to view mathematics negatively.

Fear of being wrong

A reluctance to ask the teacher for help also emerged in the context of our discussions with the 'negative' students. This was particularly evident in relation to Lagan (SC Fr), the most 'negative' of the classes in this study. In this case it was mentioned specifically in relation to their current experience of learning mathematics.

> *Pauline:* I find that it is easier, definitely easier, to ask my mum. Or sometimes, I might ask one of my friends. My *mum* is brilliant though. She would sit down with me and she has a way of saying it to me that I won't feel stupid.
> *Interviewer:* What's the difference between asking her and asking the teacher?
> *Pauline:* Well Ms Leydon tends to go very fast and you don't want to stop her and say I don't understand it. And because you didn't understand it by that time from way back it is worse. She would probably get annoyed and expect you to know what came before.
> *Interviewer:* So would that apply to all of you?
> *Anne and Sinead agree that this is the case.*
> *Sinead:* It's just hard to be the one to say you don't understand if you think everyone else does. You don't want Ms Leydon to think you are not able for it. People are afraid to be put on the spot. It can be really embarrassing.

While the boys' group in Lagan (SC Fr) reported the importance of 'asking for help when you don't understand', they did not express their reluctance to ask the teacher as clearly as was the case for the girls.

> *Vincent:* I don't think that people always ask when they need it. It is important though, to ask questions when you don't understand.
> *Interviewer:* Would you always ask yourself?
> *Vincent* (*laughs*): Not always. No. I'd try to figure it out myself first and then I'd ask my older brother or someone else at home. Not very often though. Only if I couldn't figure it myself.
> *Peter:* I don't think people always ask either. Sometimes when people ask she starts asking them a load of questions, so I would say that that would put them off.
> *Interviewer:* Would the rest of you agree or disagree with that?
> *Fergal and Joe agree that this is the case but do not contribute any further comments on the issue.*

Negative views of mathematics were evident in classes that were different in both track, academic track and social profile. The most negative views were expressed in a top track, coeducational class that was predominantly middle-class. The two other classes were boys' classes, one in a fee-paying school and the other in a designated disadvantaged school, the former being a mixed class while the latter was a top track. While negative views in the latter school seemed to be more associated with

students' own sense of failure in mathematics, in the two other schools it seemed more related to the teaching style and learning climate. Students were most negative in classes that were very competitive, classes in which no student wanted to 'be the one to ask a question'.

Fear of being 'wrong' or 'being put on the spot', was not only expressed among students that were negative about mathematics classes however, it was expressed by students who had a positive view of both the teaching of mathematics and the subject itself. Our findings regarding students' sense of being intimidated in mathematics classes concur with similar findings in a cross national study by Picker and Berry (2001) and with those of Boylan and Lawton (2000) regarding students' sense of vulnerability in mathematics classes. There are also indications from Boylan, Lawton and Povey's (2001) research that girls fear the public shame of being wrong in class more than boys, and from Boaler's (1997e) research that the competitive ethos of high stream classes facilitates anxiety around the subject of mathematics itself.

Discussion and conclusion

Most students believed that success in mathematics was dependent on having a good teacher, studying hard and liking the subject. Students did not attribute as much importance as teachers to 'natural talent' or 'innate ability' in learning mathematics. While most students regarded mathematics as an important subject in school, the reason it was seen as important was because of its usefulness, in terms of employment, third level education and everyday life.

Analysis of student data revealed considerable differences across the classes in general attitudes to, and experience of, mathematics. They differed in terms of mathematics self-image, their perceptions of classroom interaction, and in their academic expectations for the future. Six classes were broadly classifiable as either being positive (three classes) or negative (three classes) in their experience of mathematics. The remaining four classes occupied an interim place between these two positions.

While one might expect students who were high achievers in mathematics to be the most positive about the subject, we did not find this to be the case. Although the most 'positive' class was the highest performing group in the TIMSS-related test, the most 'negative' class was also a high-achieving group (second in rank-order of the ten schools). In addition, while two of the 'positive' classes were in the top-stream in their year group, this was also the case for two of the most 'negative' classes. Moreover, students who were largely negative about mathematics often described their teacher as 'good' in terms of explaining material clearly.

The focus group discussions highlighted the importance of the style of individual mathematics teachers in determining attitudes to, and experiences of, the subject. This finding concurs with international research suggesting that students' view of the subject is strongly influenced by their classroom experience of learning it (Dick and Rallis, 1991; Johnston, 1994; Ma, 1997). All students spoke about mathematics in terms of their *teacher* and rarely mentioned other issues like the curriculum, the examination system or resources for the subject. There were three teacher practices that seemed to contribute to negative views on mathematics: when teachers taught at a very fast pace, when they were critical of students who made errors or sought help, or when they pressurised students to achieve without giving positive support. Students' accounts of mathematics classes were also more negative when the teacher lacked good humour, or rarely praised or encouraged students in class. Students who were positive about their experience of learning mathematics described their teacher as a 'good' teacher with a strong knowledge of the subject, capable of explaining the material and interacting with them in a humorous, supportive and non-judgmental way. Even in these 'ideal' circumstances, however, students were often reluctant to look for help from the teacher, seeing family or friends as a less threatening source of help. A fear of being seen to be 'wrong' was an over-riding concern of students in all types of mathematics classes, a finding that concurs with that of Boylan and Lawton (2000), Boylan, Lawton and Povey (2001) and Picker and Berry (2001).

The relationship between gender and attitudes to, and experience of, mathematics was quite complex and not as stereotypical as has been reported in past studies (Forgasz and Leder, 2001; Leder and Forasz, 2000). While girls had more positive views of mathematics and their classroom experiences than boys, and significantly higher aspirations for themselves educationally, the impact of gender was mediated by social class, stream position, teacher style and students' level of attainment in the subject. Students who had positive teaching experiences, who were successful at mathematics, and who were in higher tracks (these also tended to be middle-class) were more positive regardless of gender. Moreover, boys had a Higher mathematics self-image than girls, although differences here were not significant.

Within coeducational classes, the only area in which there was a significant difference between girls and boys was in their classroom experiences; girls reported more positive experiences than boys. While girls also had slightly higher educational expectations, boys had slightly higher mathematics self-image, and more positive attitudes towards the subject.

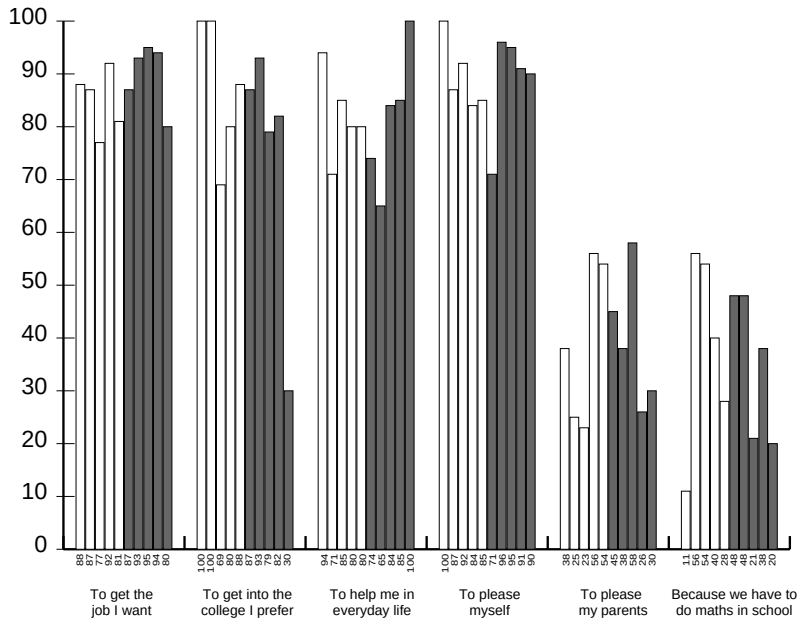
One of the most important findings from the focus group discussions with students related to the learning climate of mathematics classes generally. Several students (in top tracks especially, but also in other classes) expressed fears about asking questions or seeking explanations in class. Students of both genders (albeit girls somewhat more than boys) spoke of their fear of appearing 'stupid' in mathematics. They said they did not ask questions as they were afraid of being criticised, either by their peers, or, in some cases, by their teachers. Students seemed to feel exposed and vulnerable in mathematics, and they tried to hide their lack of understanding from peers and the teacher. They reported seeking help from friends, siblings or parents, rather than the teacher.

Our findings regarding students' sense of fear and vulnerability in mathematics classes has been reported in a number of other recent studies (Boylan and Lawton 2000; Boylan and Povey 200; Picker and Berry 2001). Our findings regarding the competitive ethos of top tracks, especially as seen by girls, corroborates Boaler's (1997) earlier findings in the UK.

Appendix 1 to Chapter 10

Figure A10.1: Students' views of 'why they need to do well' in school mathematics

(Base: 237)



Key: Single sex schools: white bars and **coeducational schools:** grey bars

1. Barrow (SSG F)
2. Nore (SSG Fr)
3. Suir (SSG Fr D)
4. Liffey (SSB Fr D)
5. Lee (SSB F)
6. Lagan (SC Fr)
7. Errigal (CS Fr)
8. Mourne (VCC Fr D)
9. Blackstairs (VCC Fr D)
10. Nephin (VCC Fr)

Note: Same Key applies to all six statements.

Appendix 2 to Chapter 10

Construction of attitude scales

In the course of the research it was necessary to construct a number of indices or 'scales' in relation to students, particularly in terms of their attitudes and aspirations. The main results from our survey of the different attitudes, beliefs and aspirations of the boys and girls surveyed are presented below.

The attitude scales used are Likert scales (Oppenheim, 1966, pp. 120-159).

(i) *Attitude towards maths (MATHATT)*

Responses to the following nine items were used in this scale. The scored responses were aggregated in the following way to give a scale that ranged in total value from 9 to 19. To control for non-response, the total score was divided by the number responded to by each student giving the final score with values ranging from 1 (very high liking for maths) to 2 (low liking for maths). The overall reliability was very high: Cronbach's Alpha = .8151.

Item	*Statement*	*Response/Score*	
1 Measy	'Maths is an easy subject'	Very easy/ easy = 1	Quite difficult/ difficult = 2
2 Museful	'Maths is useful'	Yes = 1	No = 2
	interesting'		
4 Mdiff	'Maths is difficult'	No = 1	Yes = 2
5 Menj	'Enjoy maths I do at school'	Always/most of the time/sometimes = 1	Hardly ever/never = 2
6 Mlife2	'Maths is important to everyone's life'	Strongly agree/ agree = 1	Strongly disagree/ disagree = 2
7 Mbore2	'Maths is boring'	Strongly agree/ agree = 1	Strongly disagree/ disagree = 2
8 Mfavsbj	'Maths is my favourite subject': 1st /2nd mention	Yes = 1	No = 2
9 Mlfavsbj	'Maths is my least favourite subject': 1st or 2nd mention	Yes = 1	No = 2

(ii) Maths self-image (MATHIMG)

This is a three-item scale with an Alpha of .82. It indexes the student's image of her or his own mathematical ability relative to that of peers. The items below were aggregated for each student and divided by the number of valid responses. Thus the values of the scale range from 0 (very high maths self-image) to 2 (low maths self-image).

Item		*Statement*	*Response/Score*		
1	Mustand	'This year so far, I understand the maths'	Very often = 0	Often = 1	Few times/ Never = 2
2	Mable	'Do you think you are good, bad or okay at the maths you do in school?'	Good = 0	Okay = 1	Bad = 2
3	Mprognow	'Thinking of everyone in your maths class this year, where would you place yourself'	Top/well above average = 0	Just above average/ average = 1	Below average/ well below average = 2
4	Aheadcc	'I'm usually well ahead of others in my maths class'	Strongly agree = 0	Agree = 1	Strongly disagree/ disagree = 2
5	Mvable	'In maths I can do just about anything I set my mind to'	Strongly agree = 0	Agree = 1	Strongly disagree/ disagree = 2
6	Magegp	'I am as good at my maths school work as most other people of my age'	Strongly agree = 0	Agree = 1	Strongly disagree/ disagree = 2

(iii) Positive Teacher Interaction (MATHPTI)

This is a six-item scale with an Alpha of .73. It indexes the student's image of her or his interaction with the maths teacher. The items below were aggregated for each student and divided by the number of valid responses. Thus the values of the scale range from 0 (very positive) to 3 (negative interaction).

Item		*Statement*	*Response/Score*			
1	Mwkgood	'Over the past 2 weeks in maths class I have been told my work is good'	Very often = 0	Often = 1	A few times = 2	Never = 3
2	Maskqs	'Over the past 2 weeks in maths class I have been asked questions in class'	Very often = 0	Often = 1	A few times = 2	Never = 3
3	Mpraise1	'Over the past 2 weeks in maths class I have been praised for answering a difficult question'	Very often = 0	Often = 1	A few times = 2	Never = 3
4	Mpraise2	'Over the past 2 weeks in maths class I have been praised because my written work is good'	Very often = 0	Often = 1	A few times = 2	Never = 3
5	moffans	'This year so far, I offer to answer questions without the teacher asking me to do so'	Very often = 0	Often = 1	A few times = 2	Never = 3
6	mpayatt	'This year so far, I pay attention and work hard in the class'	Very often = 0	Often = 1	A few times = 2	Never = 3

(iv) Negative Teacher Interaction (MATHNTI)

This is a four-item scale with an Alpha of .63. It indexes the student's image of her or his interaction with the maths teacher. The items below were aggregated for each student and divided by the number of valid responses. Thus the values of the scale range from 0 (less negative) to 3 (very negative).

Item		*Statement*	*Response/Score*			
1	Mtoldoff	'Over the past 2 weeks in maths class I have been given out to because my work is untidy or not done on time'	Very often = 3	Often = 2	A few times = 1	Never = 0
2	Mignored	'Over the past 2 weeks in maths class I have wanted to ask questions but have been ignored'	Very often = 3	Often = 2	A few times = 1	Never = 0
3	Mmess	'Over the past 2 weeks in maths class I have been given out to for misbehaving in class'	Very often = 3	Often = 2	A few times = 1	Never = 0
4	Mueqatt	'My maths teacher pays more attention in class to what some students say than to others'	Strongly agree = 3	Agree = 2	Disagree = 1	Strongly disagree = 0
5	Mhardtk	'I find my maths teacher is hard to talk to'	Strongly agree = 3	Agree = 2	Disagree = 1	Strongly disagree = 0

(v) General academic expectations (EXPECT)
This is a four-item scale with an Alpha of .74. It indexes academic expectations for the future. The items below were aggregated for each student and divided by the number of valid responses. Thus the values of the scale range from 0 (less negative) to 3 (very negative).

Item		*Statement*	*Response/Score*			
1	Perfjct	How well you are expected to do in the Junior Cert by – your teachers	Very well = 0	Well = 1	Just below average = 2	Well below average = 3
2	Perfjcy	– yourself	Very well = 0	Well = 1	Just below average = 2	Well below average = 3
3	Perfjcm	– your mother	Very well = 0	Well = 1	Just below average = 2	Well below average = 3
4	Perfjcf	– your father	Very well = 0	Well = 1	Just below average = 2	Well below average = 3
5	Hedt	What in your opinion is the highest certificate or qualification you are expected to get by – your teachers?	University degree = 0	3rd Level Certificate Diploma = 1	Leaving Cert = 2	Junior Cert = 3
6	Hedy	– yourself	University degree = 0	3rd Level Certificate/ Diploma = 1	Leaving Cert = 2	Junior Cert = 3
7	Hedm	– your mother	University degree = 0	3rd Level Certificate/ Diploma = 1	Leaving Cert = 2	Junior Cert = 3
8	Hedf	– your father	University degree = 0	3rd Level Certificate Diploma = 1	Leaving Cert = 2	Junior Cert = 3

Item		*Statement*	*Response/Score*			
9	Postjct	What do you think you are expected to do after the Junior Cert by – your teachers?	Definitely stay at school to do the Leaving Cert = 0	Probably stay at school to do the Leaving Cert = 1	Look for a job straight away = 2	Do a voca-tional, training or FÁS Course = 3
10	Postjcm	– your mother	Definitely stay at school to do the Leaving Cert = 0	Probably stay at school to do the Leaving Cert = 1	Look for a job straight away = 2	Do a voca-tional, training or FÁS Course = 3
11	Postjcf	– your father	Definitely stay at school to do the Leaving Cert = 0	Probably stay at school to do the Leaving Cert = 1	Look for a job straight away = 2	Do a voca-tional, training or FÁS Course = 3

Appendix 3 to Chapter 10

Analysis of relationships among scales measuring attitudes to and experience of mathematics in school, and independent variables

A correlation analysis was conducted to examine the relationships amongst the five scales outlined above, namely attitude to maths (MATHATT), self-image in relation to maths (MATHIMG), positive teacher interaction (MATHPTI), negative teacher interaction (MATHNTI) and academic expectations (EXPECT). The results of this analysis are presented in Table A10.1 (below). All of the variables are inter-correlated to a statistically significant degree, with the exception of the two classroom interaction variables (MATHPTI and MATHNTI) and the variable describing their academic expectations for the Junior Certificate and beyond.

The results show that the strongest positive relationship is that between attitude to mathematics (MATHATT) and self-image about the subject (MATHIMG). Both of these variables are correlated with the positive classroom interaction variable (MATHPTI); the strongest positive relationship being between attitude to mathematics and positive classroom interaction. In addition, a strong positive relationship was found between attitude to mathematics and negative classroom interaction; this implies a more positive attitude to mathematics is strongly related to less classroom sanctioning/correction for mistakes and misdemeanours.

Not surprisingly, our analysis showed that there is a strong positive relationship between mathematical ability and academic expectations, and to a statistically significant degree. In addition, such a positive statistically significant relationship also exists between mathematical ability and mathematical self-image.

We will now briefly discuss the inter-correlations among the Likert-scale variables and our independent variables. The independent variables referred to are as follows:

Social class: middle-class (Group I, II and III) vs. working class (IV, V).
Gender (overall): girls vs. boys
Gender (within coeducational schools): girls vs. boys
Maths achievement (TIMSS-RELATED): fail vs. grades A/B
Ability grouping: Top (Barrow (SSG F),22, 31, 56) vs. bottom stream (Suir (SSG Fr D), 51 and 57)
Within-group 'positive' mathematics learning experience: Barrow (SSG F) vs. 46; Barrow (SSG F) vs. 56 and Errigal (CS Fr) vs. 56
Within-group 'negative' mathematics learning experience: Lagan (SC Fr) vs. 22; Lagan (SC Fr) vs. 24 and Liffey (SSB Fr D) vs. 24

In relation to social class differences (Table A10.2), as defined by middle-class versus working class, the results reveal that middle-class students have significantly higher expectations than their working class counterparts. However, working class students are less likely to report classroom sanctioning relative to the middle-class students, and to a statistically significant degree.

Taking all students, girls are significantly more positive in all aspects, with the exception of maths self-image (although not statistically significant: Table A10.3). Looking at gender differences within coeducational schools, the results show that girls are significantly more likely to report rewards for achievements in their maths classes (Table A10.4).

Returning to mathematical performance, we compared the mean score difference on the above items between those who failed and those who obtained a grade B or above. Not surprisingly, we found a strong positive relationship between high mathematics achievement and both mathematics self-image and academic expectations (Table A10.5).

In relation to ability grouping, we compared the mean scores of students in the top compared to the bottom stream (Table A10.6). Overall, the top stream was accorded more positive scores on all items, except classroom correction where no differences were found. Statistically significant differences occurred in relation to mathematics self-image and academic expectations.

Table A10.1 Correlations among Likert-scale items

	MATHATT	MATHIMG	MATHPTI	MATHNTI	EXPECT	Ability‡
MATHATT	1.00	.631*	.520*	.404*	.195*	–.113
MATHIMG	.631*	1.00	.461*	.228*	.262*	–.297*
MATHPTI	.520*	.461*	1.00	.292*	.118	.032
MATHNTI	.404*	.228*	.292*	1.00	–.029	–.013
EXPECT	.195*	.262*	.118	–.029	1.00	–.503*

‡Ability refers to mathematical ability measured by TIMSS-RELATED test.
* Significant, $p < 0.01$

Table A10.2 Differences in Likert-scale item means by social class

	Middle-class	Working class	Total
MATHATT	1.28	1.30	1.29
MATHIMG	.92	.99	.96
MATHPTI	1.42	1.46	1.45
MATHNTI	.67	.55*	.61
EXPECT	1.94	2.26*	2.11

* Significant, $p < 0.01$

Table A10.3 Differences in Likert-scale item means by gender within coeducational schools

	Girls	Boys	Total
MATHATT	1.32	1.28	1.29
MATHIMG	1.01	.92	.96
MATHPTI	1.38	1.59*	1.45
MATHNTI	.51	.60	.61
EXPECT	2.14	2.23	2.11

* Significant, $p < 0.01$

Table A10.4 Differences in Likert-scale item means by mathematics achievement scores measured by score in TIMSS-RELATED test 1 (lowest) to 40 (highest)

	Fail	Grade 'A'/'B'	Total
MATHATT	1.32	1.23	1.29
MATHIMG	1.12	.80*	.96
MATHPTI	1.32	1.43	1.45
MATHNTI	.53	.60	.61
EXPECT	2.44	1.91*	2.11

* Significant, $p < 0.01$

Table A10.5 Differences in Likert-scale item means by ability grouping

	Top stream	Bottom stream	Total
MATHATT	1.33	1.35	1.29
MATHIMG	.90	1.10*	.96
MATHPTI	1.33	1.46	1.45
MATHNTI	.64	.64	.61
EXPECT	1.84	2.50*	2.11

* Significant, $p < 0.01$

Table A10.6 Differences in Likert-scale item means within 'positive' experience of mathematics in school (Barrow (SSG F), Errigal (CS Fr) and Blackstairs (VCC Fr D))

	Barrow (SSG F)	Errigal (CS Fr)	Total
MATHATT	1.05	1.14**	1.29
MATHIMG	.67	.87*	.96
MATHPTI	.89	1.14*	1.45
MATHNTI	.47	.26	.61
EXPECT	1.76	2.27**	2.11
	Barrow (SSG F)	Blackstairs (VCC Fr D)	Total
MATHATT	1.05	1.20**	1.29
MATHIMG	.67	.90*	.96
MATHPTI	.89	1.60**	1.45
MATHNTI	.47	.49	.61
EXPECT	1.76	2.06**	2.11
	Errigal (CS Fr)	Blackstairs (VCC Fr D)	Total
MATHATT	1.14	1.20	1.29
MATHIMG	.87	.90	.96
MATHPTI	1.14	1.60**	1.45
MATHNTI	.26	.49*	.61
EXPECT	2.27	2.06*	2.11

* Significant, $p < 0.01$

Table A10.7 Differences in Likert-scale item means within 'negative' experience of mathematics in school (Lagan (SC Fr), Liffey (SSB Fr D) and Lee (SSB F)).

	Lagan (SC Fr)	Liffey (SSB Fr D)	Total
MATHATT	1.56	1.40	1.29
MATHIMG	1.08	1.02	.96
MATHPTI	1.70	1.58	1.45
MATHNTI	.77	.61	.61
EXPECT	1.92	2.38**	2.31
	Lagan (SC Fr)	Lee (SSB F)	Total
MATHATT	1.56	1.35**	1.29
MATHIMG	1.08	.91	.96
MATHPTI	1.70	1.93*	1.45
MATHNTI	.77	1.06	.61
EXPECT	1.92	1.84	2.11
	Liffey (SSB Fr D)	Lee (SSB F)	Total
MATHATT	1.40	1.35	1.29
MATHIMG	1.02	.91	.96
MATHPTI	1.58	1.93*	1.45
MATHNTI	.61	1.06*	.61
EXPECT	2.38	1.84**	2.11

** Significant, $p < 0.01$

* Significant, $p < 0.05$

Table A10.8: Attitude to mathematics: average scores of girls and boys in ten case-study schools on the MATHATT scale (overall average = 1.29). The lower the score the higher the liking for mathematics.

School average scores	*Barrow (SSG F)*	*Nore (SSG Fr)*	*Suir (SSG Fr D)*	*Liffey (SSB Fr D)*	*Lee (SSB F)*	*Lagan (SC Fr)*		*Errigal (CS Fr)*		*Mourne (VCC Fr D)*		*Blackstairs (VCC Fr D)*		*Nephin (VCC Fr)*	
	1.05	1.24	1.50	1.40	1.35	1.56		1.14		1.29		1.20		1.28	
By gender	*G*	*G*	*G*	*B*	*B*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*
	1.05	1.24	1.50	1.40	1.35	1.62	1.49	1.15	1.14	1.27	1.30	1.21	1.20	1.21	1.44
Overall scores by gender						Girls: 1.26				Boys: 1.33					
Single sex versus coed by gender						SS Girls: 1.21 SS Boys: 1.38*				Coed Girls: 1.32 Coed Boys: 1.28					

*p < .001

Table A10.9: Mathematics self-image: average scores of boys and girls in ten case-study schools on the MATHIMG scale (overall average = 1.04). The lower the score the higher their academic self-image in relation to mathematics.

School average scores	*Barrow (SSG F)*	*Nore (SSG Fr)*	*Suir (SSG Fr D)*	*Liffey (SSB Fr D)*	*Lee (SSB F)*	*Lagan (SC Fr)*		*Errigal (CS Fr)*		*Mourne (VCC Fr D)*		*Blackstairs (VCC Fr D)*		*Nephin (VCC Fr)*	
	0.67	1.08	1.25	1.02	.92	1.09		0.87		1.05		0.90		0.99	
By gender	*G*	*G*	*G*	*B*	*B*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*
	0.67	1.08	1.25	1.02	.92	1.02	1.13	0.81	0.90	0.83	1.29*	1.00	0.81	0.82	1.38*
Overall scores by gender						Girls: 0.98					Boys: 0.94				
Single sex versus coed by gender						SS Girls: 0.95 SS Boys: 0.97*					Coed Girls: 0.01 Coed Boys: 0.92				

*p < .001

Table A10.10: Positive interaction in mathematics classrooms: average scores of boys and girls in ten case-study schools on the MATHPTI scale (overall average = 1.60). The scale ranges between 0 and 3. The lower the score the greater the level of perceived positive interaction/reward.

School average scores	*Barrow (SSG F)*	*Nore (SSG Fr)*	*Suir (SSG Fr D)*	*Liffey (SSB Fr D)*	*Lee (SSB F)*	*Lagan (SC Fr)*		*Errigal (CS Fr)*		*Mourne (VCC Fr D)*		*Blackstairs (VCC Fr D)*		*Nephin (VCC Fr)*	
	0.89	1.22	1.52	1.58	1.93	1.70		1.14		1.32		1.60		1.63	
Average															
By gender	*G*	*G*	*G*	*B*	*B*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*
	0.89	1.22	1.52	1.58	1.93	1.73	1.68	1.44	1.01*	1.33	1.31	1.68	1.51	1.66	1.55
Overall scores by gender						Girls: 1.27						Boys: 1.67*			
Single sex versus coed by gender						SS Girls: 1.15 SS Boys: 1.76*						Coed Girls: 1.38 Coed Boys: 1.59			

*p < .001

Table A10.11: Negative interaction in the mathematics classroom: average scores of boys and girls in ten case-study schools on the MATHNTI scale (overall average = 0.62). The scale ranges between 0 and 3. The lower the score the lower the level of perceived negative interaction/sanction.

School average scores	*Barrow (SSG F)*	*Nore (SSG Fr)*	*Suir (SSG Fr D)*	*Liffey (SSB Fr D)*	*Lee (SSB F)*	*Lagan (SC Fr)*		*Errigal (CS Fr)*		*Mourne (VCC Fr D)*		*Blackstairs (VCC Fr D)*		*Nephin (VCC Fr)*	
	0.47	0.59	0.64	0.61	1.06	0.77		0.26		0.69		0.49		0.57	
By gender	*G*	*G*	*G*	*B*	*B*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*
	0.47	0.59	0.64	0.61	1.06	0.78	0.77	0.32	0.24	0.84	0.53	0.48	0.50	0.52	0.66
Overall scores by gender						Girls: 0.53					Boys: 0. 71*				
Single sex versus coed by gender						SS Girls: 0.55 SS Boys: 0.84*					Coed Girls: 0.51 Coed Boys: 0.60				

*p < .001

Table A10.12 : Average scores of boys and girls in ten case study schools on the EXPECT scale (overall average = 1.9). The scale ranges between 0 and 3. The lower the score the higher the academic expectation.

School average scores	*Barrow (SSG F)*	*Nore (SSG Fr)*	*Suir (SSG Fr D)*	*Liffey (SSB Fr D)*	*Lee (SSB F)*	*Lagan (SC Fr)*		*Errigal (CS Fr)*		*Mourne (VCC Fr D)*		*Blackstairs (VCC Fr D)*		*Nephin (VCC Fr)*	
	1.64	1.75	2.18	2.21	1.67	1.79		2.02		2.17		1.92		2.42	
By gender	*G*	*G*	*G*	*B*	*B*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*	*B*	*G*
	1.64	1.75	2.18	2.21	1.67	1.84	1.74	2.11	1.98	2.21	2.12	1.93	1.91	2.42	2.12
Overall scores by gender						Girls: 1.87				Boys: 1.99*					
Single-sex versus coed by gender						SS Girls: 1.98 SS Boys: 2.10*				Coed Girls: 2.14 Coed Boys: 2.23					

*p < .001

Notes

[1] See *Appendix 2 of Chapter 10* for the full details on the scales and *Appendix 3 of Chapter 10* for a discussion on the relationship between each of the scales, and between independent background variables and various attitude scores.

[2] The scalability of the items included in each scale was checked using Factor Analysis and Likert Scaling techniques and the reliability of the scales was tested using Cronbach's Alpha; this statistic ranges in value from 0.0 to 1.0 and measures the extent of co-variation amongst items in the scale. For our purposes a value of .80 or over is very high and those between .60 and .80 are highly acceptable. Alpha is within this range for all five scales used here. The methodological issues pertaining to the construction of these five scales are discussed in Appendix 2 of Chapter 10.

[3] 'Positive' here refers to a positive attitude to mathematics, a strong self-image in relation to mathematics, perception of a high level of reward from the mathematics teacher for achievements and a low level of sanctioning for mistakes or misdemeanours. In addition, it includes high academic expectations in relation to the Junior Certificate Examination and more generally in relation to their future education.

[4] We had two focus groups from this class, one with three boys and the other with three girls.