



Professional Paper

The PRIME Experience

A Review of New Zealand Schools' Early Response to Scholastic PRIME Mathematics

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Lester Flockton PhD



Foreword

During 2014, Scholastic New Zealand began introducing Scholastic PRIME Mathematics as an attractive alternative to New Zealand schools' current mathematics programme. This review was conducted to obtain feedback from a group of schools that undertook to trial PRIME. The large majority of New Zealand schools have been using the Ministry of Education - sponsored Numeracy Project for their mathematics programme. It is to be expected, therefore, that any such review as this will inevitably draw comparisons between the two programmes. The review was conducted at a relatively early stage in the trial schools' implementation of PRIME, so its observations are necessarily tentative. Regardless, some very clear messages emerged that should be of wide interest to New Zealand schools.

About the author



Lester Flockton PhD is a graduate of Dunedin Teachers College and the University of Otago. He has extensive experience in New Zealand's school system as teacher, principal, inspector of schools, Ministry of Education official, researcher, university teacher, educational thinker and leader. Throughout his career in education, he has worked on many national curriculum and assessment committees and projects, including major roles in the development and writing of The New Zealand Curriculum (2007). He has led numerous professional development and learning programmes, made dozens of conference presentations here and overseas, and held office in various professional organisations.

Lester was one of the founding directors of the Educational Assessment Research Unit at the University of Otago, and one of the prime developers and co-directors of New Zealand's highly regarded National Education Monitoring Project. Lester's field of expertise combines teaching and learning, curriculum and assessment, and the leadership, governance and management of schools. He has received a number of honours in recognition of his service to education in New Zealand.

Introduction

New Zealand schools have options over which mathematics programme they choose to use. Many incorrectly think that they are obliged to use the Ministry of Education's Numeracy Project, and therefore fail to consider alternative programmes. But the Numeracy Project is an *option*, and not the only one. It is not mandatory, although it is given privileged support through Ministry funding of advisory and other services to support its implementation. What are mandatory, however, are The New Zealand Curriculum (2007) and the Government's national standards for mathematics. So whatever programme a school opts for, that programme needs to satisfy, among other things, mandated curricular requirements. An analysis of Scholastic's PRIME programme ("PRIME Mathematics in the New Zealand Context: Analysis of Linkages") has given assurance that this programme is consistent with what is expected of New Zealand schools, and very substantially meets requirements.

Among the other critically important factors that schools need to seriously consider when choosing an effective mathematics programme or reviewing their existing programme, five deserve particular attention:

1. The content and structure of the programme;
2. Recognition of understandings about how children learn and how they differ in their learning and progress;
3. Enablement and support for effective teaching and efficient programme planning and management;
4. Availability of suitable resources to support teaching and learning;
5. Results in terms of student progress and learning.

For each of these criteria, Scholastic's PRIME mathematics programme offers a very attractive alternative to the Numeracy Project, although that "attractiveness" needs to be substantiated so that schools can feel confident and assured in opting for a different programme. Accordingly, the publishers are undertaking a systematic evaluation of the programme's impact and effectiveness by tracking its implementation in a number of trial schools in New Zealand.

This report is an evaluative review of the trial schools' early responses to PRIME. The criteria for gauging the effectiveness of PRIME follow those listed above. The substance of the review is drawn from in-depth interviews conducted by an independent evaluator with principals and teachers in the trial schools.

Trial Schools

Three of the trial schools are located in Auckland, and one in Wellington. They represent a range of deciles from one to ten (school deciles are a measure of the socio-economic index of the school's community, not the quality of teaching or the school). The year levels of students and the years of experience and seniority of the teachers involved in trialling PRIME also represent a full range.

All four schools had introduced PRIME part way through the school year, so summative evaluations of student achievement relative to PRIME at this early stage of implementation are understandably tentative. Regardless, enthusiastic confidence in the effectiveness of the programme was common across all trial schools.

PRIME on its own, or PRIME in combination with an existing programme?

The trial schools all chose to use PRIME largely out of lingering concerns and dissatisfactions with the Numeracy Project. They carefully considered what PRIME had to offer before deciding to adopt it. Once decided, they all chose to make PRIME their main programme, rather than use it in combination with other programmes such as the Numeracy Project. This is significant for a number of reasons. Schools can often show reluctance to completely set aside an existing or established programme, preferring instead to use a patchwork, mix-and-match approach in the mistaken belief that holding onto what they already have, regardless of concerns and shortcomings, is a form of "risk insurance". However, the patchwork paradox is that this approach tends to significantly diminish the prospective impact, clarity and value of a new programme. In the case of PRIME, the trial schools view it as a programme complete within itself, without the need for augmentation.

PRIME a textbook programme, or PRIME a text-based programme?

Without exception, the trial schools, like many others, are textbook averse. They are strongly opposed to an approach common to many traditional mathematics textbooks that are insensitive to the critically important dynamics of teaching and learning. A distinction should be made, however, between a textbook programme and a text-based programme.

A text-based programme is one that provides a well-structured approach to both content and learning, and regards the role of the teacher as central to the delivery of the learning programme. In a text-based approach such as PRIME, the teacher, working within a well-planned and clearly explained programme, is a decision maker on such matters as pace, content emphasis, and choice of suitable practical materials. The teacher is given confidence in the sequencing of learning and students regularly revisit previously learned material so that their learning does not fade.

It would be misleading and simplistic to say that PRIME is a textbook programme. All teachers in the trial schools dismissed any such suggestion, making it clear that their role was central, yet within a well-supported and laid-out programme of learning.

1. The content and structure of the PRIME Mathematics Programme

PRIME was initially developed for Singaporean schools, where there has been considerable success with the programme and its approach. The trial schools were of the view that mathematics is a universal language that is substantially culture free in terms of learning content. The PRIME material does, however, contain a few contextual examples that relate specifically to Singapore's setting, such as the pictures of coins and the coin values (New Zealand no longer has 5 cent coins, but these are included in PRIME). Trial schools reported that these few irregularities only elicited passing comment from some students, but importantly did not detract from the relevance of the arithmetical processes they were learning and practising. They noted that the content was suitably aligned to *The New Zealand Curriculum*, and

where desirable, they found no difficulty in using New Zealand or local illustrative contexts suited to the content of learning.

Trial schools commented that some areas of content were more effectively presented and sequenced for learning in PRIME than in the Numeracy Project approach:

“PRIME has a completely different attitude towards algorithms than the Numeracy Project. In PRIME they are strongly developed through place value.”

“Place value is emphasised in PRIME, and this sets a very clear foundation for all numeracy processes.”

“Mathematics topics are covered very well in PRIME. Number knowledge/place value is very thoroughly covered in small steps within a teaching sequence that results in greater depth and retention of learning. The students manage and master these steps quite quickly and with relative ease.”

“The way that PRIME breaks down learning into fine steps helps students to make easier sense of what they are learning.”

“PRIME really breaks the concepts down in ways that make easy sense for students and teachers.”

“The integrated problem-solving approach very effectively teaches students the language of problem solving and how to actually break down a word problem. The process of problem solving is learned with increasing depth and effectiveness.”

All trial schools commented on the structure of the PRIME programme. They noted that there was a very clear sequencing of content, with a particular strength being the regular revisiting of previously learned content. This meant that earlier learning

was reinforced, so students were better able to retain what they had learned previously, and this allowed them to more confidently move to the next step of complexity in the concept or skill being learned. The sequencing of content had particular appeal to trial schools because it was built into the structure of the programme without the necessity for individual teachers having to work this out in their own planning. There are inevitable frailties when teachers are left to work out their own programme structures. Trial schools commented:

“PRIME is much easier to follow and use than the Numeracy Project.”

“It fits very well with the NZC and national standards.”

“PRIME is much better than what we were doing before, and gives better attention to the strands stuff.”

2. Recognition of understandings about how children learn and how they differ in their learning and progress

It is fundamental to an effective mathematics programme that the design and approaches used in the programme show a thorough understanding of how children learn and how they differ in their learning processes and progress. It is a fact that students vary considerably in mathematical aptitude, and that not all students are capable of reaching the same heights, exercising the same mental agilities, or developing knowledge and strategies at the same pace or to the same breadth and depth as everyone else — regardless of the quality of teaching and high expectations. An effective mathematics programme takes these differences into account and does not, for example, expect that all students can learn to perform "mental gymnastics" to the degree that allows them to draw on multiple alternative strategies when performing mathematics tasks. Understandings of learning theory are essential when developing mathematics curricula. Developers need to be more than mathematics experts.

PRIME is a programme that does recognise these fundamentals and the lessons from learning theory. The trial schools commented that the programme enables arrangements for differentiation in learning and flexible student grouping; clearly communicates learning goals for each area of content and each learning episode; spirals new learning through small, progressive steps; reinforces learning through repeatedly re-visiting and rehearsing what has previously been covered; uses language that students can handle; gives students feedback that helps them know where they are succeeding and where they still need more learning, and presents material in ways that captures and holds students' interest and attention.

"I have 5 groups and students move within those groups according to where they are at with their learning. We have more groups than we did pre-PRIME, but really, it is not a burden because of the support given by the programme. In fact, we are quite proud that we no longer feel that we can only "cope" with 3 or 4 groups, and our differentiation is more meaningful and more flexible."

"We now have more math groups since using PRIME, but we don't mind as it is more specific to students' needs and easy to manage because of the clarity within the programme and the teachers' guides."

"I have one student who does not fit into any of my differentiated groups, but she was able to work on her own programme with PRIME, and followed it without too much burden on teaching time. She is an advanced learner, and it is easy to meet her needs with PRIME."

"We are experiencing heightened interest levels in what we are doing in mathematics. The visuals and presentation of lessons are engaging and motivating for students. They can 'see' the learning — it's not abstract."

“PRIME has given our children a sense of ownership over the learning process. It has generated more mathematical discussion and more care and correctness in using mathematical language that is used right across the programme.”

“We have observed that children go back independently to what they have previously learned when working on their next steps.”

“Students have been showing a higher level of enjoyment and confidence with their maths because they are given more opportunities to work independently by being able to refer back what they have previously learned and understood.”

3. Enablement and support for effective teaching and efficient programme planning and management

Despite the vast financial outlay and huge expenditure of teacher time and development on the Numeracy Project over many years, New Zealand's performance in mathematics on international measures has tended to decline rather than improve. When official advocates for the Project are confronted with this fact, the typical response is that the problem is the teachers, not the programme. This is a somewhat telling admission to the serious mismatch between the design of that programme and its suitability for universally effective implementation.

Regardless of the somewhat simplistic causation of teachers being responsible for less than satisfactory outcomes (the issue of poor student achievement is much more complex), it is nonetheless essential that students' mathematics progress and achievement are not jeopardised as a result of their teacher's personal mathematics capability.

In reality there is a wide range of teacher confidence and competence in mathematics. It is questionable, however, as to whether high universal teacher proficiency would in itself solve the problem, if indeed that could be achieved (studies indicate that teachers who undergo PDL in programmes such as the Numeracy Project do not necessarily advance in their personal mathematics capability). It is argued that even in an ideal world where all teachers are expert mathematicians, this would unlikely resolve the challenge of significantly raising the achievement of many students who struggle with mathematics.

“The PRIME course books explain everything very clearly and are easy to follow. They provide all the information to effectively follow and use the programme without the need for a ‘course’.”

“The reading load within the programme is not a problem for us. It is not too time consuming compared to the Numeracy Project and it is very easy and straightforward to follow.”

“PRIME is so easy to plan from. Having the ‘follow up’ resources within the PRIME programme saves so much time. Our core teaching planning is now taking less time as it is all so well set out in the teachers’ guides. We know where we are heading, and what we are doing.”

“With PRIME being new to us, we expected it would take some time to get our heads around it and to implement it, but we were pleased to find that it was easy to follow and not anywhere near as demanding as what we had been using (Numeracy Project).”

“I found it was slow to start using PRIME as I was having to get acquainted with the new programme, but it turned out to be quicker to use and understand than the Numeracy Project. Once we got into the programme, it became very clear that it becomes self-explanatory.”

“The PRIME teacher guides are very helpful and supportive. They give you all the knowledge you need to teach a concept in an uncomplicated and clear way. We didn't feel that clarity of support with the Numeracy Project.”

“PRIME is teacher-friendly in terms of ease in following a common and consistent language which is important for quality teaching and students' learning and thinking.”

“PRIME has the great advantage of eliminating the variations of programme interpretation and management across classes in the school which can be a real concern because those variations are not always good. It is well structured, supportive, and gives greater cross-school consistency to our teaching, which must be good for our students.”

Teachers' comments are very clear in identifying the merits of the relative ease of becoming familiar with PRIME and being able to implement it with confidence and know-how. The ease of inducting teachers into a programme is critical, and PRIME demonstrates that it does this efficiently, effectively and in ways that elicit positive responses from teachers. Programmes that are highly dependent on teachers attending time-consuming courses and follow-on study (e.g. online webinars and guides) so that they might understand and seek clarity of its structure, processes, and resources are problematic for teachers new to mathematics teaching. Such programmes can also result in schools being vulnerable to issues of school-wide consistency of quality of teaching and programme delivery. The experience of the trial schools shows that such vulnerabilities are substantially less evident with the PRIME programme.

4. Availability of suitable resources to support teaching and learning

The provision of effective teaching and learning materials for mathematics programmes is fundamental, but the manner in which they are presented and made available is absolutely critical to their usefulness for supporting student learning and progress.

The New Zealand approach to teaching mathematics at the Primary level moved away from textbooks a number of years ago. Instead, it chose to use a variety of resources to be accessed and used at the teachers' discretion. Prior to the Numeracy Project, these resources were systematically arranged, graded, packaged and provided without cost to schools via Learning Media Ltd. The Numeracy Project has resulted in a plethora of resources, mainly online, that teachers must now search out, sift through and print off. This "supermarket" approach is particularly demanding and wasteful of teachers' valuable preparation time. There are some excellent resources in the mix, but they have to be "found".

Additional to paper-based resources, all schools have a range of concrete and representational materials to assist student learning. The trial schools were all very forthright in expressing their frustrations with the hit and miss "resource hunt" approach of the Numeracy Project, although they said some examples (selected practice sheets) are worth holding in stock for supplementary learning activities. By contrast, they all said that the PRIME resource was substantially self-sufficient, without the need for further hunting, and that the school's mathematics materials (place value blocks, etc.) were readily useful and relevant to the PRIME approach.

"We particularly like that PRIME does not bring in 'extra' materials from different sources that you have to hunt out when planning and preparing. It's all there."

"We seldom do any photocopying now. This saves so much time —and paper!"

"We have found that PRIME does not need any other 'resources'. It can easily and confidently stand on its own as a programme."

"We haven't photocopied any of the pages from the PRIME books. It's not necessary. It's saving so much time on our teacher release days."

"Students love using the PRIME practice books, and that they can write directly onto them. They are enjoying following a consistent structure with the course books' 'Let's Learn' and 'Let's do' material. And it's interesting how they engage with the graphic characters in the course books."

"I like that the school's collections of concrete materials work very well with PRIME."

"We don't have the students write on the course books, and they are shared one between two. This works very well."

"Our children really enjoy using the course books. But it's not like a textbook approach, because there is so much discussion and relating the learning to different contexts."

The issue of cost of the PRIME materials was discussed by all of the PRIME schools. To save on cost, some of the schools shared one book between two, which worked well in most cases and supported a culture of shared learning.

Some of the trial schools decided that students would not record their responses in the workbooks so that they could be re-used (the recording was done in the students' exercise books). They found that this was not an issue. All of the trial schools said that savings from constant photocopying of worksheets and the preparation time used for searching and assembling resources would compensate for the initial financial outlay on the books.

5. Results in terms of learning outcomes that are achieved by students

The results achieved by students is a critical measure of the worth of any programme, whether mathematics or some other curriculum area. Among other factors, achievement and progress are always relative to the validity of content (what learning is measured against) and individual student's capabilities. The choice of an effective programme and the quality of its delivery are high among the factors that determine results.

The assessment of students' learning and progress is a necessary part of every mathematics programme. The PRIME trial schools all noted that they were in relatively early stages of using the programme (none had been using it for a full year) and that they were still in the process of evaluating and rationalising their assessment arrangements. Whatever those arrangements, they need to serve the dual yet interrelated purposes of assessments *for* teaching and learning (formative), and assessments *of* learning (summative). Moreover, it is necessary that the summative assessments meet the purposes of making judgements about students' achievement relative to National Standards.

Assessments *for* teaching and learning are substantially about good interactive teaching. The focus is on knowing in detail what students *can do*, and what they *need to do* so that learning progresses. Much of this assessment information is not formally recorded since it would be neither practical nor necessary. The trial schools all said that formative assessment was central to PRIME.

“There is a lot of formative assessment — working with children, knowing how they are responding, and ongoing marking of work.”

“There is a lot of built-in formative assessment that links to our teacher judgements. You get a very clear idea of what each student can do and what he or she needs to learn next so as to progress.”

“I am getting a very clear idea of each student's achievement using PRIME — more so than ever before — because of the formative and summative assessments that are built into the programme. The formative and summative work together.”

Assessment for reporting is “summing up” assessment. The assessments are typically recorded in the form of marks and comments at particular times in the year or at the completion of topics or units of study.

“We have found that National Standards judgements are not so murky when linking to the PRIME programme.”

“I was easily able to make a National Standards judgement using prime, using my recordings of ongoing assessments from PRIME. Occasionally I used examples from the ARBs (Assessment Resource Banks) when I had a question over their achievement.”

“Sometimes we used GloSS as it is a requirement in the school, but we allowed students to use pen and paper so that they could apply PRIME learning to solving the GloSS questions — but GloSS is really only a small part of the triangle of assessment we use when making OTJs.”

“We have been using the 'REVIEWS' and 'WRAPPING UP' sections in PRIME as summative, and making formative notes on students as they progress through the learning tasks. The practice tasks at the end of the chapters are excellent checkpoints and help determine the 'where to next' very clearly.”

“It was hard to keep using the school's assessment tools such as GloSS because PRIME does not link to these. But the built-in formative assessments gave us substantial knowledge of students' learning, and enabled us to make quite informed OTJs.”

“Although we had been using GloSS (a school policy), it is really a tool for the Numeracy Project, so we went back to the NZC and linked it to PRIME and made our assessments accordingly, which makes a lot of sense.”

Assessments for summative purposes, and particularly for making OTJs, required the trial schools to make a paradigm shift — away from the Numeracy Project measures and towards a greater focus on the NZC. The indications are that this was leading to improved clarity and confidence in decision-making by the trial schools. However, PRIME schools would benefit greatly from having guidelines that clarify these processes and provide a useful structure or framework for reaching OTJs.

Summing Up So Far

Each of the trial schools was asked to sum up what they had come to see as the distinct benefits of PRIME and any challenges when introducing or using the programme.

Distinct Benefits of PRIME

- *Clarity and ease for planning*
- *A clear, well-presented programme structure*
- *It's a complete programme and doesn't require any supplementary or other programmes alongside it*
- *It is logical and all fits together like one giant jigsaw*
- *The sequential structure with small steps enable students to gain success within the learning of new concepts — so their confidence grows*
- *Very little time required to search and find support materials and resources*
- *Less planning time required, meaning more planning time for other areas of the curriculum*
- *Less workload with better results*
- *An excellent “scheme” for learning that is great for planning*
- *Less disproportionate planning time on mathematics*

- *The learning progressions are well laid out, properly sequenced, easy to follow, and clear to students*
- *PRIME takes the guesswork out of fitting the progressions together.*
- *You don't have to source for anything extra*
- *Delivery of the programme is clear and well supported*
- *If a teacher is not strong in maths, then they are supported by PRIME and children's learning doesn't suffer*
- *The clear, happy nature of the PRIME books*

Challenges

- *Disengaging from established structures for mathematics in the school*
- *The school needs to come to grips with the cost of purchasing the books — but that cost is counterbalanced by huge savings elsewhere and stronger programme support for non-mathematically inclined teachers*
- *The chapter topics in different grade level books don't match up or align when you are using different books with different groups*

Recommendations

Two major recommendations arise out of this review:

1. That easy-to-follow and uncomplicated guidelines be developed and provided to all schools that adopt PRIME. The guidelines should induct teachers into the programme, and address such matters as how to identify students' starting points.

It was clear that the trial schools had been set off to a good start through the initial guidance given by Scholastic. It is important that all schools get off to a good start such as this.

In respect to this recommendation, it is noted that the first PRIME Implementation Guide has been developed — for Numbers and Operations (February 2015)

2. That guidelines, and perhaps resources, be developed for summative assessment according to the requirements of the New Zealand system.

Care needs to be taken to ensure that both guidelines and resources are fully attuned to New Zealand's system and its approaches to assessment.

In respect to this recommendation, it is noted that steps are being taken to develop such guidelines and resources.

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Lester Flockton PhD

Education Specialist

Curriculum & Assessment – Teaching & Learning



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For enquires on Scholastic PRIME Mathematics, please contact:

Scholastic New Zealand Ltd

21 Lady Ruby Drive, East Tamaki, Auckland 2013

Contact: 0800 724 652

Email: schools@scholastic.co.nz

Website: www.scholastic.co.nz