Patterns of Performance and Progress of NDP Students in 2008

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The Numeracy Development Projects (NDP) have been implemented in New Zealand schools for almost a decade. The first part of this paper analyses the results of students in schools participating in the NDP for the first time in 2008. Analysis of the students' performance at the end of a year spent on the NDP showed that students in the early school years made substantial progress on the additive domain, with almost all students at stage 4 (advanced counting) or higher by the end of year 3. By the end of years 7 and 8, performance on the multiplicative and proportional domains was higher than on the additive domain. Comparison of students' performance with the curriculum level expectations (Ministry of Education, n.d.) showed that only year 2 students were close to level 1 curriculum expectations. At years 4, 6, and 8, only about half of the students were close to the expectations for curriculum levels 2, 3, and 4 respectively. Analysis showed that students' performance varied as a function of school decile, with students at high-decile schools performing better than those at middle- and low-decile schools. In the second part of the paper, an analysis of students at schools that submitted data in both 2007 and 2008 showed virtually no improvement in the second year of the NDP, except for year 2 students. Analysis of students' average stage at the beginning of the NDP and gain scores showed that in the primary years (0–6), those who started lower on the Number Framework tended to make greater gains, particularly on the additive domain. By the year 7–8 level, those who started higher on the Framework also tended to make greater gains, and this was particularly noticeable on the multiplicative and proportional domains. The net result was that initial differences favouring European students and students at high-decile schools were exacerbated and gaps between groups became wider.

The Numeracy Development Projects (NDP) have been under way for nearly a decade now. Almost all primary and intermediate schools have taken the opportunity to be involved in the NDP. The current focus is on issues of sustainability within schools, and consequently, the amount of data being entered on the nzmaths website by schools in the first or second year of professional development has decreased over recent years.

What Do We Know So Far?

Students whose teachers participated in the NDP made progress on the Number Framework from the beginning of the year their teachers were on the NDP to the end of that year (Young-Loveridge, 2004, 2005, 2006, 2007, 2008). The size of that progress was reasonably substantial, with effect sizes of between a quarter and half of a standard deviation (Young-Loveridge, 2005, 2006, 2007). All students, regardless of ethnicity, gender, age, or socio-economic status (as reflected in school decile) benefited from involvement in the NDP. Students from some groups began at higher stages on the Number Framework and made greater progress than others (Young-Loveridge, 2005, 2006, 2007). However, the size of the differences between groups is quite small compared with group differences on written tests administered to a whole class (Young-Loveridge, 2006). It seems likely that a major reason for smaller group differences on NDP assessments is that students are assessed individually by their own teacher. The questions are presented orally, and this eliminates the complicating effect of reading difficulties. When progress was examined separately for each major ethnic group and each school-decile band (0–3, 4–7, 8–10), it was found that the group of students who made the greatest progress was Pasifika (average effect size [ES] of 0.40), followed by students attending low-decile schools (ES = 0.38), then Māori students (ES = 0.35). This shows that the NDP has had an impact on students' mathematics knowledge and understanding. The focus now needs to shift from *relative* progress to *absolute* progress.

With the imminent introduction of National Standards in literacy and numeracy, it is important to focus on the levels of achievement reached by students at the end of a year in which their teachers focused on the NDP rather than simply looking at the progress made from the level at which students began. Hence, this paper focuses predominantly on data from assessments completed at the end of the year (final data).

How Did NDP Students Perform in 2008?

The analysis reported in this section of the paper was limited to final data sent in by schools participating in the NDP initiative for the first time and includes only students with complete data on all three strategy domains as well as on the knowledge domains of basic facts, place value, and fractions. There were 104 schools who participated in the initiative for the first time in 2008. Complete data was available for students attending 76 of these schools.

Cohort Composition

Table 1 shows the composition of the 2008 NDP cohort (see also Appendix A, p. 169). It is clear that this cohort varied in terms of school decile and ethnicity from one year level to the next. In the initial school years (years 0–3), the cohort was dominated by students from high-decile schools, with more than half of the students coming from the high-decile band (8–10) and the remainder coming almost equally from the low (1–3) and middle (4–7) decile bands. In the middle primary years (years 4–6), the students were more evenly distributed across decile bands. At the intermediate level (years 7–8), more than 50% of the students were from high-decile schools and approximately 10% were from low-decile schools. At the secondary level (year 9), 50% of the students were from the middle-decile band, 37% were from the low-decile band, and only 13% were from the high-decile band. It is important to look at cohort composition when interpreting data on the progress of students between year levels because particularly rapid or slow progress from one year level to another may be explained by the nature of the different cohorts being compared.

NDP cohorts at the year 0–6 level have reduced over the years from more than 10 000 students per year level earlier in the decade to little more than a few hundred in 2008. At the intermediate and secondary levels, the numbers at each year level have reduced from more than 10 000 down to about 3000 in 2008. Because of the reductions in cohort size, some of the fine-grained analyses (for example, the differential impact of the NDP initiative on students from schools differing in decile and/or ethnicity) are no longer possible for more recent data.

Table 1
Composition of the 2008 Cohort (Percentages)[1]

Group	Y0–1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Number of students	*219*	*225*	*255*	*226*	*221*	*326*	*2989*	*3010*	*2855*
School Decile									
Low (1–3)	23	21	19	19	28	20	11	12	37
Middle (4–7)	20	28	27	47	39	38	35	36	50
High (8–10)	57	51	54	35	34	42	54	52	13
Ethnicity									
NZ European	50	59	53	54	51	66	49	45	48
Māori	21	17	18	19	24	17	11	12	27
Pasifika	10	9	8	9	9	5	11	10	16
Asian	8	4	9	7	5	6	17	18	5
Other	11	11	12	11	11	6	12	15	4

NDP Students' Performance at the End of the First Year

Appendix B (pp. 170–177) shows the percentages of students at each stage on the Number Framework for each year level on each domain. Figure 1 shows the percentages of students who reached particular stages on the Framework by the end of the year that their teachers had first participated in the NDP professional development programme. Only those who had reached at least stage 4 by the end of the year are included in the graph.

It is clear from Figure 1 that there is a lot of progress in the first few years of school, with almost all students at stage 4 or higher by the end of years 3 or 4. In the early school years, performance is better on the additive domain than on the multiplicative or proportional domains. By the end of primary and intermediate years, performance is better on the multiplicative and proportional domains in terms of the percentages of students reaching the higher stages on the Number Framework. While there is a noticeable improvement at each successive year level on all three domains, the performance of year 9 students across the domains is no better than that of year 8 students. The reason for this may be that more than 50% of the intermediate cohort came from high-decile schools, whereas this is the case for only 13% of the year 9 cohort. By the same token, more than 33% of the year 9 cohort came from low-decile schools, whereas this was true for only about 10% of the intermediate cohort.

[1] Totals may be affected by rounding.

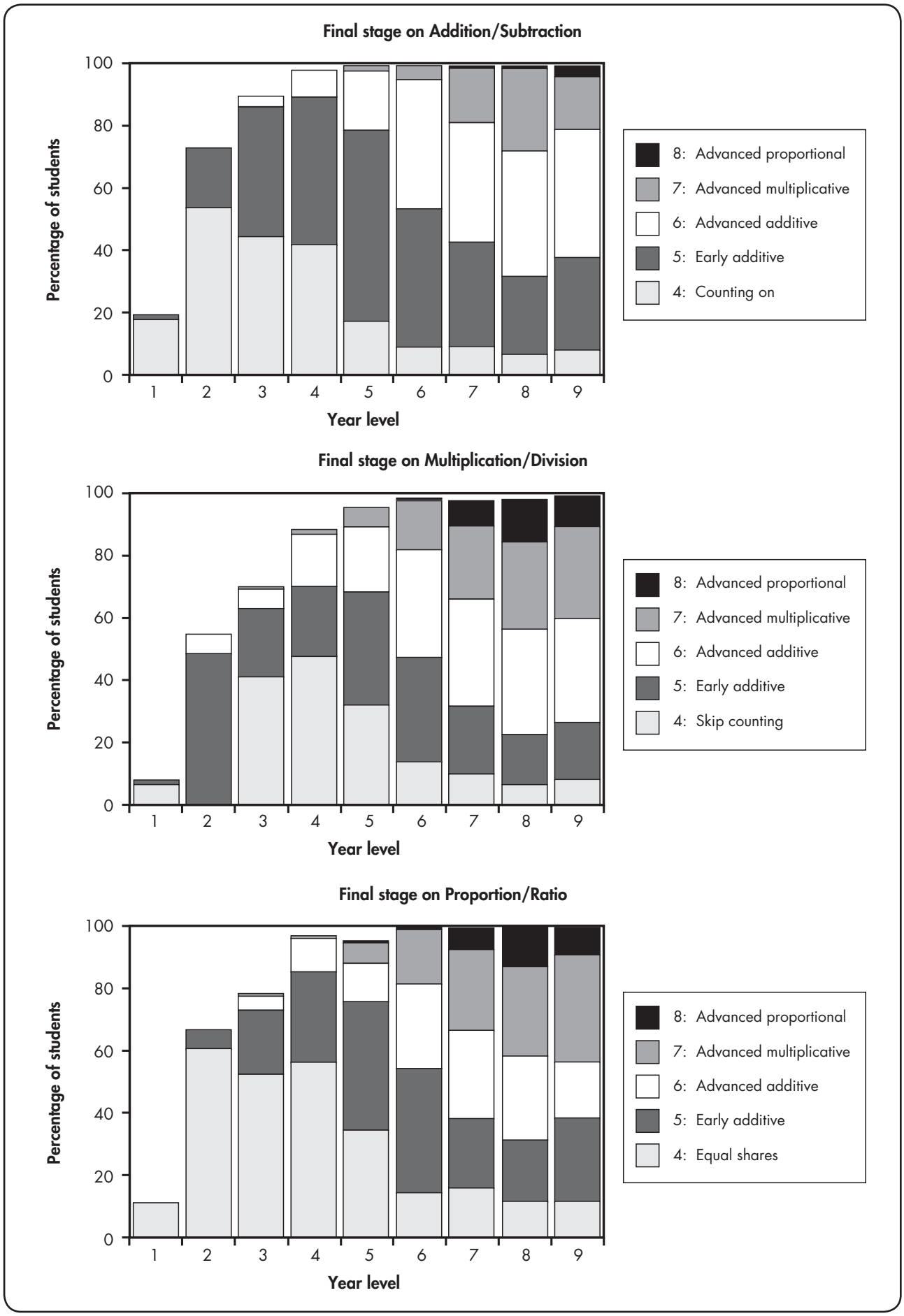

Figure 1. Percentages of students at each stage on the Number Framework on the three strategy domains as a function of year level at the end of the first year

Table 2 presents a summary of percentages of students who were at or above stages 4–7 on the additive, multiplicative, and proportional domains, with boxes indicating the year levels and cumulative stages that are relevant to the Ministry of Education's expectations for students at levels 1–4 of the curriculum. It is clear from Table 2 that, by the end of year 2, 73% of students had reached at least stage 4 (advanced counting) on the additive domain of the Number Framework. This finding is consistent with the expectations for students at level 1 on the curriculum (see Ministry of Education, 2007, n.d.). Fifty-six percent of students had reached at least stage 5 early additive part–whole thinking by the end of year 4 (level 2), and by the end of year 6 (level 3), the proportion of students who had reached stage 6 advanced additive part–whole thinking was 46%. At the end of year 8 (level 4), the proportion who had reached stage 7 advanced multiplicative part–whole thinking was 27% on the additive domain and 42% on the multiplicative and proportional domains. These results for years 4, 6, and 8 differ from the longitudinal percentages published with the curriculum level expectations for students at the end of these year levels.

Table 2

Percentages of Students at Each Stage on the Number Framework by Year Level and Domain at the End of the First Year[2]

Domain/Stage	Y0–1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Number of students	*219*	*225*	*255*	*226*	*221*	*326*	*2989*	*3010*	*2855*
Additive domain									
Stage 4+	19	73	89	98	100	99	100	99	99
Stage 5+	2	19	46	56	82	91	90	93	92
Stage 6+	0	0	4	8	21	46	57	68	62
Stage 7+	0	0	0	0	2	4	18	27	21
Multiplicative domain									
Stage 4+	8	55	70	89	97	99	98	98	99
Stage 5+	1	7	29	41	65	85	88	92	91
Stage 6+	0	0	7	19	28	51	67	75	72
Stage 7+	0	0	0	1	7	16	32	42	39
Proportional domain									
Stage 5+	0	6	26	40	61	86	84	88	88
Stage 6+	0	0	6	12	20	46	61	69	61
Stage 7+	0	0	1	0	7	18	33	42	44
Curriculum level		1		2		3		4	

One possible reason for the disappointing results shown at years 4, 6, and 8 (levels 2, 3, and 4) is that the expectation that the majority of year 2 students will be at stage 4 and counting on is not as early as it needs to be to allow for part–whole thinking to be sufficiently developed by the end of year 8. It has been clearly established that the Number Framework is not a linear scale and that progress on the first four stages is much easier than for the upper stages (Young-Loveridge, 2004). By having a large number of "micro-stages" at the lower end of the Number Framework, teachers may feel that

[2] The boxes indicate the percentage of students at a particular stage at the end of each curriculum level according to the national numeracy expectations.

they need to put a much greater emphasis on counting than is desirable in the early years. Counting is just one form of quantifying collections, and it is to be hoped that teachers are also encouraging students to quantify small collections by recognising instantly how many items there are (that is, subitising), rather than laboriously counting each item one by one. If teachers were to expect students to be counting on (stage 4) by the end of year 1 and put a greater emphasis on students knowing the sums of small addends (basic facts) as well as supporting the students' use of subitising from the beginning, then we might see greater progress in terms of the numbers of students reaching stage 5 by the end of year 4.

It is clear that students need much longer to build an understanding of the part–whole relationships among numbers than to progress through the counting stages on the Number Framework, and the sooner they are encouraged to do that, the better. This could have benefits for stages 6 and 7 later on, with many more students reaching those levels earlier than is presently the case.

Impact of School Decile on NDP Students' Performance at the end of the First Year

Figure 2 presents the percentages of students at or above stages 5 and 6 on the three strategy domains as a function of school-decile band (low: 0–3, middle: 4–7, high: 8–10). This figure shows that, in general, students from high-decile schools performed the best, followed by those from middle-decile schools, and then those from low-decile schools. There are likely to be many reasons for these differences.

The decile ranking assigned to a school is based on the income and education levels (from recent census information) of households whose children attend the school. Other factors associated with household income and education, such as the likelihood of students leaving to attend another school (which tends to be higher for lower-decile schools), also affect decile rankings. High levels of school absence or transience make it more difficult for students to maintain satisfactory progress in their learning; these factors are among those associated with lower levels of achievement.

Ritchie (2004) found a tendency for teachers to move towards higher-decile schools, meaning that low-decile schools may have disproportionately more inexperienced teachers than middle- or high-decile schools. Moreover, the expectations of teachers (based on the associations with other variables) may set up self-fulfilling prophecies that contribute to lower levels of achievement than might otherwise have been attained.

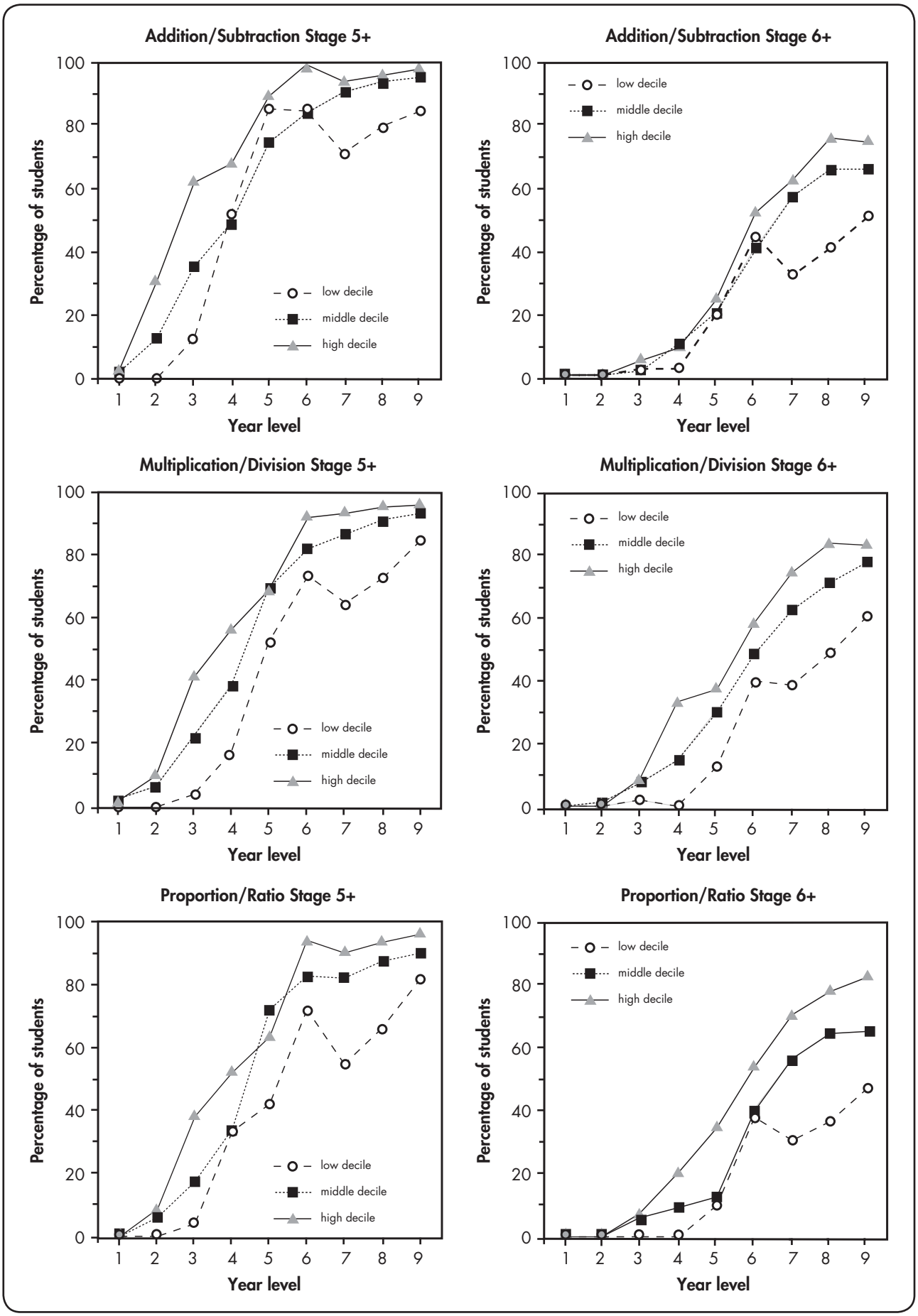

Figure 2. Percentages of students at or above stages 5 and 6 on the three strategy domains as a function of school-decile band at the end of the first year

The pattern shown in Figure 2 for students from low-decile schools indicates a marked drop in performance from year 6 to year 7. One question that has been raised is whether this drop is a reflection of the adjustment needed when students move from year 6 at a primary school to year 7 at an intermediate school. A separate analysis (see second section of this paper) compared the performance of year 7 students attending (low-decile) full primary schools with that of year 7 students attending (low-decile) intermediate schools. Those attending primary schools did slightly better than those attending intermediate schools. However, the results of this analysis were affected by the fact that all of the low-decile intermediate school students studied attended decile 1 schools, whereas some of the students at low-decile full primary schools attended decile 2 and decile 3 schools. Hence any differences could be due to the actual decile rank rather than whether the school was an intermediate or full primary school. Table 3 shows the proportion of students at low-decile schools at each decile ranking.

Table 3
Percentages[3] of Students Attending Low-decile Schools According to Decile Ranking

School Decile	Y0–1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Number of schools	*51*	*47*	*49*	*42*	*61*	*65*	*336*	*373*	*1068*
Decile 1	8	2	6	7	16	8	90	84	41
Decile 2	26	28	27	24	30	9	5	7	26
Decile 3	67	70	67	69	54	83	5	9	33

As Table 3 shows, a substantial majority of low-decile primary schools (years 0–6) are at decile 3, whereas the vast majority of low-decile schools at the intermediate level (years 7–8) are decile 1 schools. Table 3 makes it clear that the low-decile cohort at year 6 is not comparable with the low-decile cohort at year 7, and this could explain why there appears to be a noticeable drop in student performance between years 6 and 7.

The Impact of Other Variables on Students' Performance and Progress

Appendix C (p. 178) shows the average stages for students at the beginning of the NDP initiative (initial), while Appendix D (p. 179) presents the mean gain from the beginning to the end of the first year of the NDP initiative. It is clear from Appendix C that at the start of the NDP, on average, boys were at a slightly higher stage on the Number Framework than girls, and students from high-decile schools were at a higher stage than students at middle-decile schools, who in turn were at higher stages than those at low-decile schools. On average, New Zealand European and Asian students began the NDP at higher stages on the Number Framework than Māori students, who in turn began higher than Pasifika students.

It is important to interpret the average gain scores presented in Appendix D in the light of students' initial stages on the Number Framework: the lower the students began on the Number Framework, the greater the potential gains they could make, on the additive domain at least. This pattern may be explained in terms of a ceiling effect operating for the additive domain. For example, year 0–1 students from low-decile schools began the NDP with an average stage of 0.82 (compared with corresponding scores of 1.34 and 2.32 for students from middle- and high-decile schools respectively). The students from low-decile schools made an average gain of 1.18 stages (compared with 0.97 and 0.65 for students from middle- and high-decile schools respectively).

[3] Totals may be affected by rounding.

On the additive domain, gain scores in the initial years of school were approximately one stage on the Number Framework (because students could move quickly through several counting stages), whereas gain scores at the upper end of the Number Framework tended to be about half a stage. On the multiplicative and proportional domains, average gain scores were small initially because the younger students were not given the opportunity to do multiplicative or proportional tasks (if assessed using Form A of the Numeracy Project Assessment [NumPA]). However, students gained between about one-half and three-quarters of a stage once they were given the chance to do tasks within the multiplicative and proportional domains. The small numbers of students in some of the groups in years 0–6 means that these figures (mean stages and mean gains) need to be interpreted cautiously.

An examination of year 7 and 8 data on the multiplicative and proportional domains shows that not only did students from high-decile schools start higher on the Number Framework than did students at middle- and low-decile schools, they also made greater gains than either of the other two groups (see figures 3 and 4 and appendices C and D). For example, on the multiplicative domain, year 7 students from high-decile schools scored 5.50 initially (compared with 5.29 and 4.89 for students from middle- and low-decile schools respectively), and gained an average 0.73 stages (compared with 0.58 and 0.45 for students from middle- and low-decile schools respectively). A similar pattern was evident for New Zealand European and Asian students compared with Māori and Pasifika students.

This pattern, which is indicative of a widening gap between groups, suggests that expectancy effects may be operating, with teachers getting what they expect from students according to school decile, ethnicity, and gender. Further research is needed to investigate possible ways of narrowing the gaps between groups. Possible reasons need to be explored as to why this pattern appears to be particularly characteristic of the intermediate level and not of the early and middle years of primary school.

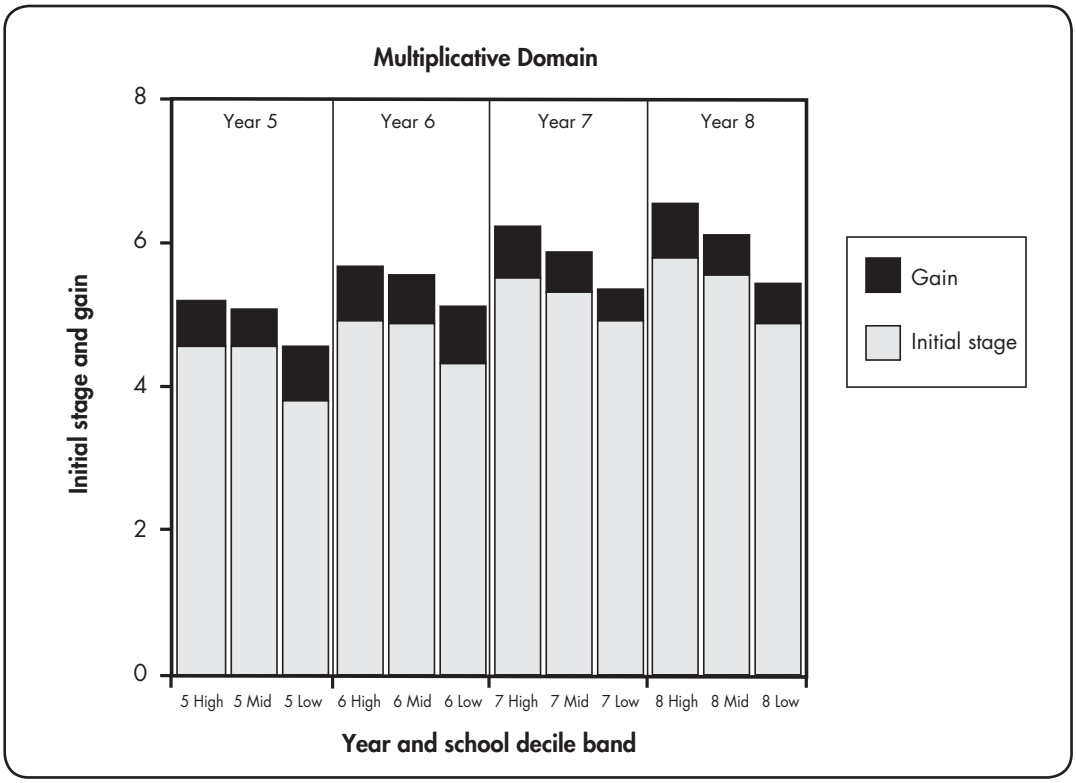

Figure 3. Average initial stage and gain on the multiplicative domain on the Number Framework as a function of year level and school-decile band

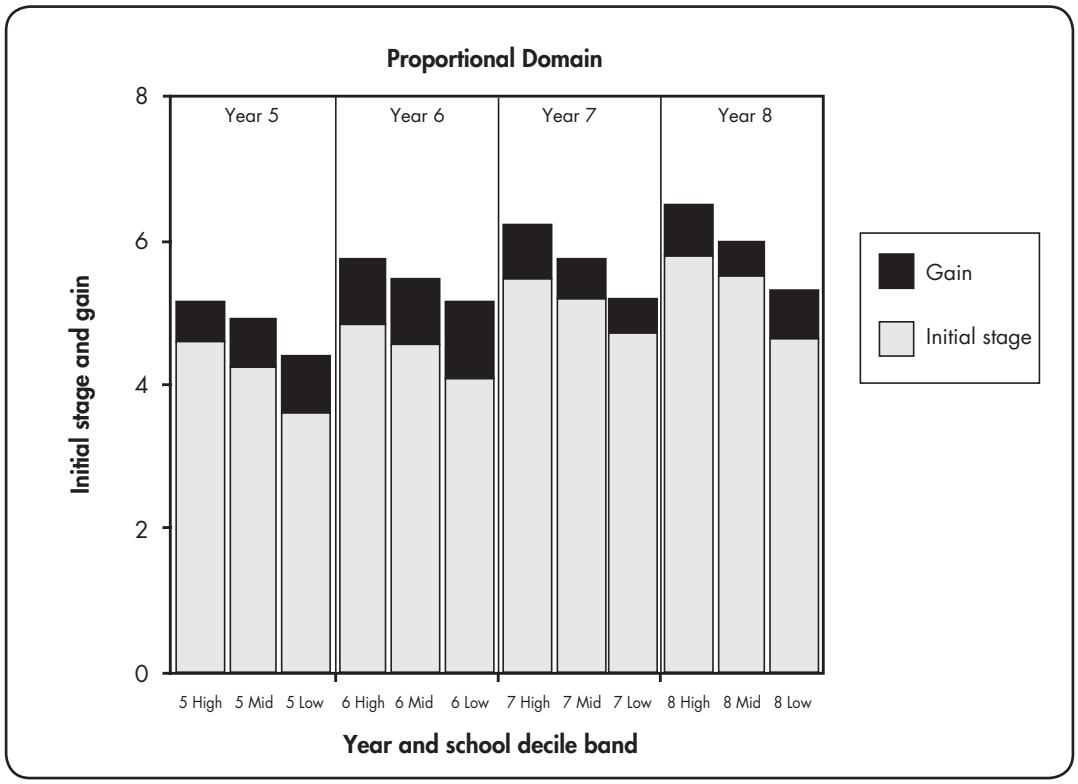

Figure 4. Average initial stage and gain on the proportional domain on the Number Framework as a function of year level and school-decile band

Students' Performance over Two Years of NDP

The Impact on Students' Performance of a Second Year on the NDP

One hundred and four schools participated in the NDP initiative for the first time in 2008, compared with 178 schools in the previous year (2007). Of the 178 schools that participated for the first time in 2007, 92 schools provided complete data for both 2007 and 2008. (Note: 68 schools returned data in 2007 but not in 2008, while three schools returned data in 2008 but not in 2007).

Comparison of the cohorts over successive years shows an increase in the proportion of students from low-decile schools from 2007 to 2008 at all year levels (see Appendix A, p. 169). The pattern for middle- and high-decile schools varies according to year level, with an increase in middle-decile schools at the upper primary level (years 4–6) and a decrease in high-decile schools. Although teachers at these year levels were not required to submit data in the year following their professional development, it is interesting to note that of those who chose to submit data, consistently more were from low-decile schools. This may reflect the higher staff turnover at low-decile schools found in other studies (for example, Ritchie, 2004) and hence the need to up-skill new teachers by involving them in professional development in the following year.

Comparison of the 2007 year 7–8 and year 9 cohorts with the same year-level cohorts in 2008 indicates a slight loss of students from high-decile schools and a relative gain in those from low-decile schools. Such patterns mean that data showing changes in performance and progress must be interpreted carefully because they may reflect changes in the cohort rather than particular aspects of the intervention, such as the teachers' deepening understanding of the Number Framework or the students' development of more strategic approaches to solving problems. Even looking diagonally across (for example, year 7 students in 2007 compared with year 8 students in 2008), it is evident that there is a drop-off in high-decile students in year 8 (24%) compared with year 7 (33%).

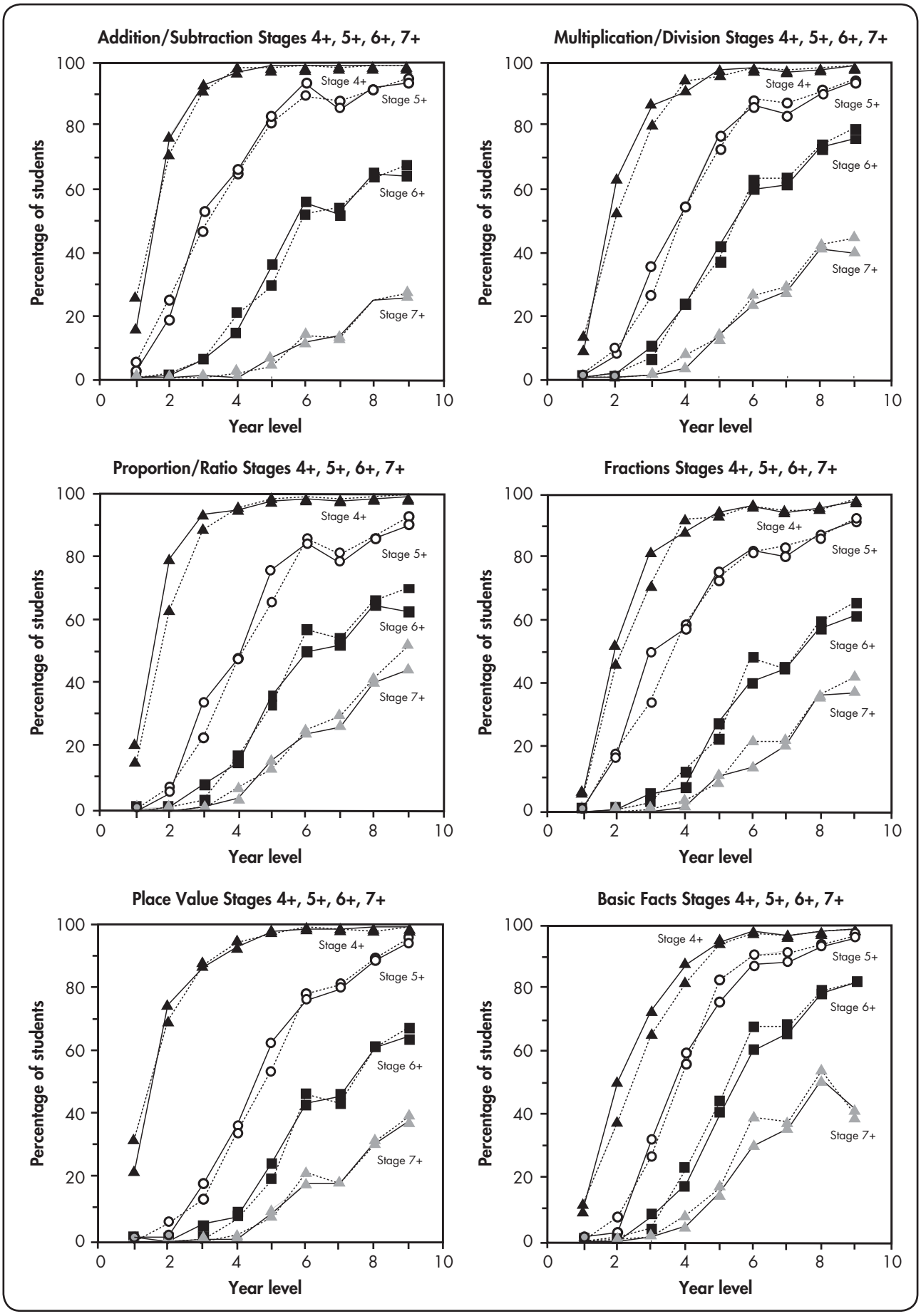

Figure 5. Percentages of students at or above stages 4–7 on strategy and selected knowledge domains as a function of year on NDP (2007, 1st year: broken line; 2008, 2nd year: solid line)

Figure 5 shows the percentages of students at or above stages 4–7 on the strategy and knowledge domains. The graphs show patterns that are fairly similar from one year to the next. Appendix E (pp. 180–184) and Table 4 show percentages for the strategy domains, with boxes indicating the year levels and cumulative stages that are relevant to the Ministry of Education's curriculum level expectations. A summary of the differences between the first year (2007) and the second year (2008) is presented in Table 5.

Table 4

Percentages of Students at or above Stages 4–7 on the Number Framework in the First (2007) and the Second (2008) Year of the NDP as a Function of Year Level and Domain (Final Data)[4]

Domain/Stage	Y0–1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Additive domain									
First year 2007	*350*	*504*	*573*	*536*	*574*	*470*	*2390*	*2285*	*3327*
Stage 4+	26	71	91	99	99	100	99	100	100
Stage 5+	5	25	47	65	81	90	88	92	95
Stage 6+	0	1	5	21	29	52	54	64	68
Stage 7+	0	0	0	2	4	14	13	25	27
Second year 2008	*274*	*278*	*360*	*449*	*451*	*589*	*2036*	*2447*	*2912*
Stage 4+	16	77	93	97	99	100	99	100	100
Stage 5+	2	19	53	66	83	94	85	92	94
Stage 6+	0	1	6	14	35	56	52	65	64
Stage 7+	0	0	1	0	6	11	14	25	25
Multiplicative domain									
First year 2007	*350*	*504*	*573*	*536*	*574*	*470*	*2390*	*2285*	*3327*
Stage 4+	13	52	80	94	96	99	98	98	99
Stage 5+	1	10	26	54	73	89	88	91	95
Stage 6+	0	1	6	24	37	63	64	74	79
Stage 7+	0	0	1	7	13	26	29	42	45
Second year 2008	*274*	*278*	*360*	*449*	*451*	*589*	*2036*	*2447*	*2912*
Stage 4+	8	63	87	91	98	99	97	98	99
Stage 5+	0	7	35	55	77	87	84	90	94
Stage 6+	0	1	10	23	42	60	61	73	76
Stage 7+	0	0	1	3	14	23	27	41	40
Proportional domain									
First year 2007	*350*	*504*	*573*	*536*	*574*	*470*	*2390*	*2285*	*3327*
Stage 4+	15	64	89	96	99	100	99	100	100
Stage 5+	0	7	23	49	66	86	81	87	93
Stage 6+	0	1	3	17	34	57	55	67	71
Stage 7+	0	0	1	7	13	26	30	42	53
Second year 2008	*274*	*278*	*360*	*449*	*451*	*589*	*2036*	*2447*	*2912*
Stage 4+	21	80	94	95	98	99	98	99	100
Stage 5+	0	5	34	48	76	85	78	87	90
Stage 6+	0	1	8	15	36	51	53	65	63
Stage 7+	0	0	1	4	16	25	27	41	45

[4] The boxes indicate the percentage of students at a particular stage at the end of each curriculum level according to the national numeracy expectations.

Table 5
Changes (between 2007 and 2008) in Percentages of Students at or above Stages 4–7 on the Number Framework in the First and the Second Year of the NDP as a Function of Year Level and Domain

Domain/Stage	Y0–1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Additive domain									
Stage 4+	–10	6	2	–2	1	0	0	0	0
Stage 5+	–3	–6	6	1	2	4	–3	0	–2
Stage 6+	0	–1	0	–7	7	4	–3	1	–3
Stage 7+	0	0	0	–1	3	–3	1	0	–2
Multiplicative domain									
Stage 4+	–4	11	7	–3	2	0	–1	–1	0
Stage 5+	–1	–3	9	0	4	–2	–4	–1	–1
Stage 6+	0	0	4	–1	4	–3	–2	–1	–3
Stage 7+	0	0	0	–4	1	–3	–2	–1	–5
Proportional domain									
Stage 4+	6	16	5	–1	–1	–1	–1	0	0
Stage 5+	0	–2	11	0	10	–1	–3	0	–3
Stage 6+	0	0	5	–2	3	–7	–2	–2	–8
Stage 7+	0	0	1	–4	3	–1	–3	–1	–8

It is clear from Table 5 that a consistent improvement in performance from one year to the next was evident only at year 2, in relation to the proportion of students who were at or above stage 4 on each domain. The difference was relatively small for the additive domain (6%) but increased for the multiplicative (11%) and proportional (16%) domains. At higher year levels, the difference was small or inconsistent across the domains. It is interesting to note such a difference for year 2 students at or above stage 4. This raises questions about the challenges for teachers of understanding just what is involved in the learning progressions as students move up the Number Framework. It may be that it is much easier for teachers in their second year in the NDP to appreciate just what is involved in moving through the various counting stages (0–4), and that this second year on the NDP enables them to benefit from their involvement the previous year, thus consolidating their learning and increasing the gains for students. Further research is needed to uncover the reasons for these patterns of difference.

It is somewhat surprising to note that the changes between 2007 and 2008 are not in a positive direction for students in years 7–9. Teachers in their schools were funded for two years of professional development, and thus it would be reasonable to expect to find more students reaching higher stages on the Number Framework once their teachers were in the second year of the NDP and had a better understanding of the NDP approach. However, this does not appear to be the case.

It is also interesting to note that a similar analysis carried out independently on year 9 data as part of the analysis for the Secondary Numeracy Project (SNP) showed a very similar outcome (Tagg & Thomas, 2009). One possible reason may be that coming to understand the higher stages on the Number Framework presents an enormous challenge for teachers and it may require considerably more than two years of professional development to have an appreciable impact on teachers' content

knowledge and pedagogical content knowledge in mathematics (Ball, Hill, & Bass, 2005; Hill, Schilling, & Ball, 2004; Hill, Rowan, & Ball, 2005; Lamon, 2007). In-depth research in the classrooms of teachers working at the year 7–8 level is consistent with the idea that ways of supporting students' multiplicative thinking, for example, take some years to understand fully (see Young-Loveridge & Mills, this volume).

Discussion

The analysis reported in this paper has shown that students in the early school years make substantial progress on the additive domain, with almost all students working at stage 4 advanced counting or higher by the end of year 3. By the end of years 7 and 8, students' performance on the multiplicative and proportional domains is higher than on the additive domain.

There are issues of comparability across different domains. The biggest discrepancy is students' performance at stage 7 on the additive domain, which is much harder to attain than stage 7 on the multiplicative or proportional domains.

Comparison of students' performance with the curriculum level expectations stated in *The New Zealand Curriculum* (Ministry of Education, 2007) showed that only year 2 students were close to the expectations for level 1. At years 4, 6, and 8, only about half of the students met the expectations for curriculum levels 2, 3, and 4 respectively. This finding has some important implications for teacher knowledge of the complexities of part–whole thinking, both additive and multiplicative. This result is consistent with work elsewhere that shows how important it is for teachers to fully understand the mathematics they are teaching, as well as to have the pedagogical content knowledge in mathematics to anticipate the developmental progressions and difficulties for their learners (for example, Ball et al., 2005; Hill, Schilling, & Ball, 2004; Hill, Rowan, & Ball, 2005).

Analysis showed that students' performance varied as a function of school decile, with students at high-decile schools performing better than those at middle- and low-decile schools. This finding reinforces the need to ensure that teacher quality is maintained at low-decile schools.

An analysis of students at schools that submitted data in both 2007 and 2008 showed virtually no improvement in the second year of the NDP, except for year 2 students. This finding is of particular concern at years 7 and 8, where schools are funded for two years of professional development. Further research is needed to document how teachers' knowledge and understanding of mathematics changes over the course of their professional development in order to gain a better understanding of how teachers experience the professional development that is provided. This issue is of particular significance because the discrepancies between students' performance and the curriculum level expectations are greatest at the end of year 8 (level 4).

Analysis of the students' average stages at the beginning of the NDP and of gain scores showed that in the primary years (years 0–6), those who started lower on the Number Framework tended to make greater gains, particularly on the additive domain. By years 7–8, those who started higher on the Number Framework also tended to make greater gains; this was particularly noticeable on the multiplicative and proportional domains. The end result is that initial differences favouring New Zealand European students and those at high-decile schools were exacerbated and gaps between groups appeared to widen. This finding reinforces the importance of ensuring that low-decile schools maintain high levels of teacher quality.

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