Mathematics in Transition Year:

Insights of Teachers from PISA 2012

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Educational Research Centre

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http://www.erc.ie

Cataloguing-in-publication data

Moran, Gráinne

Mathematics in Transition Year: Insights of Teachers from PISA 2012/

Gráinne Moran… [et al.].

Dublin: Educational Research Centre.

vi, 56p., 30cm

ISBN: 978 0 900440 39 7

Programme for International Student Assessment (PISA)

Transition Year

Teacher Surveys - Ireland

Mathematics Education - Ireland

2013

371.262-dc/23

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Preface

This report is based on the findings of a survey of a nationally representative sample of mathematics teachers and mathematics school co-ordinators, implemented as part of PISA 2012 in Ireland. The focus of the report is on the teaching of mathematics in Transition Year. Therefore, it is based on the questionnaire responses of teachers who indicated that they taught mathematics in Transition Year in the 2011/2012 school year and co-ordinators in schools that provide mathematics in Transition Year. It examines the structure and content of mathematics classes in Transition Year as well as teachers' views on the purposes of mathematics in Transition Year.

The first achievement results from PISA 2012 will be released by the OECD in December 2013 and will provide further insight into the teaching of mathematics in Ireland. A national report will also be published at this time and in-depth thematic reports, with additional analyses, will be published in early 2014.

This report is intended for teachers of mathematics and those involved in mathematics education and policymaking. It is published at around the same time as a 'sister' report, *Teaching and Learning in Project Maths: Insights from Teachers who Participated in PISA 2012* (Cosgrove, Perkins, Shiel, Fish and McGuinness, 2012). Both reports, which are the first national publications on PISA 2012, are available at www.erc.ie/pisa.

This report is divided into seven chapters. Chapter 1 describes previous research that examined Transition Year. Chapter 2 provides an overview of PISA mathematics, while Chapter 3 describes the design of the current survey, questionnaire content, and survey respondents.

Chapter 4 describes the general characteristics of teachers of mathematics in Transition Year and Chapter 5 provides an overview of the organisation of mathematics in Transition Year within schools. Chapter 6 presents teachers' views on the teaching and learning of mathematics in Transition Year, while Chapter 7 provides a set of conclusions and recommendations.

Acknowledgements

We gratefully acknowledge the help of members of the PISA national advisory committee during the implementation of PISA 2012 in Ireland, including their review of this report. In addition to the authors of this report, members of the committee include Pádraig MacFhlannchadha (DES, Chair, from February 2012), Éamonn Murtagh (DES, Chair, to February 2012), Declan Cahalane (DES), Conor Galvin (UCD), Séamus Knox (DES), Rachel Linney (NCCA), Bill Lynch (NCCA), Hugh McManus (State Examinations Commission), Philip Matthews (TCD), Brian Murphy (UCC), Maurice O'Reilly (St Patrick's College, Drumcondra), Elizabeth Oldham (TCD) and George Porter (DES, to February 2012).

Thanks are also due to staff at the Educational Research Centre, including Peter Archer (Director), Mary Rohan, Paula Chute and John Coyle. We would also like to thank Rosemary Fish, who worked as a Research Associate on PISA in Ireland until August 2012. Finally, we would like to thank the students, teachers and principals in the schools that participated in PISA 2012 and the Inspectors from the Department of Education and Skills who helped to ensure that PISA was administered in line with rigorous international standards.

Acronyms and Abbreviations Used

CAO	Central Applications Office
CPD	Continuing Professional Development
DEIS	Delivering Equality of Opportunity In Schools
DES	Department of Education and Skills
ESCS	Economic, Social and Cultural Status
ERC	Educational Research Centre
H Dip/PGDE	Higher Diploma/Postgraduate Diploma in Education
NCCA	National Council for Curriculum and Assessment
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
SD	Standard Deviation
SE	Standard Error
SSP	School Support Programme (under DEIS)
TALIS	Teaching and Learning International Survey
TIMSS	Trends in International Mathematics and Science Study
TY	Transition Year

1. Transition Year

1.1. Transition Year: An Overview

The Transition Year Programme, which is an optional one-year programme that is offered in most post-primary schools at the beginning of the senior cycle, was first introduced in a small number of post-primary schools in Ireland in the 1970s to address concerns with the overly academic nature of the senior cycle (Smyth, Byrne & Hannan, 2004). The programme is unique in that there is no similar programme offered in education systems in other countries (Clerkin, 2012).

Since its revision in the early to mid 1990s, there has been a marked increase in the number of schools and students participating. In the 2010/2011 academic year, more than 30,000 students in 574 schools were enrolled in the Transition Year Programme, accounting for 81% of schools and approximately 55% of the student cohort who completed the Junior Certificate in the previous school year. The considerable increase in the provision of Transition Year has been apparent across all school types, but particularly so among vocational schools. However, while provision rates in secondary schools and community/comprehensive schools have been generally similar since 1994/95, vocational schools are still relatively less likely to provide Transition Year, with just 57% of such schools offering the programme in 2010/11 compared to 91% of secondary schools and 88% of community/ comprehensive schools. The proportion of schools designated as disadvantaged[1] offering Transition Year has increased from 62% of such schools in 1999/2000 to 76% in 2010/11, although rates have fluctuated somewhat in the intervening years (Clerkin, 2013). While Transition Year is an optional programme for both schools and students, participation is compulsory in approximately one-quarter of the schools that offer the programme (Clerkin, 2013).

Transition Year is intended to help students make the move from the high degree of structure associated with junior cycle to the more independent learning associated with senior cycle (see http://ty.slss.ie/). The main aims of Transition Year are to 'promote the personal, social, educational and vocational development of pupils and to prepare them for their role as autonomous, participative and responsible members of society' (Department of Education, 1993, p. 3).

The content of the curriculum is decided by individual schools; however, the Department of Education and Skills (DES) has developed guidelines for participating schools. In particular, the DES notes that, while not absolutely excluding Leaving Certificate material, the Transition Year Programme should not be seen as an opportunity to spend three years rather than two studying such material (Department of Education, 1993). Despite this, an evaluation of the Transition Year Programme carried out by the Inspectorate in 1994/95 (Department of Education, 1996) found that a small number of schools allowed their students to select their Leaving Certificate subjects at the beginning of Transition Year for study during the year. Smyth, Byrne and Hannan (2004), in their survey of principals, also found that students in 6% of schools were required to select their Leaving Certificate subjects at the beginning of Transition Year and that this practice was more prevalent in boys' secondary schools and in schools where Transition Year was compulsory. However, they noted that, in general, the personal development and maturity of students were seen as the most important objectives of Transition Year by school principals, while academic performance was seen

[1] Schools are designated under the Disadvantaged Areas Scheme (DAS) until 2005. From 2005/06, schools are designated under the School Support Programme (SSP) as part of DEIS.

as a much less important objective. Tensions between the conflicting objectives of Transition Year seem to be a longstanding issue and were highlighted in the first evaluation of the Transition Year Project conducted by Egan and O'Reilly (1979).

The Transition Year Programme is included in the review of the senior cycle which is currently underway (for more information on the review of senior cycle see www.ncca.ie). As part of this review, Transition Units, which are 45-hour courses, are being developed by the NCCA in collaboration with schools and agencies working with schools. Some examples of Transition Units can be found on the NCCA's website (www.ncca.ie).

Currently, each school that offers Transition Year receives a tuition grant of €95 per student in the programme.

A recent development that is intended to have a direct impact on the teaching of mathematics in Transition Year is the *National Strategy to Improve Literacy and Numeracy Among Young People* (DES, 2011). One of the objectives of this strategy is to increase the instruction time made available for literacy and numeracy, and it includes a specific requirement that mathematics be taught regularly during Transition Year. Supporting this, the Project Maths Implementation Support Group (2010) and a recent Circular from the Department of Education and Skills (DES, 2011; Circular 0058/0011) called on schools to provide more innovative teaching and increased mathematics teaching hours in Transition Year where feasible.

1.2. Previous Research on Transition Year

Although the Transition Year programme has been in existence in some form since the 1970s, it has been relatively under-researched (Clerkin, 2012). The first evaluation of the Transition Year Project, which involved the 19 schools that were participating in the Project at the time, identified a conflict in terms of its identity, specifically with regard to whether it is seen as a curriculum project or a sabbatical arrangement, or both (Egan and O'Reilly, 1979). Closely related to this issue is the tension between the objective of Transition Year as either a 'transition-to-work' year or a 'transition-to-senior-cycle' year. While the authors noted claims that the linear subjects (i.e., mathematics, science and languages) suffered during Transition Year, they also noted that the project improved the attitudes of schools towards early school leavers; removed some of the barriers between school and the world outside; increased parental involvement; demonstrated the need for team-teaching in certain areas; and introduced the school to the experience of educational innovation.

The Department of Education Inspectorate conducted a formal appraisal of the programme in 1994/1995 (Department of Education, 1996). The purpose of this appraisal, which was conducted in 146 schools through visits from members of the Inspectorate, was to evaluate how the Guidelines on Transition Year were being implemented in each school. It was noted that the general consensus among principals, teachers and students was that the Transition Year programme is a very worthwhile initiative. The Inspectorate found that most schools provided students with a wide range of activities and learning experiences, including work experience, community service and enterprise or business activities, and that special attention was paid to students' personal growth and social development. There was evidence, however, of a very small number of schools that did not utilise the opportunity to take an interdisciplinary approach to learning but instead continued with the traditional examination-based approach which is characteristic of the implemented junior cycle

curriculum[2]. Similarly, Jeffers (2007) noted in his review of Transition Year for the DES that only a small number of cross-curricular modules were offered and that there was limited implementation of the 'wide range of teaching/learning methodologies and situations' (Department of Education, 1993, p.8) envisaged in the guidelines. The Inspectors also noted that assessment practices varied widely from school to school. As mentioned previously, one area of concern highlighted by the Inspectorate was the practice of selecting Leaving Certificate subjects for study during Transition Year in a small number of schools.

The Inspectorate made a number of recommendations in their report, including that schools should ensure that a whole-school approach is adopted in all aspects of Transition Year; an interdisciplinary, crosscurricular approach to teaching and learning should be emphasised; students' decisions in relation to subject choice for senior cycle should be delayed until the end of Transition Year; the involvement of teachers, parents, work-providers and students in the assessment procedures should be improved; and that Transition Year programmes should be regularly evaluated by schools. The report also highlighted the important role of external evaluation in the development of the programme and stated that monitoring of Transition Year by the Inspectorate and the (then) Psychological Service would continue (Department of Education, 1996).

Smyth, Byrne and Hannan (2004) drew on three sources of data in their study: a postal survey that was sent to all post-primary schools in 2001; a survey of over 10,000 students which was conducted in 1994 and included some follow-up data on Leaving Certificate results and CAO applications; and case studies of 12 schools conducted in 2001/2002. In their survey of principals, the authors found that most viewed Transition Year as very successful in promoting personal development, facilitating social skills and providing students with guidance in terms of subject choice for the Leaving Certificate, while less than half of principals perceived Transition Year as being very successful in promoting academic performance and reducing early school leaving. Principals in vocational, community/comprehensive schools and disadvantaged schools were less likely to view Transition Year as being successful in promoting academic performance than those in other school types.

Findings from Smyth et al.'s case studies showed Junior Certificate material was being revised in some classes, while Leaving Certificate material was being studied in other classes during Transition Year, and this was seen to be a major aid in developing academic performance. Jeffers (2007) also highlighted a concern among some parents, students and teachers that a drift away from an academic focus in Transition Year may have a knock-on effect in the Leaving Certificate examination. Jeffers (2011) also observed that teachers whose identities are closely tied to their students' achievements in examinations tended to link their teaching in Transition Year with the Leaving Certificate curriculum, effectively resulting in a three-year Leaving Certificate in some subjects in a number of schools.

However, teachers in Smyth et al.'s study recognised that not all students benefitted academically from Transition Year and some teachers highlighted that Transition Year may have an adverse effect on lower-performing students, in terms of their motivation and direction. The students in these schools also suggested that Transition Year is better suited to more motivated students and some felt that the lack of emphasis on academic work in Transition Year would cause readjustment problems when starting Fifth Year. In general, students saw Transition Year as a chance for them to

[2] A reform of the junior cycle curriculum and assessment is due to begin in 2014.

mature and to experience a different approach to learning, and they welcomed the break from examination pressure. However, some students felt that the lack of examination pressure created a lack of interest and lower levels of motivation in both students and teachers.

A consistent theme that has emerged in the research is that participation in Transition Year leads to improved student-teacher relationships, which are known to have a positive impact on students' learning (Smyth et al., 2004; Jeffers, 2002; 2011).

Drawing on the findings from their study, Smyth et al. concluded that in-service training for Transition Year appears to be a 'one-off' event either before or at the time Transition Year was introduced at school level. The authors recommended that schools be facilitated in allowing teachers to take part in in-service relating to Transition Year. They also recommended that teachers be supported in honing their curriculum development skills and implementing more innovative modes of assessment. Smyth et al. noted that, at the time of their study, uptake of Transition Year was more likely among students who were from middle-class backgrounds, had higher educational aspirations and were younger than average. They concluded that any benefits of the Transition Year programme would be enjoyed by students who are already more advantaged in terms of their socioeconomic background.

Looking at the effects of participation in Transition Year on students' academic outcomes, Millar and Kelly (1999) found that those who had participated in the programme outperformed those who had not by 26 CAO points, when gender, school type and previous performance in the Junior Certificate were accounted for. Consistent with these findings, Smyth et al. (2004) reported that, on average across all Leaving Certificate subjects, those who had participated in the Transition Year programme outperformed non-participants by over one grade point[3] per subject (controlling for gender) and by 0.6 grade points per subject, when parental background, age and prior performance were taken into account. The same result was found when just mathematics was considered, with Transition Year participants outperforming non-participants by 0.6 grade points, when student background, performance and attitudes were accounted for.

A striking finding from Millar and Kelly's (1999) study was the positive impact, in terms of academic achievement, of participation in the Transition Year programme on boys in disadvantaged schools. In disadvantaged community/comprehensive schools, boys who participated in Transition Year had an advantage of about 26 CAO points relative to boys who did not take part in Transition Year. Millar and Kelly (1999) also noted that students who had participated in Transition Year were more likely to retain a subject at Higher level from Junior Certificate to Leaving Certificate, and were also more likely to move from Ordinary to Higher level (especially in English and mathematics) than those who had not participated in the programme.

The flexible nature of Transition Year allows schools to develop programmes that are most appropriate to their students, something that Jeffers (2007; 2011) refers to as domestication. This means that the implemented programme can vary substantially between schools. Jeffers argues that the 'very flexibility that facilitates imagination and innovation can also be invoked by schools to justify a narrow selectivity that ignores key features of Transition Year' (Jeffers, 2007, p. 18). He suggests that, as a result, Transition Year is vulnerable to being taken over by the values and

[3] Points were allocated to each examination grade, the points ranging from 0 for E, F or NG grades, to 20 for a Higher level A1 grade. These points were averaged over all examination subjects taken.

practices of the Leaving Certificate. Perhaps the greatest challenge for schools and policy makers is striking a balance between the emphasis on personal and social development in Transition Year and maintenance of a focus on academic development.

1.3. Mathematics Education in Ireland

Mathematics education at post-primary level in Ireland has undergone a number of significant developments, at both junior and senior cycles, in the last 25 years. Much of this restructuring has been aimed at addressing issues such as the needs of lower-performing students; the high failure rate among students taking some examination levels; the length of Higher courses and the small numbers taking them; and an insufficient focus on understanding and applying knowledge. Oldham (2006) has noted that, up until that point at least, some of the problems identified during earlier revisions still remained unresolved.

The most recent curriculum initiative to take effect at post-primary level is Project Maths, which aims to address many of the issues and problems that have been identified in previous curricula. The focus of Project Maths is on developing students' mathematical skills, understanding of mathematical concepts and the application of knowledge and skills to solving problems in both familiar and unfamiliar contexts (NCCA/DES, 2011a, 2011b). Project Maths emphasises the student as an active participant in the development of his/her mathematical knowledge and skills and therefore involves changes to teaching and learning approaches as well as changes to the content of syllabi and associated examinations. Another aim of Project Maths is to increase uptake of Higher level mathematics to 30% at Leaving Certificate and to 60% at Junior Certificate.

More information on the views of mathematics teachers/co-ordinators from PISA 2012 on the implementation of Project Maths is available in *Teaching and Learning in Project Maths: Insights from Teachers who Participated in PISA 2012* (Cosgrove, Perkins, Shiel, Fish & McGuinness, 2012).

1.4. Mathematics in Transition Year

The *Transition Year Programme Guidelines for Schools* (Department of Education, 1993) recommend that at least one module of English, Irish or mathematics is offered as part of the programme in all schools. Smyth et al. (2004) found that 98.5% of schools offer mathematics as a subject in Transition Year. In the other 1.5% of schools mathematics was integrated into interdisciplinary subjects. The perceived importance of the core academic subjects in Transition Year is highlighted by the fact that 93% of English, Irish or mathematics teachers in the case study schools were allocated four or more class periods of each of these subjects per week. A review of recent post-primary subject evaluations for mathematics conducted in the context of the current report did not reveal much information on the day-to-day teaching of mathematics in Transition Year, in schools that offer the programme.

The Transition Year guidelines state that the approach taken to mathematics 'should seek to stimulate the interest and enthusiasm of the pupils in identifying problems through practical activities and investigating appropriate ways of solving them' (Department of Education, 1993, p. 12). The guidelines also suggest that teaching of mathematics in Transition Year should be more student-directed than teacher-directed and should relate the application of mathematical skills to real-life situations. Suggestions for teaching mathematics in Transition Year, which are outlined in the guidelines, include using aspects of the Leaving Certificate Applied syllabus and developing different approaches to teaching known areas of weakness in the Leaving Certificate, such as using anecdotal history of Greek geometers to provide a greater understanding of geometrical theorems.

An example of the latter approach is illustrated by Carter and Ó Cairbre (2011), who implemented 20 lesson plans of the history of mathematics in Transition Year. The authors noted an immediate positive change in perception of mathematics in all students after the first lesson and observed that this positive change was sustained after completion of the twenty lessons.

A recent report by the Project Maths Implementation Support Group has recommended that 'Transition Year, where available, should be used to provide innovative learning opportunities and to increase mathematics teaching hours as an important part of the strategy to develop and promote core transferable skills' (Project Maths Implementation Support Group, 2010, p. 21).

1.5. Conclusions

The Transition Year programme has been in place since the 1970s, yet relatively little research on its delivery or effects has been conducted, despite the considerable increase in uptake of the programme over the last two decades. The available evidence suggests that schools vary somewhat in how they devise and implement the programme (e.g., in terms of assessment) and concerns have been raised about the use of Transition Year as a lead-in to the Leaving Certificate in some schools. The general consensus among principals, teachers and students is that the Transition Year programme is a positive and worthwhile initiative, particularly as it impacts on young people's personal and social development, general maturity, confidence, motivation and relationships with teachers. However, it is also acknowledged that it does not appear to benefit all students to the same degree. Indeed some students reported finding the shift in focus away from academic work and towards more self-directed learning problematic in terms of motivation and readjustment when starting the Leaving Certificate, while others reported being less comfortable with the focus on the development of 'soft skills' in Transition Year.

The recent introduction of the Project Maths initiative (www.ncca.ie/projectmaths) has important implications for the teaching of mathematics in Transition Year as there are many parallels between the approaches described in the Transition Year guidelines and the new Project Maths curriculum. In particular, teachers might use Transition Year as an opportunity to consolidate the mathematical knowledge and skills learned during the junior cycle, and to develop these in a manner that would act as a useful bridge to the new Leaving Certificate course.

2. PISA Mathematics

2.1. PISA 2012: An Overview

The OECD's Programme for International Student Assessment (PISA) assesses the skills and knowledge of 15-year-old students in mathematics, reading and science. PISA runs in three-yearly cycles, beginning in 2000, with one subject area designated as the main focus, or 'major domain' of the assessment in each cycle. In 2012, mathematics was the major focus of the assessment for the first time since 2003.

In Ireland, 5,012 students in 183 schools participated in PISA in March 2012 and completed paper-based tests of reading literacy, mathematics and science, and student questionnaires. Of these students, 2,396 also took part in computer-based assessments of mathematics, problem solving and reading. Principals in participating schools were asked to complete a questionnaire about school resources and school organisation. In Ireland, teachers of mathematics and mathematics school co-ordinators[4] were invited to complete additional nationally developed questionnaires, and their responses to these questionnaires are the focus of this report.

2.2. The Assessment of Mathematics in PISA

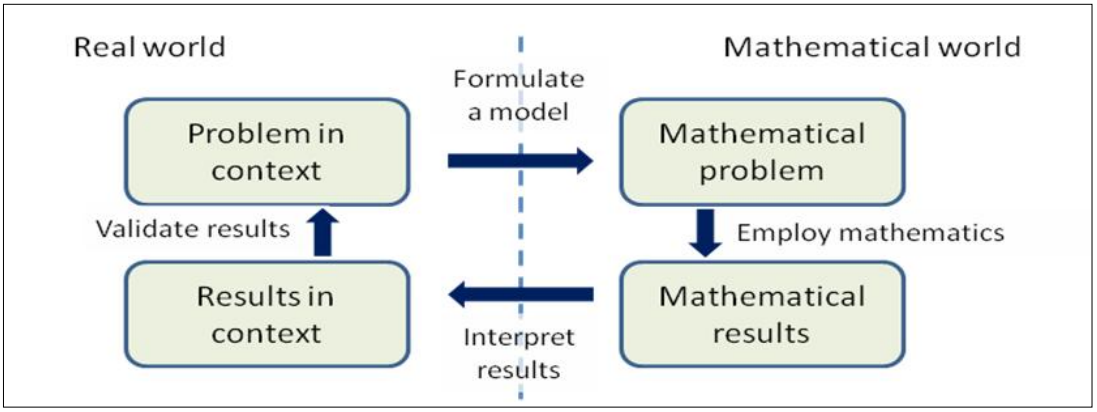
The PISA mathematics assessment focuses on active engagement in mathematics in real-world contexts that are meaningful to 15-year-olds. In PISA 2012, mathematical literacy (mathematics) is defined as

> …an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens (OECD, in press).

Central to the PISA mathematics framework is the notion of mathematical modelling (Figure 2.1). This starts with a problem in a real-world context. The problem is then transformed from a 'problem in context' into a 'mathematical problem' by identifying the relevant mathematics and reorganising the problem according to the concepts and relationships identified. The problem is then solved using mathematical concepts, procedures, facts and tools. The final step is to interpret the mathematical solution in terms of the original 'real-world' context.

[4] A mathematics school co-ordinator is the staff member in each school who has overall responsibility for mathematics education – he or she is sometimes referred to as the head of the mathematics department.

Figure 2.1. Mathematical modelling process in the PISA 2012 assessment framework



Source: OECD (in press).

The PISA mathematics framework is described in terms of three interrelated aspects: (i) the mathematical content that is used in the assessment items; (ii) the mathematical processes involved; and (iii) the contexts in which the assessment items are located.

PISA measures and reports on student performance in four content areas of mathematics: *Change and Relationships; Space and Shape; Quantity;* and *Uncertainty*. The PISA 2012 survey will, for the first time, report results according to the mathematical processes involved (see Stacey, 2012). PISA mathematics items examine three mathematical processes: *formulating* situations mathematically; *employing* mathematical concepts, facts, procedures, and reasoning; and *interpreting*, applying and evaluating mathematical outcomes. PISA also identifies seven fundamental mathematical capabilities that underpin these reported processes. These are *communicating; mathematising; representing; reasoning and argumentation; devising strategies; using symbolic, formal, and technical language and operations;* and *using mathematical tools.*

An important aspect of mathematical literacy is the ability to use and do mathematics in a variety of contexts or situations and the choice of appropriate mathematics strategies is often dependent on the context in which the problem arises. Four categories of mathematical problem situations or contexts are defined in PISA: *personal, occupational, societal* and *scientific*. In total, 85 mathematics items, drawing on all four situations, were included in the PISA 2012 assessment, though individual students were invited to respond to a subset of these items.

2.3. Mathematics Achievement in Previous Cycles of PISA

The performance of students in Ireland in mathematics dropped significantly, by 16 score points (one-sixth of a standard deviation) between 2003, when mathematics was last a major focus in PISA, and 2009. Just one other country, the Czech Republic, experienced a greater decline between the two cycles. The mean score for Ireland in 2003 (502.8) was not significantly different from the corresponding average across OECD countries (500), while, in 2009, the mean performance of Irish students (487.1) was significantly below the corresponding OECD average (495.7).

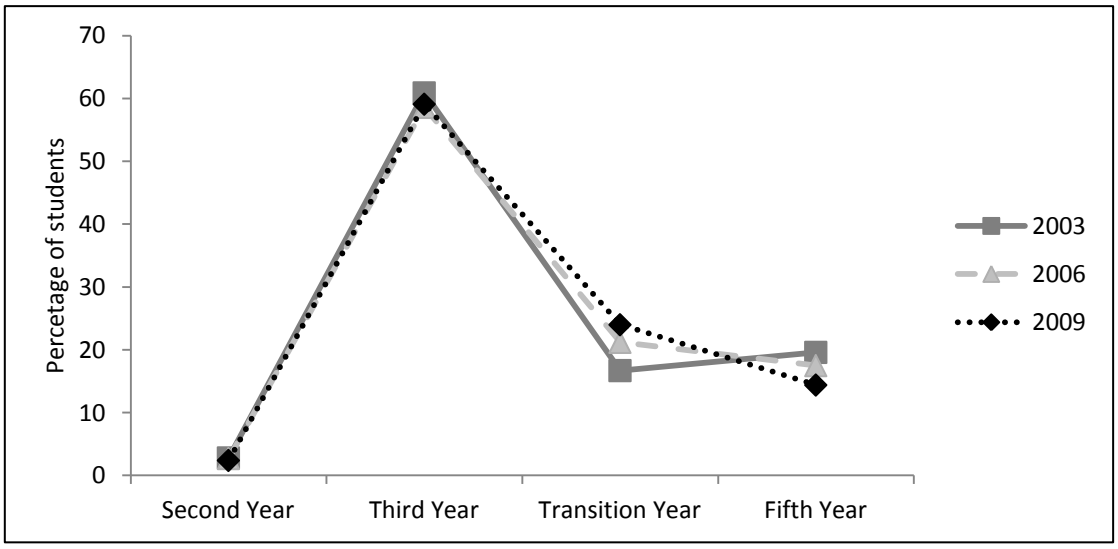
The proportions of high and low achieving students in Ireland have also changed significantly since 2003. In 2003, Ireland had significantly fewer low achieving students (i.e. students performing below

proficiency level 2[5]) (16.8%) than on average across OECD countries (21.5%). While there was little change in the percentage of low achieving students in Ireland in 2006 (16.4%), in 2009 the percentage increased to 20.8% and did not differ significantly from the OECD average (22.0%). Ireland also saw a decline in the proportion of higher achieving students (i.e. students performing at level 5 or above) in mathematics, from 11.4% in 2003, to 10.2% in 2006 and 6.7% in 2009, and was below the OECD average on this indicator in 2009.

Male students significantly outperformed female students in Ireland in 2003 and 2006; in 2009 males also outperformed females, but the difference was not significant. The performance of both male and female students dropped significantly between 2003 and 2009 (from 510.2 to 490.9 for males and from 495.4 to 483.3 for females), with most of the decline occurring between 2006 and 2009. In 2009, both male and female students in Ireland performed significantly lower than their OECD counterparts. Ireland also saw an increase in the proportion of low-achieving male (from 15.0% to 20.6%) and female students (from 18.7% to 21.0%) between 2003 and 2009, with the increase greater among male students. There has been a marked decrease in the percentage of high-achieving males (from 13.7% to 8.1%) and females (from 9.0% to 5.1%) between 2003 and 2009.

As PISA is aimed at an age-based cohort of fifteen-year-old students, the sample in Ireland is distributed over four grade levels – Second Year, Third Year, Transition Year and Fifth Year. While the proportions of students at Second and Third years has remained rather stable since 2003 (Figure 2.2), there has been a marked increase in the proportion of PISA students in Transition Year (from 17% to 24%) and a corresponding decrease in the proportion of PISA students in Fifth Year (from 20% to 14%). This increase in the proportion of Transition Year students in PISA is in line with the finding from Clerkin (2013) that the proportion of students participating in Transition Year has steadily increased, from 40% to 52%, between 2003 and 2009.

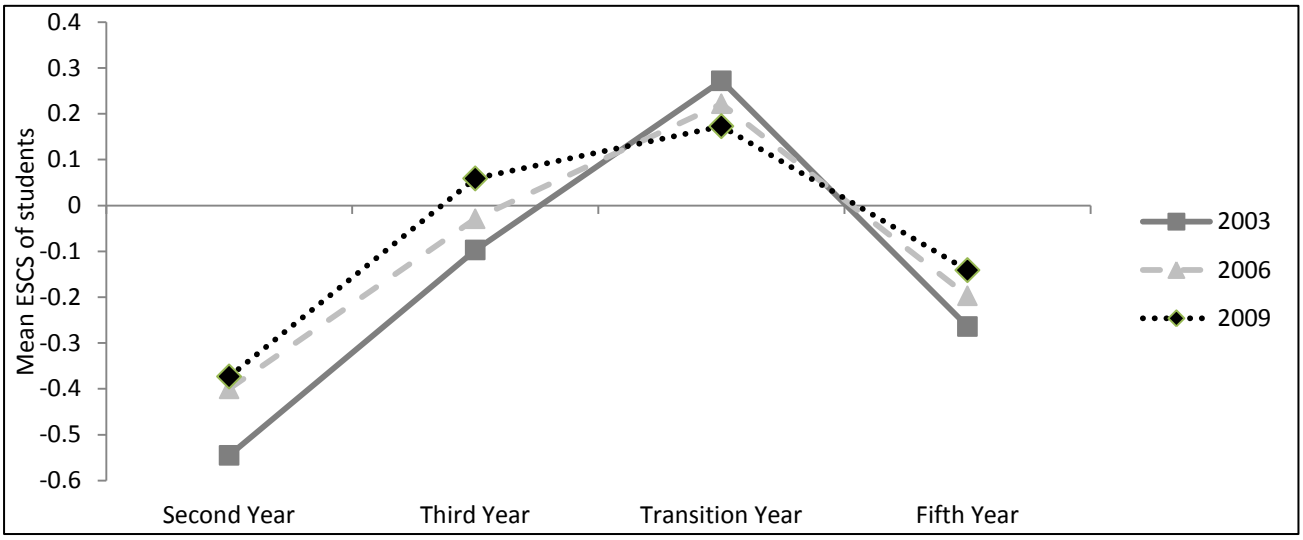
Figure 2.2. Percentage of students at each grade level across PISA cycles (2003, 2006 and 2009)



[5] PISA mathematics has six proficiency levels ranging from Level 1 (low performance) to Level 6 (high performance), with a further level ('below Level 1') for students whose mathematics ability is not assessed by the PISA test. The proportion of students scoring at or below Level 1 in a country can be interpreted as an estimate of the proportion of students who are low achievers. Similarly, the proportion of students scoring at Levels 5 or 6 can be viewed as the proportion of high achievers in a country (OECD, 2010).

Not only has the proportion of PISA students in Transition Year changed, but so also has the socioeconomic composition of students at this grade level. As can be seen from Figure 2.3, the mean levels of Economic, Social and Cultural Status (ESCS; a measure of socioeconomic status used in PISA) for students in Second, Third and Fifth Years have steadily increased since 2003, while there has been a corresponding decrease in the ESCS of students in Transition Year. However, students in Transition Year still have the highest mean ESCS of all grade levels.

Figure 2.3. Mean ESCS at each grade level across PISA cycles (2003, 2006 and 2009)



Also, there has been a steady decline in the proportion of female students (and a corresponding increase in the proportion of male students) in Transition Year in the PISA sample since 2003 (Table 2.1).

Table 2.1. Percentages of female and male students in Transition Year across PISA cycles (2003, 2006 and 2009)

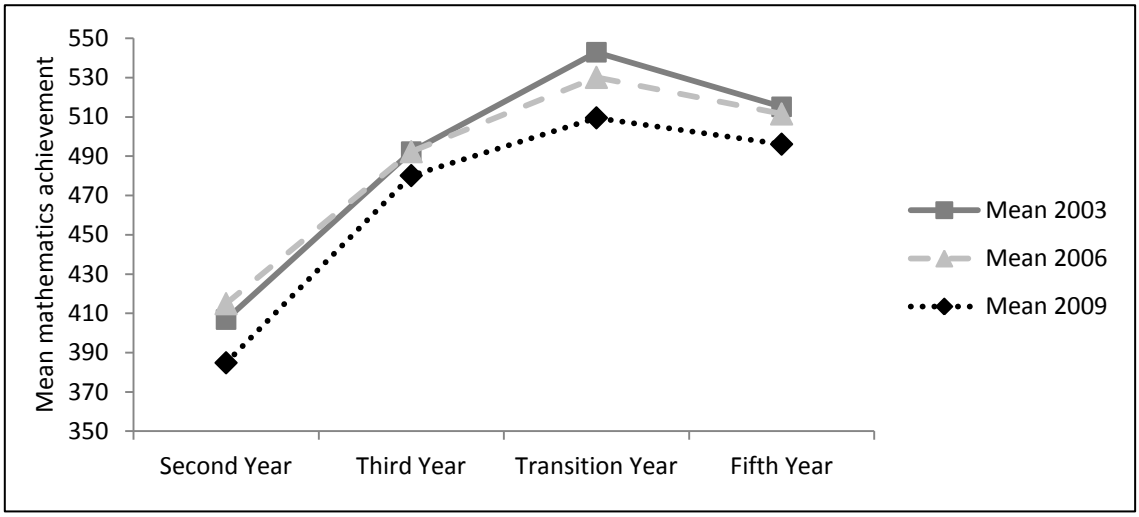
	2003	2006	2009
Female	59.0	55.5	52.8
Male	41.0	44.5	47.2
Total	100	100	100

While students in Transition Year obtained the highest mean mathematics scores in both 2003 and 2009, the largest decline (33 points) in PISA mathematics between these two cycles also occurred at this grade level (Figure 2.4). Decreases in performance were also observed for reading and (to a much lesser extent) science, with the largest declines for these two domains occurring at Fifth Year. Possible explanations for the *overall* declines in reading and mathematics performance include demographic changes in the school-going population, lower levels of engagement in PISA among participating students and the linking and scaling methodologies used in PISA (see Perkins, Cosgrove, Moran & Shiel, 2012).

The most recent cycle of TIMSS (Trends in International Mathematics and Science Study), which was conducted in 2011 among Fourth class pupils, revealed that pupils in Ireland achieved a mean mathematics score (527), which was significantly above the international average (500). Ireland was placed 17th out of 50 participating countries. In Ireland, more pupils reached the Advanced Benchmark in terms of the skills they were able to demonstrate, than the international average (9% versus 4%); however, many more students reached this benchmark in the highest achieving countries, including Northern Ireland (24%) and England (18%). Pupils in Ireland displayed relative

strengths on the content area *Number* and the cognitive process area *Knowing*, while they displayed relative weaknesses on *Geometric Shapes and Measures* and *Data Display* content areas and the cognitive process of *Reasoning* (Eivers & Clerkin, 2012).

Figure 2.4. Mean mathematics achievement at each grade level across PISA cycles (2003, 2006 and 2009)



2.4. PISA 2012 Reporting

This report is published at around the same time as a 'sister' report on Project Maths (Cosgrove et al., 2012). These two reports are the first national publications on PISA 2012. They draw on information collected in the national teacher and mathematics school co-ordinator questionnaires.

The first results from PISA 2012 will be published by the OECD in December 2013. Results will be reported in four volumes:

Volume 1: Performance in mathematics, reading and science

Volume 2: Quality and equity

Volume 3: Engagement and attitudes

Volume 4: School and system-level policies and characteristics.

Two additional reports/volumes will be published by the OECD in 2014. These are:

Volume 5: Performance on computer-based problem-solving

Volume 6: Performance on financial literacy (an option in which Ireland did not participate).

The ERC will release a national report on PISA 2012 in December 2013 which will complement the OECD's reports. In-depth thematic reports, designed to provide a fuller understanding of important themes arising from PISA 2012, will also be published by the ERC in 2014.

All national PISA publications are at www.erc.ie/pisa, while the OECD's reports are at www.pisa.oecd.org.

2.5. Conclusions

The decline in PISA mathematics performance in Ireland between 2003 and 2009 means that the mean mathematics achievement of students in Ireland is now significantly below the OECD average. The fact that the largest decline in mathematics achievement occurred among Transition Year students has caused concern. While this may be related to the fact that participation in Transition

Year has become more widespread, there is also concern that a less systematic approach to mathematics instruction in Transition Year compared to other grade levels may have contributed to this decline (Shiel, Moran, Cosgrove & Perkins, 2010). Although changes to our education system aimed at improving mathematics standards generally are already underway, with the publication and subsequent implementation of the *National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020* (DES, 2011) and the extension of Project Maths to all post-primary schools, little attention has been paid to the outcomes of teaching and learning mathematics in Transition Year. In addition, there is very little information on the content of mathematics programmes for Transition Year being implemented in schools, how they are delivered, and the amount of time spent delivering them.

3. Survey Respondents and Questionnaires

3.1. Aims of the Survey and Content of Questionnaires

Schools were selected to participate in PISA 2012 through random sampling, and students (aged 15 years) were selected at random within schools, meaning that the samples of schools and students are nationally representative of their respective populations in post-primary schools[6]. As part of PISA 2012 in Ireland, two additional questionnaire instruments were administered in these schools. One questionnaire was directed at mathematics teachers, and the other at mathematics school co-ordinators (the latter are staff members who have been designated overall responsibility for mathematics in the school). In each school, all teachers of mathematics were selected to participate.

The content of the questionnaires was established and finalised on the basis of discussions with members of the PISA national advisory committee (membership of which is shown in the Acknowledgements to this report), the literature review (see Chapter 1), and analyses of a field trial questionnaire data, which were gathered in March 2011.

The aims of administering the questionnaires were fourfold:

1. To obtain a reliable, representative and up-to-date profile of mathematics teaching and learning in Irish post-primary schools
2. To obtain information on aspects of mathematics in Transition Year
3. To obtain information on the views of teachers on the implementation of Project Maths
4. To make findings available to teachers and school principals, the DES, NCCA, and partners in education in an accessible format and timely manner.

Overall, 80.3% of mathematics teachers and 93.4% of mathematics school co-ordinators returned a completed questionnaire[7]. This report addresses the second aim listed above, so the analyses presented here focus primarily on the subsample of teachers who reported teaching mathematics in Transition Year in the 2011-2012 school year (31.2% of responding teachers) and the 79.1% of school co-ordinators who indicated that their school provides mathematics in Transition Year.

The third aim stated above is addressed in a separate ERC publication*, Teaching and Learning in Project Maths: Insights from Teachers who Participated in PISA 2012* (Cosgrove et al., 2012).

In order to address the fourth aim, to expedite the dissemination of the results from these national questionnaires, it was decided to publish reports on mathematics in Transition Year and the implementation of Project Maths prior to the availability of students' achievement scores and other PISA 2012 data. As noted in Chapter 1, data on students' mathematics achievement will be available in December 2013, and will lend further context to the data discussed in the reports.

The mathematics teacher questionnaire consisted of five sections as follows:

1. Background information (gender, teaching experience, employment status, qualifications, teaching hours, participation in CPD)

[6] See the Technical Appendix for details of the sample design.
[7] These percentages are weighted to reflect the population of teachers and co-ordinators: see the Technical Appendix for information on response rates and the computation of the sampling weights used in analyses for this report.

2. Views on the nature of mathematics and teaching mathematics
3. Teaching and learning of students with differing levels of ability
4. Views on Project Maths
5. Teaching and learning in mathematics in Transition Year (if applicable).

The mathematics school co-ordinator questionnaire was considerably shorter than the teacher questionnaire and asked about the following:

1. Organisation of base[8] and mathematics classes for instruction
2. Distribution of students across mathematics syllabus levels
3. Arrangements for mathematics in Transition Year (if applicable).

In addition to data derived from the sections of the questionnaires specifically related to mathematics in Transition Year, background information is presented, along with any other data relevant to mathematics in Transition Year, e.g., the organisation of classes for instruction.

The report also presents comparisons of responses according to various school characteristics, particularly school sector and gender composition, DEIS/SSP status[9], and Project Maths status[10]. Although Project Maths does not specifically address mathematics in Transition Year, and the revision and assessment of the revised curricula will not be complete until 2015 for junior cycle, and 2014 for the senior cycle, it is possible that it may exert some influence on teaching practices in mathematics classes in Transition Year.

3.2. Demographic Characteristics of Mathematics Teachers

Tables 3.1 and 3.2 show some demographic and school-related characteristics of the 31.2% of teachers who reported teaching mathematics in Transition Year in the 2011–2012 school year[11]. The information is also provided for the entire sample of teachers who returned a questionnaire. Around two-thirds (67%) of Transition Year mathematics teachers were female, which is very similar to both the percentage of female teachers in the overall sample (65.2%), and to the gender profile of teachers who participated in the OECD's TALIS survey, in which 69% were female (Gilleece, Shiel, Perkins & Proctor, 2009).

Around three-tenths (30.6%) of Transition Year mathematics teachers had been teaching for at least 21 years, a further 27.3% had been teaching for between 11 and 20 years, around one-fifth (20.1%) for between six and 10 years, 14.4% for three to five years, and 7.6% for two years or less. Teachers of mathematics in Transition Year were again very similar to the entire sample of teachers with respect to years of teaching experience. These findings are also in line with those reported by TALIS (Gilleece et al., 2009) and in a recent survey of mathematics teachers (Uí Ríordáin & Hannigan, 2009).

[8] A 'base class' is usually identified for administrative purposes, e.g. recording attendance.
[9] DEIS, or Delivering Equality of Opportunity in Schools, provides additional, targeted resources to schools at both primary and post-primary levels that have high concentrations of disadvantage, under the School Support Programme (SSP) (DES, 2005).
[10] Project Maths began in 2008 in 24 post-primary schools, referred to in this report as initial schools, and was rolled out across all post-primary schools in the country on a phased basis, beginning in the autumn of 2010.
[11] All results presented in this report are weighted so that they are representative of the population of mathematics teachers and mathematics school co-ordinators. See Technical Appendix for details of the weighting procedure.

Just over two-thirds (66.9%) of Transition Year mathematics teachers were in permanent employment. Of those on fixed term contracts, a similar percentage held a contract for a period of more than one school year[12] (15.6% of all Transition Year mathematics teachers) as held a contract for a period of one school year or less (17.5%). Again, these findings are almost identical to those derived from the entire pool of respondents. They do, however, vary somewhat from the characteristics of teachers who took part in TALIS (Gilleece et al., 2009), of whom a greater percentage (74%) were in permanent employment, and fewer were on a fixed-term contract for more than one school year (8%). The proportion of TALIS participants on a fixed-term contract for one school year or less did not differ from that reported here (18%).

Table 3.1. Demographic characteristics of all teachers participating in the PISA 2012 mathematics teacher survey, and of Transition Year mathematics teachers

Characteristic	All Teachers		TY Mathematics Teachers	
	N	%	N	%
Overall	1321	100.0	412	31.2
Gender				
Female	844	65.2	272	67.0
Male	451	34.8	134	33.0
Years Teaching Experience				
One to two	83	6.3	31	7.6
Three to five	207	15.7	59	14.4
Six to ten	287	21.8	83	20.1
Eleven to twenty	334	25.4	112	27.3
Twenty one or more	405	30.8	125	30.6
Employment Status				
Permanent	852	66.0	268	66.9
Fixed term > 1 year	201	15.6	63	15.6
Fixed term ≤ 1 year	238	18.4	70	17.5

Note. Data are weighted to reflect the population of teachers. See Technical Appendix for an explanation of the weighting procedure.

Of those teachers who taught mathematics in Transition Year, 26.7% worked in all girls' secondary schools, approximately one-fifth (19.8%) in vocational schools, a further 19.2% in all boys' secondary schools, 17.7% in mixed secondary and 16.6% in community/comprehensive schools (Table 3.2). Slightly less than one-fifth (17.2%) were in DEIS/SSP schools, and 14.3% were in fee-paying schools. Four percent of Transition Year mathematics teachers worked in Project Maths initial schools[13]. Two-thirds (66.6%) were in schools that had enrolments of 401 to 800, approximately one-sixth (16.9%) were in small schools (i.e., student numbers of 400 or fewer) and one-sixth (16.4%) were in very large schools (>801 students).

These figures are broadly similar to those for all teachers surveyed, although there are some differences. By comparison to 'all teachers', the percentage of Transition Year mathematics teachers

[12] This finding is complicated by the fact that some of those classified as having fixed term contracts for a duration of more than one school year may have contracts of indefinite duration, though the extent to which this is the case cannot be established from the data.

[13] All 23 initial Project Maths schools were sampled to participate in PISA 2012. Of the original 24 Project Maths initial schools, one was amalgamated with another school and therefore was not included as a Project Maths initial school in the sample for PISA 2012.

is smaller in both vocational schools (19.8% compared to 25%) and DEIS/SSP schools (17.2% compared to 21.2%), and larger in fee-paying schools (14.3% compared to 8.7%).

Table 3.2. School-related characteristics of all teachers participating in the PISA 2012 teacher survey, and of Transition Year mathematics teachers

Characteristic	All Teachers		TY Mathematics Teachers	
	N	%	N	%
Overall	1321	100.0	412	31.2
Sector Gender Composition				
Community/Comprehensive	219	16.6	69	16.6
Vocational	330	25.0	82	19.8
Secondary all boys	226	17.1	79	19.2
Secondary all girls	298	22.6	110	26.7
Secondary mixed	248	18.8	73	17.7
DEIS/SSP Status				
No	1041	78.8	341	82.8
Yes	280	21.2	71	17.2
Initial Project Maths School				
No	1267	95.9	395	95.7
Yes	54	4.1	18	4.3
Fee Pay Status				
No	1207	91.3	353	85.7
Yes	114	8.7	59	14.3
School Size				
Small (≤400)	275	20.8	70	16.9
Medium (401-600)	481	36.4	165	40.1
Large (601-800)	370	28.0	109	26.5
Very Large (>801)	195	14.7	68	16.4

Note. Data are weighted to reflect the population of teachers.

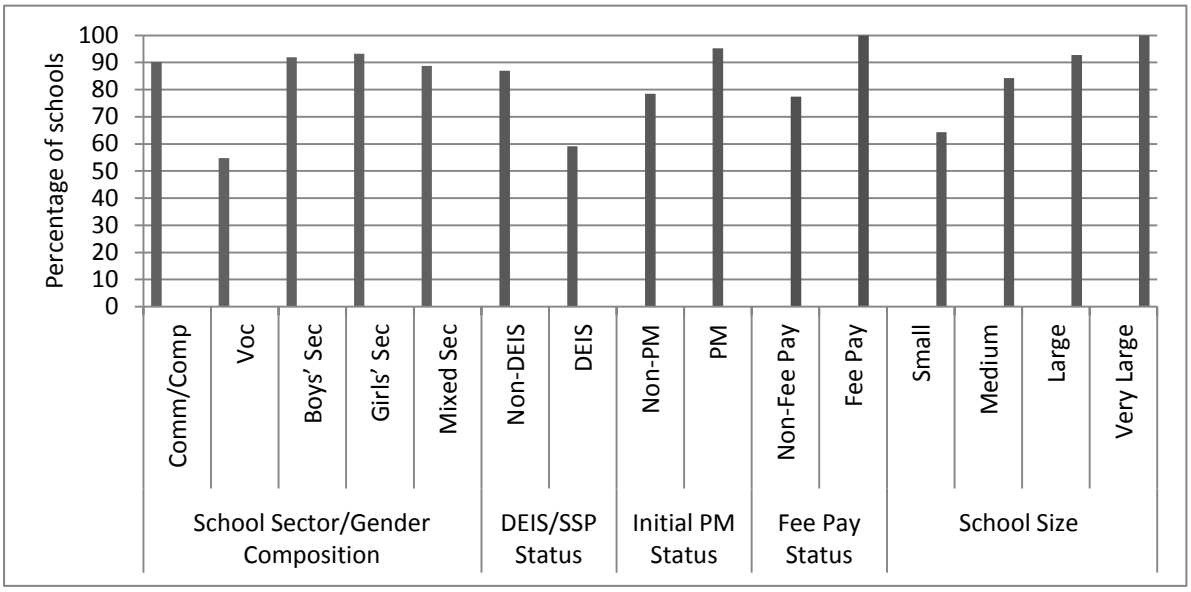
3.3. Demographic Characteristics of Schools

Figure 3.1 presents demographic characteristics of the 79.1% of schools that provided mathematics in Transition Year. Just over half (54.8%) of the vocational schools surveyed provided mathematics in Transition Year. The range for other school types extended from 88.7% (mixed secondary) to 93.2% (girls' secondary). The percentage of DEIS/SSP schools offering mathematics in Transition Year was also low (59.1%)[14]; in contrast, it was particularly high in Project Maths initial (95.2%) and fee-paying schools (100%). There was an almost linear relationship between the provision of mathematics in Transition Year and school size, with 100% of very large schools offering mathematics in Transition Year, compared to only 64.3% of small schools[15].

[14] This may be due, at least in part, to a comparative lack of student interest in participating in Transition Year in DEIS/SSP schools.

[15] Small schools are likely to have difficulties in composing a sustainable Transition Year cohort each year.

Figure 3.1. Demographic characteristics of schools that provided mathematics in Transition Year



In addition to the 79.1% of schools that provided mathematics in Transition Year, a further 0.9% of schools offered the Transition Year programme itself, but did not provide mathematics lessons for Transition Year students[16]. This is similar to Smyth et al.'s (2004) finding that just 1.5% of schools offering Transition Year did not provide mathematics as a subject in that year. Combining the data for schools in PISA offering Transition Year with and without mathematics classes, 80% of schools in the current study offered the Transition Year programme. This estimate is 2% higher than that found in 2009 (Clerkin, 2013), which may suggest a continued increase in the proportion of schools offering Transition Year.

A further point to note with regard to some analyses is that when the sample is subject to the weighting procedure (see Technical Appendix), effective sample sizes become quite small. The weighted estimate of the number of Transition Year mathematics teachers in initial Project Maths schools is much lower than the actual number of such teachers (18, compared to 53). This adjustment is necessary as initial Project Maths schools were over-represented in the sample, by comparison to the population. Small sample sizes can lead to some difficulties in interpreting the data; therefore, low emphasis is placed on comparing findings relating to mathematics in Transition Year in initial Project Maths schools and other schools.

3.4. Key Findings and Conclusions

This report draws on information collected in the mathematics teacher and mathematics school co-ordinator questionnaires. Overall, 80% of responding schools offered the Transition Year programme. The percentage of schools that did not provide mathematics lessons to their Transition Year students was negligible (0.9% overall). Transition Year was not offered uniformly across schools of different type, with particularly low provision in vocational (54.8%), DEIS/SSP (59.1%) and small schools (64.3%); on the other hand, provision was particularly high in girls' secondary (93.2%),

[16] It is possible that in these schools, mathematics was integrated into interdisciplinary subjects; however, data on this are lacking in the current study.

fee-paying (100%) and very large schools (100%)[17]. These findings are broadly similar to those reported by Jeffers (2002).

The analyses presented in this report are based on the responses of the 79.1% of co-ordinators in PISA 2012 schools that provided mathematics in Transition Year, and the 31.2% of teachers in those schools who reported teaching mathematics to Transition Year students in the 2011-2012 school year. The report aims to provide information on the structure and content of mathematics classes in Transition Year, as well as teachers' perceptions of the purposes of mathematics in Transition Year, and background characteristics of Transition Year mathematics teachers. Further examination of the issues will be possible when student achievement data become available in December 2013.

[17] These estimates exclude the 0.9% of schools that did not offer Transition Year mathematics.

4. General Characteristics of Transition Year Mathematics Teachers

4.1. Teacher Background and Qualifications

This section describes the qualifications of Transition Year mathematics teachers, and their perceptions of the adequacy of those qualifications for teaching mathematics at post-primary level. Findings on the qualifications of all teachers responding to the questionnaire are also presented, for comparative purposes.

The Teaching Council (2012) specifies that in order to teach mathematics at post-primary level, teachers should have completed at least a primary degree in which mathematics was a major subject (minimum of 30% of the period of the degree) and that the breadth and depth of the syllabi undertaken are such as to ensure competence to teach mathematics to the highest level.

More than seven-tenths (70.9%) of Transition Year mathematics teachers held a primary degree that featured mathematics up to final year, 14.1% held a primary degree that had mathematics in first and second year, and 11.4% had studied mathematics in the first year of their degree only (Table 4.1). Just 2.9% had completed a primary degree that did not include mathematics as a subject.

Compared to all mathematics teachers, Transition Year mathematics teachers were more likely to hold a primary degree with mathematics up to final year (70.9% compared to 60%), and less likely to hold a primary degree with mathematics in first year only, or in first and second year (25.5% compared to 35.4%).

Table 4.1. Percentages of all teachers and Transition Year mathematics teachers who hold primary degrees with varying quantities of mathematics content

Degree Content	All Teachers	TY Mathematics Teachers
Primary degree with mathematics up to final year	60.0	70.9
Primary degree with mathematics in first and second year	20.1	14.1
Primary degree with mathematics in first year only	15.3	11.4
Primary degree that did not include mathematics as a subject	3.3	2.9
None of the above	1.2	0.6

The most common type of primary degree held by Transition Year mathematics teachers was a BA or BSc with mathematics (68% of teachers), while approximately one in ten had completed a BA or BSc without mathematics (Table 4.2). Seven percent held a B Comm or Business degree, and a similar proportion had completed a B Ed, with most of the latter having studied mathematics as a subject.

It was more common among Transition Year mathematics teachers to have completed a BA or BSc with mathematics than it was among all teachers (68% compared to 58.3%), while Transition Year mathematics teachers were less likely than all teachers to have completed either a BA or BSc without mathematics (9.8% compared to 13.1%)[18], or a B Comm or Business degree (7.4% compared to 13%).

[18] These estimates differ from those in Table 4.1, and are derived from a separate questionnaire item. This may be due to some of the teachers who held a primary degree with mathematics in first year only, or in first and second year, indicating that they held a BA or BSc without mathematics.

Table 4.2. Percentages of all teachers and Transition Year mathematics teachers who hold primary degrees of various types

Degree Type	All Teachers	TY Mathematics Teachers
B Comm or Business degree	13.0	7.4
B Eng	3.0	4.2
BA or BSc with mathematics	58.3	68.0
BA or BSc without mathematics	13.1	9.8
B Ed with mathematics	6.3	5.4
B Ed without mathematics	2.4	2.1
Other	3.9	3.1

A Higher or Postgraduate Diploma in Education (H Dip/PGDE) that included mathematics education was the most common type of postgraduate qualification held by Transition Year mathematics teachers (66.3%), while one in six (16.8%) held a H Dip/PGDE that did not include a focus on mathematics education (Table 4.3). Approximately one-tenth of Transition mathematics teachers did not report having completed any postgraduate qualification. Of these, the vast majority (86.1%) indicated that they had a primary degree which included mathematics or mathematics education for two years or more.

The postgraduate qualifications of Transition Year mathematics teachers were somewhat more likely to have a focus on mathematics education than those of all teachers, e.g., more Transition Year mathematics teachers had completed a H Dip/PGDE with mathematics education (66.3%, compared to 56.3% of all teachers).

Table 4.3. Percentages of all teachers and Transition Year mathematics teachers with various postgraduate qualifications

Postgraduate qualification	All Teachers	TY Mathematics Teachers
No postgraduate qualification (includes B Eds)	10.3	9.6
Postgraduate degree related to mathematics (but not the teaching of mathematics)	4.7	6.5
Postgraduate degree related to the teaching of mathematics	5.2	6.4
Postgraduate degree unrelated to mathematics or the teaching of mathematics	11.2	9.3
Higher Diploma in Education/Postgraduate Diploma in Education *with* Mathematics	56.3	66.3
Higher Diploma in Education/Postgraduate Diploma in Education *without* Mathematics	22.0	16.8

Note. Teachers could hold more than one postgraduate qualification.

The manner in which teachers were asked about their qualifications does not allow us to make a direct comparison with Teaching Council guidelines. However, it is likely that 11.9% of Transition Year mathematics teachers (i.e., those with a BA, BSc or B Ed without mathematics) would not meet the requirements[19]. No inferences can be made about a further 10.5% (i.e., those with a B Comm or Business degree, or 'other' primary degree), as the mathematical content of these degree types cannot be determined from the data, and may vary from institution to institution. The remaining 77.6% (i.e., those with a B Eng, or a BA, BSc or B Ed *with* mathematics) are likely to meet the criteria. Therefore, our best estimate from the information available is that somewhere between 78% and

[19] It is not possible to be definitive about this, as some of this group may hold qualifications that feature substantive mathematics content, e.g., science.

88% of Transition Year mathematics teachers surveyed were qualified to teach mathematics according to Teaching Council guidelines.

Overall, 15.6% of Transition Year mathematics teachers stated that they had *not* studied mathematics teaching methods as part of their pre-service teacher education (Table 4.4)[20]. The percentage of teachers who had not studied mathematics teaching methods varied by school type, being highest in community/comprehensive (20.1%) and boys' secondary schools (18.7%) and lowest in girls' secondary (10.8%) and mixed secondary schools (11.9%).

Table 4.4: Percentages of Transition Year mathematics teachers who had studied mathematics teaching methods in their teacher preparation: Overall, and by school characteristics

Characteristic	Yes (%)	No (%)
Overall	84.4	15.6
School Sector Gender Composition		
Community/Comprehensive	79.9	20.1
Vocational	85.7	14.3
Boys' Secondary	81.3	18.7
Girls' Secondary	89.2	10.8
Mixed Secondary	88.1	11.9
DEIS/SSP Status		
No	84.1	15.9
Yes	85.5	14.5
Initial Project Maths School		
No	84.3	15.7
Yes	85.6	14.4

A substantial minority (29.3%) of Transition Year mathematics teachers had worked in another profession prior to teaching (Table 4.5). The proportion of teachers in vocational schools who had done so (39.1%) was the highest across school types, followed by teachers in community/ comprehensive schools (31.3%). More teachers in DEIS/SSP schools had also worked in a different profession (34%, compared to 28.3% of teachers in non-DEIS/SSP schools).

[20] Note that this percentage does not tally exactly with the information presented in Tables 4.2 and 4.3, as these data are derived from a separate questionnaire item concerning material studied, rather than qualifications. Also, typically, two teaching methods subjects are taken.

Table 4.5: Percentage of Transition Year mathematics teachers who worked in a profession in another field prior to teaching: Overall, and by school characteristics

Characteristic	%
Overall	29.3
School Sector Gender Composition	
Community/Comprehensive	31.3
Vocational	39.1
Boys' Secondary	24.6
Girls' Secondary	28.2
Mixed Secondary	23.3
DEIS/SSP Status	
No	28.3
Yes	34.0
Initial Project Maths School	
No	29.3
Yes	29.8

Teachers were also asked the nature of the profession in which they had previously worked, where this was the case. The most frequently selected categories were science or technology (50.9%), other profession (43.5%) and business or finance (28%) (Table 4.6).

Table 4.6: Percentages of Transition Year mathematics teachers who worked in a profession in another field prior to teaching, by previous professional background

Area or Profession	%
Business or Finance	28.0
Science or Technology	50.9
Secretarial or Administration	10.4
Hospitality or Catering	9.0
Sales or Marketing	7.7
Other	43.5

Note. Teachers could select more than one prior profession. Percentages apply to the 29.3% of teachers who indicated that they had worked in a prior profession.

Of those that had worked in another profession prior to becoming a mathematics teacher, 24.1% had done so for approximately one year, 46.5% for two to four years, and 29.4% for five or more years (Table 4.7).

Table 4.7: Percentages of Transition Year mathematics teachers who worked in a profession in another field prior to teaching, by number of years spent working in another profession

Length of Time	%
About a year	24.1
About two years	18.9
About three years	16.3
About four years	11.3
Five years or more	29.4

Note. Percentages apply to the 29.3% of teachers who indicated that they had worked in a prior profession.

A series of items asked teachers to rate the extent to which they felt that specific aspects of their coursework were adequate in preparing them to teach mathematics at post-primary level. Teachers were asked to consider both undergraduate and postgraduate coursework in their response. Although, for each aspect of their qualifications, the majority of Transition Year mathematics teachers either agreed or strongly agreed that they were adequately prepared, substantial minorities disagreed in each case (Table 4.8). This was most marked for the assessment of mathematics, which 35.5% of teachers did not feel was adequately addressed in their pre-service

education, followed by teaching methods/pedagogy of mathematics (28.3%) and assessment in general (26.2%).

Table 4.8. Perceived adequacy of coursework for preparing Transition Year mathematics teachers to teach mathematics in post-primary schools

Aspect of qualification	Strongly Disagree	Disagree	Agree	Strongly Agree
Mathematical content	5.2	14.9	44.6	35.3
Teaching methods/pedagogy of mathematics	6.2	22.1	47.1	24.5
Assessment of mathematics	6.1	29.4	43.6	20.8
General teaching methods/pedagogy	3.0	15.1	56.5	25.5
Assessment in general	5.4	20.8	52.7	21.1

4.2. Teaching Hours and Classes Taught

Table 4.9 shows average hours spent teaching mathematics to different year groups, for both Transition Year mathematics teachers and all respondents. It is important to note that these figures refer to hours, rather than class periods. Teachers who had taught mathematics to Transition Year students in the 2011-2012 school year spent an average of 2.4 hours per week teaching mathematics to Transition Year students. Transition Year mathematics teachers spent fewer hours on average teaching mathematics to Transition Year students than to students at any other year level.

Table 4.9. Average hours Transition Year mathematics teachers and all teachers spend teaching per week

	All Teachers		TY Mathematics Teachers	
Teaching Hours*	Mean	SD	Mean	SD
First Year mathematics	2.9	0.7	2.9	0.6
Second Year mathematics	2.9	0.6	2.9	0.5
Third Year mathematics	3.0	0.6	3.0	0.5
Transition Year mathematics	2.3	0.7	2.4	0.7
Fifth Year mathematics	3.3	0.7	3.4	0.6
Sixth Year mathematics	3.4	0.7	3.4	0.6
Other levels/programmes e.g. Repeat LC or PLC mathematics	2.4	0.9	2.6	1.0
Total hours teaching mathematics per week	9.2	5.2	11.9	5.2
Hours teaching all other subjects	9.8	6.4	7.3	6.0
Total hours teaching per week	18.9	4.5	19.2	4.0
Percentage of all teaching time spent teaching mathematics	51.5	29.3	64.0	28.0
Percentage of all teaching time spent teaching mathematics in Transition Year	12.9	7.4	11.5	8.1
Percentage of all mathematics teaching time spent teaching mathematics in Transition Year	23.2	15.9	21.1	17.1

*Teachers who indicated that they did not teach any hours at each year level were excluded from the calculation of means and standard deviations for each year level individually. The total number of hours spent teaching mathematics is based on the sum of hours across year levels.

Total hours spent teaching per week across all subjects was comparable for Transition Year mathematics teachers and all teachers (19.2 and 18.9 hours, respectively), but Transition Year mathematics teachers spent a greater proportion of their total teaching hours teaching mathematics

(64%, compared to 51.5% for all teachers). On average, Transition Year teachers spent 21.1% of their total mathematics teaching time on teaching mathematics to Transition Year students, which came to 11.5% of their total teaching time.

4.3. Continuing Professional Development (CPD)

A series of items asked teachers to estimate the number of hours they had spent engaged in continuing professional development (CPD) related to mathematics, both during and outside of school time, over the last three years. Teachers were advised to consider both formal and informal activities in their estimates. Table 4.10 shows the average number of hours[21] that all mathematics teachers and Transition Year mathematics teachers reported that they spent on the different forms of mathematics CPD.

The time spent on the different types of CPD by Transition Year teachers tended to be quite low, with the notable exceptions of formal CPD on Project Maths (21 hours on average over the last three years) and self-directed CPD (15.7 hours on average). Least time was spent on formal CPD aimed at addressing a gap in qualifications (1.7 hours), formal CPD on the Junior Certificate mathematics syllabus aside from Project Maths (1.9 hours), and formal postgraduate study that included mathematics or mathematics education (2.1 hours). Overall, Transition Year mathematics teachers had spent an average of 49.4 hours engaged in mathematics CPD in the previous three years, although there was a lot of variation around this (SD=25.9 hours).

Transition Year mathematics teachers had spent slightly more time engaged in each of the different types of CPD than all teachers, though the only statistically significant difference was in self-directed CPD (15.7 compared to 14.2 hours).

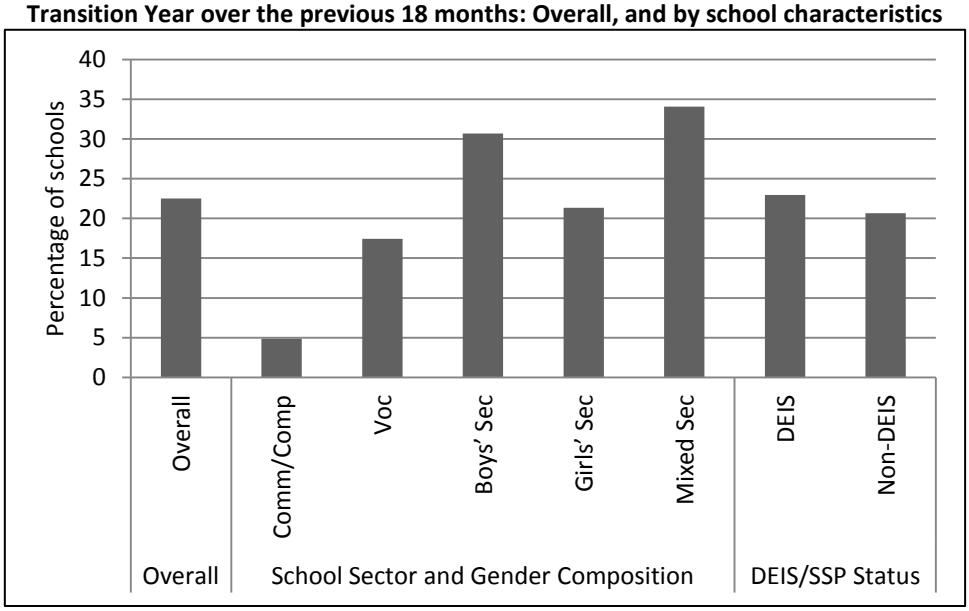
Table 4.10: Average hours of CPD participation by all teachers and Transition Year mathematics teachers in the last three years

	All Teachers			TY Mathematics Teachers		
Type of CPD	Mean	SE	SD	Mean	SE	SD
Formal CPD on Project Maths	20.2	0.34	9.6	21.0	0.36	9.5
Formal CPD on the Junior Certificate mathematics syllabus other than Project Maths	1.8	0.18	5.2	1.9	0.52	5.0
A formal CPD course designed to address a gap in your qualifications to teach mathematics	1.5	0.19	5.7	1.7	0.71	6.2
In-school professional development activities relating to mathematics	3.0	0.23	5.7	3.2	0.54	6.1
Self-directed CPD, e.g. study of Project Maths materials; of books or journals on mathematics education	14.2	0.34	11.4	15.7	0.14	11.6
External meetings relating to mathematics, e.g. the Irish Maths Teachers Association	2.9	0.23	5.9	3.7	0.73	6.6
Formal postgraduate study that included mathematics or mathematics education (e.g., M.A., M.Ed.)	1.6	0.19	6.3	2.1	0.59	7.2
Total CPD Hours	45.2	0.87	25.9	49.4	1.33	25.9

[21] The hours of CPD discussed in this section should be treated as broad estimates, since they are values that were recoded from the original response categories as follows: None=0; 1-8=4; 9-16=12; 17-24=20; 25+=28.

Mathematics school co-ordinators were asked whether or not teachers in their school had participated in CPD in the past 18 months, specifically relating to mathematics in Transition Year[22]. Overall, co-ordinators in 22.5% of schools reported that teachers of mathematics in Transition Year had participated in such CPD, but this varied widely according to school sector and gender composition (Figure 4.1). Participation was very low in community/comprehensive schools (4.9% of schools), while it was relatively high in mixed and boys' secondary schools (34.1% and 30.7%, respectively). Participation in CPD related to mathematics in Transition Year was comparable in DEIS/SSP (23%) and non-DEIS/SSP schools (20.7%).

Figure 4.1: Percentages of schools in which teachers had participated in CPD related to mathematics in Transition Year over the previous 18 months: Overall, and by school characteristics



The teacher questionnaire also included questions on the proportion of mathematics CPD attended outside of school time and factors preventing CPD attendance. Analyses of the responses of all teachers to these items are reported in Cosgrove et al. (2012).

4.4. Key Findings and Conclusions

The proportion of Transition Year mathematics teachers who were qualified to teach mathematics according to Teaching Council guidelines cannot be ascertained from the data; our best estimate is that somewhere between 78% and 88% meet the criteria.

Significant minorities of both Transition Year mathematics teachers and all mathematics teachers surveyed disagreed that their undergraduate and postgraduate coursework adequately prepared them in the areas of mathematics assessment (35.5% of Transition Year mathematics teachers) and mathematics teaching methods (28.3% of Transition Year mathematics teachers). The new Professional Diploma in Mathematics for Teaching, available from the autumn of 2012 and running for three years (see www.nce-mstl.ie), may help to address the needs of some teachers, particularly 'out of field' mathematics teachers. With respect to assessment, two further developments are of relevance: the School Self-Evaluation (SSE) process (see www.schoolself-evaluation.ie) which is

[22] It is worth noting in this context that data are lacking on rates of participation in CPD sessions for Transition Year co-ordinators. Due to the intended cross-curricular nature of the Transition Year programme, this form of CPD may influence the teaching and learning of mathematics in Transition Year.

currently being rolled out, in which assessment, including self-assessment, is a key feature; and the planned provision of CPD in assessment and moderation for all junior cycle teachers as part of the current reform of the junior cycle. However, these initiatives, which are not specific to mathematics, will take some years to implement. Our findings suggest the need to provide upskilling opportunities for all mathematics teachers, particularly in the areas of assessment and teaching methods. The quality of teacher education, both pre- and in-service, is a concern for mathematics teaching in general, and is discussed in more detail in Cosgrove et al. (2012).

Almost three in ten (29.3%) Transition Year mathematics teachers had worked in another profession prior to teaching, many in the science/technology (50.9%) and business/finance sectors (28%). The prior experiences of this group are likely to be particularly valuable in teaching mathematics in Transition Year, given its focus on practical activities that apply mathematical skills to real-life problems, and the more general emphasis on the vocational development of students in Transition Year (Department of Education, 1993).

Transition Year mathematics teachers reported spending 49.4 hours, on average, engaged in mathematics CPD during the preceding three years, of which the majority had been spent on formal CPD on Project Maths (21 hours) and self-directed CPD (15.7 hours). Participation in school-level CPD specifically related to mathematics in Transition Year was not common: teachers in just 22.5% of schools that offered mathematics in Transition Year had done so in the previous 18 months. There was a large disparity in the proportions of schools of different sector and gender composition that had participated in CPD on mathematics in Transition Year, from just 4.9% of community/ comprehensive to 34.1% of mixed secondary schools.

Mathematics teachers spent less time teaching mathematics to Transition Year students than to students at any other year level, resulting in a low proportion of total teaching time being spent on teaching mathematics to Transition Year students (one-fifth of all mathematics teaching time, and one-eighth of all teaching time, approximately). This, in part, reflects lower enrolment in Transition Year, since it is not compulsory in all schools in which it is offered.

5. Organisation of Mathematics in Transition Year

This chapter looks at the number of hours of mathematics teaching that are timetabled and taught in Transition Year, ability grouping practices for mathematics in Transition Year, patterns of mathematics syllabus uptake in junior and senior cycles, and some general features of mathematics programmes in Transition Year.

5.1. Hours Timetabled and Received

School co-ordinators provided estimates of the number of hours of mathematics teaching that were timetabled for Transition Year students in their school, and the number of hours actually taught.

Overall, an average of 83.1 hours of mathematics teaching was timetabled for Transition Year, and 70.1 hours, on average, were taught, though there was considerable variation in responses (standard deviations of 18.9 and 22.6 hours, respectively) (Table 5.1). When hours taught was calculated as a percentage of hours timetabled, it was found that Transition Year students received 84.1% of their timetabled mathematics instruction on average across schools. This disparity between hours timetabled and taught may be due to student participation in multi-day activities that typically take place during Transition Year, such as work experience (Department of Education, 1996).

Students in mixed secondary schools were timetabled significantly fewer hours of mathematics instruction compared with vocational schools (75 compared to 88.5 hours)[23]. Mixed secondary schools also delivered the fewest hours of instruction (60.8), while boys' secondary and community/comprehensive schools delivered the greatest amount (76.8 and 77.5 hours, respectively)[24]. The proportion of timetabled mathematics hours taught was significantly lower in both mixed secondary (80.5%) and vocational schools (82.3%) than in boys' secondary schools (91.6%). There were no significant differences by DEIS/SSP status, though DEIS schools both timetabled and delivered a somewhat greater amount of hours, on average, than non-DEIS schools.

Table 5.1: Mean hours of mathematics instruction timetabled and delivered to Transition Year students per year: Overall, and by school characteristics (School co-ordinators' estimates)

	Hours Timetabled		Hours Delivered		% Hours Delivered	
Characteristic	Mean	SD	Mean	SD	Mean	SD
Overall	83.1	18.9	70.1	22.6	84.1	14.3
School Sector Gender Composition						
Community/Comprehensive	85.0	27.1	77.5	33.2	86.9	12.2
Vocational	88.5	15.7	73.1	17.8	82.3	12.8
Boys' Secondary	86.0	15.4	76.8	12.8	91.6	6.6
Girls' Secondary	82.8	16.4	68.0	23.0	83.3	16.9
Mixed Secondary	75.0	18.4	60.8	21.8	80.5	16.8
DEIS/SSP Status						
No	82.0	18.3	69.1	22.6	83.9	14.9
Yes	86.8	20.8	73.4	22.7	84.9	12.7

[23] Formal tests of significance are carried out on group mean differences, but not on group percentages, in this report. For details on how comparisons of means are made, see the Technical Appendix.

[24] Mean hours of Transition Year mathematics instruction taught differs significantly between mixed and boys' secondary schools only.

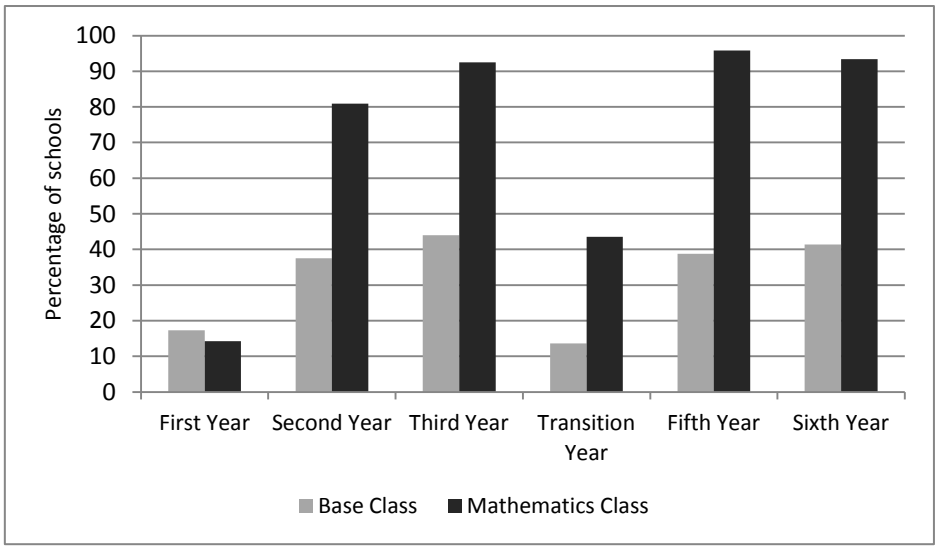
5.2. Ability Grouping

Figure 5.1 shows the percentages of schools that grouped students by ability for their base classes and mathematics classes for each year level. Ability grouping for mathematics in Transition Year is the focus of this section; groupings for base classes and other year levels are provided for comparative purposes.

In First Year, there was relatively little ability grouping, and such grouping was at similar levels for base and mathematics classes (17.3% and 14.3% of schools, respectively). After First Year, two patterns were evident: ability grouping for both base and mathematics classes increased dramatically; and ability grouping for mathematics classes increased to roughly double that of base classes.

Transition Year was an exception to the first pattern, in that ability grouping for base classes remained at around the level seen in First Year (13.6%). Ability grouping for mathematics in Transition Year was also low when compared to other year levels (43.5% compared to around 90% in Third, Fifth and Sixth Years), though it was practised with much greater frequency than ability grouping for base classes in Transition Year.

Figure 5.1. Percentages of schools that practised ability grouping for base and mathematics classes, by year level (School co-ordinators' estimates – all schools)



As shown in Table 5.2, there was no clear relationship between the prevalence of ability grouping and school size for Transition Year, for either base or mathematics classes, although there is an indication that ability grouping for mathematics classes in Transition Year was somewhat more common in larger schools. This general pattern was also found to be the case for other year levels (Cosgrove et al., 2012).

Table 5.2. Percentages of schools that practised ability grouping for base classes and mathematics classes in Transition Year by school enrolment size (School co-ordinators' estimates – all schools)

Year level/Class	Very Small (300 or fewer)	Small (301-400)	Medium (401-600)	Large (601-800)	Very large (801 or more)
Base class	15.0	5.4	22.4	5.1	9.4
Mathematics class	23.3	38.8	50.3	53.6	44.6

Table 5.3 shows the prevalence of ability grouping for base and mathematics classes by other school characteristics (DEIS/SSP status and school sector/gender composition).

Ability grouping of base classes appears to be consistently more common in DEIS/SSP than non-DEIS/SSP schools for all years, including Transition Year (22.1% in DEIS/SSP and 11.2% in non-DEIS/SSP schools). This pattern was reversed for ability grouping of mathematics classes, with such grouping being less prevalent in DEIS/SSP than non-DEIS/SSP schools, again including Transition Year (40.2% in DEIS/SSP and 44.5% in non-DEIS/SSP schools), but not First Year.

Table 5.3. Percentages of schools that practised ability grouping for base classes and mathematics classes: Overall, and by school characteristics (School co-ordinators' estimates – all schools)

Year level/Class	Overall	Non - DEIS/SSP	DEIS/SSP	Comm/ Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
Base Class								
First year	17.3	8.0	39.4	24.6	16.0	25.7	13.7	10.7
Second year	37.6	31.3	52.3	37.4	40.2	45.7	25.4	38.6
Third year	43.9	36.7	60.9	37.4	49.4	53.9	25.4	49.9
Transition year	13.6	11.2	22.1	11.4	8.7	33.1	2.3	16.5
Fifth year	38.8	37.9	40.9	21.1	45.9	50.7	20.6	47.1
Sixth year	41.4	38.4	48.2	23.8	48.9	50.7	20.6	53.4
Mathematics Class								
First year	14.3	8.5	28.5	22.2	10.1	21.2	14.3	10.0
Second year	80.9	83.5	74.6	89.2	70.1	84.1	83.7	88.1
Third year	92.5	96.3	83.0	91.7	86.0	92.3	96.7	100.0
Transition year	43.5	44.5	40.2	54.5	26.2	49.4	51.0	41.4
Fifth year	95.8	98.6	88.7	91.7	94.8	100.0	99.2	93.6
Sixth year	93.4	93.8	92.3	91.7	86.5	93.1	100.0	100.0

Note. 0.5% to 6.2% of respondents did not provide responses to these items.

Patterns of ability grouping in Transition Year varied according to school type. Base class ability grouping in Transition Year was much more prevalent in boys' secondary schools (33.1%) than on average across all school types (13.6%), while it was much less prevalent in girls' secondary schools (2.3%). This pattern was also apparent across other year levels.

Ability grouping for mathematics class in Transition Year was at similar levels for community/ comprehensive (54.5%), girls' secondary (51%) and boys' secondary schools (49.4%), while it was much lower for vocational schools (26.2%)[25]. Ability grouping for mathematics class showed little variation according to school sector and gender composition in other year levels, with the exception

[25] In some schools, e.g. very small schools, mixed ability classes may be a product of having just a single Transition Year group, rather than being purposely adopted as a policy.

of First Year, as the practice was very prevalent (over 85% in Third, Fifth and Sixth Year) across all school types.

5.3. Mathematics Syllabus Level Uptake

School co-ordinators were asked to estimate the percentages of students in their schools studying mathematics at each syllabus level during the 2011-2012 school year. The percentage of students taking Higher level mathematics decreased between Third and Fifth Year (from 48.5% to 31.9%), and again in Sixth Year, to 20.3%[26] (Table 5.4). There was a corresponding increase in the percentages of students studying Ordinary or Foundation level mathematics, from 51.3% in Third Year to 75.6% in Sixth Year.

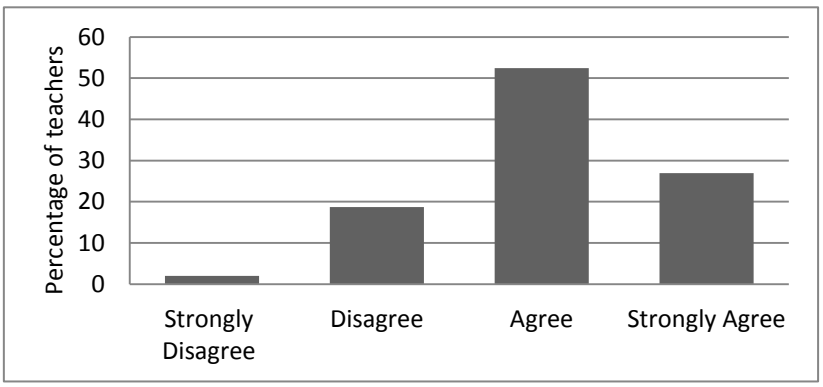
Table 5.4. Percentages of students studying mathematics at each syllabus level, by year level (School co-ordinators' estimates – all schools)

Year/Syllabus level	Higher		Ordinary/Foundation		Common	
	%	SD	%	SD	%	SD
First year	10.6	26.8	5.0	15.3	84.4	36.2
Second year	51.2	29.1	35.5	25.3	12.8	33.1
Third year	48.5	20.8	51.3	20.8	0.2	1.3
Fifth year	31.9	15.6	66.7	15.4	1.4	5.7
Sixth year	20.3	15.3	75.6	18.2	4.1	15.7

Note. 4.7% to 10.5% of respondents did not provide responses to these items. The Common Level course is taken in lieu of Higher, Ordinary or Foundation level mathematics, where syllabus level has not yet been decided.

While the majority of Transition Year mathematics teachers agreed or strongly agreed that a purpose of mathematics in Transition Year is to encourage students to take Leaving Certificate mathematics at Higher level, a substantial minority (20.7%) disagreed or strongly disagreed (Figure 5.2). It is also noteworthy that just 26.9% expressed strong agreement with the statement. Teachers may, however, have been taking into consideration the fact that some students will have not taken Higher level mathematics at Junior Certificate. Combined with the magnitude of the drop in the proportion of students taking Higher level mathematics across year levels, this suggests that teachers could take further advantage of the potential of Transition Year to encourage students to study mathematics at Higher level in Fifth and Sixth Year.

Figure 5.2. Percentages of Transition Year mathematics teachers agreeing that a purpose of mathematics in Transition Year is to encourage students to take Leaving Certificate mathematics at Higher level



[26] If the percentage of students studying Higher level mathematics in Sixth Year was calculated as a percentage of a First Year cohort, the estimate would be even lower, due to students leaving school before Sixth Year.

5.4. General Features of Mathematics Programmes in Transition Year

School co-ordinators were asked whether mathematics classes in Transition Year were timetabled as modular (e.g., a block of classes during one part of the school year, but not another) or continuous (i.e., regularly timetabled throughout all or most of the school year). In almost all schools (96.9%), classes were continuous (Table 5.5). This varied very little according to the characteristics of schools, although a somewhat greater percentage of community/comprehensive schools (12%) scheduled classes in a modular fashion.

Table 5.5: Percentages of schools that timetable mathematics classes in Transition Year as modular or continuous: Overall, and by school characteristics

Characteristic	Modular (%)	Continuous (%)
Overall	3.1	96.9
School Sector Gender Composition		
Community/Comprehensive	12.0	88.0
Vocational	0.0	100.0
Boys' Secondary	4.0	96.0
Girls' Secondary	2.3	97.7
Mixed Secondary	0.0	100.0
DEIS/SSP Status		
No	2.1	97.9
Yes	6.8	93.2

Table 5.6 shows the percentages of schools in which mathematics in Transition Year had various features, according to school co-ordinators. Nine in ten schools had their own mathematics programmes for Transition Year, and approximately seven in ten (69.6%) expected teachers to follow a specific mathematics programme in Transition Year. It was common practice to regularly assign mathematics homework to Transition Year students (88.4%), and to administer an end-of-year mathematics test in Transition Year (75.7%). Fewer than half of schools (46.2%) expected that teachers would use Transition Year to begin covering material for the Leaving Certificate, and just over one-third (34.2%) directed teachers to use a specific mathematics textbook(s) with Transition Year students[27].

Comparisons by DEIS/SSP status reveal that mathematics in Transition Year tended to be more structured in DEIS than non-DEIS schools, at least with regard to these features. For example, practically all DEIS schools (96.7%) had their own mathematics programme for Transition Year, and it was far more common for DEIS schools to use an agreed mathematics textbook/textbooks in Transition Year (61.8%, compared to 26.4% of non-DEIS schools), and to use Transition Year to begin covering Leaving Certificate material (60.1% vs. 42.3%).

Differences by school sector and gender composition tended not to be as great as those by DEIS/SSP status. Compared to overall averages, vocational schools placed a greater emphasis on some of the elements, e.g., 95% had their own mathematics programme in Transition Year, 45% used a specific textbook for mathematics in Transition Year, and 61.4% used Transition Year to start covering Leaving Certificate material. Boys' secondary schools were also more likely to have their own mathematics programme in Transition Year (97.9%), and to expect teachers to follow a specific

[27] Schools in which teachers were not directed to use a specific mathematics textbooks(s) with Transition Year students were no more likely to have developed their own mathematics programme for Transition Year (89.4% of schools compared to 90% of all schools).

mathematics programme in Transition Year (78.3%). Mixed secondary schools, on the other hand, tended to place less emphasis on the various features, e.g., 82.8% had their own mathematics programme in Transition Year, and 37.7% used Transition Year to begin covering material for the Leaving Certificate.

Table 5.6: Percentages of schools in which mathematics in Transition Year has various features: Overall, and by school characteristics

Feature/Statement	Overall	Non DEIS/SSP	DEIS/SSP	Comm/Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
This school has its own mathematics programme for TY	90.0	88.2	96.7	89.5	95.0	97.9	86.4	82.8
Teachers in this school are expected to follow a specific maths programme for TY (developed by this school or from elsewhere)	69.6	67.0	78.7	67.4	66.6	78.3	65.3	71.0
Teachers in this school are expected to use a specific (agreed) textbook(s) with maths students in TY	34.2	26.4	61.8	29.5	45.0	29.5	33.7	31.9
TY students are regularly assigned homework in maths	88.4	87.8	90.4	91.3	85.5	92.7	90.8	83.0
An end-of-year maths test is given to TY students	75.7	72.4	87.6	78.3	74.6	72.9	76.4	76.6
Teachers are expected to use TY to begin covering material for the Leaving Certificate	46.2	42.3	60.1	43.0	61.4	42.7	45.8	37.7

5.5. Key Findings and Conclusions

On average, Transition Year students received 70.1 hours of mathematics instruction in a year, and mathematics classes were delivered in a continuous (rather than modular) fashion in practically all schools (96.9%). Thus, schools appear to be meeting the requirement in the *National Strategy to Improve Literacy and Numeracy Among Young People* (DES, 2011) that mathematics be taught regularly during Transition Year. However, students received just 84.1% of the hours that they were timetabled to receive, on average. Further, hours received varied significantly according to school sector and gender composition, due to a combination of differences in the amount of hours that were timetabled, and differences in the proportion of those hours that were delivered. These findings suggest that mathematics teaching hours in Transition Year could be increased, in line with recent recommendations from the Project Maths Implementation Support Group (2010) and the DES (2011; Circular 0058/0011), with schools compensating for missed instructional time. This could be achieved by allocating blocks of time for mathematics teaching, which would reduce the impact of participation in other activities on mathematics instruction, as well as provide increased opportunities for more innovative teaching and learning activities that require significant time to implement.

Ability grouping ('streaming'/'setting') for mathematics instruction was much less prevalent in Transition Year (occurring in 43.5% of schools) than in Third, Fifth and Sixth Year (around 90% of schools). However, it was practised with much greater frequency than ability grouping of base classes (13.6% of schools). Ability grouping for mathematics in Transition Year tended to be less common in vocational schools.

There was a steady decline in the percentage of students opting for Higher level mathematics between Third (48.5%) and Sixth Year (20.3%) and also between Fifth (31.9%) and Sixth Year, and just 26.9% of Transition Year mathematics teachers strongly agreed that a purpose of mathematics in Transition Year is to encourage the uptake of Higher level mathematics for the Leaving Certificate[28]. As discussed in Chapter 1, previous research (Millar & Kelly, 1999) indicates that participation in Transition Year is associated with a greater likelihood of taking the subject at Higher level. However, our findings suggest that greater advantage could be taken of the Transition Year programme in promoting this outcome.

In the majority of schools, mathematics in Transition Year had the following features: a school mathematics programme for Transition Year, a specified mathematics programme for Transition Year teachers to follow, regular homework, and an end-of-year test. It was much less common for schools to specify a textbook or textbooks for mathematics in Transition Year (34.2%). Differences in the adoption of these features across school types corroborate other evidence (e.g., Smyth et al., 2004) that schools vary somewhat in their delivery of mathematics in Transition Year. For example, DEIS/SSP schools tended to implement a more structured approach to mathematics in Transition Year than non-DEIS/SSP schools. It seems likely that this may be aimed at preventing possible adverse effects of a less systematic approach to instruction during Transition Year on the subsequent motivation and achievement of lower-performing students, as discussed in Chapter 1.

Finally, it is of note that 46.2% of schools expected teachers to use Transition Year to begin covering Leaving Certificate mathematics material. This finding may be of concern in light of previous findings that Transition Year may be used as a lead-in to the Leaving Certificate in some schools, in opposition to DES guidelines (see Chapter 1). However, it can be surmised that, in some schools, at least parts of the Leaving Certificate course may be adopted in order to provide the benefits of a systematic approach to mathematics teaching in the absence of an agreed curriculum. The finding that DEIS/SSP schools were more likely to start covering Leaving Certificate mathematics material during Transition Year would seem to support this, as a systematic approach may be more useful to lower-performing students, as mentioned above. However, where such an approach may be used, it would also seem important to provide students with mathematical experiences that they might not otherwise access, such as practice in solving extended problems, and some exposure to the history of mathematics.

[28] Teachers' responses to this item may have been influenced by the phrasing of the question, as it may have been interpreted as implying that *all* students should be encouraged to take Higher level mathematics.

6. Teaching and Learning Mathematics in Transition Year

The data in this chapter are derived from the sections of the questionnaires pertaining to mathematics in Transition Year. Therefore, results are presented for teachers of Transition Year mathematics and mathematics co-ordinators in schools that provide mathematics to Transition Year students only.

6.1. Views on the Purposes of Mathematics in Transition Year

Teachers were asked to rate their level of agreement or disagreement with 12 statements about the purpose of mathematics in Transition Year, shown in Table 6.1. There was little variation in responses, with high percentages of teachers expressing agreement with each of the purposes[29]. Practically all teachers agreed or strongly agreed that purposes of mathematics in Transition Year were to: maintain mathematics skills learned during the junior cycle (98.2%); further develop mathematics skills acquired in the junior cycle (98.1%); increase students' confidence in their mathematics ability (96.7%); improve students' confidence in their problem-solving ability (96.6%); encourage greater interest in mathematics (96.1%); allow students to experience mathematics differently (93.8%); and enable students to apply mathematics in their own lives (91.8%). For all statements, however, the modal response was to agree, with relatively small percentages strongly agreeing. It is particularly noteworthy that just one-third of teachers *strongly* agreed that the purposes of mathematics in Transition Year are to increase students' confidence in their mathematics ability (36.7%) and their problem-solving ability (31.4%), and to encourage greater interest in mathematics (33.9%), given that the guidelines for Transition Year (Department of Education, 1993) recommend that these aspects of mathematics in Transition Year should be emphasised.

The least frequently endorsed purpose concerned familiarising students with the history of mathematics, with which 38.9% disagreed or strongly disagreed, and only 9.9% strongly agreed. There was also some disagreement with the view that a purpose of mathematics in Transition Year is to introduce students to careers in mathematics (21.4%), to enable students to solve complex problems set in real-life contexts (15.8%), to prepare students for Leaving Certificate mathematics (15.7%) and to develop students' ability to model situations mathematically (11%).

[29] It is possible that the wording of this question may have lent itself to positive response bias. Had the wording been more specific, e.g., "In my school, the purpose of Transition Year maths is …", teachers may have been more inclined to express disagreement.

Table 6.1: Percentages of Transition Year mathematics teachers by level of agreement with various statements concerning the purposes of mathematics in Transition Year

The purpose of Transition Year mathematics is to …	Strongly Disagree	Disagree	Agree	Strongly Agree
Allow students to experience mathematics differently	0.5	5.6	66.5	27.3
Prepare students for Leaving Certificate mathematics	1.6	14.1	71.3	13.0
Enable students to apply mathematics in their own lives	0.8	7.3	72.2	19.6
Develop students' ability to model situations mathematically	0.6	10.4	72.1	16.9
Enable students to solve complex problems set in real-life contexts	0.7	15.1	66.3	18.0
Further develop mathematics skills acquired in the junior cycle	0.0	1.9	67.4	30.7
Familiarise students with the history of mathematics	8.5	30.5	51.2	9.9
Increase students' confidence in their mathematics ability	0.5	2.9	60.0	36.7
Improve students' confidence in their problem-solving ability	0.0	3.4	65.2	31.4
Maintain mathematics skills learned during the junior cycle	0.0	1.8	65.5	32.7
Expose students to more concrete mathematics materials	0.7	10.3	66.3	22.8
Encourage greater interest in mathematics	0.1	3.9	62.2	33.9
Introduce students to careers in mathematics	3.5	17.9	57.4	21.2

6.2. Resources Used in the Teaching of Mathematics in Transition Year

Teachers were asked to rate the frequency with which they used various resources in preparing for and teaching mathematics to Transition Year classes[30]. The most frequently used resources were Project Maths resources (which 62.3% of teachers reported using often or always), the mathematics syllabus for Transition Year prepared by their school (61.9%), Leaving Certificate textbooks (56.9%) and mathematics websites (46.7%) (Figure 6.1).

Dynamic geometry software was often or always used by just over a quarter (25.7%) of teachers, and around one in five used Transition Year maths textbooks (19.7%) or a graphics/graphing calculator (18.7%). Less frequent use was made of programming software and the DES publication, *A Resource for Transition Year Mathematics Teachers* (O'Cairbre, McKeown and Watson, 2006), which were often or always used by just over one in ten teachers (11.2% and 11.8%, respectively).

[30] Between 4.8 and 9.4% of teachers did not provide responses to these items.

Figure 6.1. Percentages of Transition Year mathematics teachers reporting that they often or always use various resources for Transition Year mathematics classes

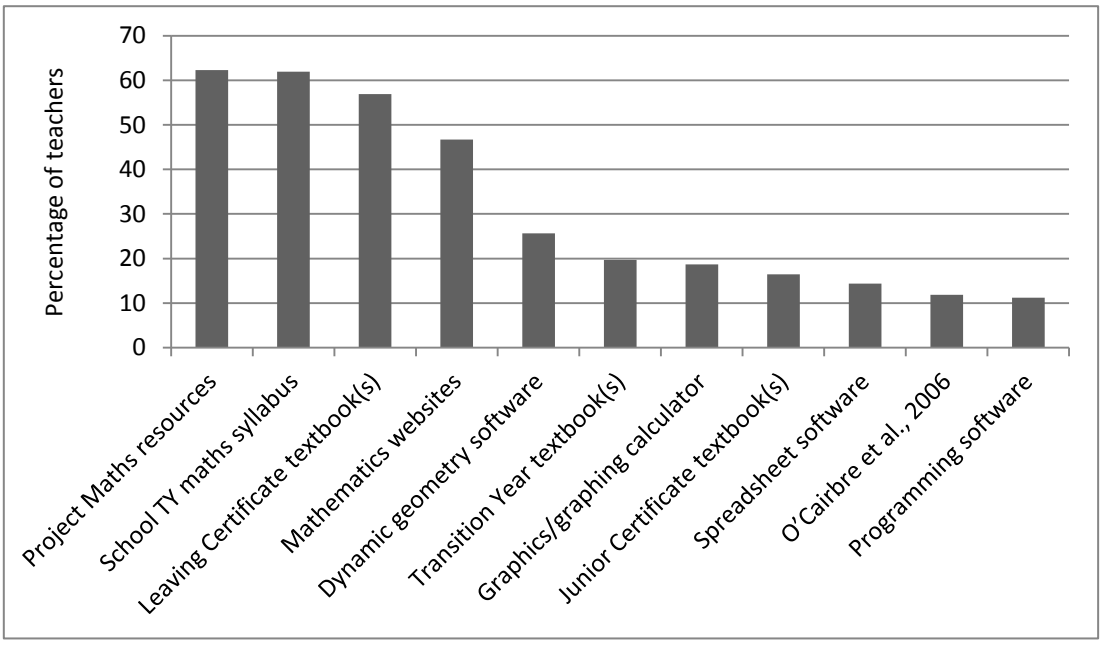


Table 6.2 shows percentages of teachers who reported that they often or always used the different mathematics resources in teaching mathematics to their Transition Year students, by various school characteristics. There was some variation by school sector and gender composition in the use of the following: a school mathematics syllabus for Transition Year (55.7% in community/comprehensive to 70.8% in mixed secondary schools); Transition Year textbooks (14.3% in girls' secondary to 26.3% in boys' secondary schools); and Project Maths resources (50.8% in mixed secondary to 69.9% in both boys' and girls' secondary schools).

As might be expected, Project Maths resources were also used with relatively high frequency by teachers with their Transition Year students in Project Maths initial schools (85.2%, compared to 61.2% in other schools). This was in contrast to Leaving Certificate textbooks, which were less frequently used by teachers in Project Maths initial schools (36.3% vs. 57.9% of teachers in other schools).

Teachers in DEIS/SSP schools tended to rely somewhat more on Transition Year textbooks (27.6% compared to 18.1% in non-DEIS/SSP schools) and Junior Certificate textbooks (23.8% vs. 15%). Dynamic geometry software was used relatively frequently by teachers in both DEIS/SSP schools (33.3%, compared to an overall average of 25.7%) and Project Maths initial schools (40%).

Finally, there was a good deal of variation in frequency of use of mathematics websites, which were often or always used by a relatively low proportion of teachers in girls' secondary schools (38%), compared to those in vocational, community/comprehensive and Project Maths initial schools (56.4% to 57.6%).

Table 6.2: Percentages of Transition Year mathematics teachers who often or always use various resources in mathematics classes in Transition Year: Overall, and by school characteristics

Resource	Overall	Non DEIS/ SSP	DEIS/ SSP	Non Initial PM	Initial PM	Comm/ Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
The mathematics syllabus for Transition Year prepared by the school	61.9	62.0	61.7	61.9	62.8	55.7	61.9	62.4	59.5	70.8
A Resource for Transition Year Mathematics Teachers (O'Cairbre et al., 2006)	11.8	11.3	14.6	12.1	5.6	16.3	12.3	8.6	6.9	17.9
Transition Year textbook(s)	19.7	18.1	27.6	19.8	15.8	19.6	24.8	26.3	14.3	14.6
Project Maths resources	62.3	61.8	64.5	61.2	85.2	58.3	58.6	69.9	69.9	50.8
Junior Certificate textbook(s)	16.5	15.0	23.8	16.6	13.8	15.1	16.0	12.0	18.7	19.7
Leaving Certificate textbook(s)	56.9	56.3	59.9	57.9	36.3	58.3	60.2	52.8	58.2	54.7
Spreadsheet software	14.4	13.8	17.3	14.1	21.2	14.0	13.6	17.2	14.1	13.1
Programming software	11.2	10.1	16.7	11.0	15.9	11.5	16.0	10.6	11.3	6.2
Dynamic geometry software (e.g. Geogebra, Geometer's sketchpad)	25.7	24.1	33.3	25.0	40.0	27.2	26.7	27.3	24.0	23.8
Mathematics websites	46.7	47.2	43.9	46.3	55.2	57.6	56.4	45.4	38.0	40.5
Graphics/graphing calculator	18.7	18.6	18.8	18.2	28.1	17.5	25.6	20.4	18.5	10.7

6.3. Assessment of Mathematics in Transition Year

A majority (83.4%) of Transition Year mathematics teachers reported that they assign end-of-year grades to their students.

The level of importance that teachers assigned to various factors in arriving at grades tended to vary (Table 6.3), but the following factors were assigned medium or high importance by the majority of teachers: final written test (88.1% of teachers), tests administered during the year (84.9%), continuous assessment (80.8%), regular in-class assignments or assessments (78.5%), participation in class activities (74.5%) and classroom observation (71.5%). The factors considered to be of least importance overall were group project work, to which 56.7% of teachers stated that they assigned either low or no importance, and textbook work, which 54.1% viewed as being of low or no importance. The degree to which individual project work contributed to final mathematics grades varied widely, with an even split between teachers who assigned it a medium or high level of importance, and those who assigned it low importance, or none at all. Teachers' ratings of homework also varied, though a majority (59.5%) assigned it medium or high importance in arriving at final grades.

Table 6.3: Percentages of Transition Year mathematics teachers by level of importance that they assign to various factors when arriving at final mathematics grades for Transition Year students

Factor	None	Low	Medium	High
Individual project work	23.1	26.9	33.4	16.6
Group project work	29.1	27.6	27.9	15.3
Final written test	3.9	8.0	31.5	56.6
Tests administered during the year	4.5	10.5	47.1	37.8
Classroom observation	10.4	18.1	40.1	31.4
Participation in class activities	11.8	13.8	38.6	35.8
Homework	16.3	24.2	37.5	22.0
Textbook work	20.6	33.5	31.1	14.8
Continuous assessment	8.1	11.0	46.5	34.3
Regular in-class assignments or assessments	7.0	14.6	41.3	37.2

Note. This table is based on the 83.4% of Transition Year mathematics teachers who reported that end-of-year grades are assigned for mathematics in Transition Year.

Teachers in Project Maths initial schools tended to place more emphasis on the following factors when arriving at grades for mathematics in Transition Year: individual project work (which 70.4% of teachers in initial schools rated as being of medium or high importance, compared to 49.1% in other schools); group project work (61.1% vs. 42.5%); classroom observation (82.3% vs. 71.1%); and participation in class activities (85.9% vs. 73.9%) (Table 6.4). Conversely, those teaching in Project Maths initial schools tended to assign less importance to the other forms of assessment and assignment, e.g., final written test (69% in initial schools compared to 88.8% in other schools), homework (49.8% vs. 59.8%), and continuous assessment (63.4% vs. 81.6%).With the exception of continuous assessment, these differences seem to be broadly consistent with the emphasis Project Maths places on students as active participants in their learning (NCCA/DES, 2011a, 2011b).

Greater proportions of teachers in DEIS/SSP schools rated homework (69.9%) and textbook work (61.9%) as being of medium or high importance in assigning end of year grades, by comparison to the overall averages (59.5% and 45.9%, respectively). Teachers in boys' secondary schools also placed a comparatively high level of emphasis on homework (69.1%).

Table 6.4: Percentages of Transition Year mathematics teachers who assign medium or high importance to various factors when arriving at final mathematics grades for Transition Year students: Overall, and by school characteristics

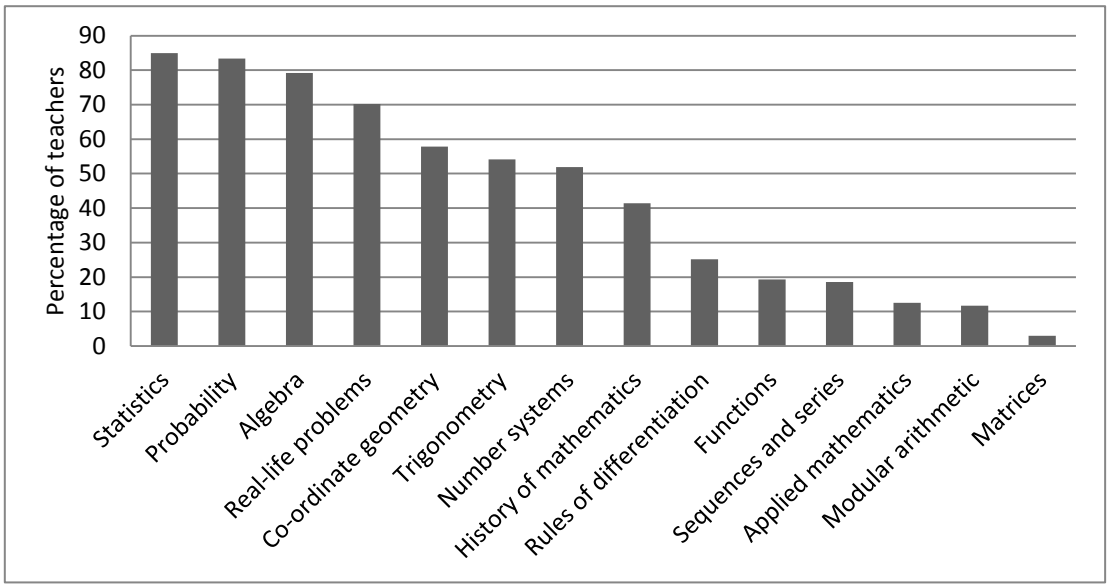
Factor	Overall	Non DEIS/ SSP	DEIS/ SSP	Non Initial PM	Initial PM	Comm/ Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
Individual project work	50.0	49.2	53.9	49.1	70.4	50.0	54.2	41.8	48.6	56.1
Group project work	43.3	43.8	40.9	42.5	61.1	40.1	43.6	36.7	46.0	49.1
Final written test	88.1	87.7	90.1	88.8	69.0	88.8	83.5	88.1	90.6	88.7
Tests administered during the year	85.0	84.1	89.0	85.6	71.8	82.3	85.5	84.2	87.8	83.6
Classroom observation	71.5	72.6	66.6	71.1	82.3	67.2	69.5	75.1	73.4	71.3
Participation in class activities	74.4	75.5	69.6	73.9	85.9	70.5	72.9	73.8	75.9	78.6
Homework	59.5	57.1	69.9	59.8	49.8	54.1	64.2	69.1	57.1	52.7
Textbook work	45.9	42.3	61.9	46.5	30.0	44.5	51.6	50.7	45.9	35.4
Continuous assessment	80.8	80.9	80.7	81.6	63.4	71.0	79.8	83.7	83.0	85.9
Regular in-class assignments/assessments	78.4	79.1	75.5	78.9	68.2	72.6	72.5	85.6	79.5	81.8

Note. This table is based on the 83.4% of Transition Year mathematics teachers who reported that end-of-year grades are assigned for mathematics in Transition Year.

6.4. Topics Covered in Mathematics in Transition Year

Teachers were presented with a list of topics, and asked to indicate which they covered in their mathematics classes in Transition Year. The most frequently endorsed topics were statistics (taught by 84.9% of teachers), probability (83.3%) and algebra (79.1%) (Figure 6.2). The teaching of real-life problems was also quite prevalent (70.2%) as was co-ordinate geometry, though to a lesser degree (57.8%). Just over half of teachers covered trigonometry (54.1%) and number systems (51.9%), and 41.4% taught the history of mathematics. Fewer than one in five teachers covered functions, sequences and series, applied mathematics and modular arithmetic, while matrices were taught by just 3%.

Figure 6.2. Percentages of Transition Year mathematics teachers indicating that they cover various topics in their Transition Year mathematics classes



As shown in Table 6.5, there were some differences in topics taught, depending on whether teachers were in Project Maths initial schools or not. Teachers in initial schools were more likely to teach number systems (76.1% compared to 50.7% in other schools), sequences and series (49.5% vs. 17.2%) and functions (50.2% vs. 17.9%), while they were less likely to teach co-ordinate geometry (45.7% vs. 58.4%). Real life problems were taught slightly more frequently in initial schools than in other schools (76.4% vs. 69.9%).

Generally, the percentages of teachers who reported teaching the different topics were quite similar across schools of different sector and gender composition, and DEIS/SSP status. There were, however, some differences. For example, teachers in DEIS/SSP schools were more likely to teach co-ordinate geometry (72.2% compared to 54.8% in non-DEIS/SSP schools), and less likely to teach the history of mathematics (29% vs. 44%). The teaching of trigonometry also varied somewhat across school type, being covered by 67.8% of teachers in mixed secondary schools, compared to 41.5% in vocational schools.

Table 6.5: Percentages of Transition Year mathematics teachers indicating that they cover various topics in their Transition Year mathematics classes: Overall, and by school characteristics

Topic	Overall	Non DEIS/ SSP	DEIS/ SSP	Non Initial PM	Initial PM	Comm/ Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
Number systems	51.9	50.9	56.6	50.7	76.1	61.4	47.4	50.7	48.5	54.0
Trigonometry	54.1	55.5	47.6	54.0	58.1	63.9	41.5	49.2	51.6	67.8
Co-ordinate geometry	57.8	54.8	72.2	58.4	45.7	63.7	55.3	58.4	51.7	63.6
Matrices	3.0	2.7	4.3	3.2	0.0	6.4	3.0	3.5	0.0	3.7
Modular arithmetic	11.7	11.2	14.1	11.2	21.2	13.4	9.2	14.6	10.5	11.5
Rules of differentiation	25.2	26.3	19.9	25.2	23.8	33.4	26.5	28.6	13.2	30.0
Algebra	79.1	80.0	74.9	79.0	83.1	75.7	78.7	77.3	81.9	80.7
Sequences and series	18.6	18.9	17.1	17.2	49.5	26.3	16.9	20.2	11.0	22.6
Real-life problem	70.2	70.9	66.5	69.9	76.4	62.0	79.1	65.8	69.0	74.4
Functions	19.3	18.3	24.1	17.9	50.2	28.8	15.3	17.3	19.3	16.8
Statistics	84.9	84.9	84.8	84.6	91.6	85.6	80.5	84.6	84.6	89.9
Probability	83.3	85.1	74.8	83.4	82.0	83.4	84.0	87.9	76.8	87.3
Applied mathematics	12.6	12.9	10.8	12.3	17.8	9.4	15.6	19.9	6.5	13.3
History of mathematics	41.4	44.0	29.0	41.4	41.6	36.7	34.2	44.8	43.3	47.2

Note. 5.1% of teachers did not provide responses to these items.

6.5. Assigning Transition Year Students to Leaving Certificate Mathematics Programmes

School co-ordinators were asked to rate the level of importance attached to various factors they took into account in assigning Transition Year students to Leaving Certificate mathematics classes within their schools. Most emphasis tended to be placed on Junior Certificate examination results, which 73.2% of schools rated as being of high importance. A high level of importance was also placed on students' own preferences or interests (60% of schools) and on teachers' judgements (47.2%). An end of Transition Year test in mathematics (17.2%) and standardised test results (15.7%) were viewed as less important.

Table 6.6: Percentages of schools placing low, medium and high levels of importance on various factors in assigning Transition Year students to Leaving Certificate mathematics classes

Factor	Low	Medium	High
Junior Certificate examination results	5.8	21.0	73.2
Students' own preferences or interests	7.1	33.0	60.0
End of Transition Year test in mathematics	48.1	34.7	17.2
Teachers' judgements	9.1	43.7	47.2
Standardised test results	53.4	30.9	15.7

Table 6.7 shows the percentages of schools placing high levels of importance on the different factors when assigning Transition Year students to Leaving Certificate mathematics classes, overall, and according to school characteristics.

DEIS/SSP schools tended to place greater emphasis on Junior Certificate examinations results (86.3% compared to 69.7% in non-DEIS/SSP schools), an end of Transition Year test in mathematics (22% vs. 15.8%), and teachers' judgements (54.6% vs. 45.2%), while they relied less on students' own preferences (50.8% vs. 62.4%) and standardised test results (10.1% vs. 17.3%).

Although the level of importance assigned to criteria varied across schools of different sector and gender compositions, the relative weighting of the criteria remained similar. For all school types, an end of Transition Year test in mathematics and standardised test results were the least important

factors. With the exception of mixed secondary schools, all school types reported relying most heavily upon Junior Certificate examination results.

Table 6.7: Percentages of schools placing high levels of importance on various factors in assigning Transition Year students to Leaving Certificate mathematics classes: Overall, and by school characteristics

Factor	Overall	Non DEIS/ SSP	DEIS/ SSP	Comm/ Comp	Voc	Boys' Sec	Girls' Sec	Mixed Sec
Junior Certificate examination results	73.2	69.7	86.3	86.9	78.1	83.8	69.5	53.6
Students' own preferences or interests	60.0	62.4	50.8	41.9	73.3	65.8	42.0	72.7
End of Transition Year test in mathematics	17.2	15.8	22.0	9.0	19.0	18.4	25.1	12.6
Teachers' judgements	47.2	45.2	54.6	51.8	35.6	57.4	52.8	41.7
Standardised test results	15.7	17.3	10.1	22.2	13.8	19.7	9.8	15.5

6.6. Key Findings and Conclusions

Teachers' patterns of response to statements concerning their views on the purposes of mathematics in Transition Year in general may indicate a lack of clarity on this issue. While the majority agreed with each of the twelve purposes listed, teachers were reluctant to express strong agreement. It is also possible that this indicates a recognition by teachers of the complexity of the multiple goals of Transition Year. Only about one-third of teachers strongly agreed that a purpose of mathematics in Transition Year is to increase students' confidence in their mathematics and in their problem-solving ability, and to encourage greater interest in mathematics, despite the very strong emphasis placed on these objectives in the Transition Year guidelines (Department of Education, 1993). It is also of note that approximately 40% of teachers disagreed that the purpose of mathematics in Transition Year is to familiarise students with the history of mathematics, as recent research (Carter & Ó Cairbre, 2011) suggests that positive and sustained changes to student perceptions of mathematics can result from the teaching of this topic.

The resource most frequently used in the teaching of mathematics in Transition Year was Project Maths material, which 62.3% of teachers reported that they often or always used. The only other resources used with much regularity were the school mathematics syllabus for Transition Year (61.9%), Leaving Certificate textbooks (56.9%) and mathematics websites (46.7%). Fairly infrequent use was made of other Information and Communication Technology resources, such as programming software (11.2%), spreadsheet software (14.4%), and dynamic geometry software (25.7%). Although use of a graphics/graphing calculator was also fairly infrequent (18.7%), it is likely that this represents huge growth since 2004, when a study of calculator use among a nationally-representative sample of Third Year students in Ireland found little or no evidence of the use of graphics/graphing calculators by their mathematics teachers (Close et al., 2008).

It is noteworthy that, in Project Maths initial schools, Project Maths resources were used much more frequently (85.2%), and the use of Leaving Certificate textbooks was correspondingly less frequent (36.3%). These findings may imply a dearth of appropriate resources for mathematics in Transition Year prior to the introduction of Project Maths, or of teachers' knowledge of such resources, or ability to access or utilise them.

The majority (83.4%) of teachers assigned end-of-year mathematics grades to their Transition Year students. In arriving at these grades, teachers tended to assign most importance to tests,

assignments, and classroom activities. Least importance was assigned to group project work and textbook work, while teachers varied in their evaluations of the importance of individual project work and homework. Differences in the assessment practices between initial Project Maths schools and others suggest that Project Maths may be providing teachers with the resources to implement more innovative methods of assessment that are more suited to the active approach to learning that characterises Transition Year, such as group project work. DEIS/SSP schools were more likely to use more traditional, and ostensibly less demanding forms of assessment, such as homework and textbook work.

The topics that were most frequently taught in mathematics class in Transition Year included statistics (covered by 84.9% of teachers), probability (83.3%), algebra (79.1%), and real-life problems (70.2%). Statistics and probability now receive greater emphasis than in the old mathematics syllabi, and were included in the first phase of the introduction of Project Maths. Just four in ten teachers covered the history of mathematics, even though this is encouraged in the Transition Year guidelines, and resource materials are available. These findings suggest that teachers may need to be encouraged to draw on a range of content areas in mathematics in Transition Year, though individual content areas do not need to be presented in isolation, but can, instead, be combined into integrated modules or lesson plans.

Junior Certificate examination results were the most important factor for schools in assigning Transition Year students to Leaving Certificate mathematics programmes (73.2% of schools reported that this factor was assigned a high level of importance), while very little emphasis was placed on either standardised test results (15.7%), or an end of Transition Year test in mathematics (17.2%). This pattern did not vary much across schools of different types.

7. Conclusions and Recommendations

7.1. Introduction

This report is based on a nationally representative survey of mathematics teachers and mathematics school co-ordinators which was implemented as part of PISA 2012 in Ireland. As mathematics in Transition Year is the focus of the report, analyses are for the most part limited to subsamples of interest, i.e., those teachers who taught mathematics in Transition Year in the 2011-2012 school year, and co-ordinators in schools that provide mathematics in Transition Year. The report aims to provide information on the structure and content of mathematics classes in Transition Year and teachers' perceptions of the purposes of mathematics in Transition Year. Research on this topic is of importance for a number of reasons including: the comparatively large drop in the mathematics achievement of students in Transition Year in the OECD PISA study between 2003 and 2009; a paucity of information on the implementation of mathematics in Transition Year in schools; and a lack of emphasis on teaching and learning of mathematics in Transition Year in the context of general educational reform aimed at improving mathematics standards.

Achievement data for students who participated in PISA 2012 will be available in December 2013, which will lend further context to the information in this report. We will also be able to compare students' performance in mathematics in PISA 2012 with the performance of comparable samples in previous cycles of PISA, in order to monitor trends nationally, including trends among 15-year olds in Transition Year. In PISA 2015, we will be able to investigate the impact of the introduction of Project Maths, as well as broader issues in mathematics education, as some of the pupils who participated in the most recent cycle of TIMSS in Grade 4 will be eligible to participate in PISA 2015.

This chapter presents some general conclusions and recommendations based on the findings of the report.

7.2. Purposes of Mathematics in Transition Year

The findings of this survey indicate some degree of mismatch between the official aims of both Transition Year and mathematics in Transition Year, and the views of teachers. As stated in Chapter 1, the main aims of Transition Year are to 'promote the personal, social, educational and vocational development of pupils and to prepare them for their role as autonomous, participative and responsible members of society' (Department of Education, 1993, p. 3), while mathematics in Transition Year 'should seek to stimulate the interest and enthusiasm of the pupils in identifying problems through practical activities and investigating appropriate ways of solving them' (Department of Education, 1993, p. 12). However, only a minority of Transition Year mathematics teachers strongly agreed that each of the following is a purpose of mathematics in Transition Year: increase students' confidence in their mathematics and problem-solving ability; encourage greater interest in mathematics; introduce students to careers in mathematics; and enable students to solve complex problems set in real-life contexts.

It is possible that increased levels of student confidence and interest in mathematics would increase uptake of Higher level mathematics for Leaving Certificate, which is one of the aims of the *National Strategy to Improve Literacy and Numeracy among Children and Young People, 2011-2020* (DES, 2011), and of Project Maths.

The decline in the percentage of students opting for Higher level mathematics between Third and Sixth Year, which was found in our study, has been a concern for many years. As noted in a recent report (Engineers Ireland, 2010), Transition Year is a 'generally untapped resource' (p. 1) with regard to increasing uptake of Higher level mathematics for the Leaving Certificate, and improving students' mathematics standards more generally. The present study found that a substantial minority of teachers disagreed or strongly disagreed that a purpose of mathematics in Transition Year is to encourage students to take Leaving Certificate mathematics at Higher level, which may reflect a tension in the Transition Year guidelines between using Transition Year to build skills for the Leaving Certificate, and ensuring that it is not used as a 'lead-in' to the Leaving Certificate.

1. The aims, structure and content of mathematics in Transition Year should be reviewed in light of Project Maths, and the DES guidelines as they relate to mathematics should be updated. Schools and teachers should be supported in implementing strategies to achieve the revised aims.
2. In teaching mathematics in Transition Year, schools and teachers should focus on increasing student engagement with mathematics, and building confidence in students' mathematical abilities. Teachers and schools should be supported, for example, through CPD, in ensuring that students of all ability levels reach their potential in mathematics during this year.
3. Schools and teachers should use Transition Year to promote student awareness of the importance and relevance of mathematics in a range of contexts. In particular, mathematics teaching should introduce students to careers in mathematics, and inform them about the mathematics requirements and content of third-level courses. This could be facilitated through a whole-school approach to the subject, e.g., collaboration between mathematics teachers and Guidance Counsellors, work experience, and input from industry and the third-level education sector[31].

7.3. The structure of Mathematics Lessons in Transition Year

The vast majority of schools appear to be meeting the requirement contained in the *National Strategy to Improve Literacy and Numeracy among Young People, 2011-2020* (DES, 2011) that mathematics be taught regularly during Transition Year. Just under 1% of schools reported that they do not provide mathematics lessons for Transition Year students. However, it is of concern that students in Transition Year are timetabled to receive on average 83 hours of mathematics teaching, but receive on average just 84% of these hours. This disparity between hours timetabled and taught may be due to student participation in multi-day activities that characteristically take place during Transition Year (Department of Education, 1996). In any event, the fact that students in Transition Year spend less than two-and-a-half hours per week on mathematics suggests that the teaching hours for mathematics in Transition Year should be increased where feasible, in line with the recent recommendations from the Project Maths Implementation Support Group (2010) and the DES (2011; Circular 0058/0011).

4. The DES should expand on the guidelines issued (Circular 0058/0011) regarding increasing mathematics teaching time during Transition Year, and indicate the minimum amount of mathematics teaching that all schools should provide across the school year.

[31] A recommendation that the DES develop a strategy to build links between the third-level and post-primary education sectors with the aim of increasing student interest in mathematics is also included in *Teaching and Learning in Project Maths: Insights from Teachers who Participated in PISA 2012* (Cosgrove et al., 2012).

5. Schools should ensure that the teaching of mathematics is prioritised during Transition Year, when it is likely that students will be engaged in other activities that demand large blocks of time. In the context of whole-school planning, schools should aim to meet the minimum recommended amount of mathematics teaching. This could be facilitated through improved timetabling for Transition Year, for example, scheduling out-of-school activities first, and then developing the timetable for regular classes. Schools should have freedom and autonomy in how they achieve this annual target, for example, by allocating longer blocks of time for mathematics teaching as needed, and/or through inter-disciplinary work.

The findings from this survey show that ability grouping ('streaming'/'setting') for base and mathematics classes in Transition Year is much less prevalent than in other years, with the exception of First Year. However, similar to other year levels, ability grouping for mathematics classes is practised with much greater frequency than ability grouping for base classes in Transition Year. Recent research suggests that mixed-ability teaching approaches provide more positive outcomes in mathematics when compared with more traditional approaches (e.g. Boaler, 2008; Linchevski & Kutscher, 1998). Further, there is strong evidence that ability grouping has negative consequences for lower performing students and few benefits for higher achieving students (e.g. Smyth & McCoy, 2011; Smyth, Dunne, Darmody & McCoy, 2007). Transition Year provides a unique opportunity to promote the use of mixed-ability teaching approaches in mathematics, given that it is not constrained by a set curriculum and examinations.

Related to this is the use of resources in teaching mathematics in Transition Year. Our findings show that Project Maths resources were the most frequently used, followed by the school mathematics syllabus for Transition Year and Leaving Certificate textbooks. Unsurprisingly, Project Maths resources were relied upon more heavily in the initial Project Maths schools, while there was less use of Leaving Certificate textbooks in these schools. Therefore, it is likely that, as the Project Maths curriculum becomes more established in all schools, more use will be made of resources associated with the initiative, even in the absence of any formal link between Project Maths and Transition Year mathematics.

The outcomes of assessments of mathematics in Transition Year did not feature very prominently in allocating students to Leaving Certificate mathematics classes, with schools preferring to rely on Junior Certificate examination results instead. If schools and teachers are to succeed in using Transition Year as a means to increase the level of uptake of Leaving Certificate Higher level mathematics, they need to rely more on the outcomes of mathematics assessments during Transition Year, including the use of a broader range of assessment methods.

6. The use of mixed-ability mathematics classes should be promoted further in Transition Year. Also, teachers should be supported in making more use of mixed ability teaching methods, through CPD and guidelines on mathematics in Transition Year.
7. The DES and its agencies (NCCA, PDST (Professional Development Service for Teachers)) should support teachers in making use of resources that emphasise an active, student-led approach to learning with the aim of fostering student engagement. This could take the form of the development of Transition Units for mathematics that take such an approach.
8. Decisions regarding the allocation of students to Leaving Certificate mathematics classes should take into account all available sources of information, including work completed during Transition Year, and any gains in students' confidence and knowledge.

7.4. Professional Development for Teachers

While the majority of teachers surveyed perceived that their undergraduate and postgraduate education had adequately prepared them to teach mathematics at post-primary level, there were significant minorities who did not feel adequately prepared, particularly in the areas of mathematics assessment and mathematics teaching methods.

The results of this survey show that teachers tended to assign most importance to traditional forms of assessment, such as tests, assignments, and classroom activities, when arriving at end-of-year grades for mathematics in Transition Year. The issue of assessment has already been noted in the *National Strategy to Improve Literacy and Numeracy Among Children and Young People, 2011-2020*, which states that assessment for learning (AfL) 'is not used sufficiently widely in our schools and we need to enable teachers to improve this practice' (DES, 2011, p. 74).

The survey results also indicate that between 12% and 22% of Transition Year mathematics teachers may not hold a qualification with the required specialisation in mathematics referred to in the Teaching Council guidelines. While recent developments in teacher education, including the introduction of the Professional Diploma in Mathematics for Teaching and the extension of consecutive teacher education from one to two years from 2014, aim to address this issue, the findings of this survey suggest that upskilling opportunities for *all* mathematics teachers working in the profession (including those whose qualifications meet the requirements of the Teaching Council) are needed. This seems particularly important as just 22.5% of schools that offer Transition Year indicated that their teachers had participated in CPD specifically relating to mathematics in Transition Year in the 18 months leading up to the survey.

9. Continuing professional development (CPD) for Transition Year should prioritise the teaching and learning of mathematics. Where possible, this should be offered in the form of online resources and training modules, to facilitate participation.
10. CPD related to mathematics should aim to address aspects of pre-service education where gaps have been identified, and should include a focus on mathematics teaching methods, and the assessment of mathematics. Teachers should be supported in implementing more innovative approaches to the teaching and assessment of mathematics in Transition Year that promote the overall aims of encouraging student engagement, enhancing student confidence and improving mathematical understanding, for example, mixed-ability teaching methods and assessment for learning.

7.5. Evaluation of Mathematics in Transition Year

The current study provides a broad overview of the teaching of mathematics in Transition Year. There is a need for a more in-depth analysis of mathematics teaching and learning, including an examination of the knowledge and skills that students acquire during this year, as well as those they may lose. This is particularly important in the context of ongoing educational reform at post-primary level, e.g., the introduction of Project Maths and the junior cycle review. Factors associated with students' mathematical development during Transition Year should also be examined, including the effects of different teaching methods, grouping arrangements, and assessment approaches.

11. The Department of Education and Skills should conduct a study at national level that quantifies the cognitive and affective gains arising from participation in mathematics in Transition Year. The study should also look at any loss of mathematical skills by students during Transition Year and the effects of such loss on performance in Leaving Certificate mathematics. An ERC study, which plans to revisit the Millar and Kelly (1999) study with more recent data, could form part of this review.
12. The teaching and assessment of mathematics in Transition Year should be included as part of an ongoing review of senior cycle mathematics, such as that recommended in Cosgrove et al., 2012.
13. Transition Year may provide an opportunity to consolidate the mathematical knowledge and skills learned during the junior cycle, and to develop these in a manner that would act as a useful bridge to the new Leaving Certificate course. The NCCA should identify ways in which schools and teachers can align mathematics activities in Transition Year more closely with the aims of Project Maths.
14. The teaching and learning of mathematics in Transition Year should be included as part of any school self-evaluation.

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Technical Appendix

This Appendix contains technical background information on the analysis procedures used to report results. It is likely to be of relevance to readers with an interest in the analysis methodologies underlying the results.

A.1. Sample Design, Response Rates and Computation of Sampling Weights

Like any large-scale educational assessment, it is important that the sampled schools, teachers and students are representative of their respective populations. Schools were sampled first, with probability proportional to size (with larger schools having a higher likelihood of being sampled). Prior to sampling, schools were grouped by the enrolment size of PISA-eligible (15-year-old) students and school sector (community/comprehensive, secondary, and vocational). Small schools had 40 or fewer PISA students enrolled; medium ones had 41-80 students enrolled, and large schools had 81 or more students enrolled. In addition, all 23[32] schools that participated in the initial stage of Project Maths were included in the sample. This resulted in ten strata or clusters of schools:

- Size 41-80 / Community/Comprehensive
- Size > 80 / Community/Comprehensive
- Size <=40 / Secondary
- Size 41-80 / Secondary
- Size > 80 / Secondary
- Size <=40 / Vocational
- Size 41-80 / Vocational
- Size > 80 / Vocational
- Project Maths initial schools.

Within each cluster, schools were sorted by the percentage of students whose families are eligible for a medical card (split into quartiles), and the percentage of female students enrolled (also split into quartiles).

Once schools were sampled, students were sampled at random within each school. However, the focus of this section is a description of the sample of teachers and mathematics school co-ordinators, so the remainder discusses these respondents, rather than the students that participated.

The sample of mathematics teachers was defined as *all teachers of mathematics in the school.* Therefore this included mathematics teachers of both junior and senior cycles, although the teacher questionnaire tended to focus on junior cycle, since the majority of PISA students were in junior cycle at the time of the assessment. At the beginning of the administration of PISA, school principals were asked to provide the ERC with the total number of mathematics teachers in the school, and the numbers of questionnaires were sent out were based on this information. However, it emerged that, in 32 of the 183 participating schools, more teachers returned questionnaires than expected (i.e. the total number of returns was more than the expected number of mathematics teachers). In these schools, the total number of mathematics teachers was adjusted to equal the total number of returns, or else the response rate would have exceeded 100% for those schools.

[32] There were originally 24 Project Maths initial schools, of which one was amalgamated with a non-initial school.

It is estimated, therefore, that there were 1645 mathematics teachers in participating schools. Of these, 1321 returned a questionnaire, which constitutes an acceptable response rate of 80.3%. On average, 7.2 questionnaires were returned per school, and school-level teacher response rates ranged from 7% to 100%.

In all analyses of the teacher questionnaire, data are weighted by a teacher weight. This ensures that the reported results are representative of the population of mathematics teachers in Ireland. The teacher weight consists of four components. The first component, the school base weight, is the reciprocal of the schools' probability of selection. The second, school non-response adjustment, is an adjustment that is applied to account for the fact that two of the 185 sampled schools did not participate. The third component is an adjustment to take the over-sampling of initial schools into account; if this were not done, initial Project Maths schools would contribute disproportionately to estimates for the sample as a whole. The fourth component is a teacher non-response adjustment. Since each mathematics teacher has a selection probability of 1, it is necessary only to compute the non-response adjustment, which is the number of returned questionnaires divided by the number of expected questionnaires. Hence, the teacher weight is: school base weight X school non-response adjustment X adjustment for oversampling of initial Project Maths schools X teacher non-response adjustment. For analyses in this report, the normalised teacher weight is used; that is, the population weight adjusted in order to return the same N as the number of respondents. The normalised rather than the population weight is used in order to avoid artificially inflating the power of analyses.

The sample of mathematics school co-ordinators (and hence the computation of the weights) is more straightforward than that of mathematics teachers, since there was only one co-ordinator per school. In total, 171 co-ordinators returned a questionnaire, which constitutes a highly satisfactory response rate of 93.4%. The mathematics school co-ordinator weight was computed as the school base weight * co-ordinator non-response adjustment. As with the analyses of the teacher questionnaire data, the normalised school co-ordinator weight is used in all analyses in this report.

A.2. Correcting for Uncertainty in Means and Comparisons of Means

We surveyed a sample of mathematics teachers rather than the whole population of mathematics teachers. The resulting estimates (e.g., percentages and mean scores) are prone to uncertainty due to sampling error. The precision of the estimates is measured using the standard error, which is an estimate of the degree to which a statistic, such as a mean, may be expected to vary about the true (but unknown) population mean. Assuming a normal distribution, a 95% confidence interval can be created around a mean using the following formula: Statistic ± 1.96 standard errors. The confidence interval is the range in which we would expect the population estimate to fall 95% of the time, if we were to use many repeated samples.

To correct for the uncertainty or error due to sampling, we have used SPSS® macros developed by the Australian Council for Educational Research (ACER). The standard errors were computed in a way that took into account the complex, two-stage, stratified sample design. The macros incorporate sampling error into estimates of standard errors by a technique known as variance estimation replication. This technique involves repeatedly calculating estimates for N subgroups of the sample and then computing the variance among these replicate estimates. The particular method of variance estimation used was Jackknife N. Variance estimation replication is generally used with multistage stratified sample designs, and usually has two units (in this case, schools) in each variance

stratum. In the case of the teacher data, there were 90 variance strata, and there were 85 such strata for the mathematics co-ordinator data. Using the particular Jackknife method, half of the sample is weighted by 0, and the other half is weighted by 2. For more information on this and related techniques, see Brick, Morganstein, and Valliant (2000); the PISA data analysis manual (second edition) also provides a good overview of the rationale and implementation of this family of methods (OECD, 2009).

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ISBN: 978 0 900440 39 7
9 780900 440397