chapter 7

# The Teachers

Glenn S Chamberlain

CHAPTER 7

# THE TEACHERS

**As part of the information collected along with the survey of mathematics and science achievement, TIMSS collected data from teachers about their academic and professional backgrounds, instructional practices, resources, and attitudes towards teaching mathematics and science. These responses are very important in helping to describe standards 2 and 3 mathematics and science education in New Zealand. As nearly all teachers around the world teach both subject areas at this level, most of the questions focus on mathematics, but responses will usually apply to science as well. Finally, selected variables from the teacher data have been correlated with the students' achievement scores to identify potential relationships. Zero-order correlations quoted do not necessarily indicate a causal relation.**

New Zealand has never previously taken part in a large-scale international study of mathematics and science performance at the 9-year-old level. However, some comparisons will be possible with general background data collected in the IEA Reading Literacy Study conducted in 1990. In addition, the First International Science Study (FISS) in 1970–71 and the Second International Science Study (SISS) in 1983–84, which surveyed 10-year-old students, will provide an opportunity for international comparisons with results from TIMSS. While this report concentrates on the New Zealand data, selected comparisons with other countries' population 1 data from TIMSS will be made, and comparisons will also be made with the population 2 (forms 2 and 3) TIMSS data. The TIMSS population 1 data for other participating countries is unpublished at the time of writing, and while it is unlikely to change, it should be regarded as preliminary. Unless otherwise stated, the results presented in this chapter refer to New Zealand data only.

The conceptual framework for TIMSS, as described earlier in the report (see Chapter 1), comprise three different curriculum levels — the *intended*, *implemented*, and *attained* curricula. It is the *implemented* curriculum which information collected from the teachers helps to describe.

## BIOGRAPHICAL DETAILS

### Gender

Nearly three-quarters of the standards 2 and 3 teachers who were teaching mathematics and science in TIMSS were female. A summary of the proportion of female and male teachers for population 1 is reported in Table 7.1.

**Table 7.1**

**Gender of standards 2 and 3 teachers**

| Gender | Percent of teachers |
|---|---|
| Female | 72 |
| Male | 28 |

Note: Teachers N = 288.

The information in Table 7.1 confirms that primary school teaching is largely undertaken by women. In the Reading Literacy Study in 1990, the proportion of New Zealand standard 3 teachers who were women was 76 percent (Chamberlain, 1993).

In the First International Science Study (FISS), 16 out of the 18 countries participating had mainly females teaching at the 10-year-old level (Comber & Keeves, 1973). Likewise in the Second International Science Study (SISS), only two of the 17 countries had a majority of male teachers teaching their 10-year-olds (Postlethwaite & Wiley, 1992).

Of the TIMSS countries at the upper class level, only the Netherlands, Greece, Iran, Thailand, and Kuwait did not have a substantial majority of women as population 1 teachers. The Netherlands is the only country to show a majority of male teachers in their population 1 sample. In the Czech Republic, Portugal, Scotland, Israel, Latvia, and Slovenia at least 90 percent of the teachers were women.

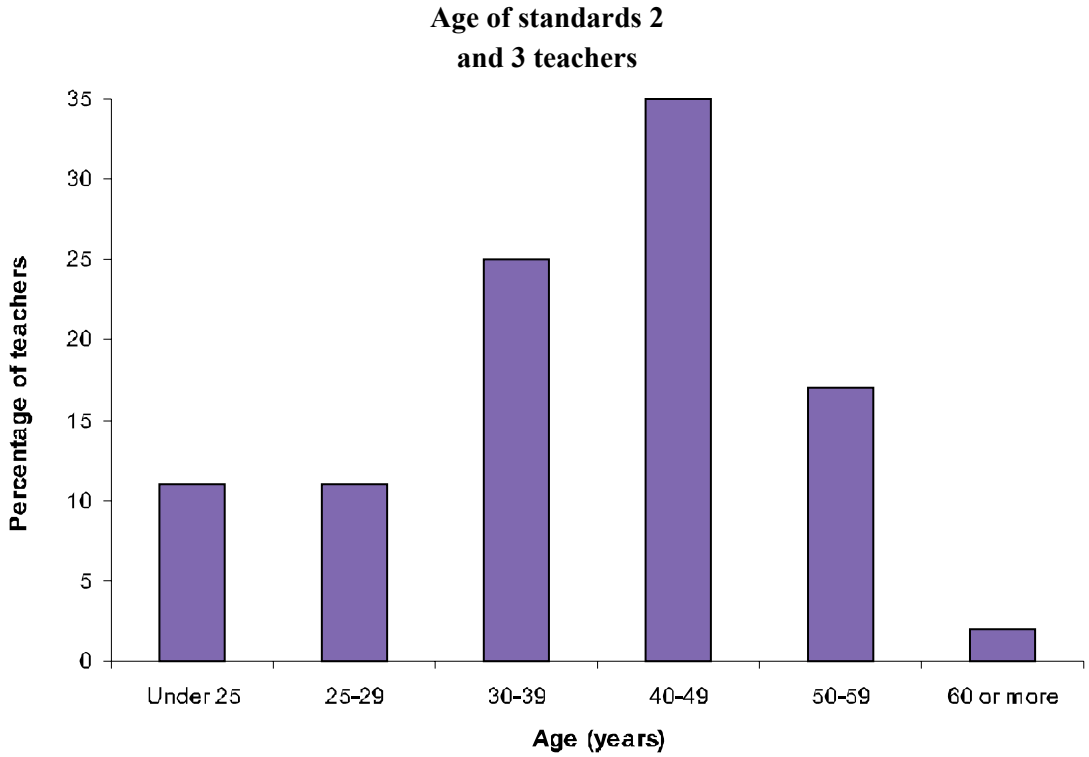
## Age

The largest proportions of standards 2 and 3 teachers were found in two age categories, '40–49' (one-third) and '30–39' (one-quarter) years of age respectively. The next highest category was the 17 percent of teachers in the '50–59' age group, followed by the two youngest age categories, each of which contained about ten percent of the teachers. The data collected on the age of population 1 teachers is presented in Figure 7.1.

The mean age of the New Zealand standards 2 and 3 teachers was 39.7 years. As a comparison, the mean age of teachers of 10-year-olds reported across 16 countries in FISS was 35.3 years (Comber & Keeves, 1973). By the time SISS was conducted some 15 years later, the mean age had increased to 38.3 across 17 countries (Postlethwaite & Wiley, 1992). In New Zealand, the ageing of the teacher population can be attributed mainly to the large reduction in teacher training intakes as the school age population fell, a reduction in the losses of teachers from the profession that occurred during the early 1980s, and an increasing intake of mature students to colleges of education (Millar, 1986).

As in New Zealand, the modal age group for population 1 teachers in over half of the TIMSS countries was '40–49' years. In about one-third of countries, the modal age group was '30–39' years. The Czech Republic was the only country in which '50–59' years was the modal group, but about one-third of the Norwegian teachers were also in this age group at the standard 3 level.

**Figure 7.1**




Note: Teachers N = 288.

# EDUCATION AND TEACHING EXPERIENCE

## Education and Teaching Qualifications

Population 1 teachers were asked to indicate the highest level of formal education they had completed. Forty percent of teachers had completed secondary school (that is, form 6 or form 7) and undertaken a three- or four-year college of education course, while a further 22 percent had completed secondary school, along with a one- or two-year college of education course. Just over one-quarter of the teachers had completed a bachelors degree or higher in addition to a college of education course. A summary of the level of education attained by standards 2 and 3 teachers is presented in Table 7.2.

**Table 7.2**

**Level of education of standards 2 and 3 teachers**

| Education | Percent of teachers |
|---|---|
| Teacher training without completing fm 6 or fm 7 | 3 |
| Completed fm 6 or fm 7 + 1 or 2 yrs teacher training | 22 |
| Completed fm 6 or fm 7 + 3 or 4 yrs teacher training | 40 |
| Bachelors degree + teacher training | 25 |
| MA(educ) + teacher training | 2 |
| Other | 7 |

Notes: 1 Teachers N = 288.
2 Missing data = 1%.

The context of the question used to collect data on teacher qualifications for the Reading Literacy Study differs from that used in the current study, so no comparison is possible. While the TIMSS questionnaire did not ask about specific subject areas, the extent of mathematics and science knowledge of trainee teachers at the primary level remains an area of concern (Clark & Vere-Jones, 1987). No direct relationship was found between the general qualifications of the New Zealand population 1 teachers and their students' achievement in mathematics and science.

All the population 1 teachers from the United States and Greece possessed university degrees, but most of the Greek teachers were reported to have degrees without any teacher training. A large majority of teachers in Latvia, Korea, Canada, and England had also completed degrees.

## Teaching Experience

It is often hypothesised that teaching performance improves with experience. Teachers with a more extensive teaching background are said to be more effective in promoting certain aspects of students' mathematics and science achievement and/or activities. Teaching experience was measured by obtaining the total number of years that each teacher had been teaching.

As can be seen from the summary statistics reported in Table 7.3, the mean number of years spent teaching by population 1 teachers was 14.4. In comparison, the mean number of years of teaching experience reported by New Zealand standard 3 teachers in 1990 was 14.0 (Chamberlain, 1993). In SISS teachers of 10-year-olds across 16 countries had taught, on average, for 15.5 years (Postlethwaite & Wiley, 1992).

The fact that teaching at the middle primary level is largely undertaken by women and that their mean age was nearly 40 years, yet the average number of years of teaching experience was just over 14, is explained by many teachers having records of broken service or having entered teacher training as mature students. Although the distribution of teacher ages was similar for the majority of

TIMSS countries, only five of these countries had lower means for years of teaching experience at the upper class level.

**Table 7.3**

**Number of years standards 2 and 3 teachers have spent teaching: summary statistics**

| | |
|---|---|
| N | 286 |
| Range | 1-45 |
| Median | 13.0 |
| Mean | 14.4 |
| Std. deviation | 9.4 |

The TIMSS data showed no significant direct relationship between teaching experience and student achievement. However, it was noted that teachers who had been teaching the longest tended to have the lowest scoring students in mathematics and science. It may be the case that the slowest achieving students tend to be assigned to the most experienced teachers, or it may be that classroom teachers' effectiveness peaks some years before the age of retirement. It is also the case that many better teachers have been promoted to positions outside the classroom.

## Part-time or Full-time Teaching

With an increasing number of part-time workers in the workforce (Millar, 1986), it was of interest to see what percentage of population 1 teachers taught part-time, and what relationship, if any, this may have with their students' achievement.

**Table 7.4**

**Employment status of standards 2 and 3 teachers**

| Work basis | Percent of teachers |
|---|---|
| Part-time | 3 |
| Full-time | 97 |

Note: Teachers N = 288.

The results presented in Table 7.4 show that only three percent of New Zealand standards 2 and 3 teachers in the sample were employed on a part-time basis, not enough to establish a relationship between the teacher of the class and student achievement. In most other countries less than five percent of the teachers were not full-time. On the other hand, in Iceland about half of the teachers were part-time, and in Iran just over one-third were part-time.

### Previous Class Levels Taught

Another aspect of a teacher's experience is to the extent to which a teacher has taught at different class levels. Population 1 teachers were asked to indicate which class levels they had taught in the past five years. A summary of the results is shown in Table 7.5.

**Table 7.5**

**Class levels at which standards 2 and 3 teachers have taught in the past five years**

| Class level | Percent of teachers |
|---|---|
| New Entrants | 25 |
| J1/J2 | 37 |
| J3/Standard 1 | 57 |
| Standard 2 | 82 |
| Standard 3 | 82 |
| Standard 4 | 61 |
| Form 1 | 26 |
| Form 2 | 21 |
| Forms 3–7 | 9 |

Notes: 1 Teachers N = 288.
2 Missing data = 1 to 2%.

Over 80 percent of the population 1 teachers had taught at the standard 2 and standard 3 levels during the five years prior to the year of data collection. Many had gained experience at other primary class levels, but few had taught secondary school classes. This was true for nearly all other countries, but approximately 15 percent of teachers in the Canadian sample had taught at senior secondary levels.

Interestingly, teachers who had recently taught at the J1/J2 ($r = 0.25$, $p < 0.0010$), J3/standard 1 ($r = 0.21$, $p < 0.0038$), and standard 4 ($r = 0.15$, $p < 0.0414$) levels tended to have students who scored higher in mathematics. Correlations with science achievement also revealed significant relationships at the J1/J2 ($r = 0.23$, $p < 0.0024$) and J3/standard 1 ($r = 0.22$, $p < 0.0036$) levels, as well as in standard 2 ($r = 0.19$, $p < 0.0100$).

## CLASSROOM TEACHING AND RELATED ACTIVITIES

### Class Levels Taught

Teachers were asked to indicate which class levels they were teaching mathematics and science to at the time of the survey, in order to reveal the extent of teaching undertaken in more than one class level.

One teacher indicated that they did not teach mathematics at any class level and, similarly, seven teachers said they were not teaching any science. Two-thirds of the teachers taught mathematics and science at the standard 2 and/or standard 3 level. The next most common class levels for population 1 teachers to be teaching mathematics and science included standard 4 and J3/standard 1. It is likely that many of these teachers were teaching *composite*, or multi-level, classes — a common feature of primary schools in New Zealand. The fact that only two-thirds of the teachers reported teaching both mathematics and science at the population 1 level may reflect some specialisation in the teaching of these subjects. During the selection of the sample, there was evidence of teaching syndicates and the rearranging of classes to be taught mathematics and science.

## Teaching-Related Activities

Population 1 teachers were asked to indicate (on a five-point scale) the amount of time they spent on a series of teaching-related activities, outside the formal school day. The results are summarised in Table 7.6.

The three teaching-related activities on which standards 2 and 3 teachers appeared to spend most of their non-teaching time on were 'administrative tasks and staff meetings', 'planning lessons by yourself', and to a lesser extent, 'reading and marking other work'. In contrast, the two teaching-related activities that consumed the least amount of time for New Zealand standards 2 and 3 teachers were 'meeting with parents' and 'meeting students for tutoring/guidance'.

**Table 7.6**

**Amount of time standards 2 and 3 teachers spent on activities outside the formal school day**

| Activities | None (%) | Less than 1 hour (%) | 1–2 hours (%) | 3–4 hours (%) | More than 4 hours (%) |
|---|---|---|---|---|---|
| Preparing or marking tests/ exams | 6 | 46 | 35 | 6 | 3 |
| Reading and marking other work | 2 | 11 | 38 | 29 | 20 |
| Planning lessons by yourself | 0 | 4 | 31 | 41 | 24 |
| Meeting students for tutoring/ guidance | 29 | 49 | 14 | 4 | 0 |
| Meeting with parents | 5 | 77 | 15 | 1 | 0 |
| Professional reading/development | 5 | 32 | 40 | 15 | 5 |
| Updating student records | 1 | 18 | 60 | 17 | 3 |
| Admin tasks & staff meetings | 0 | 3 | 26 | 37 | 33 |

Notes: 1 Teachers N = 288.
2 Missing data ranged from 0% to 5%.

Another important factor is the meeting of teachers to discuss and plan curriculum or teaching approaches. Other things being equal, the frequency with which those meetings are held may be a good indication of the degree of professionalism present, although the size of the school also affects this variable. Population 1 teachers were asked to indicate (on a seven-point scale) how often they met for these purposes.

About 40 percent of the standards 2 and 3 teachers reported meeting on a weekly basis, while another 16 percent met 'two or three times a week'. The next most common frequency for meeting was 'monthly' (13%), 'once or twice a year' (12%), and 'almost every day' (10%).

Population 1 teachers were asked to report (on a four-point scale) how familiar they were with official documents about the curriculum, examinations, and pedagogy. This data is presented in Table 7.7.

**Table 7.7**

**Standards 2 and 3 teachers' familiarity with documents**

| Documents | No doc (%) | Not fam (%) | Fairly fam (%) | Very fam (%) |
|---|---|---|---|---|
| National curriculum for mathematics | 0 | 4 | 52 | 43 |
| National curriculum for science | 0 | 12 | 57 | 31 |
| School curriculum guide | 8 | 9 | 42 | 34 |
| National pedagogy guide for mathematics | 40 | 43 | 5 | 1 |
| National pedagogy guide for science | 39 | 44 | 4 | 1 |

Notes: 1 Teachers N = 288.
2 Missing data ranged from 1 to 12%.

Most of the population 1 teachers were familiar with three of the documents — 'national curriculum for mathematics', 'national curriculum for science', and 'school curriculum guide'. Slightly more teachers were familiar with the *intended* mathematics curriculum than the *intended* science curriculum. The large majority of teachers also reported that they were unfamiliar with special-purpose pedagogy guides. Advice on pedagogy is a feature of *Mathematics in the New Zealand Curriculum* (Ministry of Education, 1992) and *Science in the New Zealand Curriculum* (Ministry of Education, 1993), the national curriculum statements for mathematics and science, but there are no national guides focusing on pedagogy at this level.

Teachers were also asked how familiar they were with national examination specifications. New Zealand standards 2 and 3 teachers were generally unfamiliar with these so their teaching is unlikely to be affected by any public examination 'backwash effect'. In a few countries — Austria, Iran, Kuwait, Singapore, and Slovenia — majorities of teachers said they were 'very familiar' with national examination specifications.

## Class Size

Standards 2 and 3 teachers were asked to record the total number of students in their class. Since many New Zealand primary schools make use of composite, or multi-level, classes for organisational purposes, the data collected at the population 1 level included a significant number of these. Table 7.8 presents summary statistics on class size.

**Table 7.8**

**Number of students in standards 2 and 3 teachers' classes: summary statistics**

| Statistic | Students being tested | Total students in composite classes |
|---|---|---|
| N | 254 | 176 |
| Median | 17.0 | 30.0 |
| Mean | 18.0 | 29.4 |
| Std deviation | 8.9 | 5.8 |

The mean number of students being tested in the classes of the standards 2 and 3 teachers was 18.0. The equivalent figure for the whole class and taking into account composite classes was 29.4. As a comparison, the respective mean class sizes reported in 1990 by standard 3 teachers in the Reading Literacy Study was 17.8 and 29.8 (Chamberlain, 1993). Internationally, the mean class size a decade earlier (equivalent to the total number of students here) across 14 countries in SISS was 31.6 (Postlethwaite & Wiley, 1992).

Median class sizes for mathematics upper grade (equivalent to standard 3) were largest in Korea (43), Singapore (39), and Hong Kong (35). Median class sizes in Iran, Israel, Cyprus, England, and Ireland were about the same as for New Zealand. The other 17 countries for which data were available had lower median class sizes. Norway (19), Austria, Hungary, Greece, and Iceland (all 20) were lowest. Clearly smaller class sizes on their own do not lead to higher achievement. Social and cultural factors, as well as the other variables discussed in this report, play a large part.

Considerable research has been carried out in Western countries into the effects of class size on achievement (see, for example, reviews by Odden, 1990; Robinson, 1990). Most of the research has shown that for class size to have a significant positive effect on mathematics and science achievement, the number of students per class needs to be less than 15–20 students and that teaching approaches must change. Along with the gains in achievement, the effects on educational outcomes of improved classroom management, reduction of teacher stress, and a more thorough completion of learning tasks through smaller classes represent important claimed benefits.

## Ability Level of Students

Population 1 teachers were asked to estimate the percentage of students in their class who they considered to be of high, middle or low ability in comparison to other students in New Zealand. The percentage estimates of students' abilities are summarised in Table 7.9.

**Table 7.9**

**Percentage estimates of students' abilities given by standards 2 and 3 teachers: summary statistics**

| Statistic | High Ability (%) | Middle Ability (%) | Low Ability (%) |
|---|---|---|---|
| N | 235 | 231 | 236 |
| Median | 15.0 | 50.0 | 25.0 |
| Mean | 17.9 | 52.6 | 29.8 |
| Std deviation | 15.7 | 20.5 | 21.9 |

Note: Missing data = 7%.

Population 1 classes typically were said by teachers to have about 18 percent of students of high ability, another 30 percent in the low ability category, and approximately half the students about average. There was a wide range of variation among the teachers' estimates as indicated by large standard deviations, and examples at the extremes were found at both class levels. Given that TIMSS sample selection methods ensured a representative sample at the standards 2 and 3 level, the tendency for teachers to see more students as having low ability than high ability may point to a problem with teacher expectation. This tendency was also detected in the population 2 (forms 2 and 3) teachers (Chamberlain, 1996a & 1996b).

Teachers from five other countries shared this characteristic with New Zealand teachers; in nine countries aggregate teacher judgements gave about the same high and low proportions; and in the remainder teachers tended to estimate higher proportions in the higher group than in the lower group. In nearly all countries, aggregate teacher estimates placed 50 percent or higher in the middle group.

The ability of New Zealand teachers to estimate the percentages of students in their classes in different ability groups for mathematics and science proved to be quite variable. Teachers' estimations of their high-ability and low-ability students correlated moderately ($r = 0.39$, $p < 0.0001$ and $r = –0.51$, $p < 0.0001$ for mathematics; $r = 0.40$, $p < 0.0001$ and $r = –0.52$, $p$ 0.0001 for science) with the students' actual outcomes on the achievement tests.

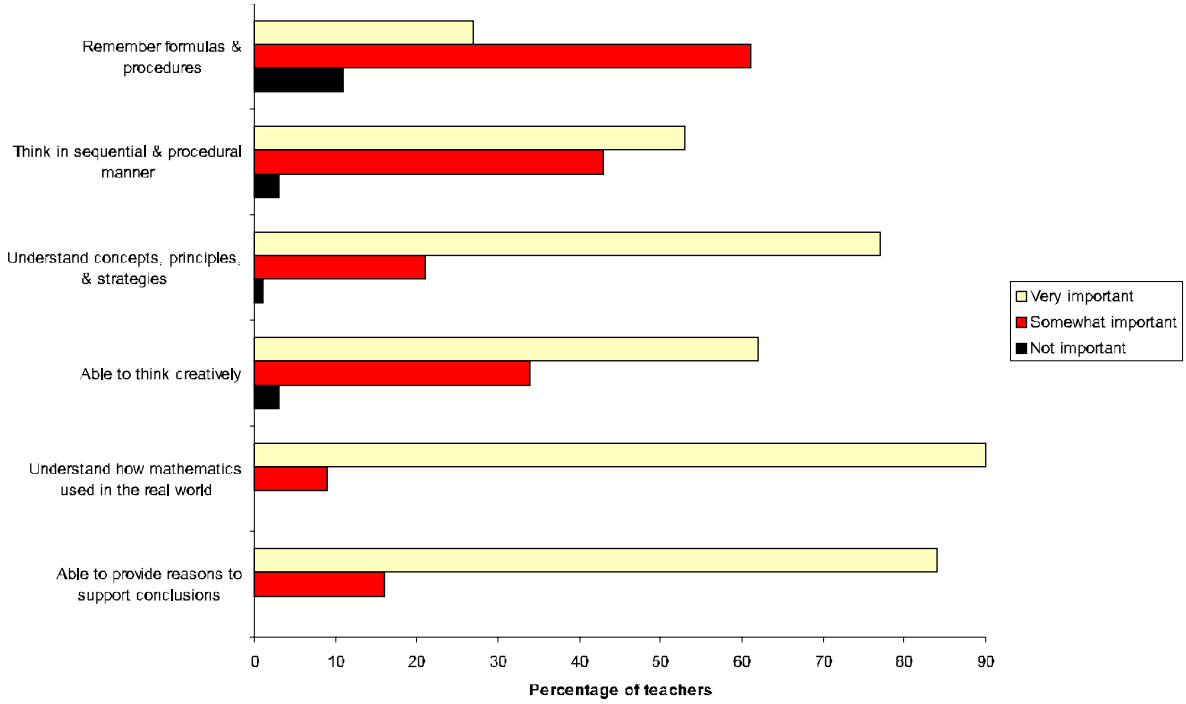
# TEACHERS OPINIONS ON LEARNING MATHEMATICS

## To be Good at Mathematics

To gain an insight into what teachers perceive as being important attributes for students to have in order to become high achievers in mathematics, they were asked to rate (on a three-point scale) the importance of six different concepts or abilities. The results for the population 1 teachers are presented in Figure 7.2.

**Figure 7.2**

**Importance of listed concepts and abilities towards being good at mathematics as rated by standards 2 and 3 teachers**




Notes: 1 Teacher N = 288.
2 Missing data ranged from 0 to 1%.

There were three mathematics concepts and abilities that were rated 'very important' by three-quarters or more of the New Zealand standards 2 and 3 teachers — 'understand how mathematics is used in the real world' (90%), 'able to provide reasons to support conclusions' (84%), and 'understand concepts, principles, and strategies' (77%). Two other concepts and abilities were also rated 'very important' by a majority of teachers, but less strongly — 'able to think creatively' (62%) and 'think in a sequential and procedural manner' (53%). Approximately 60 percent of the primary teachers considered 'remember formulas and procedures' as being only 'somewhat important', while just over one-quarter thought it was 'very important'.

New Zealand teachers were less likely than their counterparts in most other TIMSS population 1 countries to regard it as 'very important' to 'think in a sequential and procedural manner', or to 'remember formulas and procedures'. They were more likely than most to regard it as 'very important' to 'provide reasons to support solutions' and more likely than teachers in any other country to believe it 'very important' to 'understand real world use' of mathematics (Mullis et al, 1997).

## Statements About Mathematics

Teachers' opinions were also sought through their reaction to a series of statements about mathematics in general, as well as the teaching of mathematics. Population 1 teachers were asked to indicate how much they agreed or disagreed (on a four–point scale) with each of the statements. A summary of this data is set out in Table 7.10.

**Table 7.10**

**Extent of standards 2 and 3 teachers' agreement/ disagreement with statements about mathematics**

| Statements | Strongly Disagree (%) | Disagree (%) | Agree (%) | Strongly Agree (%) |
|---|---|---|---|---|
| Mathematics is primarily an abstract subject | 20 | 62 | 15 | 2 |
| Mathematics is primarily a formal way of representing the world | 2 | 31 | 57 | 8 |
| Mathematics is primarily a practical & structured guide to address real situations | 0 | 12 | 62 | 24 |
| If students are having difficulty, an effective approach is to give them more practice by themselves | 18 | 40 | 33 | 6 |
| Some students have a natural talent for mathematics | 1 | 10 | 65 | 23 |
| More than one representation should be used in teaching a mathematics topic | 1 | 1 | 32 | 66 |
| Mathematics should be learned as sets of algorithms or rules that cover all possibilities | 25 | 54 | 18 | 2 |
| Basic computational skills are sufficient for teaching primary school mathematics | 35 | 50 | 11 | 4 |
| A liking for and understanding of students are essential for teaching mathematics | 3 | 9 | 44 | 43 |

Notes: 1 Teachers N = 288.
2 Missing data ranged from 1% to 4%.

The majority of New Zealand teachers disagreed with 'basic computational skills are sufficient for teaching primary school mathematics', 'mathematics is primarily an abstract subject', and 'mathematics should be learned as sets of algorithms or rules that cover all possibilities'. Of the remaining statements which most teachers indicated agreement with, the one showing strongest agreement was 'more than one representation should be used in teaching a mathematics topic'.

New Zealand teachers were less likely than those in a majority of the other countries to agree that 'mathematics is primarily a formal way of representing the real world', or that 'if students are having difficulty, an effective approach is to give them more practice by themselves in class' (Mullis et al, 1997).

## JOB SATISFACTION

### Career Choice

As a point of general interest, population 1 teachers were asked two questions about their careers. Firstly, whether teaching was their first choice as a career when beginning university or teachers college; and secondly, whether they would change to another career if they had the opportunity. Table 7.11 contains a summary of the results.

**Table 7.11**

**Standards 2 and 3 teachers' level of agreement on questions about career choice**

| Question | Yes (%) | No (%) |
|---|---|---|
| Was teaching your first choice as a career? | 85 | 14 |
| Would you change career if the opportunity arose? | 55 | 41 |

Notes: 1 Teachers N = 250.
2 Missing data = 1% to 4%.

Most (85%) of the population 1 teachers indicated that teaching was their first choice as a career. In comparison, only about 60 percent of the form 3 mathematics and science teachers in population 2 indicated that teaching was their first choice (Chamberlain, 1996a & 1996b). However, teachers responses to the second question revealed that more than half would change career given the opportunity. It could be argued that teachers dissatisfied with their careers are unlikely to be fulfilling their teaching potential.

Teaching was not the first choice of career for higher proportions of the population 1 teachers in New Zealand than in several other countries, but New Zealand teachers were the most likely, by a considerable margin, to say they would change career given the opportunity.

## Appreciation of Work

Another interesting issue was the teacher perception of the appreciation of the value of their work. Population 1 teachers were asked to indicate whether or not they thought society and students appreciated their work. The results are presented in Table 7.12.

**Table 7.12**

**Standards 2 and 3 teachers' level of agreement on questions about appreciation of work**

| Question | Yes (%) | No (%) |
|---|---|---|
| Does society appreciate your work? | 30 | 66 |
| Do your students appreciate your work? | 76 | 20 |

Notes: 1 Teachers N = 250.
2 Missing data = 4% to 5%.

About two-thirds of the New Zealand teachers believed that society did not appreciate their work. There were more (8% to 18%) form 2 and form 3 teachers who agreed with this statement (Chamberlain, 1996a & 1996b). But three-quarters of standards 2 and 3 teachers thought that their students appreciated their work, slightly more than was the case for population 2 teachers. More than 90 percent of Thai teachers believed that society appreciated their work, but less than 10 percent of Czech Republic or of Hungarian teachers believed this. In most countries, teachers had somewhat more confidence that students appreciated their work than did New Zealand teachers.

## Ranking of Professions

To provide some insight into how teachers perceive the relative social status of teaching, population 1 teachers were asked to rank their profession alongside eight others. A rank of one was assigned to the profession with the highest status, and nine to the profession with the lowest status. Mean rankings by New Zealand teachers have been calculated and these appear in Table 7.13. Rankings of some vocations varied from country to country, but teachers tended to be given about the same ranks across countries.

A comparison of the teachers' mean rankings reveals that doctors were assigned the highest social status, followed by lawyers and accountants. Standards 2 and 3 teachers ranked secondary teachers higher than primary teachers.

**Table 7.13**

**Mean rankings assigned to nine professions by standards 2 and 3 teachers**

| Profession | Mean Rank |
|---|---|
| Doctor | 1.4 |
| Lawyer | 2.4 |
| Accountant | 3.8 |
| Engineer | 4.3 |
| Senior public servant | 5.5 |
| Secondary teacher | 5.7 |
| Nurse | 6.4 |
| Primary teacher | 6.6 |
| Labourer | 8.8 |

Notes: 1 Teachers N = 240.
2 Highest social status = 1; Lowest social status = 9.

### Books in the Home

The final question in this section asks population 1 teachers to estimate the number of books in their homes. This question is traditionally included in student questionnaires in IEA studies because number of books in students' homes correlates with achievement (Caygill, 1993). In TIMSS it was hypothesised to be a surrogate measure for teacher cultural capital. Overall, almost 80 percent of teachers had 100 books or more in their homes, with over half (54%) of these having more than 200.

## CHARACTERISTICS OF MATHEMATICS CLASSES

### Amount of Instruction Time

As a measure of the degree to which New Zealand students have an opportunity to learn, population 1 teachers were asked to calculate the total number of minutes per week devoted to the teaching of mathematics to their class. Table 7.14 contains summary statistics of the amount of instruction time.

**Table 7.14**

**Number of minutes per week standards 2 and 3 teachers teach mathematics to their classes: summary statistics**

| | |
|---|---|
| N | 245 |
| Median | 225.0 |
| Mean | 211.7 |
| Std Deviation | 67.9 |

On average, students at the middle primary level received about 212 minutes of mathematics instruction per week. Thirteen percent of teachers said their classes were receiving 300 minutes or more of instruction in mathematics, while at the other end almost 10 percent of students managed only 60 minutes or less of instruction per week.

The mean number of total available instructional minutes per week reported by schools was 1473.0 at the standards 2 and 3 level. Therefore, it can be estimated that population 1 teachers were spending, on average, about 14 percent of their total instructional time teaching mathematics. As a comparison, standard 3 teachers in 1990 were spending one-fifth (22%) of their time on reading instruction and another 29 percent of the instruction time on language, writing, and other literature activities (Chamberlain, 1993). This much lower emphasis given to mathematics instruction was also evident in the junior class levels as reported in the evaluation of the *Beginning School Mathematics* resource (Visser & Bennie, 1996).

In comparison with median teaching times for mathematics reported by teachers in other countries, New Zealand was about the middle of the range, but times were greater in other English language countries (Singapore 330 minutes; England and United States 300 minutes; Ireland 260 minutes; Australia, Scotland, and Canada 250 minutes).

**Language of Instruction**

With an increasing number of Maori immersion and bilingual schools, and the development of schools offering instruction in Samoan, the effect of language of instruction is of increasing interest. Standards 2 and 3 teachers were asked to indicate the primary language of instruction used to teach mathematics. In nearly all the classes in the population 1 sample, the primary language of instruction was English. However, there were three classes, or one percent of the sample, where instruction was conducted in te reo Maori. The number of students being taught in bilingual or immersion classes is still relatively small and the probability of their being selected in a random sample is very low, but with the steady increase in Kura Kaupapa Maori, future IEA studies are likely to show a change in this.

**Use of Textbooks and Other Resources**

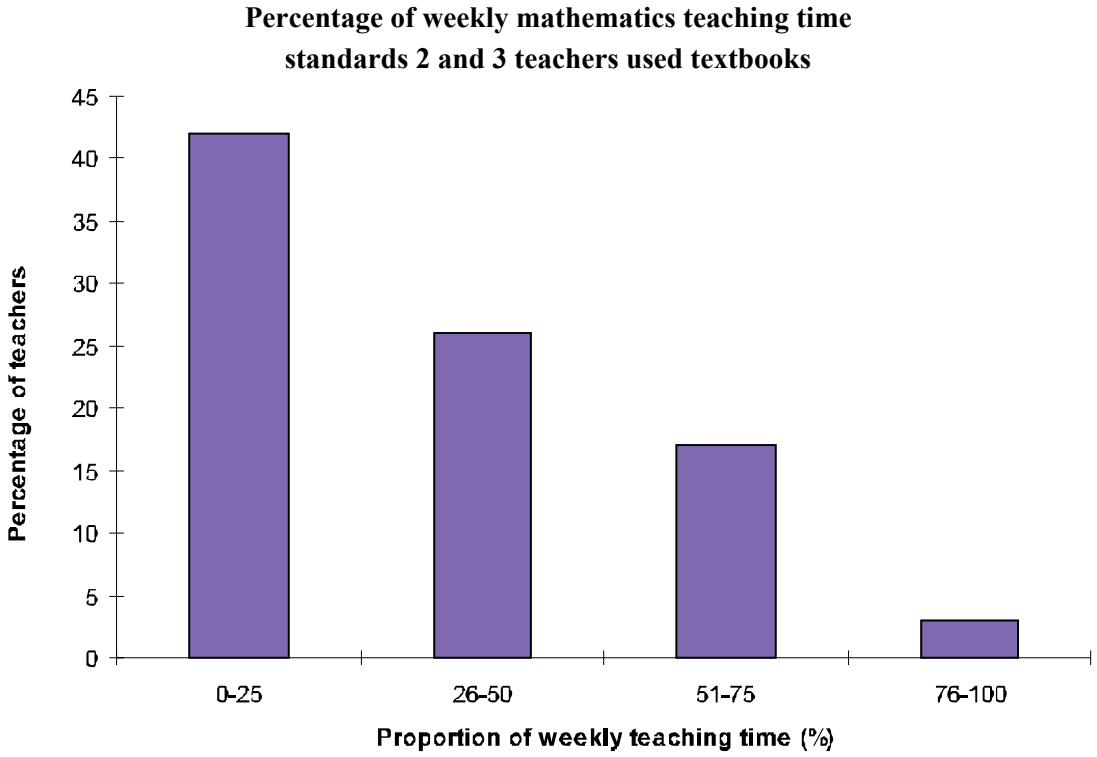
To ascertain the extent of textbook use, population 1 teachers were asked to indicate whether or not they used a textbook in teaching mathematics to their class. In addition, those who said yes were also asked to supply details of the textbooks they used most often.

In most countries, textbooks are used extensively by teachers in teaching mathematics at this level. Only in Australia and New Zealand do less than 94 percent of upper grade (standard 3 level) teachers use them (Mullis et al, 1997).

Just over 70 percent (N = 179) of the New Zealand standards 2 and 3 teachers used mathematics textbooks. The most commonly cited textbook by these teachers was *School Mathematics*, followed by *Young Australian Mathematics*.

It was considered important to try and measure the proportion of instructional time based on texts. Population 1 teachers were asked to estimate the percentage of their weekly mathematics teaching time which was based on textbooks. The results are summarised in Figure 7.3.

**Figure 7.3**




Notes: 1 Teachers N = 250.
2 Missing data = 11%.

Figure 7.3 shows that most standards 2 and 3 teachers report making little used of mathematics textbooks to support their teaching. It would be of interest to learn what, if any, resources are being used by these teachers.

## Use of Groups in Mathematics Class

To gauge the extent that population 1 teachers grouped students when teaching their mathematics class, they were asked to indicate the frequency (on a three-point scale) of this practice. The results are reported in Table 7.15.

All standards 2 and 3 teachers divided their class into groups, at least some of the time, to teach mathematics.

New Zealand population 1 teachers were much more likely than teachers in any other country except Scotland to use grouping, and to use it frequently. They were also among the least likely to use whole-class teaching (Mullis et al, 1997).

**Table 7.15**

**Frequency that standards 2 and 3 teachers use groups in their mathematics class**

| Frequency | Percent of teachers |
|---|---|
| Never | 0 |
| Sometimes | 52 |
| Always | 46 |

Notes: 1 Teacher N = 255.
2 Missing data = 2%.

## Limitations to the Quality of Teaching

The quality of classroom teaching can often be affected, or even disrupted, by the actions of the students or parents, or through a lack of resources. Population 1 teachers were asked to consider to what extent the following situations limit how they taught their mathematics class. A summary of the data is presented in Table 7.16.

At the standards 2 and 3 level, the main limitation on how they taught mathematics was said to be the 'high student/teacher ratio', with over one-fifth of teachers indicating the strongest category. Other major limitations identified by teachers included 'students with different academic abilities', 'disruptive students', 'lack of student instructional equipment', 'students with special needs', and 'lack of equipment for teacher demonstrations'.

The limitations which teachers felt had the least negative impact on their mathematics teaching were 'threats to teacher or student safety', where over 80 percent of standards 2 and 3 teachers indicated it had no influence. On the other hand, the fact that eight percent of teachers find the latter a problem

is still a matter for concern. The majority of teachers also considered three other limiting factors as not being a problem – 'low morale among teachers', 'parents interested in children's schooling', and 'low morale among students'.

Correlation analyses produced a number of significant negative correlations between the limitations listed in Table 7.16 and student achievement in mathematics. Standards 2 and 3 teachers who rated 'students with special needs' ($r = –0.27$, $p < 0.0007$), 'uninterested students' ($r = –0.26$, $p < 0.0012$), 'disruptive students' ($r = –0.24$, $p < 0.0030$), 'parents uninterested in children's schooling' ($r = –0.29$, $p < 0.0004$), 'lack of student instructional equipment' ($r = –0.21$, $p < 0.0095$), 'low morale among teachers' ($r = –0.25$, $p < 0.0018$), and 'low morale among students' ($r = –0.26$, $p < 0.0015$) as major limitations on how they taught their science classes were more likely to have students who did poorly in mathematics.

**Table 7.16**

**Factors that limit how standards 2 and 3 teachers teach their mathematics class**

| Limiting factor | None (%) | A little (%) | Quite a lot (%) | A great deal (%) |
|---|---|---|---|---|
| Students with different academic abilities | 14 | 40 | 32 | 11 |
| Students with different social backgrounds | 33 | 46 | 15 | 4 |
| Students with special needs | 34 | 40 | 14 | 9 |
| Uninterested students | 21 | 54 | 19 | 4 |
| Disruptive students | 25 | 43 | 20 | 10 |
| Parents interested in children's schooling | 64 | 22 | 11 | 2 |
| Parents uninterested in children's schooling | 51 | 31 | 11 | 4 |
| Lack of computer hardware | 39 | 35 | 16 | 6 |
| Lack of computer software | 38 | 36 | 16 | 6 |
| Lack of student instructional equipment | 23 | 43 | 22 | 9 |
| Lack of equipment for teacher demonstrations | 26 | 44 | 21 | 7 |
| Inadequate physical facilities | 37 | 36 | 19 | 5 |
| High student/teacher ratio | 21 | 22 | 33 | 22 |
| Low morale among teachers | 75 | 15 | 6 | 3 |
| Low morale among students | 58 | 28 | 8 | 3 |
| Threats to teacher/student safety | 84 | 6 | 3 | 5 |

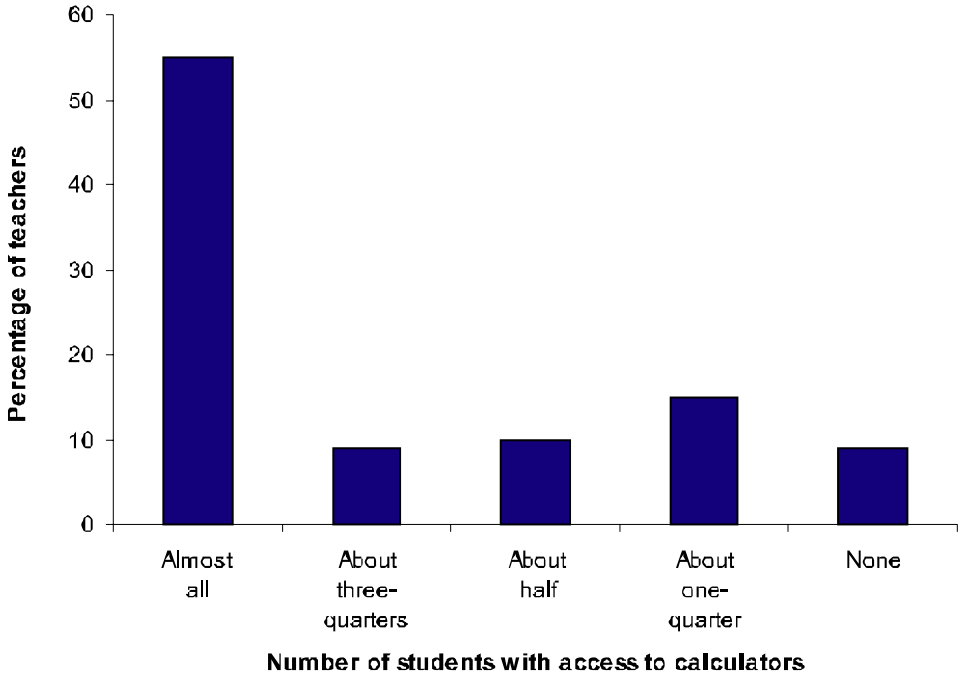
Notes: 1 Teachers N = 254.
2 Missing data = 4 to 12%.

## Use of Calculators

One of the recent changes to national curricula has seen the inclusion of technology. This incorporates, in part, encouragement of the use of calculators and also computers. The focus here was to gain some insight into how wide-spread the use of calculators was at the population 1 level, as well as the types of activities that teachers have their students use them for. Figure 7.4 and Table 7.17 contain a summary of the data on calculators.

**Figure 7.4**

**Proportion of standards 2 and 3 teachers indicating how many of their students had access to calculators during mathematics lessons**




Notes: 1 Teachers N = 254.
2 Missing data = 2%.

Figure 7.4 shows that over half (55%) of the population 1 teachers indicated that 'almost all' of their students had access to calculators during mathematics lessons, while a further 15 percent of teachers said 'about one-quarter' of the students had access to calculators. Nine percent of teachers reported that 'none' of their students had access to calculators.

What type of activities during mathematics lessons did the teachers have their students use a calculator for and how frequently were they used? About three-quarters of standards 2 and 3 teachers said that calculators were 'never or very rarely' used by their students for 'tests and exams'. Approximately one-third of teachers responded that calculators were used in 'routine computation',

'solving complex problems', and 'exploring number concepts' on a weekly basis, with 12 to 13 percent of these doing so 'almost every day'. At the population 2 level, teachers had their students using calculators more often for 'routine computation', 'solving complex problems', and 'exploring number concepts' when teaching mathematics (Chamberlain, 1996a). Nearly one-fifth of the students (see Chapter 6) reported that they 'never' used calculators during mathematics lessons, while 57 percent used calculators in 'some lessons'.

**Table 7.17**

**Frequency with which standards 2 and 3 students used calculators in mathematics classes**

| Activities | Almost every day (%) | Once or twice a week (%) | Once or twice a month (%) | Never or very rarely (%) |
|---|---|---|---|---|
| Checking answers | 19 | 41 | 24 | 14 |
| Tests and exams | 1 | 3 | 13 | 78 |
| Routine computation | 13 | 31 | 29 | 23 |
| Solving complex problems | 12 | 35 | 32 | 17 |
| Exploring number concepts | 12 | 34 | 36 | 16 |

Notes: 1 Teachers N = 255.
2 Missing data = 3 to 6%.

Calculators were said by teachers to be used 'never or hardly ever' in class by almost all 9-year-olds students in most countries. Exceptions to this included New Zealand, England, Australia, United States, and Canada (Mullis et al, 1997).

## Planning Mathematics Lessons

To find out how population 1 teachers plan for their mathematics lessons, teachers were asked to report their main source of written information when planning different aspects (eg which topics to teach; how to present a topic) of a mathematics lesson. Tables 7.18 and 7.19 present the results collected on lesson planning.

**Table 7.18**

**Extent of standards 2 and 3 teachers' reliance on selected sources to plan mathematics lessons**

| Sources | Never (%) | Rarely (%) | Sometimes (%) | Always (%) |
|---|---|---|---|---|
| Own previously prepared lessons | 9 | 15 | 55 | 21 |
| Written plan by teachers at school | 38 | 20 | 30 | 10 |
| Other teachers/mathematics specialists at school | 22 | 34 | 40 | 3 |
| Student textbooks | 7 | 22 | 59 | 9 |
| Other texts or resource books | 0 | 5 | 64 | 29 |
| Teacher guides/edition of textbook | 7 | 18 | 53 | 20 |
| External examinations or standardised tests | 53 | 27 | 15 | 2 |

Notes: 1 Teachers N = 254.
2 Missing data = 2 to 3%.

At the middle primary level, about 30 percent of teachers 'always' used 'other texts or resource books' to plan mathematics lessons, while almost two-thirds of the teachers did this 'sometimes'. The next most commonly used sources included 'own previously prepared lessons' and 'teacher guides/edition of textbook', where one-fifth of the teachers used these 'always'. Teachers also used 'student textbooks' frequently as well. The sources least likely to be used by teachers for planning lessons were 'external examinations or standardised tests' and, to a lesser extent, 'written plan by teachers at school' and 'other teachers/mathematics specialists at school'. In comparison, population 2 teachers were more likely to place greatest emphasis on 'own previously prepared lessons' when planning their mathematics lessons, and form 3 teachers also gave more weight to 'external examinations or standardised tests' (Chamberlain, 1996a).

In terms of deciding 'which topics to teach', over two-thirds of the standards 2 and 3 teachers used the 'national mathematics curriculum' and a further 16 percent used the 'school curriculum guide'. Teachers were more likely to use 'other resource books' (one-third), 'teacher edition of textbook' (one-quarter), and the 'national mathematics curriculum' (one-fifth) in deciding 'how to present a topic'. The majority of population 1 teachers cited 'other resource books' when 'selecting problems and exercises for classwork', and finally for 'selecting problems and applications for assessment', one-third of teachers used 'other resource books' and another 25 percent the 'national mathematics curriculum'. At the population 2 level, over half of the form 3 mathematics teachers used the 'student edition of the textbook' as a source for 'selecting problems and exercises for classwork' (Chamberlain, 1996a).

**Table 7.19**

**Main sources of information used by standards 2 and 3 teachers to plan their mathematics lesson**

| Sources | Which topics to teach (%) | How to present a topic (%) | Selecting problems/ exercises for classwork (%) | Selecting problems/ applications for assessment (%) |
|---|---|---|---|---|
| National examination prescriptions | 0 | 0 | 0 | 0 |
| National mathematics curriculum | 69 | 20 | 9 | 25 |
| School curriculum guide | 16 | 9 | 2 | 12 |
| Teacher edition of textbook | 6 | 25 | 19 | 15 |
| Student edition of textbook | 0 | 6 | 23 | 5 |
| Other resource books | 3 | 34 | 40 | 35 |

Notes: 1 Teachers N = 254.
2 Missing data = 5 to 8%.

# TYPICAL MATHEMATICS LESSON

To construct a picture of a 'typical' mathematics lesson at the standards 2 and 3 level, teachers were asked to respond to a series of questions based on the most recent lesson in which they taught mathematics. There is no equivalent section for science at this level.

## Duration of the Recent Typical Lesson

Population 1 teachers were asked to record — in minutes — the duration of a recent mathematics lesson. A summary of the data is presented in Table 7.20.

**Table 7.20**

**Duration of a typical mathematics lesson recorded by standards 2 and 3 teachers: summary statistics (minutes)**

| | |
|---|---|
| N | 240 |
| Range | 10–90 |
| Median | 45.0 |
| Mean | 45.2 |
| Std deviation | 9.7 |

The typical mathematics lesson taught by New Zealand standards 2 and 3 teachers was 45 minutes in duration, a similar length to population 1 mathematics lessons in most countries. As a comparison at the population 2 level, Chamberlain (1996a) reported that the typical mathematics lessons were slightly longer for New Zealand form 2 (49 minutes) and form 3 (56 minutes) teachers respectively.

## Mathematics Topics Taught in the Recent Typical Lesson

To investigate how various mathematics topics were being taught, population 1 teachers were first asked to indicate from a list of topics those that they were teaching in their most recent typical lesson. Table 7.21 contains a summary of the results.

**Table 7.21**

**Mathematics topics standards 2 and 3 teachers taught in the recent, typical lesson**

| Topics | Percent of teachers |
|---|---|
| Whole numbers | 45 |
| Common fractions | 15 |
| Decimal fractions | 12 |
| Percentages | 4 |
| Other number sets & concepts | 16 |
| Number theory | 20 |
| Estimation & number sense | 38 |
| Measurement units & processes | 29 |
| Perimeter, area, & volume | 12 |
| Basics of 1 & 2 dimensional geometry | 6 |
| Geometric congruence & similarity | 4 |
| Geometric transformations & symmetry | 8 |
| Constructions & 3 dimensional geometry | 9 |
| Ratio & proportion | 6 |
| Functions, relations & patterns | 22 |
| Equations, inequalities, & algebraic formulas | 11 |
| Probability & statistics | 14 |
| Sets & logic | 10 |
| Problem solving strategies | 52 |
| Other mathematics content | 18 |

Notes: 1 Teachers N = 254.
2 Missing data = 15 to 24%.

The most commonly taught mathematics topics during a recent typical lesson by standards 2 and 3 teachers included 'problem solving strategies', 'whole numbers', and 'estimation and number sense'. Mathematics topics that teachers were least likely to be teaching at that stage of the year (last half of October) were 'percentages', 'geometric congruence and similarity', 'basics of one- and two-dimensional geometry', and 'ratio and proportion'. The data illustrate the wide range of topics under study, a situation which is likely to be true at any stage of the school year. This suggests that many of the topics may have received a rather cursory treatment, or alternatively, that the content standards 2 and 3 mathematics classes are exposed to over the course of a year may vary considerably from school to school.

Three-quarters of the standards 2 and 3 teachers reported that the lesson they had selected was a continuation of a previous lesson, while 15 and 11 percent respectively said it was an introduction or the end of a topic.

**Homework Given in the Recent Typical Lesson**

Two questions about homework were asked of population 1 teachers: firstly, did they assign homework after their most recent typical mathematics lesson; and secondly, if yes, how much time would it take for a typical student to complete this homework?

Only about one-quarter of the standards 2 and 3 teachers said they assigned mathematics homework after their most recent lesson. Table 7.22 contains a summary of the amount of time that teachers estimated for a typical student to complete the homework.

The mean estimates given by New Zealand teachers revealed that they thought a typical population 1 student would take nearly 17 minutes to complete the homework, about the same as the estimates of teachers in most other countries, usually once or twice a week. At the population 2 level, the mean teacher estimate of the time a typical student would take to complete mathematics homework was 21 minutes (Chamberlain, 1996a).

**Table 7.22**

**Standards 2 and 3 teachers' estimates of the number of minutes for a 'typical' student to complete their mathematics homework: summary statistics (minutes)**

| | |
|---|---|
| N | 56 |
| Median | 15.0 |
| Mean | 16.6 |
| Std deviation | 15.3 |

## Order of the Recent Typical Lesson

Presented with a list of classroom activities that may occur during a lesson, population 1 teachers were asked to describe how their lesson developed by ranking in order of use the listed activities. In addition, teachers were also asked to record the number of minutes they spent on each activity. The results are displayed in Table 7.23.

Most teachers began their mathematics lesson with a 'review of previous lesson(s)' and/or 'a short quiz or test to review previous lesson', although one-third of teachers did not use the latter at all. This was then followed by a 'review or correction of previous lesson's homework' before the teacher's 'introduction' and 'development' of the lesson's topic. The final phase of the lesson involved the 'assignment of student homework'.

**Table 7.23**

**Mean rank order and number of minutes standards 2 and 3 teachers spent on activities during a typical mathematics lesson**

| Classroom activities | Mean rank order | Mean no. of mins | Percentage not using |
|---|---|---|---|
| Review of previous lesson(s) | 1.4 | 6.4 | 9 |
| A short quiz or test to review previous lesson | 1.4 | 6.8 | 35 |
| Oral recitation or drill (students responding aloud) | 2.1 | 5.1 | 41 |
| Review or correction of previous lesson's homework | 2.3 | 7.2 | 50 |
| Introduction of a topic (class discussion, teacher explanation/demonstration, film, video, use of concrete materials etc) | 2.3 | 8.3 | 32 |
| Development of a topic (class discussion, teacher explanation/demonstration, group problem solving, film, video, etc) | 2.9 | 11.4 | 5 |
| Small group activities (with or without teacher) | 3.7 | 16.2 | 10 |
| Students do paper-and-pencil exercises related to topic (not the same as homework) | 4.4 | 15.0 | 9 |
| Assignment of student homework | 5.5 | 5.8 | 46 |
| Students work on homework in class | 5.6 | 7.0 | 54 |

Notes: 1 Teachers N = 254.
2 Mean rank order: 1.0 = first to 10.0 = tenth.
3 Missing data = 15 to 44%.

Teachers also reported that they allocated the largest amounts of time to the following classroom activities — 'small group activities', 'students do paper and pencil exercises related to topic' and 'development of a topic'. There were three activities which between 46 and 54 percent of the teachers did not use at all, namely — 'students work on homework in class', 'review or correction of previous lesson's homework', and 'assignment of student homework'.

### Use of Small Groups in the Recent Typical Lesson

Teachers reported how often during their most recent typical mathematics lesson they made use of small group work. Small groups includes pairs of students working together. The results can be found in Table 7.24.

**Table 7.24**

**Frequency with which standards 2 and 3 teachers used small group work (including pairs) in their typical mathematics lesson**

| Frequency | Percent of teachers |
|---|---|
| None of the time | 8 |
| Some of the time | 71 |
| All the time | 18 |

Notes: 1 Teachers N = 254.
2 Missing data = 4%.

Almost 90 percent of standards 2 and 3 teachers used small group work during their recent typical mathematics lesson, with nearly one-fifth of these doing this 'all the time'. Only eight percent of teachers recorded 'none of the time'. As a comparison at the population 2 level, three-quarters of the form 2 teachers reported using small group activities 'all the time' (Chamberlain, 1996a).

# GENERAL CLASSROOM PRACTICES

## Guiding Students' Approaches

Teachers indicated how frequently (on a four-point scale) they direct, or ask, their students to undertake listed instructional approaches in mathematics. The results are summarised in Table 7.25.

**Table 7.25**

**Frequency with which standard 2 and 3 teachers use particular instructional techniques during mathematics lessons**

| Instructional techniques: Ask students to . . . | Almost never (%) | Some lessons (%) | Most lessons (%) | Every lesson (%) |
|---|---|---|---|---|
| explain the reasoning behind an idea | 1 | 23 | 56 | 16 |
| represent and analyse relationships using tables, charts or graphs | 6 | 79 | 10 | 1 |
| work on problems for which there is no immediately obvious method of solution | 24 | 62 | 9 | 1 |
| use computers to solve exercises or problems | 67 | 28 | 2 | 0 |
| write equations to represent relationships | 10 | 54 | 29 | 3 |
| practice computational skills | 2 | 29 | 45 | 21 |

Notes: 1 Teachers N = 254.
2 Missing data = 3 to 4%.

The two most commonly used listed instructional techniques in mathematics included asking their students to 'explain the reasoning behind an idea' and 'practice computational skills'. In contrast, two-thirds of the teachers reported that they 'never or almost never' had their students 'use computers to solve exercises or problems', while one-quarter reported the same for 'work on problems for which there is no immediately obvious method of solution'.

## Incorrect Student Responses

Teachers were asked to indicate how often they applied each of four listed methods when their students responded incorrectly during a class discussion on mathematics. Table 7.26 contains a summary of the results.

**Table 7.26**

**Frequency with which standards 2 and 3 teachers applied listed approaches when their students responded incorrectly**

| Approach taken by teacher | Almost never (%) | Some lessons (%) | Most lessons (%) | Every lesson (%) |
|---|---|---|---|---|
| Correct the student's error in front of the class | 48 | 41 | 6 | 1 |
| Ask the student another question to help him or her get the correct response | 1 | 21 | 58 | 17 |
| Call on another student who's likely to give the correct response | 25 | 59 | 11 | 1 |
| Call on other students to get their responses and then discuss what is correct | 21 | 56 | 19 | 3 |

Notes: 1 Teachers N = 254.
2 Missing data = 3 to 4%.

Teachers at the middle primary level were unlikely to respond to their students incorrect responses by 'correcting the student's error in front of the class' or, to a lesser extent, 'call on another student who's likely to give the correct response' or 'call on other students to get their responses and then discuss what is correct'. Rather, the teachers were far more inclined to 'ask the student another question to help him or her get the correct response'. Population 2 teachers of mathematics were more likely to use 'call on other students to get their responses and then discuss what is correct' in comparison to their standards 2 and 3 colleagues (Chamberlain, 1996a).

## Organisation of Mathematics and Science Classes

To find how population 1 teachers organise their mathematics and science classes, they were asked to record how frequently they employed each of six different listed organisational situations. The results are presented in Table 7.27.

The most commonly used approaches to class organisation during mathematics at the standards 2 and 3 level were to have students to 'work in pairs or small groups with assistance from the teacher' and 'work individually with assistance from the teacher'. A large majority of teachers indicated that five organisational approaches were used for 'some lessons'. There was no real difference compared with the results of the form 2 teachers, but approximately one-quarter of form 3 mathematics teachers 'never or almost never' used the first, fourth, and fifth listed approaches to class organisation (Chamberlain, 1996a).

**Table 7.27**

**Frequency with which standards 2 and 3 teachers used listed class organisational situations during mathematics and science**

| Class organisation: Students . . . | Mathematics | | | | Science | | | |
|---|---|---|---|---|---|---|---|---|
| | Almost never (%) | Some lessons (%) | Most lessons (%) | Every lesson (%) | Almost never (%) | Some lessons (%) | Most lessons (%) | Every lesson (%) |
| work individually without assistance from the teacher | 11 | 61 | 16 | 9 | 19 | 67 | 9 | 1 |
| work individually with assistance from the teacher | 1 | 51 | 39 | 5 | 7 | 72 | 17 | 2 |
| work together as a class with the teacher teaching the whole class | 13 | 70 | 11 | 3 | 7 | 72 | 16 | 1 |
| work together as a class with students responding to one another | 9 | 68 | 16 | 3 | 5 | 66 | 23 | 2 |
| work in pairs or small groups without assistance from the teacher | 8 | 65 | 19 | 5 | 8 | 71 | 16 | 1 |
| work in pairs or small groups with assistance from the teacher | 1 | 45 | 42 | 9 | 0 | 58 | 35 | 3 |

Notes: 1 Teachers N = 254.
2 Missing data = 2 to 4%.

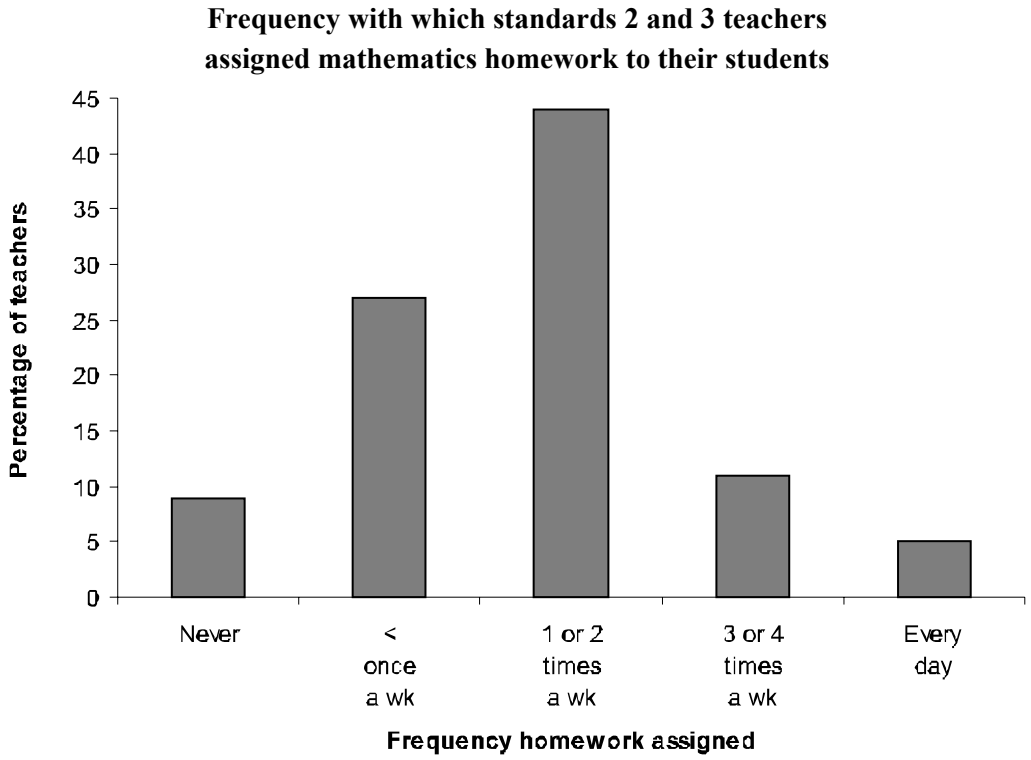
For science classes, 'work in pairs or small groups with assistance from the teacher' and 'work together as a class with students responding to one another', were the most frequently used approaches of organisation. As for mathematics, large numbers of teachers used all of the approaches sometimes. Slightly more (16 to 18%) form 3 science teachers 'never or almost never' used the fourth and fifth listed approaches to class organisation (Chamberlain, 1996b).

## Mathematics Homework

The many claimed benefits of homework have been well documented by researchers (see, for example, Burnham, 1988), and a positive association between setting of homework and student achievement is commonly found.

Population 1 teachers were asked four questions about homework. Firstly, how often did they assign mathematics homework for their students? The data has been presented in Figure 7.5.

**Figure 7.5**




Notes: 1 Teachers N = 254.
2 Missing data = 4%.

Forty-four percent of the standards 2 and 3 teachers assigned mathematics homework to their students 'one or two times a week', while just over one-quarter of the teachers gave homework 'less than once a week'.

The second question about homework for population 1 teachers asked them, "If you assign mathematics homework, how many minutes of homework do you usually assign to your students?"

Over half (56%) of the standard 2 and 3 teachers assigned 'less than 15 minutes' of mathematics homework to their students, and a further 38 percent of teachers allocated '15–30 minutes' of homework. In comparison, between 60 and 75 percent of form 2 and form 3 teachers reported that they gave '15–30 minutes' of mathematics homework (Chamberlain, 1996a).

The third question about homework for population 1 teachers asked those teachers who assign mathematics homework to indicate (on a four-point scale) how often they assign different types of homework to their students. The results are summarised in Table 7.28.

**Table 7.28**

**Types of mathematics homework assigned to students by standards 2 and 3 teachers**

| Types of homework | Never (%) | Rarely (%) | Sometimes (%) | Always (%) |
|---|---|---|---|---|
| Worksheets or workbook | 16 | 16 | 47 | 18 |
| Problem/question sets in textbook | 57 | 15 | 22 | 1 |
| Reading in a textbook or supplementary materials | 82 | 7 | 6 | 0 |
| Writing definitions or other short writing assignment | 75 | 12 | 6 | 0 |
| Small investigation(s) or gathering data | 7 | 15 | 70 | 3 |
| Working individually on long term projects or experiments | 52 | 23 | 19 | 0 |
| Working as a small group on long term projects or experiments | 67 | 20 | 7 | 0 |
| Finding one or more uses of the content covered | 37 | 23 | 34 | 1 |
| Preparing oral reports either individually or as a small group | 61 | 21 | 13 | 0 |
| Keeping a journal | 75 | 12 | 7 | 0 |

Notes: 1 Teachers N = 230.
2 Missing data = 3 to 7%.

The responses of the standards 2 and 3 teachers revealed that only two of the listed types of mathematics homework were used 'sometimes' or 'always', namely 'small investigation(s) or gathering data' (73%) and 'worksheets or workbook' (65%). Interestingly, seven of the ten homework tasks were 'never' used by between 50 and 80 percent of the New Zealand teachers; these included 'problem/question sets in textbook', 'reading in a textbook or supplementary materials', 'writing definitions or other short writing assignment', 'working individually on long-term projects or experiments', 'working as a small group on long projects or experiments', 'preparing oral reports either individually or as a small group', and 'keeping a journal'. Differences at the population 2 level included form 2 teachers' greater use of 'finding one or more uses of the content covered', while the form 3 mathematics teachers assign 'problems/question sets in textbook' to their students more often (Chamberlain, 1996a).

The final question about homework for population 1 teachers asked those who assign mathematics homework to their students to indicate how often they completed listed tasks for the administration, marking, and feedback of the homework. A summary of the results can be seen in Table 7.29.

**Table 7.29**

**Frequency with which standards 2 and 3 teachers completed listed mathematics homework-related tasks**

| Homework-related tasks | Never (%) | Rarely (%) | Sometimes (%) | Always (%) |
|---|---|---|---|---|
| Record whether or not the homework was completed | 12 | 5 | 29 | 50 |
| Collect, correct, and keep assignments | 45 | 20 | 18 | 11 |
| Collect, correct assignments, and then return to students | 11 | 8 | 25 | 50 |
| Give feedback on homework to whole class | 5 | 8 | 36 | 47 |
| Have students correct their own assignments in class | 19 | 15 | 50 | 10 |
| Have students exchange assignments and correct them in class | 41 | 21 | 30 | 3 |
| Use it as a basis for class discussion | 9 | 12 | 67 | 9 |
| Use it to contribute towards students' grades or marks | 52 | 20 | 19 | 3 |

Notes: 1 Teachers N = 221.
2 Missing data = 4 to 6%.

About half of the standards 2 and 3 teachers would 'always' 'record whether or not the homework was completed', 'collect, correct assignments, and then return to students', and 'give feedback on homework to whole class', while another 25 to 36 percent of teachers completed these tasks 'sometimes'. Other tasks teachers carried out on a frequent basis in response to their students' mathematics homework included 'have students correct their own assignments in class' (60%) and 'use it as a basis for class discussion' (75%). In contrast, between 60 and 75 percent of the teachers 'never' or 'rarely' used 'collect, correct and keep assignments', 'have students exchange assignments and correct them in class', and 'use it to contribute towards students' grades or marks'. At the population 2 level, the teachers used their students' homework to ' . . . contribute towards students' grades or marks' more often (Chamberlain, 1996a).

On average, New Zealand teachers assign less homework in mathematics than teachers in other countries, with the exception of the Netherlands, but most assign some homework on a regular basis.

# CHARACTERISTICS OF SCIENCE CLASSES

## Amount of Instruction Time

As a measure of the degree to which New Zealand students have an opportunity to learn, population 1 teachers calculated the total number of minutes per week devoted to the teaching of science to their class. The teachers also indicated how science was taught, that is, as a separate subject or integrated with other subjects.

Forty-three percent of standards 2 and 3 teachers reported that they taught science as a separate subject, whereas 52 percent indicated that they taught science by integrating it with other subjects. Table 7.30 contains summary statistics of the amount of instruction time.

**Table 7.30**

**Number of instructional minutes per week standards 2 and 3 teachers teach separate science and integrated science to their class: summary statistics**

| Statistic | Separate | Integrated |
|---|---|---|
| N | 96 | 118 |
| Median | 60.0 | 60.0 |
| Mean | 81.3 | 83.0 |
| Std deviation | 57.0 | 57.9 |

There was little difference between the mean number of instructional minutes per week of science taught by standards 2 and 3 teachers as either a separate subject or integrated with other subjects. In contrast, the mean number of minutes per week for mathematics, reported earlier in this chapter, was 212. Given that the mean number of total available instructional minutes per week reported by schools was 1473.0, it can be estimated that, on average, population 1 teachers were spending between five and six percent of their total instructional time teaching science. Compare this to the 14 percent teaching mathematics and 22 percent on reading instruction.

How does this compare internationally? In FISS (1970–71) the mean percent of instruction time reported by 14 countries for science at the 10-year-old level was 11 minutes (Comber & Keeves, 1973). Over a decade later in SISS, with data collected across 14 different countries and at the same age level, the figure was 15 minutes (Postlethwaite & Wiley, 1992).

In most TIMSS countries, more teaching time is devoted to science at this level. In ten countries, the median time allocated was at least twice that for New Zealand.

**Language of Instruction**

With an increasing number of Maori immersion and bilingual schools, and the development of schools offering instruction in Samoan, the effect of language of instruction is of increasing interest. For nearly all the classes in the population 1 sample, the primary language of instruction for science was English. However there were four classes, or two percent of the sample, where instruction was conducted in te reo Maori. The number of students being taught in bilingual or immersion classes is still relatively small and the probability of their being selected in a random sample is very low.

## SUMMARY

The data presented in this chapter on the New Zealand standards 2 and 3 teachers who participated in TIMSS provide profiles not only of the 'average' teacher and class at the population 1 level, but also of the strategies and approaches these teachers used to teach mathematics and science. Selected international results have been included to provide a contrast.

In New Zealand, the 'typical' teacher of standards 2 and 3 mathematics and science was a female, 40-years-old, had completed secondary school and a college of education programme, had between 14 and 15 years of teaching experience, was teaching on a full-time basis, and spent about 14 and six percent of their total weekly instructional time teaching mathematics and science, respectively. For most of the teachers, teaching was their first choice as a career but over half would change jobs if the opportunity arose.

The 'typical' standards 2 and 3 class was a composite class of approximately 30 students. During mathematics lessons textbooks and calculators were used for some of the instructional time, the class was organised into smaller groups, and they received 15 to 30 minutes of mathematics homework once or twice a week.

Data was also collected to develop profiles of a 'typical mathematics lesson' for standards 2 and 3 teachers.

The results from TIMSS provide useful insights into characteristics of population 1 teachers of mathematics and science, their classes, and the practices and strategies they employ to teach mathematics and science in New Zealand. In addition, the data collected will provide a basis for further analysis and comparisons with future studies.