Numeracy education: what do we know and what can we learn from the literacy experience

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Note

This paper was prepared in 1998/1999 and some information in the paper may not reflect more recent developments

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Introduction

This paper has been written as one of a set of seven source papers commissioned by the Australian Association of Mathematics Teachers (AAMT) to assist it in the preparation of a Draft Numeracy Monograph setting out the Commonwealth's position and policies in relation to school numeracy education in the context of the *National Literacy and Numeracy Plan*.

The purpose of this paper is to attempt to summarise what is known and what can be learnt from recent attention to literacy. In recent years, considerable emphasis has been placed on developing and implementing policies with respect to literacy, both at the State/Territory level and at the national level, particularly through the Ministerial Council on Employment, Education, Training and Youth Affairs (MCEETYA).

This has been accompanied by renewed efforts by schools to improve student literacy outcomes, particularly in the early years. These efforts have arisen in response to system-level policies and programs, but also in response to the dissemination of information relating to recent advances in literacy education.

In developing parallel policies with respect to numeracy it is important that as much as possible be learnt from the literacy experience so that those aspects of the literacy experience that have been negative can be avoided and those aspects that have had a positive impact can be identified and emulated. It is also important that every effort be made to ensure that work undertaken in numeracy does not lead to policies and initiatives that are disconnected from parallel policies and initiatives for literacy. Rather, the aim should be to expand the work undertaken in literacy to create powerfully interconnected policies and programs for both literacy and numeracy.

Section 2 of the paper provides a descriptive account of the current situation with respect both to literacy and numeracy and on recent changes as perceived by principals in primary schools, drawing upon findings from a recent national survey.

Section 3 looks briefly at factors that have led to a renewed interest in improving student literacy outcomes and on a reassessment of the place of literacy in the curriculum.

Section 4 provides a brief commentary on 'zero tolerance of failure' policies of the kind that underpin the National Literacy and Numeracy Strategy.

Section 5 considers the relevance to national strategies of knowledge regarding school effectiveness and improvement and on the change process in education.

Section 6 examines a 'design' approach to improving literacy outcomes and the relevance of this approach to numeracy.

The paper concludes (Section 7) by focusing on the role of school systems and the Commonwealth in generating successful strategies for improving numeracy that reflect the best of the literacy experience.

Perceptions of principals regarding literacy and numeracy in schools

The National Literacy and Numeracy Plan, while applying to all stages of schooling, focuses on the early years. An insight into the current situation and into recent changes affecting literacy and numeracy in primary schools is provided by a DEETYA funded national survey of school principals. This was undertaken by the Australian Primary Principals Association (APPA) and the *Centre for Applied Educational Research* at The University of Melbourne (Hill et al., 1998).

The aim of the survey was to investigate the places of literacy and numeracy within the primary school curriculum and the priority which schools are attaching to them. The motivation for the study was an appreciation of the importance of literacy and numeracy within the primary school curriculum, as well as a concern that pressures to add more to the curriculum may have been exerting a negative impact on the time, resources and priority given to literacy and numeracy. A questionnaire was sent in March 1998 to principals in a stratified random sample of Australian primary schools and returns were received from 459 schools.

The survey results indicated that in response mainly to external pressures, schools over the past three years have sought both to broaden the curriculum and to place a greater emphasis on literacy and numeracy. The sources of these external pressures have included parents, school systems and the wider community. Some of the pressures can be seen to be 'market driven', while some are driven by the perception that schools have an important role to play in addressing social issues and filling the 'gaps' left by traditional institutions and agencies.

The greatest curriculum changes over the past three years have been an increased emphasis on literacy, especially in the early years, followed by an emphasis on the use of computers and technology in the classroom. The survey established that there has been a degree of overcrowding of the curriculum, but that this has not adversely affected the time or importance attached to literacy or numeracy. It also established that the major emphasis of schools has been on literacy, especially early literacy, rather than on numeracy.

The areas of the curriculum for which principals perceived the greatest increases in time were *English* and *Technology*, followed by *Mathematics*, *Health and Physical Education* and *LOTE*, whereas the areas of the curriculum in which schools perceive the greatest decreases in allocated time were *The Arts*, *Studies of Society and Environment* and *Science*.

In the early years, primary schools are devoting, on average, approximately nine hours a week to literacy and just under four hours a week to numeracy. In the final years, primary schools are devoting just over eight hours a week to literacy and five hours to numeracy. This suggests that primary schools are converging on a 40-20-40 division of time (40% to English/literacy, 20% to mathematics/numeracy and 40% to other key learning areas).

Principals indicated that there is greater clarity about literacy standards that schools are expected to achieve, due mainly to curriculum and standards frameworks in the States/Territories. They also thought that students are making the same progress or greater progress in literacy and numeracy and that teachers' confidence in ensuring success in literacy and numeracy is the same or has increased over the past three years. Significantly, more principals believed that low achieving students have benefited most from changes to the curriculum in recent years, as opposed to high achieving students. Responses to open-ended questions indicated a high level of commitment to enhancing intervention programs and special assistance for 'at risk' students.

Principals indicated that they have increased freedom to make decisions about the time allocated to different learning areas, if not about content of the curriculum. They also perceived that more financial support has been made available for literacy, particularly literacy intervention for 'at risk' students, but that less financial support has been made available for numeracy. On the other hand, responses to open-ended questions produced a significant number of responses from schools that have been able to allocate additional resources to numeracy. Principals also believed that access to professional development and support have increased for literacy, especially in the early years, but that professional development and support for numeracy have decreased slightly.

Responses to open-ended questions revealed that principals perceived that the most important changes affecting the teaching of literacy in recent years have been:

- new curriculum initiatives, particularly State/Territory initiatives
- the introduction of new literacy programs such as the *Early Years Literacy Program* (formerly *Keys to Life*), *Reading Recovery*, *First Steps*, etc.
- new teaching and organisational strategies
- increased professional development and training

- the appointment of specialist/support teachers
- either *increased* resources or *inadequate* resources available for literacy (opinion was equally divided on whether they were increased or inadequate), and
- increased attention to matching teaching to the needs of students.

Principals perceived that the most important changes affecting the teaching of numeracy have been:

- new teaching strategies including the use of new resources
- new curriculum initiatives, particularly State/Territory initiatives
- more resources available for numeracy
- the development of school plans/policies for numeracy
- increased professional development, and
- an increase in experienced special and support staff.

Primary school principals believed that the most positive actions that could be taken to ensure that literacy and numeracy are given priority within the school curriculum were:

- to increase funding
- to increase access to appropriate professional development and training
- to increase provision or access to specialist and support staff, and
- to reduce overcrowding of the curriculum.

The findings of this survey present a generally positive picture regarding the place of literacy and numeracy in the primary school curriculum and on the impact of relevant government policies and programs. This is particularly true with respect to the place of literacy in the curriculum for students in the early years. They indicate that at this stage, significantly less attention has been given to numeracy. They point to the kinds of issues that need to be addressed if numeracy is to receive the same attention as literacy within primary schools and if the foundations established in the early years in literacy are to be extended to numeracy and to the later years.

Establishing the rationale for improvement and change

There are powerful reasons for the recent focus on literacy in schools. In terms of macro-level influences, literacy has benefited from a renewed interest among political leaders in ensuring high standards of basic education as a precondition to national prosperity and social stability. Over the past decade and a half, Australia,

along with other advanced economies, has struggled to maintain economic well-being and to adjust to new economic realities (Marginson, 1997). The demand for unskilled labour has almost disappeared as the nation has experienced the full impact of globalisation and the technological revolution. The factors that used to be critical in determining the nation's wealth — labour, capital and resources — have given way to a new set of factors, namely the knowledge, attitudes and skills of the workforce. In this context, there has been renewed interest in the role of education in facilitating broader economic objectives and in developing human capital. In particular there has been explicit recognition that at a collective level, Australian society relies strongly on high levels of basic education, that values such as equality, fraternity and democracy are hard to sustain without educated citizens, and that high levels of basic education are essential for economic prosperity, particularly through the formation of a flexible, dynamic and highly skilled workforce, (Maglen et al., 1994).

These arguments have undoubtedly contributed to the current emphasis on literacy in schools. They are, of course, arguments that apply as much to numeracy as to literacy, although the more universal nature of literacy inevitably means that there is a predisposition to give literacy greater attention. In addition, it is possible that the vital role of numeracy in everyday life is less transparent to many in the community at large, including educators, than that of literacy. Other reasons for the additional attention to literacy include:

- the relatively lower levels of mathematics education of primary teachers;
- the multicultural character of Australian society and the self-evident need to address the needs of large numbers of students from non-English speaking backgrounds;
- the relative abundance of innovative and sophisticated programs and materials to support the teaching of literacy, many of which have a strong theoretical and empirical basis. These include *Reading Recovery*, WA *First Steps* and Victorian *Early Years Literacy Program*;
- evidence regarding the costs to the community of failure to ensure basic literacy for all students in the form of lost tax revenues and increased welfare payments, employment benefits and crime-related costs, to name but a few (Jordan at al., 1992);
- the stimulus provided by the recent *National Schools English Literacy Survey* (Management Committee, 1997), which drew attention to a number of deficiencies in literacy standards in Australian primary schools, including a high proportion of students not meeting minimum or 'benchmark' standards, the particularly low levels of achievement of certain groups of students, and the large gap separating high and low achievers.

Information regarding the numeracy performance of Australian students has been forthcoming in recent years from the *Third International Mathematics and Science Study (TIMSS)* (Harmon et al., 1997). The results of this study were perceived to be generally positive, with Australia ranked 11th at fourth grade and 10th at eighth grade, outperforming other English-speaking countries such as the United States, Canada, Scotland, England and New Zealand. On the other hand, these overall results mask dramatically different results obtained in different States/Territories that in part appear to be accounted for by age differences of students in different systems. As a consequence, the *TIMSS* data, while revealing that Australia is not among the top league of nations in mathematics, created an impression that Australia was performing well in relation to those nations with which it most frequently compares itself. The contrast between *NSELS* and *TIMSS* is self evident: the former had the effect of drawing attention to deficiencies and providing a stimulus for increased attention to literacy, while the latter suggested that there was no need for serious concern, at least at the national level with numeracy, and that the relatively low levels of performance in certain States and Territories could be explained in terms of sampling anomalies.

To summarise, the rationale for improvement and change in numeracy is less well established than that for literacy, although the arguments are quite parallel. In seeking to communicate a greater priority for numeracy an important consideration is whether to make a separate case for numeracy or to link the case for numeracy more closely to that already established for literacy. The advantage of the former is that it encourages specific attention to numeracy. The advantage of the latter is that it avoids the notion of a separate and competing priority in a context in which schools already feel burdened by externally-imposed priorities for change and improvement.

'Zero tolerance of failure' policies for literacy and numeracy

The March 1997 agreement of the Commonwealth and State/Territory Ministers for Education to develop national educational 'benchmarks' or standards and their endorsement of a new national sub-goal that, 'every child commencing school from 1998 will achieve a minimum acceptable literacy and numeracy standard within four years', can be seen as an example of governments adopting what have been referred to as 'zero tolerance of failure' policies.

In education, such policies involve setting standards that are challenging and that (almost) all students are expected to achieve. They also involve establishing targets for meeting these standards over a finite period of time, and national and/or state assessment programs to ascertain the extent to which the targets are being met. Finally, and most importantly, they involve re-focusing the mission of schools and

re-designing how they operate so that meeting the standards becomes their main priority.

Setting national goals that embody 'zero tolerance of failure' is a powerful way of focusing energies and efforts. On the other hand, if the goals are unrealistic, there is the serious likelihood that schools will become saddled with impossible expectations and subsequently blamed for their inevitable failure. In addition, it is important to be clear about those students for whom the meeting of minimum standards will always be problematic, particularly those with disabilities and impairments. It is thus important that there is evidence at hand to demonstrate that the national goal and associated 'benchmarks' are achievable and for what proportion of the student population. In literacy it was possible to cite Australian research that suggested that improvements in student early literacy outcomes were achievable and that the target embodied in the national goal may indeed be attainable (Hill at al., 1998). It will be equally important to provide evidence that significant improvements in numeracy also are attainable. This evidence will be even more credible if it is based on experience within local rather than overseas schools and school systems.

School effectiveness and improvement

Strategic thinking aimed at developing a national approach to enhancing literacy and numeracy needs to draw upon a range of relevant literature which must be integrated into a single knowledge base, relevant to the aims of the strategy. From the literacy experience it is apparent how important *discipline-based* knowledge can be in informing and guiding improvement efforts.

For example, recent efforts to improve literacy outcomes have been inspired by impressive empirical evidence in the mainstream literature, indicating that failure to make satisfactory progress in literacy is preventable for all except a very small proportion of children (Pikulski, 1994). Unfortunately, the massive literature relevant to the teaching of literacy in schools is not all encouraging or of uniformly high quality. Indeed, a significant amount is contentious, contradictory, difficult to access, or of marginal value to classroom practitioners. The monograph published by DEETYA entitled *Literacy for all: The challenge for Australian schools* fulfilled a useful role in providing a brief and coherent perspective of relevant literature emphasising recent Australian research (Commonwealth of Australia, 1998). An important task in developing a national approach to numeracy will be to provide policy-makers and practitioners with a similar summary of powerful knowledge relevant to the improvement of numeracy outcomes of students.

While discipline-based knowledge addresses aspects of the content of a national strategy, it does not address the more general aspects of effectiveness at the school level and processes of improvement and change. It is therefore important that discipline-based knowledge be placed in the context of a broader body of knowledge regarding *school effectiveness and improvement* and knowledge regarding *the process of change in education*. This knowledge base has been critical in informing recent initiatives related to literacy and numeracy. For example, it has been highly influential in shaping the *National Literacy Strategy* and *National Numeracy Strategy* now being implemented in the UK. Significantly, the chair of the National Numeracy Task Force in the UK has been Professor David Reynolds, perhaps the foremost academic in the field of school effectiveness in that country.

This section focuses on this broader body of knowledge, on how it has been integrated into recent initiatives aimed at improving literacy outcomes, and on the relevance of this body of knowledge for numeracy.

The study of school effectiveness is concerned with developing theories which explain why students in some schools make greater progress than would be expected, given a knowledge of the intake characteristics of these students. The study of school improvement and of change in education has focused on processes whereby schools become effective and on how schools become better places. In essence, the knowledge base on school effectiveness and improvement has depended upon four kinds of studies.

The first kind has involved quantitative studies that have attempted to predict academic progress on the basis of a number of hypothesised factors, using a random sample of students within schools. This research has relied on natural variation to identify key factors and assumes that the variation among students and between schools in the value they add to student progress, is sufficiently important to lead to useful conclusions about effective schooling.

The second kind has involved qualitative case studies of schools known to be effective and has focused on explaining why and how these schools have become effective and what the characteristics are that they share. This research has assumed that we have most to learn from schools that have already demonstrated their effectiveness, although recently a strong case has been made to pay equal attention to ineffective or failing schools.

The third kind has been very much related to the second but has focused on documenting efforts to improve particular schools and on the conditions that assist in bringing about change in schools. This research assumes that knowledge regarding the characteristics of effective schools does not of itself provide a recipe that can be followed by less effective schools, but rather, that this knowledge needs to be supplemented by a knowledge of the processes by which effective schools

harness the energies and commitment of its staff to bring about change and improvement.

The fourth and most recent kind has been quasi-experimental improvement studies that have sought to implement and evaluate, using multi-site replications and comparisons with control groups of schools, the impact of particular programs (e.g., *Reading Recovery*) or whole-school designs (e.g. *Coalition of Essential Schools, Success for All*). These studies assume that more can be learned from deliberate and highly systematic attempts to improve learning outcomes that build on knowledge derived from the three preceding kinds of studies, than from the study of natural variation within and among schools or from the study of schools that have already been shown to be effective.

From the first group of studies, much has been learned about the complexities of measuring the 'value-added' contribution of schools with respect to student learning outcomes. Methodological advances have provided researchers with techniques to estimate the proportion of total variation in student outcomes due to the effect of school membership, having adjusted for students' initial levels of ability and performance and various background characteristics. Application of these methods indicates that school effects are relatively modest (say between 8–15 percent of the variance in value-added scores) (cited in Reynolds et al., 1994), and that the importance of school organisational characteristics in explaining student progress has been greatly overrated (Wang et al., 1993). However, there is significant evidence to suggest that while variation among schools in the value they add is relatively small (except at the margins), there is substantial variation in effectiveness between classes within schools (as much as 30–50%), (Hill & Rowe, 1996). Furthermore, the variables that best predict whether students make progress tend to be those integrally concerned with the quality of teaching and learning (Wang et al., 1993) and what happens within the classroom, such as: high expectations, time on task or engaged learning time, and focused teaching that succeeds in engaging all students within their 'zone of proximal development' (Scheerens & Bosker, 1997).

From the second group of studies come rich descriptions of schools that are clearly effective. These descriptions all tend to converge on the following five factors (Edmonds, 1979) as being characteristics of effective schools:

1. strong educational leadership
2. an emphasis on acquiring basic skills
3. an orderly and safe environment
4. high expectations of student attainment
5. frequent assessment of student progress.

A more extended summary, which also incorporates findings from the first group of studies, has been provided by Sammons and colleagues (1995) and includes the following eleven factors:

1. *professional leadership* that is firm and purposeful, participative and in which the principal seeks to be the leading professional
2. *shared vision and goals*, unity of purpose, consistency of practice, collegiality and collaboration
3. an orderly and attractive *learning environment;*
4. *concentration on teaching and learning*, the maximisation of learning time and a focus on achievement
5. *purposeful teaching*, including efficient organisation, clarity of purpose, structured lessons and adaptive practices
6. *high expectations* for all that are communicated consistently and ensure students are intellectually challenged
7. *positive reinforcement* from clear and fair discipline and feedback to students on their progress
8. *monitoring progress* both in respect to student performance and the performance of the school as a whole
9. *student rights and responsibilities*, raising students' self esteem, giving them positions of responsibility and control of the work they do
10. *home-school partnerships*, with parent involvement in their children's learning
11. *a learning organisation* which emphasises school-based staff development.

From the third group of studies come numerous accounts that demonstrate that there are no simple answers to guide those seeking quantum improvements in student learning outcomes. There have been many attempts at raising standards by one means or another, but reformers have invariably found that it is difficult to improve student learning in a sustained way across more than a handful of schools at any one time (Zywine at al., 1995). As Sarason (1990) has suggested, this is because most reforms fail to penetrate the classroom door and impact upon classroom teaching. On the other hand, much knowledge has been accumulated regarding successful improvement strategies, such as: the importance of adapting external change for internal purposes; of building partnerships; of focusing on student learning rather than broad aims; of establishing context specificity before designing the strategy; of planning strategically not tactically; and of building capacity and nurturing the conditions for change (adapted from Hopkins, 1995). Also, through the work of

researchers such as Fullan and Hargreaves, much is known about successful strategies for harnessing the energies and commitment of teachers in bringing about change, especially through appropriate forms of professional development (Fullan, 1993).

From the fourth group of studies, namely quasi experimental improvement studies, come some of the most impressive improvements in student learning that have been recorded within the educational research literature. These studies subsume the three previous kinds of studies in that they specifically incorporate school effectiveness, school improvement and educational change knowledge in the context of a rigorously evaluated improvement project, aimed at re-designing the way in which schools operate. One of the best known examples of this kind of study is the *Success for All* program of Slavin and colleagues. Well-designed evaluations of multi-site replications of this program in a wide range of settings with disadvantaged children have demonstrated consistently dramatic improvements in student literacy outcomes. Moreover, these improvements have been especially pronounced for low achieving students (Slavin et al., 1994)

Success for All is not a discrete program that can be introduced into schools as an 'add-on'. Rather, it is an educational 'design' that aims to transform the whole ecology of schooling. It is predicated on the notion that in order to ensure that all students are able to read and write to a high standard, schools have to be conceptualised differently. This means identifying all of the critical elements of schools and of school systems, working out what needs to change in order for them to operate effectively and in alignment with all the other elements, and then redesigning them accordingly. Wilson and Daviss describe the redesign process as follows:

> The redesign process is the integration of research, development, dissemination, and refinement by which innovations and the procedures that create them are originated, improved, and made affordable….the redesign process is an institutionalized method of strategic, systemic change that works unceasingly to enact a vision of excellence as well as to redefine excellence itself when changing conditions make it necessary (Wilson & Daviss p.22, 1994).

In the USA, there is now a number of 'designs' that adopt a comprehensive, whole-school approach to improvement of learning outcomes. The best-known of these designs are the nine designs promoted by the *New American Schools Development Corporation* (Stringfield at al., 1996). Each design required many hundreds of hours of design work by teams of educators working to create a coherent and consistent approach to improvement, based wherever possible on 'best practice' and findings from discipline-based research and the research literature on school effectiveness and improvement. These designs were then piloted in a small number of schools and subject to rigorous evaluation before being implemented more widely.

In the following section, a design approach to improving early literacy within the Australian context is described. This design emerged out of research and developmental work undertaken as part of the *Early Literacy Research Project (ELRP)* by Crévola and Hill (1998) with a group of 27 disadvantaged government primary schools and more recently with more than 120 Catholic primary schools in Victoria. The design is readily applicable, however, to numeracy and for students other than educationally disadvantaged students in the early years.

A design approach to improving literacy outcomes

In creating a new model of car, the automotive design team knows that the basic design elements of the car (e.g. the four-stroke engine under the hood, the steering wheel, the floor-mounted accelerator and brake pedal) are unlikely to change: what changes is how effectively, efficiently and reliably each element performs. Likewise, in schools, the elements that are critical to its success in ensuring students achieve success in core areas such as literacy and numeracy are relatively unchanging. On the other hand, in schools that have succeeded in institutionalising on-going improvement into their operations, there is constant attention to improving each element and ensuring that when combined with all others, the school operates smoothly and effectively. Figure 1 summarises a set of design elements that it would be claimed are unchanging elements in all schools, but which need to be constantly subject to re-design in the ongoing quest for more effective models of schooling.

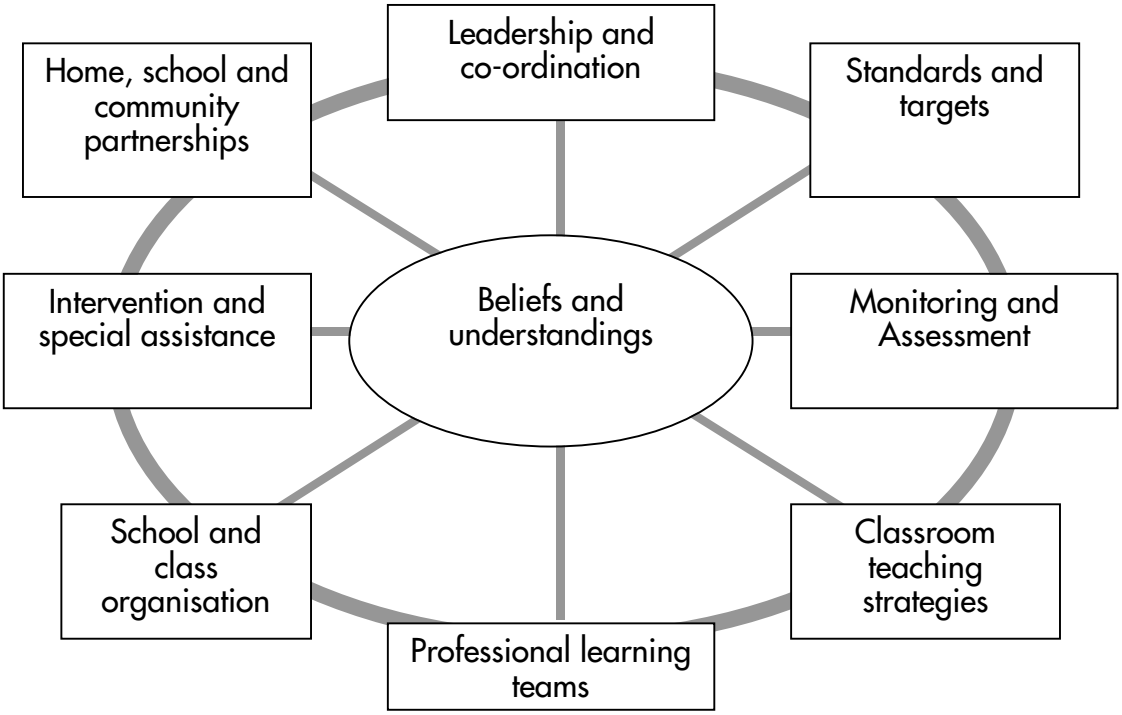

Figure 1. General design for improving learning outcomes (Hill & Crevola, 1997)

Beliefs and understandings

Beliefs and understandings about teaching and learning are central to the design summarised in Figure 1. The most important of these is a belief in the capacity of the overwhelming majority of students to achieve high standards, given sufficient time and support. Unfortunately, in far too many schools, particularly those serving students from disadvantaged backgrounds, there has long been a culture of low expectations with respect to student literacy and a tendency to equalise time and support for all students. (The equalising of time and support is evident in the fact that the length of the school year and the school day, and the amount of time devoted to literacy and numeracy, tend to be the same for all students in most schools. Indeed in many schools, the more able students are given and do much more homework than their less able peers in inverse relationship to their needs.) In such schools, students perform to mediocre levels and the learning gap between the 'haves' and the 'have nots' becomes so great as to render focused teaching a virtual impossibility. The learning gap in literacy of at least five years of schooling by Year 3 identified in the National Schools English Literacy Survey (see Section 3) is symptomatic of this pervasive culture of low expectations. Conversely, in effective schools, as is consistently revealed in the school effectiveness research literature, there are high expectations of all students, teaching and learning are highly focused on the needs of each student, and students achieve high standards, in spite of personal and home background circumstances. (The classic definition of an effective school, is one in which students make greater progress than could be predicted from a knowledge of the entry characteristics of its students.)

In the area of literacy, low expectations are invariably associated with an exaggerated view of the influence of the home and an under-estimation of the power of good teaching to make a difference. In the area of numeracy, it is likely that low expectations are also common, but associated more with the view that some students have natural mathematical aptitudes (particularly boys) and some do not (particularly girls) and that time and effort should not be wasted on those lacking these aptitudes, or conversely, that the less mathematically inclined should be provided a 'watered down' curricula that embodies significantly lower expectations. Countering such negative views, where they appear, is a critical task in implementing the design summarised in Figure 1.

In addition to believing in the capacity of the overwhelming majority of students to make progress, given sufficient time and support, it is equally important that there is a parallel belief in the capacity of almost all teachers to teach all students to high standards given the right conditions and assistance. The critical issue, of course, is knowing the conditions under which all teachers can teach to high standards and the kinds of support they need in order to do so.

At a deeper level, the design of Figure 1 is based on the belief that all teachers need to be able to articulate what they do and why they do it the way they do. In other words, the design reflects the view that practice must be grounded in theory and that teachers should aspire to a 'professional' rather than a 'trade' or 'craft' view of teaching. This means that it is necessary to go beyond acting intuitively and in the light of experience as to what works and does not work, be able to reflect critically on one's practice in relation to theoretically based and empirically verified models of teaching and learning.

Standards and targets

Standards and associated targets are critical to the model summarised in Figure 1. High expectations of student achievement need to be reflected in explicit standards that have been 'benchmarked' against those of other systems to ensure that they reflect 'best practice'.

The national goal referred to earlier is for all students entering school in 1998 to reach challenging 'benchmarks' or standards in literacy and numeracy by Year 3. This goal provides a clear focus for all Australian primary schools over the coming years and the standards underpinning the overall national target are already in place. Unfortunately these standards have been subject to little by way of rigorous benchmarking with those of other systems. That which has been done in the area of numeracy/mathematics leads to the disturbing conclusion that the national 'benchmarks' may represent levels of performance that in most other systems are required of students at a younger age than in Australia (Lokan & Ainley, 1998).

There may be other limitations in the standards and targets so far established with respect to numeracy. In the case of literacy, where so much depends on students making progress in the first two years of schooling, it is vital that there are intermediate standards and targets relating to these early years.

At the commencement of the *Early Literacy Research Project (ELRP),* schools had the benefit of content standards published by the Victorian Board of Studies, but lacked detailed performance standards and associated targets relevant to the first three years of schooling. This gap was filled by adopting a set of precise standards and targets derived from those of Clay and Tuck in their '*three waves of teaching*' (1991). They argue that with good teaching in the first year of schooling, one can expect 80 percent of students to have reading and writing under way. During the second year of schooling, with good teaching and using *Reading Recovery* as an accelerative one-to-one intervention program, one can expect to have a further 18 percent under way. This leaves approximately two percent for whom further referral and special support will be necessary during the remainder of their schooling.

On the basis of this work, a set of standards was operationalized for *ELRP* schools based on the text level of students, which was established by taking 'running records' using a set of 28 unseen graded texts. Two standards were identified, namely a minimum standard and a target standard. These targets and standards are summarised as follows:

Stage of schooling	Target percent meeting standard	Minimum standard	Target standard
End of Kindergarten	80%	Text Level of 1 or above	Text Level of 5 or above
End of Year 1	98%	Text Level of 15 or above	Text Level of 20 or above

It will be noted that two kinds of targets were identified: a 'minimum' standard and a 'target' standard. This was done to ensure that the targets embodied a challenge for all schools and for all students and did not focus solely on the bottom end of the performance continuum. To specify only minimum standards is to run the risk of encouraging a culture of low expectations for the majority of students.

Finally, the targets were specifically linked to an explicit level of performance and to a procedure for assessing whether students had reached that standard. This was achieved by making use of *Reading Recovery Text Levels* (which range from 1 to 26) and adding two additional levels of text, by making use of a set of benchmark texts that had been carefully levelled using a readability measure, and by taking a 'running record' of each student using these unseen texts. These targets have provided the impetus for schools within the *ELRP* with respect to setting appropriate expectations and have provided a benchmark for evaluating progress towards meeting the overall national literacy goal. It is suggested that in the case of numeracy, it is equally important that attention be given to finer-grained standards and targets appropriate for the first three years of schooling.

Monitoring and assessment

In the past, assessment has been something of an 'Achilles Heel' for education in Australia. For many years there has been a pervasive culture of resistance to assessment, particularly if it has implied the use of standardised forms of assessment. This culture is changing rapidly with the growing recognition that ongoing improvement in education implies regular monitoring and assessment.

Assessment is important to establish whether targets have been met and whether progress has been made towards ensuring that all students meet the set standards.

But there is much more to monitoring and assessment than using it for summative purposes. The most important function of monitoring and assessment within the design summarised in Figure 1 is to assist teachers to find out as much as possible about their students, to establish starting points for teaching and to use this diagnostic information to drive classroom instruction.

Effective teaching implies a focus on the learning needs of each student, and building on their strengths in seeking to remedy their weaknesses. It implies finding out as quickly as possible what each student does and does not know and monitoring students' progress to ensure that each student is always working within his or her level of challenge or 'zone of proximal development' (Vygotsky, 1978).

In the area of literacy, a great deal of work has been undertaken to assist teachers to become expert observers of students' literacy behaviours and to make use of their observations to guide and direct teaching. The Western Australian *First Steps* program typifies this work. Within the *Early Literacy Research Project,* there has been a deliberate emphasis on making teaching information driven. Assessment has been used to guide decision-making with respect to the identification of 'at risk' students and to ensure that instruction is related directly to the learning needs of each student. It has also been used to evaluate the effectiveness of the overall program and to track change over time. Consistent with the principle that instruction should be based on a detailed observation of each child as a learner, all classroom teachers within the *ELRP* trial schools take daily running records of their students' reading behaviours. The resulting information is used to establish dynamic instructional groups for the teaching of reading within the classroom and to ensure that students are working at an appropriate level of difficulty. In addition, detailed, systematic observation of each child is carried out at the beginning and end of each year, based on Clay's *Observation Survey of Early Literacy Achievement* and *Record of Oral Language* (1993). While this is initially a time-intensive process, it ensures that there is a detailed diagnostic profile of each student compiled by the classroom teacher which provides the information necessary for matching teaching to the needs of each student.

As students become older, so it is possible to make greater use of group tests, which can be administered more speedily and efficiently than individually-administered tests or observation schedules. However, to the extent that group administered tests decrease the likelihood that teachers will gain detailed knowledge about individual students, caution must be exercised about their use. The assessment tasks developed by the ACER as part of the *National Schools English Literacy Survey*, while group tests, required the close involvement of teachers in their administration and in scoring them. As a consequence, teachers gained greatly in their knowledge and understanding of their students.

In articulating a national numeracy strategy, attention may need to be given to the development of well-researched one-to-one approaches for assessing and monitoring student progress, particularly in the early, formative years.

Classroom teaching strategies

There is an important sense in which all teachers are teachers of literacy and literacy is acquired across the curriculum. This is particularly true in the context of teaching students who have already acquired a certain level of competence. For example, once students are fluent readers, they can benefit from extending and developing their literacy skills in the context of other genres and different subjects. Similar arguments hold for numeracy.

At the same time, it is important that instructional time is set aside specifically for the teaching of literacy and numeracy. Effective teaching is structured and focused on the learning needs of each student in the class. This constitutes the most difficult challenge faced by teachers, particularly given the wide range of needs and abilities within the typical classroom. It requires teachers to have detailed understandings of how children learn and well-developed classroom routines, structures, organisation and management related to small-group instruction. It also requires teachers to motivate and engage students using a range of classroom practices and strategies.

The literacy experience indicates that much time and energy can be wasted on debates of dubious relevance regarding particular methods of teaching, of which the best known is the phonics versus whole language debate. Fortunately, most classroom practitioners recognise that teachers are most effective when they use a range of methods and adopt a balanced approach.

The literacy experience also indicates that there is no need to go out in search of what constitutes good practice. This is already known. Rather, the emphasis needs to be on ensuring that all teachers have a deep understanding of what constitutes good practice.

The *ELRP* has looked to the good early years teaching practices operating in New Zealand classrooms as a basis for developing balanced and focused teaching programs (Department of Education, New Zealand, 1985). Within the *ELRP*, teachers combine the following strategies within their daily literacy programs:

- Oral language
- Reading to children
- Language experience (reading)
- Shared reading
- Guided reading
- Independent reading
- Modelled writing
- Language experience (writing)
- Shared writing
- Interactive writing
- Guided writing
- Independent writing

In each of the trial schools, the classroom literacy program consists of a reading and a writing workshop conducted within a two-hour teaching block. Each session begins and ends with a teacher-directed whole class focus. The main part of each workshop consists of activities that have a small-group focus. This allows for explicit teaching of instructional groups, while the remainder of the class is engaged in self-regulated activities in Learning Centres. Trained volunteers are used where possible, to assist the students to remain on task and to free the teacher for small group instruction. In this way, the expertise of the teacher is applied at the point of greatest need. The structure of the two-hour literacy teaching block is shown in Figure 2. It is within this three-part, whole-class, small-group, whole-class structure that each of the above strategies are integrated into effective classroom practice.

Whole class focus

The daily reading workshop begins with a 'whole class' focus which is based on the Shared reading strategy. Shared reading can consist of books, charts, poems, songs etc. The daily writing workshop begins with a 'whole class' focus which consists of either Modelled writing or Shared writing.

Small group teaching focus

This section of the reading and writing workshop focuses on the explicit teaching of small groups of students. During the reading workshop the strategies of reading to children, language experience and guided reading take place at the same time that learning centres are in operation for the remainder of the class. During the writing workshop the teaching strategies of language experience, interactive writing and guided writing take place while the remainder of the class are engaged in independent writing and various other activities included to extend the students' understandings of grammar and spelling.

Whole class focus: sharing

This is the concluding section of both the reading and writing workshops and it is a time for reflection when students articulate what they have learnt. During this time the teacher encourages the development of the students' oral language. This share time draws the workshop to a close and the teacher concludes the formal reading and writing components for the day.

Figure 2. Structure of the daily two-hour literacy teaching block

In the case of numeracy, it is likely that parallel teaching strategies can be identified and that they are most effective when incorporated into a one-hour numeracy/mathematics block, within a whole-class/small-group/whole-class structure. In schools where parallel strategies and structures apply for both literacy

and numeracy, classroom routines and expectations of student on-task behaviours will be established more readily.

Professional learning teams

A crucial element in any design aimed at improved teaching and learning in schools is the provision of effective, ongoing and practical professional learning opportunities for teachers. The general design summarised in Figure 1 not only assumes that good teachers make a difference, but that processes need to be in place to ensure that all classes are operating at the same level as the most effective classes — in terms of improving student learning outcomes. Experience suggests that the great majority of teachers are able to improve their effectiveness as professional practitioners, given the right conditions and support, but that achieving quantum improvements in teacher effectiveness is difficult, if not impossible, using traditional models of professional development and in-service training.

Effective professional learning assumes effective leadership to create the motivation and commitment to change and improvement. It also involves intensive, sustained, theoretically-based yet practically-situated learning, with opportunities to observe good practice, to be involved in coaching and mentoring processes and to take time for reflection (Hargreaves & Fullan, 1991). Moreover, professional learning is most powerful when it occurs within the context of teachers working as members of a team and in pursuit of specific learning outcomes for students.

The literacy experience has consistently demonstrated the power of good professional development that recognises the above principles, many of which were incorporated into some of the earliest models of professional learning, such as the *Early Literacy In-service Course (ELIC),* which had its parallel in the *Early Mathematics In-Service Course (EMIC)*.

Within the *ELRP*, the kind of thinking underpinning *ELIC* has been extended by an emphasis on data-driven professional learning and on the establishment of 'professional learning teams' as critical ingredients in creating both a culture and a process for ongoing improvement in the quality of teaching in schools. As members of professional learning teams, teachers have increasingly assumed joint responsibility for the learning outcomes of all the students under their care, so that successful learning becomes a shared responsibility, not just a responsibility of the individual classroom teacher. They have also assumed responsibility for each other's professional growth and development, so that successful teaching is also a shared responsibility in which the team provides individual members with both the pressure and support to improve.

Within the *ELRP*, classroom teachers of students in the first three grades were formed into professional learning teams under the leadership of a co-ordinator with a 0.6 to 1.0 time release. Each team was provided with eight full days of off-site, university-based professional development in the first year of implementation and four days in the second year. In addition, the co-ordinators attended twice the number of sessions. On-site professional development took place through weekly meetings of learning teams and through opportunities created by the co-ordinators for modelling, demonstrating, coaching, mentoring, observing each other and through visits to professional learning teams operating in other *ELRP* schools.

A vital component of the professional learning program was a full-day visit to each of the trial schools by the university-based professional development co-ordinator. These visits were critical in making a direct connection between understandings gained during off-site professional development sessions and the actual working knowledge (classroom practice) of the teachers involved. They also provided opportunity for the co-ordinator and the principal to raise leadership issues pertaining to their particular school.

The lesson to be learnt from the *ELRP* is that effective professional development cannot be done 'on the cheap'. It represents a whole-school commitment to a process of ongoing development and improvement directed at meeting challenging targets for specific student learning outcomes. It also implies a commitment by governments and systems to the funding of quality professional development programs. This same message is equally applicable to numeracy.

School and class organisation

In order to maximise engaged learning time and focused teaching, it is necessary to ensure that:

- schools are organised around the learning needs of students (as opposed to, for example, the work conditions of teachers)
- adequate time is allocated for core learning and that this time is free from external interruptions
- resources are allocated to support the co-ordination of professional learning teams and time for these teams to meet on a regular basis
- the most 'at risk' students receive extra time and support
- classes are organised in ways that facilitate focused teaching and minimise internal disruptions.

In the early stages of the *ELRP*, there were challenges in ensuring an adequate allocation of time to specific literacy instruction. While many schools had formerly

made provision for a daily two-hour literacy block, over the years new content had been added to the curriculum and more time had been allocated to areas such as the visual and performing arts, languages other than English, information and other technologies and health and physical education. Invariably, this was at the expense of time devoted to direct literacy instruction. In other words, the stage had been reached when it was necessary to reassess priorities and deal with the problems generated by an over-crowded curriculum.

Even once schools had allocated adequate time to direct literacy instruction, the actual time available was much less than the notional time allocation due to frequent interruptions. These include planned or semi-planned events such as school assemblies, that were often scheduled in prime learning time, the withdrawal of students for special activities and programs, excursions, rehearsals, swimming lessons, and so on. They also included unplanned interruptions such as messengers entering the classroom during lesson time, public address system announcements, collections of monies, dealing with personal issues of individual students and teachers, and so on.

While it was evident that some of these interruptions were unavoidable or even desirable, it was also apparent that many should never happen. In a school culture in which the work of the classroom teacher is valued and teaching is seen as being of paramount importance, every effort should be made to respect the need for freedom from interruptions. Thus *ELRP* schools had to put in place simple rules or conventions to minimise interruptions to scheduled lesson time.

There were also major issues relating to class composition and classroom organisation. Many of the trial schools had composite or multi-grade classes to accommodate uneven numbers of students in different grade levels. Others had, for philosophical reasons and as a matter of choice, opted for multi-age groupings of students. Reviews of research into multi-grade and multi-age grouping practices indicate that there are neither negative nor positive effects associated with these forms of class organisation (Kulik & Kulik, 1992). On the other hand, positive effects are associated with those forms of class organisation that facilitate teaching focused to the learning needs of students (such as cross-age grouping and within-class grouping). Within the ELRP, some schools have continued to make use of multi-grade and multi-age forms of class organisation. However, all have formed four or five dynamic instructional groups within each class and have made use of learning centres and task management boards to ensure 'on-task' behaviour of students during the small group focus of the two-hour literacy block.

Issues related to the scheduling of adequate time and the minimising of interruptions and disruptions apply equally to numeracy as to literacy. Indeed, there is some evidence to suggest that numeracy may have suffered more from the consequences

of an 'overcrowded curriculum' than literacy. Issues related to class organisation loom large in mathematics, particularly for older students, with many schools retaining forms of class organisation that research has indicated do not facilitate the progress of all students. It is thus critical that there be a greater awareness of this research and of the advantages and disadvantages of different kinds of class organisation, many of which can co-exist within the same classroom. For example, it is possible to have within-class instructional groups, within a multi-age classroom.

Intervention and additional assistance

Everyday experience, let alone the findings of innumerable research studies indicate that even with the very best classroom teaching, a significant proportion of students fails to make satisfactory progress, for a whole variety of reasons. For such students, early intervention is essential to enable them to catch up quickly to their peers. Without timely and effective intervention, these students continue to fall further and further behind in their school work and experience diminished self esteem and increased alienation from schooling. This intervention and special assistance is a vital element of the design summarised in Figure 1.

Within the literacy context, the research indicates that schools have a narrow 'window of opportunity' to assist low performing students to catch up and the only real answer to narrowing the 'learning gap' is to intervene quickly, relentlessly and with all the resources at the school's disposal. Wasik and Slavin have found conclusive evidence to support the efficacy of various one-to-one tutoring programs, of which the most impressive evidence was for *Reading Recovery* (Wasik & Slavin, 1993). Although relatively costly, Dyer has estimated substantial net cost savings of one-to-one tutoring (Dyer, 1992). Unfortunately, even one-to-one interventions such as *Reading Recovery* do not represent a once-and-for-all 'fix' for all 'at risk' students. In particular, such programs do not and cannot be expected to address the factors that have led to certain students being 'at risk' in the first place. For this reason, there is also a need for specialist assistance for students who after intensive one-to-one intervention continue to experience difficulties. This assistance might take the form of referral to specialists or placement in special settings. More generally, it will take the form of individual learning plans devised in consultation with the school principal, the classroom teacher, specialists and parents or care-givers.

The literacy experience indicates that one-to-one intervention programs such as *Reading Recovery* are successful in assisting many 'at risk' students to catch up with their peers, but are expensive to implement. Schools need to commit resources to the training of new *Reading Recovery* teachers as well as to deploy sufficient trained teachers to enable full coverage for all students needing access to *Reading Recovery*. Nevertheless, despite the high costs of full implementation, system after system and

school after school have committed themselves to implementing *Reading Recovery* because of the clear evidence of its success with those learners making the least progress.

Unfortunately, there is no well-established parallel to *Reading Recovery* to assist those students making little progress in the area of numeracy. In part, this may be a reflection of the fact that on commencing school there is much less of a learning gap between students in their readiness to become numerate than there is in their readiness to speak, listen, view, read and write in English (Rowe & Hill, 1996). On the other hand, there is substantial evidence that the learning gap quickly grows and some students get left behind to the point at which they are unable to profit from regular class instruction.

Home/school/community partnerships

There is a strong body of research to show that when parents, care givers and the community are supportive of the work of the school and involved in its activities, students make greater progress (Cairney et al., 1995). But to be effective, it is not enough to establish links with the home. What is needed are comprehensive and permanent programs of partnerships with families and communities.

There are many reasons for developing school, family and community partnerships. They can improve the school programs and school climate, provide family support and services, increase parents' skills and leadership, connect families with others in the school and in the community, and help teachers with their work. However, the main reason to create such partnerships is to help students succeed in school and in later life. When parents, teachers and students view one another as partners in education, a caring community forms around students in a way that supports learning.

The literacy experience indicates that parents play a vital role in improving student literacy outcomes, which ranges from listening to students read and reading to students at home, to assisting in the classroom, particularly in the early years. Indeed, the whole model of teaching and learning with respect to literacy embedded within the *ELRP* and other approaches commonly used in schools across the country, is entirely dependent on the availability of parents or other community volunteers assisting in the classroom.

A similar case for the importance of home, school and community partnerships can be mounted for numeracy and indeed is part of a general case that covers all kinds of student outcomes in all areas of the curriculum. The literacy experience indicates that many traditional approaches to engaging parents and the local community have met with limited success and that schools must be prepared to try different approaches,

particularly, to connect with those families with whom the school has little or no contact or positive and mutually supporting relations. Fortunately, excellent support materials have been developed that provide guidance in establishing effective partnerships.

Leadership and co-ordination

Leadership and co-ordination constitute the final element in the general design summarised in Figure 1. Studies of effective schools have consistently drawn attention to the importance of strong educational leadership and indeed it is often cited as the most important characteristic.

Miles talks about change as progressing through three phases, namely initiation, implementation and institutionalisation (cited in Fullan with Stiegelbauer, 1991). During each phase, the principal and the leadership team need to be able to provide an appropriate balance of direction, pressure and support. Direction is necessary to focus energies and resources. Pressure is necessary to provide a stimulus and incentive to change and improve. Low expectations and complacency are unavoidable consequences of lack of pressure. At the same time, pressure needs to be balanced with appropriate support and assistance. Improvement in schools rarely happens simply by raising the level of challenge or by exhorting teachers to work harder or more effectively. It happens because the right mix of pressure and support are in place.

Within the *ELRP*, the critical role of principals in ensuring the success in the area of literacy is recognised in the form of regular meetings with the project team to discuss progress, share concerns and participate in shaping the ongoing direction of the project. Principals have been key players at every stage of implementation, even though they typically delegate much of the day-to-day work associated with the project to a literacy co-ordinator.

As part of the initial conditions of entry to the project, a literacy co-ordinator was appointed in each of the trial schools. The role of the literacy co-ordinator has proved crucial to success within the *ELRP* schools in ensuring the right mix of pressure and support. Their role has been to:

- assist in the development of classroom materials
- provide direction, support and assistance to classroom teachers
- develop, implement and co-ordinate the design elements within the school in consultation with the school principal
- co-ordinate data collection
- provide in-school professional development for teachers

- disseminate information to the school community.

Once again, a parallel case exists for attention to leadership and co-ordination in support of numeracy, and in particular, for principals to allocate adequate time to instructional leadership directed at numeracy and resources to enable effective co-ordination of numeracy programs within the school.

Evaluating designs

Incorporating the above general design elements into a specific whole-school approach to improvement and reform, implies a massive investment of time and other resources. Staff are more likely to make such a commitment if there is strong empirical evidence that implementation of the reforms is likely to lead to the desired outcomes. Slavin has argued that it is important that there be multi-site evaluations of the effectiveness of specific designs, using matched control groups of schools (1997). Undertaking rigorous evaluations of whole-school designs is a costly and technically demanding business, but if the outcomes are positive and firm evidence is available regarding the efficacy of a particular design, that evidence is likely to be powerful in leveraging additional resources and in influencing policies regarding the allocation of existing resources.

The design of the *ELRP* was based around annual pre- and post-testing over a three year period (1996–98) in 27 trial schools and a matched sample of control or reference schools. The results of an initial evaluation of the first year of implementation (1996), indicate that over ten separate measures of literacy progress and following adjustment for a range of background characteristics, effect sizes for participating schools in excess of 0.6 of a standard deviation were achieved (Crevola & Hill, 1998). In terms of the proportions of students meeting the defined minimum standards, unpublished data indicate an improvement over the two-year period 1996–97 from 49% to 75% in the Preparatory Year, and from 70% to 91% in Year 1.

Already, results from the project have had a major impact on funding policies. In May 1998, the State government announced significant additional funding to assist all Victorian government primary schools to implement its Early Years Literacy (formerly *Keys to Life*) Program. This program is based on the design elements summarised in Figure 1. The additional funds have been specifically targeted to cover the appointment of a literacy co-ordinator and the implementation of *Reading Recovery* in every State primary school. The approach that has been adopted to make available the extra funds, represents one of the first attempts by an Australian education system to link additional resources specifically to improved learning outcomes of students. The funding will be provided on the condition that schools submit plans that commit them in an on-going way to meeting challenging, pre-

defined standards and to implementing a design approach based on the elements described above.

The literacy experience thus suggests that if schools are to be encouraged or required to adopt particular programs or whole-school approaches to improving numeracy outcomes for students, there should first be proper evaluations of such programs and approaches that justify their adoption. Furthermore, the existence of quality evidence regarding the efficacy of such programs or approaches will be increasingly important if schools or school systems wish to access new resources.

Learning from the negatives as well as the positives

There is much that is positive that can be learnt from the literacy experience and applied to numeracy. In particular, certain well-designed literacy programs that seek to substantially deepen teachers' subject and pedagogical knowledge, such as *First Steps* and *Reading Recovery*, provide good models that are worthy of emulation in the context of numeracy.

It is also important that attention be given to the negatives of the literacy experience, as well as to the positives. Probably the best-documented of the 'negatives' associated with the myriad of initiatives aimed at improving literacy outcomes, is the difficulty that program developers and systems have had (with a few notable exceptions) in achieving full implementation in more than a handful of schools. Many promising programs founder when attempts are made to use them to bring about systemic improvement. As Darling-Hammond has commented, good teaching that leads to structured content knowledge and deep understanding is extraordinarily hard and requires both a massive investment in quality professional development and a willingness to restructure, or rather redesign, schools to support learning for knowledge and understanding (1997). All too often, the necessary investment in professional development does not occur and the need for and willingness to engage in restructuring or re-design is not present. In such circumstances, excellent programs are frequently called into question when the real problem has not been the program or initiative itself but the inadequacy of the implementation and scale-up strategies (Elmore, 1996).

Locking in improvement

The final phase in the adoption of a whole-school, design approach such as that summarised in Figure 1 is the phase of 'institutionalisation' in which reform initiatives are no longer regarded as discrete projects with a defined beginning and end, but in which the key elements of the reforms are embedded in the ongoing

structures, processes and practices of the school. This 'institutionalisation' of reform cannot be taken for granted. All too often, at the end of a project that has resulted in significant gains, the school begins to focus on other priorities and things gradually revert to the old ways of doing business. Key personnel become exhausted or move on, and the innovative practices disappear or remain in a watered-down or half-hearted form.

To prevent this happening, it is necessary for schools and school systems to 'lock in' the changes that have led to improvement. Indeed, it is important to go a stage further and build in to daily operations continuous improvement processes so that the gains achieved during the implementation phase are not only sustained, but progressively extended. Even the most successful of reforms that have led to impressive improvements remain fragile and can easily dissipate without such attention.

The literacy experience and the experience of educational reform more generally suggest that it is important that initiatives aimed at improving numeracy in schools do not stop at the development and implementation phases, but lead to sustained and ongoing change and improvement.

The role of systems and the Commonwealth

The literacy experience indicates that the Commonwealth and school systems are able to exert a powerful influence on what happens in schools, particularly when they act in a concerted fashion in pursuit of the same objectives. The evidence for this is clear from the national survey of primary schools reported in Section 2. The same survey also provides evidence of the perceptions of school principals regarding the most positive actions that could be taken to ensure that both literacy and numeracy are given priority within the school curriculum, namely:

- to increase funding
- to increase access to appropriate professional development and training
- to increase provision of specialist and support staff
- to reduce overcrowding of the curriculum.

While not denying that each of the above actions would be welcomed by schools and would assist in improving student outcomes, it is suggested that the literacy experience points to the importance of particular roles of systems and the Commonwealth with respect to numeracy, namely:

- the promotion and dissemination of ideas and information, including both discipline-based knowledge about numeracy and knowledge about the broader

context of improvement and change (i.e. as represented by the design elements summarised in Figure 1);

- the establishment of internationally-benchmarked, explicit numeracy standards and targets within the context of an achievable curriculum that is not 'overcrowded';
- the development of assessment materials and the implementation of assessment programs to monitor students' progress and to inform classroom teaching in the area of numeracy;
- the development of systemic change and improvement strategies designed to enable schools to meet national numeracy goals and school-level targets;
- the introduction by the Commonwealth and by State/Territory governments of new approaches to outcomes-oriented funding and accountability for outcomes that provide both the means and the incentive for schools to adopt improved approaches to teaching and learning in the area of numeracy and that build in feedback on the success or otherwise of these implementations;
- the funding and evaluation of large-scale numeracy improvement initiatives and programs, including funding for professional development of teachers and for generating classroom materials;
- the promotion of research and development aimed at developing and testing new and improved approaches and strategies for improving teaching and learning in the area of numeracy.

The main challenge within the Australian context in establishing a practical plan for improving numeracy outcomes arises from the fact that school education is primarily the responsibility of the States and Territories. This makes co-ordinated action difficult and complex, and dictates that in addition to a national level plan indicating broad goals, targets and strategies, there must also be plans at the system and the school levels that provide additional levels of detail. As a consequence, Australia's National Literacy and Numeracy Plan inevitably appears more general and leaves much more to decision-making at the system and school levels than, for example, the *National Literacy Strategy* and the *National Numeracy Strategy* published by the Department for Education and Employment in England.

The final report of the Numeracy Task Force established by the Blair Labour government in the UK, chaired by Professor David Reynolds and entitled *The Implementation of the National Numeracy Strategy* (Reynolds 1998), contains 24 key recommendations that are notable for their explicitness and prescriptiveness. For example, the first of these is as follows:

> From the autumn term 1999, all primary and special schools should teach a daily mathematics lesson to all pupils, lasting between 45 and 60 minutes depending

on pupil ages. Teachers should teach the whole class together for a high proportion of the lesson, and oral and mental work should feature strongly in each lesson.

Other recommendations refer explicitly to:

- funding and recruitment of numeracy consultants
- implementation of a Framework for teaching
- the giving and observation of demonstration lessons by skilled and trained local teachers
- the provision of funding for 5 days of release time for teacher training and details regarding the content and nature of these five days
- the attendance by principals and mathematics co-ordinators at an initial 3-day training conference
- the provision of intensive support to schools identified as needing additional support
- the negotiation of local school numeracy targets for 2002
- the involvement of special schools in the strategy and assistance to regular schools with special education needs children
- guidance on the use of calculators in the classroom, classroom assistants and adult helpers
- action to promote numeracy, including pilot projects, attendance at conferences and publicity campaigns
- training of OFSTED inspectors
- action to be taken to align professional standards for teachers and head teachers with the National Numeracy Strategy
- action to extend a Family Numeracy pilot program.

Not surprisingly, the thrust of some of these recommendations are the source of considerable contention. Within the Australian context, such detail is unlikely to emerge in any national strategy document, although it is possible that when set alongside plans developed at the State/Territory level, a similar degree of comprehensiveness can be achieved. It is also probable that the national strategy is unlikely to remain static, but will be modified over time as information becomes available from feedback mechanisms such as the reporting of aggregated State/Territory data on the benchmarks through the National Report on Schooling.

On a final note, there are good grounds for optimism regarding the potential for substantial progress to be made with respect to developing and implementing plans

aimed at improving numeracy outcomes. The literacy experience indicates that schools are much clearer about the importance of ensuring that all students achieve high standards of literacy and numeracy and welcome recent initiatives directed at improving the quality of teaching and learning and that focus on foundation learning. There is every prospect that developments in the area of numeracy will build on this commitment and goodwill and enable schools to better equip students for life in a world in which literacy and numeracy will continue to be critical.

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