



Department of Employment, Education,  
Training and Youth Affairs

**NUMERACY =**

**everyone's business**

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The Report of the  
Numeracy Education Strategy Development Conference  
May 1997

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Australian  
Association of  
Mathematics  
Teachers Inc.



## **Numeracy = Everyone's Business**

The Report of the Numeracy Education Strategy Development Conference

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# Forewords

## 1. Department of Employment, Education, Training and Youth Affairs

The Commonwealth Minister for Employment, Education, Training and Youth Affairs, the Honourable David Kemp MP, has demonstrated a strong commitment to schooling and to numeracy education. The Commonwealth has played a leadership role in ensuring that literacy and numeracy are given a national focus and in shaping a clear national agenda in these crucial areas.

This national agenda has now been set in place by Commonwealth, State and Territory Ministers. All Ministers have agreed to a national literacy and numeracy goal:

*That every child leaving primary school should be numerate, and be able to read, write and spell at an appropriate level.*

They have also agreed to a sub goal:

*That every child commencing school from 1998 will achieve a minimum acceptable literacy and numeracy standard within four years.*

The Department of Employment, Education, Training and Youth Affairs (DEETYA) has welcomed the opportunity to work with the Australian Association of Mathematics Teachers and the Education Department of Western Australia in making the Numeracy Education Strategy Development Conference and this report possible. The Conference, which has been funded by the Commonwealth, has been a valuable national initiative. This Conference Report will be a useful contribution to professional and public debate on key issues in the important area of numeracy education.

## 2. The Australian Association of Mathematics Teachers

The identification of numeracy as a priority in school education across the country is welcomed by the Australian Association of Mathematics Teachers. It is a recognition of the central role that numeracy plays in our personal, civic and vocational lives and, ultimately, to Australia's future economic and social prosperity.

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Those who teach mathematics will continue to play a key role in assuring and enhancing young peoples' numeracy through schooling. The emerging view of numeracy as a cross-curricular learning means that they will be working with all their colleagues in whole school initiatives which support numeracy development. This report provides educational leaders and practitioners at all levels with a framework and guidance for these initiatives.

The strength of this report lies in the people and partnerships involved. Our Association is delighted to have been able to work with the Education Department of Western Australia and the Department of Employment, Education, Training and Youth Affairs to bring together the committed individuals and organisations who have contributed to the report. It represents a well-informed vision and practical strategies for creating a numeracy education without peer. I commend it to you.

*Dianne Siemon, President AAMT*

### **3. Education Department of Western Australia**

The Education Department of Western Australia welcomed the opportunity to join with the Australian Association of Mathematics Teachers to host the Numeracy Education Strategy Development Conference in Perth in May 1997. The conference was funded by the Commonwealth and brought together a broad cross-section of the education community to deliberate on the current state of numeracy education in Australia and how best to move forward.

The Conference participants set themselves an ambitious goal: to formulate recommendations to guide local, state and national work in the field of numeracy education over the next decade. The achievement of this goal is demonstrated by the quality and comprehensive nature of this report. The recommendations and discussions contained in the report provide powerful impetus to educators throughout Australia as we strive to improve the numeracy outcomes of students throughout schooling.

The spirit of collaboration and shared purpose which has developed through this conference contributes significantly to the status of this report. The development of partnerships across sectors and interests in education are essential as we consider how best to direct the resources of education towards our common goals. I commend this report to you and encourage continued and expanding opportunities to develop such ventures in the future.

*Cheryl Vardon, Director-General Education Department of Western Australia*

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# Introduction and background

## Why a project?

Since early 1996 or so a number of announcements have indicated an increasing commitment to improving the levels of literacy and numeracy achievement of Australian students. Most important among these is the announcement in March 1997 of a National Plan for Literacy and Numeracy by all Commonwealth, State and Territory Education Ministers, (see Appendix 2) and the related allocation of significant funding to literacy and numeracy education through Commonwealth budgets.

The recognition of numeracy as a fundamental element of education is long standing. The current emphasis in government and the community on the need for Australia to maintain and enhance its competitiveness is based to a large extent on the 'clever' development and uptake of technology. Success in this, and ultimately this country's economic and social prosperity, inevitably relies on high levels of numeracy within the workforce and community.

Whilst the Commonwealth government and most state and territory authorities have undertaken substantial work in the area of literacy, attention to numeracy as an educational issue has been much more recent<sup>1</sup>. Hence, in relation to school education, understandings of numeracy development are at a more formative stage than understandings of literacy. The development and implementation of a set of state and national strategies for numeracy, incorporating a reporting framework and benchmarks, will require sustained and purposeful effort and a level of funding and commitment commensurate with that for literacy. Definitions or descriptions of what constitutes numeracy need to be developed, elaborated, exemplified, discussed and revised. Curriculum construction supportive of numeracy development in all learning areas, teaching and learning practices, assessment, community information strategies and teachers' professional development needs are all issues for numeracy education. An extensive research and development program is needed to support work on these issues. This will inform policy and program development. What is needed is a comprehensive national strategy which will improve numeracy

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1 The distinction is drawn here between numeracy and mathematics. Mathematics, as a core element of the curriculum, has had programs and projects directed towards its improvement.

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outcomes of students throughout schooling, and which is complementary to, and helps progress, Commonwealth and State and Territory initiatives such as the National Plan. This project was established to seek the input of a broad cross-section of the educational community and to develop shared understandings of perspectives on the issues surrounding numeracy education.

### **Establishing the project**

Two formal partnerships were central to this project. The concept of, and drive for the project came from discussions between the Education Department of Western Australia (EDWA), through the then Superintendent of Mathematics Ms Jayne Johnston who formulated the original idea, and the Australian Association of Mathematics Teachers (AAMT), through its then President Mr Will Morony. This partnership has worked effectively to create a project that has been enriched by the symbiosis that comes when two different kinds of organisation with a common goal — in this case improving achievement in numeracy for all young people in Australian schools — work together. This project demonstrates that partnerships such as this can work, and that they can maximise outcomes.

A Steering Committee was established by the principal partners to be responsible for the carriage of the whole project. This committee drew in key expertise and has worked before, during and after the Conference to ensure that project targets have been met. The membership of the Steering Committee is included in Appendix 1.

The Education Department of Western Australia and the AAMT form a second formal partnership with the Commonwealth Department of Employment, Education, Training and Youth Affairs (DEETYA), which funded the project through the Literacy and Special Programs Section of its Schools Division. DEETYA officers took a keen interest in the project and provided active support in many ways. DEETYA has shown a willingness to sponsor the gathering of advice from a wide cross-section of the educational community through an open process. This open and responsive approach should give encouragement to all those who wish to work with DEETYA to improve education in our schools.

Important to this project have been the partnerships of the third kind — those which reach across education — that have either been tentatively established or strengthened by the project. If numeracy education is to progress, as it must for the benefit of our young people and the society as a whole, mathematics educators must have productive partnerships with others — colleagues with other curriculum specialities, principals, parents and the community, employers and teacher educators. The goodwill and energy created by this diverse group working together on numeracy education through this project have been outstanding and highly encouraging for all concerned.



## The conference and associated processes

The Conference was held in Fremantle on 18–21 May 1997. It consisted of two parts. On May 18–19 the project brought together a small group of people (18 participants) with particular expertise, experience and interest in numeracy education. The group included classroom teachers, teacher educators, curriculum officers, policy makers, school administrators and researchers with interests across the whole of schooling and beyond into adult numeracy. Throughout this report, this group is referred to as the Working Group. A list of participants and their affiliations is included in Appendix 1.

The Working Group shared current understandings about numeracy and its relation to literacy, mathematics, the school curriculum in general and contexts outside schooling. They discussed initiatives in accountability and enhancement of numeracy and considered directions for the future. They prepared for the involvement and engagement of the broadly-based Representative Group who attended the second part of the Conference on 20–21 May.

In establishing the Representative Group, invitations were sent to a wide range of national groups and organisations. These included State and Territory education systems, Catholic and Independent school systems, the state and regionally based Affiliated Associations of the AAMT, the Mathematics Education Research Group of Australasia, Curriculum Corporation, the Australian Council for Educational Research, associations of early childhood educators, parent groups and principals. Many groups nominated a person based in Western Australia to represent them. A sizeable group from the Education Department of WA also attended, including people from the curriculum and education services areas and a number of principals. They reflected learning areas and interests other than mathematics. A list of the Representative Group and their affiliations is included in Appendix 1.

The small Working Group acted as facilitators and recorders in the group discussions which formed a significant part of the program for the Representative Group. The approach was one of starting from 'global' issues like the nature and constituent aspects numeracy through to, eventually, considering several of the more specific outcomes required of this project. The recommendations in this report summarise the advice of the Conference. A copy of the Conference Program for the two days is attached in Appendix 3, with the Project Outcomes included in Appendix 4.

Those present maintained an exceptional level of constructive engagement throughout the four days. The diversity of perspectives and interests represented within the Working and Representative groups enhanced the discussions about numeracy education, and its relationship with different aspects of schooling. The atmosphere was one of respect for others' views and a desire to be part of communal thinking about the issues. The process for the second two days in particular was

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designed to achieve this, but the success of the event would not have been possible without the professionalism and commitment to education of those attending.

### **This report**

Detailed summary records of discussions throughout the Conference were kept, and these have been drawn on heavily in preparing this report. A first draft of the Report was prepared and circulated to participants in the middle of June. Feedback from participants and the organisations they represented resulted in a second draft being circulated in late July. The final report was prepared on the basis of all the input received, and the advice of the Steering Committee.

Chapters 1 and 2 contain the key findings and recommendations of the project. Chapter 3 provides the collected advice of those involved in the project. This material will support further work in numeracy education. A summary of the project's ten recommendations is included in Chapter 4. The Appendices are substantial. Included are background to the project, lists of participants and other details about the Conference itself, in addition to a number of sections which record the output of sessions and provide many interesting and useful perspectives and ideas for readers to consider.

# 1 Numeracy in contemporary education

## 1.1 Some common understandings

Through the process of the Conference, common understandings about numeracy and numeracy education have been established. These represent important 'starting points' for this report.

### Literacy and numeracy are distinct

The International Literacy Year (1990) definition of literacy states that 'literacy ... includes numeracy'. This project takes a different view. Literacy and numeracy are seen as distinct areas. The two areas are, however, complementary and these relationships will need to be explored in ongoing work.

### Numeracy is more than number sense

This project acknowledges that numeracy is more than a capacity to work with numbers. Facility with number is one important aspect of what has been called 'number sense'. Number sense incorporates both an ability to use numbers and an appreciation of number and number relationships. In addition to 'number sense', notions such as 'data sense' (involving the use of statistical and measurement information), 'spatial sense' (involving the use of spatial, visual and location information) and 'formula sense' (involving the use of formulae, graphs etc.) were identified as 'mathematical' aspects of numeracy.

### Numeracy and school mathematics

Numeracy is not a synonym for school mathematics, but the two are clearly interrelated. All numeracy is underpinned by some mathematics; hence school mathematics has an important role in the development of young people's numeracy. The implemented mathematics curriculum (i.e. what happens in schools) has a responsibility for introducing and developing mathematics which is able to underpin numeracy. However this 'underpinning of numeracy' is not all that school

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mathematics is about. Learning mathematics in school is also about learning in the discipline — its structure, beauty and importance in our cultures. Further, while knowledge of mathematics is necessary for numeracy, having that knowledge is not in itself sufficient to ensure that learners become numerate.<sup>2</sup>

### Numeracy is cross-curricular

An immediate implication of this thinking is that, for schooling, numeracy is a cross-curricular issue. That is, an appropriate level of numeracy underpins learning and progress in other learning areas. Students without appropriate levels of numeracy are 'at risk' in their learning and general progress at school. Like literacy, numeracy is therefore '**everyone's business**'.

Advances in numeracy education cannot be achieved through attention to the teaching and learning of school mathematics alone. Initiatives are needed across the curriculum — in The Arts, Science, Society and the Environment and so on — in order to enhance and assure young people's numeracy achievements, and to enhance their general learning. Literacy education has progressed in this way over the last 10–20 years. In fact, identifying the parallels with the ways in which the 'literacy education agenda' has progressed was a recurring theme within the Conference. Learning from experience in literacy education is identified as a key strategy to inform future work in numeracy education.

## 1.2 Describing numeracy

Since its first use in the late 1950s, the term 'numeracy' has taken on several meanings. These are well documented in *Numerate Students, Numerate Adults*, Education Department of Tasmania, 1995.

Currently, working definitions of the term include:

*Numeracy involves abilities which include interpreting, applying and communicating mathematical information in commonly encountered situations to enable full, critical and effective participation in a wide range of life roles.*

Literacy and Numeracy Strategy 1994–98,  
Department of Education Queensland, 1994

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2 Maintaining this distinction between mathematics and numeracy also creates a pedagogical challenge for mathematics educators. There is a body of knowledge about mathematics education and this guides work in the area, but it is not clear which principles and practices of teaching and learning in mathematics will support numeracy development.

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*To be numerate is to have and be able to use appropriate mathematical knowledge, understanding, skills, intuition and experience whenever they are needed in everyday life. Numeracy is more than just being able to manipulate numbers. The content of numeracy is derived from five strands of the mathematics curriculum – space, number, measurement, chance and data, and (pattern and) algebra – as described in the National Statement and Profiles.*

Numerate Students, Numerate Adults,  
Education Department of Tasmania (1995)

*(We believe that) numeracy is the ability to choose and use mathematics to transit a 'real' issue.*

Numeracy, Primary Mathematics Association of  
South Australia, 1997

*Numeracy, is the effective use of mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life. For the purposes of this project, the National Numeracy Benchmarks will refer to the contribution that school mathematics and other areas of learning make to the development of students' numeracy. They will incorporate the development of students' understanding and competence with number and quantity (i.e. measurement), shape and location and the handling and interpretation of quantitative data.*

National Benchmarking Taskforce, 1997

This project identifies the following elements as central to any description of numeracy.

**numeracy involves**

**... using**

**... some mathematics**

**... to achieve some purpose**

**... in a particular context**

These apparently simple concepts were the focus of extensive discussion which served to identify some key threads for each.

**Numeracy involves... using**

Choice of the mathematics to use in a particular situation — and indeed the choice to use mathematics at all — clearly depends on the mathematics available to the individual and their evaluation of its appropriateness in the situation. Actually being able to use the mathematics (i.e. to 'do it') implies fluency with it.

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A person's disposition to use mathematics is also critical in numeracy. This includes personal confidence, comfort and willingness to 'have-a-go' through the use of mathematical or quantitative means. A focus on disposition is particularly pertinent in view of the alienation which many of the adult population feel towards things mathematical, and the consequent fear of mathematical activity.

Also relevant to the 'using' aspect of numeracy is the effective use of general thinking skills such as reflection, analysis and synthesis.

### **Numeracy involves using... *some mathematics***

Although there is agreement that the implemented<sup>3</sup> mathematics curriculum in schools carries a responsibility to introduce and develop the mathematics that underpins numeracy, this is not an 'exclusive source' of the mathematics. The mathematics of the community is legitimately part of numeracy. This mathematics may differ between cultures and locations. For example, a traditional Aboriginal community may have mathematics which is commonly known within that community, but may be less relevant outside it. Such mathematics is likely to exist precisely because it is useful and is therefore integral to the numeracy required to learn and function within that community.

While some mathematical content knowledge is essential to numeracy, so too are mathematical process skills (such as estimating, counting, locating and the logic of mathematical problem solving).

### **Numeracy involves using some mathematics... *to achieve some purpose***

The most immediately obvious 'purposes' are those which are practical, with tangible outcomes. These may include such things as successfully altering a recipe for a different number of people, checking change in a transaction and planning the funding and timing aspects of a group social outing. Practical purposes also include the need to make a decision, come to a better understanding, check an argument or learn something.

Numeracy will also enable and enhance a person's ability to think and act critically. In part this is an orientation towards using mathematics in a critical (analytical) way in relation to making decisions, coming to a better understanding, checking an argument or learning something. Further, it is about recognising that mathematics

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3 The focus is on the curriculum which students are exposed to, not the intended curriculum of syllabi, statements and the like.

needs to be used to appreciate mathematically-based arguments and the effects of different numeracy 'discourses'. Resolving issues such as 'from whose perspective' and 'in whose interest' are integral to a critical orientation towards information and arguments.

**Numeracy involves using some mathematics to achieve some purpose...  
*in a particular context***

A person can be more or less numerate in relation to the particular context which she or he wants to work in to achieve some result. 'Levels' of numeracy are possible in relation to a particular situation, but these are not necessarily graduated in terms of the sophistication (or otherwise) of mathematics used.

*There are ... situations-specific variations in numeracy demand, not only in degree (how great are the mathematical demands) but also in kind (what sort of mathematical demands). ... (a) person with good computational skills may be regarded as ... highly numerate in the context of work on the floor of the stock market but be unable to interpret the spatial information on a map or plan and so be insufficiently 'numerate' for a job as a courier or garment maker. As with literacy, a person is more or less numerate with respect to particular contexts, not numerate or innumerate.*

*From school mathematics to numeracy: making connections, in press, Willis, 1997*

The following description of numeracy represents a summary of this discussion and should inform future work in numeracy education.

To be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life.

In school education, numeracy is a fundamental component of learning, performance, discourse and critique across all areas of the curriculum. It involves the disposition to use, in context, a combination of:

- underpinning mathematical concepts and skills from across the discipline (numerical, spatial, graphical, statistical and algebraic);
- mathematical thinking and strategies;
- general thinking skills; and
- grounded appreciation of context.

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# 2 The future for numeracy education

The recent announcements of the Commonwealth, State and Territory Ministers of Education indicating an increased commitment to improving standards of literacy and numeracy of Australian students include agreement on a National Plan for Literacy and Numeracy (see Appendix 2). This Plan will provide the framework for work in numeracy at the National, State, Territory and local levels. The input and advice provided by participants at the Conference has, where appropriate, been linked to elements of the Plan. This Chapter summarises the group's advice on how the Plan should be implemented.

## 2.1 An agreed position on what constitutes numeracy

In order to develop a comprehensive national strategy which will improve numeracy outcomes of students through schooling, and which is complementary to State and Territory initiatives, it is important that these are based on a shared understanding of numeracy.

There is a range of views of what constitutes numeracy, from narrow conceptions of basic arithmetic skills, to broader competencies relating to the capacities to use mathematical ideas readily, effectively and creatively in a range of contexts. There have been a number of national projects which have considered matters relating to numeracy, including the development of the National Statements and Profiles and the Mayer competencies, adult literacy and numeracy initiatives and the current numeracy benchmarking project. The Conference outcomes were informed by these views and initiatives.

The principles and description of numeracy developed by this project (see Chapter 1) should inform current and future initiatives in numeracy education.

**Recommendation 1** That as part of the National Plan the Ministerial Council for Employment, Education, Training and Youth Affairs (MCEETYA) adopt the position on numeracy developed by this project that:

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- a) The following principles are fundamental to development of students' numeracy:
- numeracy is both distinct from literacy and complementary to it;
  - the mathematical underpinning of numeracy is not restricted to working with number, but also includes work with space, data (statistical and measurement) and formulae;
  - the introduction and development of these mathematical underpinnings is a responsibility of mathematics teaching in schools;
  - numeracy is cross-curricular and is a responsibility for all educators;

and that:

- b) to be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life.

## **2.2 Coordinating the implementation of the National Plan**

The explicit focus on numeracy as a priority area of the Commonwealth Government, and of the States and Territories through the initiatives of MCEETYA, is welcomed.

The importance of the development of young people's literacy as a cornerstone of their education, and its relationship to their future prospects, has long been recognised. As a consequence there has been considerable development in our understandings of how to improve students' literacy outcomes. For many Australian schools and systems literacy initiatives have been a priority for a number of years. National and State and Territory structures and processes are therefore well established and these have contributed significantly to recent advances in literacy education.

The extent of the numeracy developments signalled by this report, and their importance, make it essential to establish appropriate national structures and processes, of a similar order to those for literacy, to coordinate work in numeracy education.

**Recommendation 2** That MCEETYA facilitate the establishment of networks and structures to coordinate initiatives which will support the focus on numeracy in the National Plan.

## **2.3 Identification and intervention**

The National Plan calls for 'intervention as early as possible to address the needs of all students identified as being at risk'.

'Early intervention' is often interpreted as referring to intervention in the first 2 or 3 years of schooling. The early years of schooling are considered crucial in terms of development of students' numeracy concepts and specific comments are made in Section 2.4.

'Early intervention', however, has implications for all levels of schooling. There are many points throughout students' school careers where they may become 'at risk' with respect to their numeracy development. Identifying when and why this has occurred, as early as possible, is the best strategy for dealing with it. There is a need for research and support, particularly in assisting classroom teachers to recognise critical signals which will lead to early identification of problems, and in equipping them to intervene appropriately to address the needs of these students.

**Recommendation 3** That Commonwealth, State and Territory governments address numeracy education for **all** levels of schooling and **all** groups of students, particularly to ensure identification and intervention as early as possible for students at risk, through initiatives and strategies that are funded to implement the National Plan.

## **2.4 Comprehensive assessment in the first years of schooling**

The National Plan for Literacy and Numeracy demands 'comprehensive assessment of all students by teachers ... in the first years of schooling with the purpose of adequately addressing their literacy and numeracy needs and identifying ... students at risk...'. Ensuring that teachers in the early years have an appropriate range of identification and intervention strategies is an important element of the National Plan.

The focus on comprehensive teacher-based assessment is applauded. The role of the teacher in making well informed judgements about a student's conceptual development, in being able to diagnose areas which require attention, and

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developing teaching and learning programs which will address these areas, is central to the improvement of students' learning outcomes.

The identification of the numeracy needs of students in their first years of schooling requires research, development and support. For many teachers there is a need for a more informed personal knowledge base from which to make these judgements. This base includes knowing about mathematical concepts and their relationship to numeracy development in the early years, understanding key indicators of student progress, or lack of it, and knowing what to do about it.

Students come to school from a range of backgrounds. They will each have some numeracy concepts, but what these are, and how they are used, is likely to differ according to factors such as cultural and socio-economic background, or location (e.g. urban, rural, remote). There is a need for a greater understanding of what numeracy related knowledge students come to school with, how to recognise different manifestations of early numeracy concepts and how this knowledge might be used to develop students' numeracy understandings.

**Recommendation 4** That Commonwealth, State and Territory governments fund research, materials development and professional development initiatives in the Early Years which

- are consistent with the description and principles in Recommendation 1;
- investigate how early numeracy concepts developed in the pre-school years can be recognised in students from diverse cultural and socio-economic backgrounds;
- broaden teachers' identification and intervention strategies in the early years.

## **2.5 Assessment of numeracy**

This project assumes a rich view of numeracy as contextualised use of mathematical skills, drawing on individual experiences and attitudes. This breadth must be reflected in assessment processes at the classroom, school system and State and Territory levels.

There are a number of state-based assessment procedures which address some aspects of numeracy, although most focus on assessing mathematical content in a relatively limited way. Means of assessing aspects of numeracy such as consistently choosing to make use of mathematical ideas in curriculum areas other than

mathematics, or having the disposition to use mathematics creatively to solve day-to-day problems which are not overtly mathematical, are almost non-existent in these programs. Furthermore, assessing students' progress towards such outcomes is hampered by the limited range of assessment processes available.

The development of a broader range of assessment processes to inform teacher judgements at the classroom level will be required to ensure valid and reliable information on students' numeracy development

**Recommendation 5** That Commonwealth, State and Territory governments fund research, materials development and professional development initiatives in assessment of numeracy which:

- enable assessment of all aspects of numeracy (as described in Recommendation 1) at classroom, school, school system and State and Territory levels;
- inform and improve the consistency and validity of teacher judgements.

## **2.6 National reporting by systems and school authorities**

The National Plan requires 'progress towards national reporting by systems and school authorities on student achievements in numeracy...'. A key element of this is the development of agreed national benchmarks of achievement.

The numeracy benchmarks for years 3 and 5 being developed by the Benchmarking Taskforce represent the education community's estimates at the present. They are based on very limited data and are essentially untested. In particular, the absence of data equivalent to that gained from the National School English Literacy Survey and used in the preparation of the literacy benchmarks limits confidence in the resultant products.

The draft numeracy benchmarks are also limited because they are based mostly on descriptions of mathematical content. While this may be a useful interim position, and may be all that is possible at present, in the longer term the benchmarks will need to be expanded and possibly reconceptualised, to be more consistent with the description of numeracy in Recommendation 1. Also, progress towards national reporting by systems and school authorities on student achievement against the national benchmarks will require a broader range of assessment techniques and processes than is currently used in most system-wide assessment and reporting programs.

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National reporting also demands that the information provided by systems and school authorities across Australia be comparable. This requires that the information collected refer to the same concepts (i.e. that the information is valid) and that similar judgements about student learning are being made across systems and school authorities (i.e. the information is reliable). Conference participants, a number of whom have educational measurement expertise, indicated that this is an area which requires more sophisticated approaches than have been used in the past.

### **Recommendation 6**      That MCEETYA

- (a) undertake a national numeracy survey and establish a process to review and revise the numeracy benchmarks on the basis of information gained from this survey, and from the input of schools and teachers who have worked with the benchmarks;
- (b) commission research and development to improve the validity and reliability (and hence comparability) of information used to report numeracy achievement at State and Territory and school authority level.

## **2.7 Research**

Research is an important element of the National Plan. Particular needs in terms of research efforts needed to support numeracy education are outlined in Section 3.1.

This report promotes a view of numeracy which is not yet widely held in the education and wider communities. Research is the means of answering questions that flow from adopting this view of numeracy. An important priority is the development of a rich understanding of aspects of numeracy and the implications for learning and performance across a range of contexts. Research is also essential to increase the knowledge about teaching and assessment strategies which enhance numeracy learning.

The ongoing commitment of substantial funds by the Commonwealth to literacy and numeracy research to support the National Plan is welcomed. It allows the opportunity, over the life of the Plan, to reflect the adoption of numeracy as a priority area through the provision of substantial funding to much needed research into issues in numeracy education.

### **Recommendation 7**      That at least 40% of Commonwealth and State and Territory funds allocated for research associated with the National Plan over its life be directed towards research

into numeracy education. Priorities for research should include:

- aspects of numeracy and their implications across the curriculum and for schooling generally;
- teaching for numeracy;
- assessment of numeracy.

## **2.8 Professional development and support**

The National Plan calls for professional development to support its key elements. Professional development for teachers and educational leaders will help develop shared understanding of the concepts and issues. It will ensure progress towards the National Goals by increasing understanding and use of identification and intervention strategies to enhance all students' numeracy development. More detailed comments on professional development are contained in Section 3.2.

Professional development initiatives must take a broad, cross-curriculum approach to the development of students' numeracy. This approach demands that responsibility for the development of students' numeracy is recognised and shared by all teachers. While some teachers, both primary and secondary, may accept this responsibility, there is inadequate understanding of how mathematical ideas support learning across the curriculum, and how to take advantage of this to support students' numeracy learning. Increasing all teachers' understandings of the numeracy demands and opportunities across all school activity will support progress in numeracy education by ensuring that every opportunity to identify and attend to students' numeracy development is taken.

The Commonwealth's financial support for professional development in the National Plan demonstrates the commitment to numeracy as a priority area.

**Recommendation 8:** That at least 40% of Commonwealth and State and Territory funds allocated for professional development associated with the National Plan over its life be directed towards numeracy education. Coordination of these professional development initiatives should be undertaken by DEETYA, with appropriate advice gained through the structures and processes identified in Recommendation 2. Priority should be given to programs which:

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- (a) develop shared understandings of the numeracy demands across all learning areas, and of the responsibilities of all teachers to contribute to the development of students' numeracy;
- (b) focus, for all teachers and educational leaders, on the nature of numeracy;
- (c) increase teachers' understandings and use of identification and intervention strategies in relation to numeracy;
- (d) enable teachers to address the numeracy learning needs of all students.

## **2.9 The role of teacher education**

The implementation of the National Plan has significant implications for preservice and inservice teacher education. All teachers have a role to play in supporting the implementation of the National Plan. Entrants to the profession will be expected to make their contribution to students' numeracy development. Indeed, they are well-placed to bring contemporary understandings of numeracy and numeracy education to share in their workplaces.

All tertiary institutions will respond in some way to the intentions of the National Plan. Some have established courses and research programs which are already an important resource in numeracy education. Others will move in this direction in the future. The coordinated approach to numeracy education recommended by this report will be assisted by the establishment of mechanisms to monitor and report on the responses of tertiary institutions.

**Recommendation 9** That the Australian Council of Deans of Education report at the end of 1999 to the Commonwealth Minister for Schools on actions taken in pre-service and inservice teacher education courses to support the implementation of the National Plan and the achievement of the National Goals for numeracy.



## 2.10 A Community Education and Participation Strategy in Numeracy

The importance of the National Goals for our society demands that all sectors of the community are informed. A commitment to two-way communication will allow leaders in numeracy education to inform and educate the community, while providing opportunities to reflect on what the community is saying in order to inform their planning for the area.

This project is recommending significant shifts in the conception of numeracy and related practices for the education sector. It is essential that parents, employers, the vocational education and training sector and other community groups understand and support these changes. A broadly-based, coordinated strategy for communication and participation is required.

**Recommendation 10:** That MCEETYA develop a National Community Education and Participation Strategy in Numeracy to support the National Plan. The implementation of this Strategy should target and involve national and state agencies responsible for school education, vocational education and training, employers and community groups.

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# 3 Further elaboration and advice

## 3.1 Research needs identified

Numeracy education can learn a great deal from the work in literacy education in the last decade. There is much to be gained from complementary approaches to literacy and numeracy which allow numeracy developments to benefit from, and be strengthened by, literacy initiatives.

Nevertheless, while the need for a continued focus on the improvement of students' literacy outcomes is acknowledged, it is important to note that, in the past, less attention has been given to numeracy. Often considerations of numeracy have been subsumed into debates about literacy, and, as a consequence, a focus on the development of the unique aspects of numeracy education has been lost. Hence it is essential to have research to extend the understandings and work in numeracy education.

Several strands of research are available to support initiatives in numeracy education. Research into young children's learning in number is extensive. It provides a rich source of information to guide projects which relate directly to this area, either through the development of resources for teaching and teachers' skill enhancement or through enabling identification and early intervention in terms of children's number learning, in particular.

Assessment in mathematics has also been an area of considerable research effort. Hence, workers in the area of numeracy assessment are able to draw on this body of knowledge in terms of task and question development and analysis and scaling of responses through, in particular, item response theory. Given this reliance on work in mathematics assessment there has been a tendency for these programs to focus on the mathematical aspects of numeracy — this is certainly true of most of the systemic assessment programs.

Numeracy as a cross-curricular learning has a much less developed research base. In Australia the recent Key Competencies Pilot Project provides some potentially useful work, as does some of the work in Adult Numeracy since 1990. At the international level the work on situated cognition, much of which has been done in relation to learning mathematics, gives some insight into the issue of transfer of learning from

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one context to another. Projects which are working in this area are therefore fairly strongly oriented towards researching issues relating to numeracy across the curriculum.

The identification of areas of numeracy education requiring research, access to funding and coordination of research efforts, and the initiation of needed research all require attention through national structures (see Recommendation 2) to ensure that the research is well targeted. Research should be initiated through processes which involve the educational community and its leaders, building on the collaborative beginning made by this project.

The areas for research identified through this project fall into three clusters — aspects of numeracy, teaching and assessment.

### **Aspects of numeracy**

The focus of research in this area is establishing the details of the nature and place of numeracy in education and general life. There is some information about numeracy and its development, but this is restricted to a few aspects of numeracy (e.g. number sense). The definition of numeracy adopted in this project (Recommendation 1) means that other aspects about which little is known require attention through research. Foci for research include:

- finding out about, and how to change, teachers' and the community's understandings of numeracy;
- establishing and analysing people's numeracy requirements in ranges of contexts;
- investigating how numeracy develops, and the key characteristics, inclinations and understandings which are indicative of numerate behaviours;
- establishing the contribution mathematics plays in the development of numeracy;
- if numeracy is revealed only in use, investigating the role that situations or contexts play in the recognition and development of numeracy.

The question of 'whose numeracy' arose during the course of the Conference. There was some unease that comments about numeracy are not sufficiently cognisant of the diversity of students, communities and educational settings present in this country. This diversity includes cultural groupings as well as settings in which young people are exposed to numerate thinking and action. Examples include helping on the farm where non-school methods are often used, and in relation to parents' methods of estimating and calculating when shopping. The need to

investigate how to ensure that numeracy education is inclusive and empowering for all in our schools is acknowledged and signalled as a matter of urgency.

### Teaching

While there is an increasing amount of information to support teaching and learning in mathematics, the broader scope of numeracy education presents new challenges. Areas for research include:

- if numeracy is about mathematics in use, how can the school curriculum (mathematics and other contexts) and teaching practices best support the development of students' numeracy;
- what are the elements which characterise good teaching of numeracy across the curriculum and how can all teachers be encouraged and enabled to be involved;
- the development and evaluation of a wide range of intervention strategies for students at risk.

### Assessment

There is a growing collection of data derived from students' performance on pencil-and-paper, machine marked tests of mathematical skills<sup>4</sup>. This data clearly has its place, but does not address all aspects of numeracy as described in Chapter 1. At best, the data provides relatively coarsely grained information about the mathematical aspects of numeracy.

It is naive and dangerous for education decision makers to be seduced by the relative simplicity of current tests of mathematical skills – naive because it is contrary to the findings and directions in all other areas of education<sup>5</sup>; dangerous because it could lead to a 'back-to-basics' orientation with a single-minded focus on decontextualised mathematical skills.

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4 The Tasmanian 10N and 14N tests, NSW and South Australia Basic Skills Tests of Aspects of Numeracy, WA Monitoring Standards in Education, the Queensland Assessment of Performance Program and Year 6 test and the Victorian Learning Assessment Program are Australian examples. Much of the TIMSS data is of the same broad type on the international scene, and, although self generated answers did feature, the focus remained on mathematical skills.

5 The recognition of the importance of 'authenticity' of assessment in the TIMSS was achieved through the use of 'performance task' assessments. This is outside the methodology currently used by systems in Australia, but reflects international concern about the issue.

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The broad and rich sense of numeracy which this project promotes requires means for collecting data on student performance across a very wide range of domains.

The education field in general is grappling with the issue of assessing (and thereby gaining data about) student achievement across the range of valued outcomes. While some progress has been made, assessment remains a central concern of both educational researchers and practitioners. A significant area of progress has been that of 'informed and rigorous teacher professional judgement'. Assessments based on such teacher judgements have a significant role to play in individual, class, school and school system regimes of assessment.

Assessment of students' numeracy is central to achieving the National Goals. Research in the area of numeracy assessment should enable the development of an increased range of strategies and tools at teacher, school and school system levels, and confidence in these assessments. Areas for attention include:

- developing means for assessing all the aspects of numeracy identified in Recommendation 1;
- developing assessment processes which provides information that supports good teacher judgements;
- developing means for assuring that the assessment of student numeracy is consistent and comparable at State and Territory, school system, school and teacher level.

A well-constructed national numeracy survey will begin to address all of these issues in a coherent way and provide an excellent base for future work. There was strong support among those at the Conference for the methodology of a numeracy survey to build on, where possible and desirable<sup>6</sup>, the methodology of the National School English Literacy Survey.

In the case of numeracy education, a well constructed and conducted national survey would provide a means for encouraging uptake and to inform the ongoing developmental work with the numeracy benchmarks. The development of literacy standards and benchmarks has been (and will be) informed by the data from the literacy survey. In the absence of a numeracy survey, no such similar nexus is possible. Hence the role of the numeracy survey would be to 'test out' the numeracy standards and benchmarks and inform their revision in the medium term. This is seen as important in establishing their educational credibility.

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6 Some concern has been expressed about the usefulness of an Item Response Theory approach in the context of a multi-dimensional area such as numeracy

More generally, the study would have three further advantages for progressing numeracy education:

- providing data from systematic assessment of aspects of numeracy which more closely mirror this project's view of numeracy<sup>7</sup>;
- strengthening and validating the broad view of numeracy advocated by this project;
- stimulating and informing further work in numeracy assessment, through its implementation of assessment strategies which meet contemporary needs.

Further comments about a numeracy survey are contained in Section 3.4.

## **3.2 Professional development in numeracy education**

Professional development is critical in advancing understanding and effective practices for numeracy education. This is seen as being broader than teacher professional development and should incorporate developmental work with stakeholders including educational managers (in all educational sectors), teachers and teacher educators.

There is some overlap between the consideration of professional development and discussions about communication and dissemination. This project distinguishes between providing and discussing information (considered in the next section) and professional development which involves conscious efforts to change educators' thinking and actions. The sets of strategies and actions in each are intended to complement each other.

### **Audience**

The title of this report — *Numeracy = Everyone's Business* — signals that the audience for professional development initiatives needs to be extremely wide and cover all the key professional stakeholders. The focus should be on teachers and educational managers in primary schools, mathematics and non-mathematics teachers as well as educational managers in high schools and teacher educators.

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7 There is no suggestion, however, that a survey, as a single instrument, could be 'across' all the aspects of numeracy, however. To attempt this would be to attempt what is currently impossible in numeracy, as it is in literacy.

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The differing needs of these groups will need to be both acknowledged and valued for effectiveness of professional development to be maximised. This will involve the design of courses, materials and programs targeted at their particular needs at the time.

### **Priorities for professional development initiatives**

This project identifies key issues which should inform professional development initiatives in numeracy education. The content of numeracy education professional development programs and materials needs to be informed by current, relevant, state of the art research.

For teachers of mathematics in secondary schools and tertiary institutions it may not be necessary to focus on the overtly 'mathematical' aspects of numeracy teaching and learning. There is a role which could include leadership and support of colleagues in developing their understanding of numeracy education. Hence there may need to be particular emphases in mathematics teachers' professional development in numeracy education on issues related to this role. These emphases might include 'seeing' the numeracy in non-mathematical contexts, helping their peers to become self-aware in terms of their own numeracy and establishing means for identifying and valuing students' numeracy outside of the context of school and learning.

For teachers in primary schools professional development is more likely to need to focus on both the 'mathematical' and the 'non-mathematical' aspects of numeracy teaching and learning. Such an orientation recognises the identification by many teachers of a need to improve their own knowledge and skills in mathematics<sup>8</sup> in addition to the more general issues inherent in numeracy education.

Numeracy education professional development programs and materials should take account of the synthesis of knowledge and experience drawn from this project. Programs should have as their key priorities:

- the cross-curricula nature of numeracy;
- understanding and skills in using integrated, student initiated, issues based

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8 See, for example, the Discipline Review of Teacher Education in Mathematics and Science (Speedy Report) 1989.



and thematic approaches to teaching and learning as effective means for assisting numeracy development;

- understanding of, and effective responses to, the cultural context of numeracy and developing cross cultural perspectives;
- how children learn mathematics and how they learn to be numerate;
- teachers' knowledge of mathematics and how it is integrally part of learning across the curriculum and, particularly in the case of specialist teachers outside of mathematics, in their area of expertise;
- the importance of disposition and positive attitude in the development of numeracy, and how these orientations can be fostered;
- appropriate and constructive procedures for assessing numeracy.

### Strategies for professional development

Within the framework provided by the Commonwealth's commitment<sup>9</sup> to strategic professional development in literacy and numeracy, and commitments in other jurisdictions, it is clear that there will be substantial effort in this area for at least the next three years as a key element of implementation of the National Plan.

Professional Development in numeracy education needs to involve cohesive and strategic national planning and implementation over an extended time frame, with appropriate levels of funding from monies targeted at programs in literacy and/or literacy/numeracy<sup>10</sup>.

As indicated in Recommendation 2, national structures and processes should be established for the initial development of national programs and be maintained for the ongoing implementation, evaluation and modification of such programs.

A major component of professional development strategies within numeracy education should involve the synthesis and use of any relevant existing materials or experiences. The National Database (Appendix 5) will provide a substantial amount of relevant information, particularly if it is maintained over the duration of the National Plan.

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9 It has been announced that the Commonwealth will provide \$7 million over 3 years (1997–1999) to assist State and Territory government and non-government education authorities to implement strategic professional development initiatives to support the implementation of the National Plan for literacy and numeracy.

10 In some jurisdictions, numeracy is still incorporated in 'literacy' while in others the Commonwealth's approach of referring to 'literacy and numeracy' has been adopted.

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It is acknowledged that substantial work has already been done in the area of general professional development of educators<sup>11</sup>. Any actions or strategies in numeracy education should build on this body of knowledge and understanding. Of particular importance and relevance is that programs should provide time for teachers to experience, trial, reflect upon and further develop effective numeracy education strategies.

### **3.3 Communicating messages about numeracy education which involve the community**

The broad range of perspectives involved in this project provides the capacity to identify priorities and strategies across the educational and wider communities.

A key principle which will need to be evident is that communication is a two way process. This project has modelled an inclusive and responsive process for the future and should be the benchmark for future interaction, communication and dissemination.

Many in the education and wider community have strong, but possibly ill-informed opinions about numeracy. Narrow and ultimately unhelpful views such as 'Numeracy is knowing their tables' and 'it is the job of maths teachers' need to be challenged and an alternative, informed view of what it means to be numerate, presented in ways that are understood by the audiences.

Much of the discussion of this topic reiterated sound principles of communication in general. Important among these were:

- be clear about audiences and tailor information to them;
- have simple, honest and consistent messages;
- communication needs to be planned, professional and proactive.

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11 The summary and other reports generated by the National Professional Development Program (1994-96) provide useful, recent material. Education systems have developed principles and practices over many years. There is also a great deal of research and practice based knowledge in the tertiary sector.

## Audiences

The title of this report has clear implications for the range of audiences that should be informed about and involved in numeracy education issues. Audiences include

- parents;
- teachers — of mathematics; of other areas; of students with special learning needs; primary teachers when teaching mathematics and when not; teachers at all levels with leadership responsibilities of all kinds;
- students;
- educational leaders — in schools, systems (management and curriculum) and tertiary institutions;
- teacher educators — those with a particular interest in mathematics and those with other specialities;
- employers — managers; those with responsibility for recruitment and training;
- politicians;
- the media;
- the wider community.

## High priority messages

Communication and dissemination about numeracy education should focus on consistent, simple messages which are elaborated for the audience. These messages should initially focus on numeracy as:

- an essential life skill (for learning, for work and personally);
- 'more than numbers';
- a responsibility for all educators.

Providing information about students' numeracy achievement, as in the National Plan, and elsewhere, is part of the general emphasis on accountability in education. Communicating about student achievement in numeracy needs to be honest and informative, but must always take a positive orientation by recognising good achievement and providing guidance which enables improvement. An imperative will be that the dissemination of results, and interpretations of results, provide suggestions and encouragement for making improvements where these are needed, in addition to any criticism.

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### **Strategies for effective communication**

Communication and dissemination about numeracy education should be committed to a two-way flow of information that respects and responds to people's responses and reactions.

Traditional strategies such as publicity campaigns, brochures and in-school information sessions should be augmented by creating a public and popular presence for some key communicators about numeracy education (through greatly increased presence on the Department for Industry, Science and Tourism's Register of Science and Technology Communicators and other means for 'self-promotion') and through influencing the contents of popular narratives (e.g. a focus on the importance of numeracy evident in the script of *Neighbours*). The commitment to two-way communication will require the use of interactive communication strategies which involve conversation and interaction. (e.g. school principals and other leaders supported by materials to engage school communities in discussing the issues). Electronic media also provide opportunities for two-way engagement (e.g. email lists and other Internet strategies; talk-back radio).

Communication and involvement about numeracy education should be informed by a national networking strategy, with a newsletter, website and other forms of communication assisting information sharing and collaboration across the country, and between different sectors and groups. These mechanisms could be sponsored by DEETYA, Curriculum Corporation or private interests, with oversight by the national structures and processes of Recommendation 2.

### **3.4 Some initial supportive strategies**

This section brings together a range of themes and suggestions from the conference discussions. It serves to inform some aspects of 'next steps' to be taken.

#### **Numeracy and literacy**

Professional development initiatives will be informed by an analysis of reports and summaries of work done in literacy education in recent years. It will be instructive to seek out and make available information about, and evaluations of, the strategies used for communication and dissemination about literacy education at the national, state, school levels by systems, professional and other organisations.

The main discussion about research and development needs in relation to numeracy education was preceded by a discussion relating to funding of research. Funding for literacy research and professional development has been significantly higher. The

International Year of Literacy in 1990 has been instrumental in this. No funding impetus of this magnitude has so far been made available for research in numeracy education and this project argues for and recommends (Recommendation 7) application of funding commensurate with the priority on numeracy education.

## Establishing the current policy positions

It would be useful if there was a comprehensive audit undertaken to identify State, Territory and Commonwealth policies that refer to numeracy in some way, to assess the degree of compatibility between them and current government initiatives and to recommend further actions in order to assure complementary policy developments.

## Sharing information

The work of this project to establish the database of current initiatives provides a useful resource. It has relied on voluntary submission of information by workers in the field, and could not claim to be comprehensive in its current form. Maintaining and promoting it over time will allow it to fulfil its potential to inform, create links between initiatives and help avoid unnecessary duplication of effort and waste of resources.

## Seeding the national network

The location of the Conference in Perth means that this project has created significant potential for advancing numeracy education in WA. Similar conferences in other States and Territories could profitably consider the outcomes of the Perth event and sow the seeds for future collaboration and work in those locations. This would create a nucleus of informed and committed people across the educational and general community.

## A national numeracy survey

A National Numeracy Survey is a means for gathering much needed data. The National School English Literacy Survey (1995–97) has been a well received, collaborative initiative which has and will inform work in literacy education. It is necessary to match this work in literacy with a similar effort in numeracy.

In the case of numeracy education, a well constructed and conducted national survey would provide a means for encouraging uptake and to inform the ongoing developmental work with the numeracy benchmarks (see Section 2.6). The development of literacy benchmarks has been (and will be) informed by the data

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from the literacy survey. In the absence of a numeracy survey, no such similar nexus is possible. Hence the role of the numeracy survey would be to 'test out' the numeracy benchmarks and inform their revision in the medium term.

In a more general sense, the study would have three further advantages for progressing numeracy education:

- providing data from systematic assessment of aspects of numeracy which more closely mirror this project's view of numeracy<sup>12</sup>;
- legitimating the broad view of numeracy advocated by this project;
- stimulating and informing further work in numeracy assessment, through its implementation of assessment strategies that are unfamiliar to many.

There was strong support among those at the Conference for the methodology of a numeracy survey to emulate and improve on, where possible and desirable<sup>13</sup>, the methodology of the National School English Literacy Survey. It was noted that some preliminary work has been done which could inform the development of a National Numeracy Survey. This includes the TIMSS Performance Assessment Tasks and the ACER development of DART Materials for Mathematics Assessment (year 5), as these are attempting to emulate the DART English materials that were used extensively in the National School English Literacy Survey.

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12 There is no suggestion that a survey, as a single instrument, could be 'across' all the aspects of numeracy, however. To attempt this would be to attempt what is currently impossible in numeracy, as it is in literacy.

13 Some concern was expressed about the usefulness of an Item Response Theory approach in the context of a multi-dimensional area such as numeracy.

# 4 Summary of recommendations

## An agreed position on what constitutes numeracy

**Recommendation 1** That as part of the National Plan the Ministerial Council for Employment, Education, Training and Youth Affairs (MCEETYA) adopt the position on numeracy developed by this project that:

- a) The following principles are fundamental to development of students' numeracy:
- numeracy is both distinct from literacy and complementary to it;
  - the mathematical underpinning of numeracy is not restricted to working with number, but also includes work with space, data (statistical and measurement) and formulae;
  - the introduction and development of these mathematical underpinnings is a responsibility of mathematics teaching in schools;
  - numeracy is cross-curricular and is a responsibility for all educators.

and that:

- b) to be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life.

## Coordinating the implementation of the National Plan

**Recommendation 2** That MCEETYA facilitate the establishment of networks and structures to coordinate initiatives which will support the focus on numeracy in the National Plan.

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### Identification and intervention

*Recommendation 3* That Commonwealth, State and Territory governments address numeracy education for **all** levels of schooling and **all** groups of students, particularly to ensure identification and intervention as early as possible for students at risk, through initiatives and strategies that are funded to implement the National Plan.

### Comprehensive assessment in the first years of schooling

*Recommendation 4* That Commonwealth, State and Territory governments fund research, materials development and professional development initiatives in the Early Years which

- are consistent with the description and principles in Recommendation 1;
- investigate how early numeracy concepts developed in the pre-school years can be recognised in students from diverse cultural and socio-economic backgrounds;
- broaden teachers' identification and intervention strategies in the early years.

### Assessment of numeracy

*Recommendation 5* That Commonwealth, State and Territory governments fund research, materials development and professional development initiatives in assessment of numeracy which:

- enable assessment of all aspects of numeracy (as described in Recommendation 1) at classroom, school, school system and State and Territory levels;
- inform and improve the consistency and validity of teacher judgements.



## National reporting by systems and school authorities

- Recommendation 6* That MCEETYA
- (a) undertake a national numeracy survey and establish a process to review and revise the numeracy benchmarks on the basis of information gained from this survey, and from the input of schools and teachers who have worked with the benchmarks;
  - (b) commission research and development to improve the validity and reliability (and hence comparability) of information used to report numeracy achievement at State and Territory and school authority level.

## Research

- Recommendation 7* That at least 40% of Commonwealth and State and Territory funds allocated for research associated with the National Plan over its life be directed towards research into numeracy education. Priorities for research should include:
- aspects of numeracy and their implications across the curriculum and for schooling generally;
  - teaching for numeracy;
  - assessment of numeracy.

## Professional development and support

- Recommendation 8* That at least 40% of Commonwealth and State and Territory funds allocated for professional development associated with the National Plan over its life be directed towards numeracy education. Coordination of these professional development initiatives should be undertaken by DEETYA, with appropriate advice gained through the structures and processes identified in Recommendation 2. Priority should be given to programs which:

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- (a) develop shared understandings of the numeracy demands across all learning areas, and of the responsibilities of all teachers to contribute to the development of students' numeracy;
- (b) focus, for all teachers and educational leaders, on the nature of numeracy;
- (c) increase teachers' understandings and use of identification and intervention strategies in relation to numeracy;
- (d) enable teachers to address the numeracy learning needs of all students.

### The role of teacher education

*Recommendation 9* That the Australian Council of Deans of Education report at the end of 1999 to the Commonwealth Minister for Schools on actions taken in pre-service and inservice teacher education courses to support the implementation of the National Plan and the achievement of the National Goals for numeracy.

### A Community Education and Participation Strategy in Numeracy

*Recommendation 10* That MCEETYA develop a National Community Education and Participation Strategy in Numeracy to support the National Plan. The implementation of this Strategy should target and involve national and state agencies responsible for school education, vocational education and training, employers and community groups.

# Appendices

1. Acknowledgment of those involved
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    - Steering Committee
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2. National Plan for Literacy and Numeracy
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7. Record of discussion — on numeracy at different ages
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# Appendix 1

## Acknowledgment of those involved

### Steering Committee

Chris Cameron	APPA, APAPDC, Forrest Primary School, ACT
Jayne Johnston	EDWA (co-chair)
Margaret McCulloch	DEETYA
Graham Miecklejohn	Dept of Education, Queensland
Will Morony	AAMT (co-chair)
Debbie Scott	AAMT; UNSW
Sue Willis	Murdoch University
Garry Winter	DEETYA

### Participants — Working Group

#### Steering Committee plus

John Hogan	EDWA
Alistair McIntosh	Edith Cowan University
Lisa-Jane O'Connor	Elizabeth Vale Primary School, South Australia
Di Siemon	RMIT
Howard Reeves	Tasmanian Dept of Education
Joy Cumming	Griffith University
Janette Bobis	University of Western Sydney
Rosemary Callingham	Tasmanian Dept of Education
Marian Kemp	Murdoch University
Bob Wright	Southern Cross University
John Brewster	Shepherson College, NT

## **Participants — Representative Group**

### Working Group plus

Richard Korbosky	Catholic Education Office, WA
Bret Handcock	Australian Parents Council
Di Rees	EDWA
Denise Skidmore	Mindarie Primary School, WA
Glenys Reid	EDWA
Greg Piggott	EDWA
Lyn Beard	EDWA
Jan Lokan	ACER
Kath Ireland	Dept of Education & Children's Services, SA
Gail Costello	Association of Independent Schools, WA
Mike Rowland	Australian Federation of Societies for Studies of Society & Environment Inc.
Maria Xanthis	Graduate School of Education University of WA
Chris Coombes	Dept of Education & Children's Services, SA
Eve Recht	ACER
Kevin Ford	Board of Studies, NSW
Kathy McLean	Curriculum Corporation
Glenda Bradley	Mathematical Association of Victoria
Joy Scott	Curtin University
Cath Pern	MERGA
Mark Jeffery	Murdoch University
Norma Jeffery	Curriculum Council of WA
Max Polgrase	Australian Secondary Principals Association
Keith Rinaldi	Primary Principals Association, WA
Ken Wyatt	EDWA
Alison Bevan	EDWA
John Van Wyke	EDWA
Jocelyn Cook	EDWA
Iris Forrest	EDWA
Rob Beresford	EDWA
Mark Brown	EDWA
Peter Gould	Dept of School Education, NSW
Robin Pascoe	National Association of Arts Education

Garry Winter	Literacy Section DEETYA
Phil Rofe	NT Dept of Education
Barry Salmon	Curriculum Development, QSCC
Carol Cockburn	ACT Dept of Education
Annabelle Cassells	ACT Dept of Education
Greg Williams	Catholic Principals' Assoc.
Bill Dickinson	Assoc. of Heads of Independent Schools
Barry Kissane	Mathematical Assoc of W.A.
Rae Durham	Australian Council of State School Organisations
Pam Hammond	Dept of School Education, Victoria
Carol Allen	Australian Early Childhood Association
Jennie Bickmore-Brand	Australian Literacy Foundation

## **Other important and valued contributions came from**

- Alistair McIntosh and Debbie Scott who prepared written summaries of the research and professional development discussions;
- Ann Belperio, Sally Nicholas, Toby Spencer, Kari Adams from the AAMT Office and Marlene Morley in the Mathematics Section of the Education Department of Western Australia for organisational and administrative support;
- Paula Bowen who provided 'on the ground support' in Perth;
- Cheryl Vardon and Di Kerr of EDWA who opened and closed the Conference respectively, and for providing other support and encouragement;
- The Executive of the AAMT for their support and encouragement.

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# Appendix 2

## National plan for literacy and numeracy

### National Initiatives in literacy and numeracy

#### Literacy and numeracy: priority areas for this government

The capacity of young people to participate in schooling, post secondary education and the workforce, is determined to a significant extent by their level of ability in literacy and numeracy.

The Commonwealth government recognises the importance of the pre-school years and the early years of schooling as providing the foundation blocks for developing appropriate literacy and numeracy skills in young people. State and Territory governments have given considerable emphasis to literacy and numeracy development in the early years of schooling in recent years.

The Commonwealth places importance on the early years because research indicates that if children have not met appropriate literacy and numeracy standards by the end of primary school, they are unlikely to make up the gap through the rest of schooling.

The Australian Council for Educational Research (ACER) has examined performance in reading and numeracy for a representative sample of 14-year-olds over the period 1975 to 1995. The ACER's recent report, *Reading and Numeracy in Junior Secondary Schools: Trends, Patterns and Consequences*, notes that:

- the consequences of poor literacy include an increased likelihood of leaving school early, relatively poor access to university education, the prospect of higher levels of longer term unemployment, and a greater chance of being in lower paid, less skilled jobs;
- comparison of test results suggests that there has been little change in reading ability between 1975 and 1995. Then, as now, around three in ten of Australia's youth have not achieved mastery in basic reading comprehension;
- as with reading skills, numeracy is closely linked to school completion, access to university, unemployment and the quality of jobs. Poor numeracy amongst

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young people is less extensive, with some overall improvement evident. The period 1975 to 1995 saw an increase in the proportion of students achieving mastery from around 80% to 85%. Boys consistently perform slightly better than girls.

The Commonwealth government has made a significant investment in improving literacy and numeracy learning outcomes:

- grants of more than \$3 billion a year for schools in Australia; and, specifically;
- \$153 million a year through the Literacy Program. In 1997, under the National Literacy Strategies and Projects strand of the Literacy Program, the Commonwealth is making available approximately \$6 million to be spent on research studies and pilots.

### **An agreed national plan for literacy and numeracy**

At the March 1997 meeting of the Ministerial Council of Employment, Education, Training and Youth Affairs (MCEETYA), the Commonwealth, State and Territory Ministers of Education agreed to new national literacy and numeracy goals:

- that every child leaving primary school should be numerate, and be able to read, write and spell at an appropriate level.

Ministers also agreed on a new literacy and numeracy sub-goal:

- that every child commencing school from 1998 will achieve a minimum acceptable literacy and numeracy standard within four years (this recognises that a very small percentage of students suffer from severe educational disabilities).

The Commonwealth, State and Territory Governments also endorsed a national plan to support the national literacy and numeracy goals. In summary, the National Plan provides for early assessment and identification of at risk students, early intervention, regular assessment against agreed national benchmarks, national reporting of student achievement and recognition of the importance of professional development in improving literacy and numeracy learning outcomes.

The National Plan specifically includes:

- comprehensive assessment of all students by teachers as early as possible in the first years of schooling with the purpose of adequately addressing their numeracy and literacy needs and identifying those students at risk of not making adequate progress towards the national numeracy and literacy goals;
- intervening as early as possible to address the needs of all students identified as being at risk;

- development of national benchmarks in literacy and numeracy (at Years 3, 5; 7 and 9);
- assessing students against the Year 3 Benchmark to be numerate and to be able to read, write and spell from 1998 onwards (and against the Year 5 Benchmark as soon as possible) using rigorous State-based assessment procedures, and that speaking, listening and viewing be added as soon as possible. As part of this process, States and Territories have agreed to move to universal assessment i.e.. assessment of all students;
- progress towards national reporting by systems and school authorities on student achievements in numeracy, reading, writing and spelling against the Year 3 and Year 5 Benchmarks for each year, beginning in 1999 on 1998 results, data provided being comparable by State and Territory;
- agreement to provide professional development to support the key elements of the National Plan.

The National Plan will build on existing State and Territory initiatives. Efforts to lift literacy skills in the early years of schooling are already a priority in every State and Territory. The Plan recognises the wide range of valid approaches to raising literacy and numeracy standards across the country, this diversity reflecting:

- the differences between States, Territories and systems;
- the differing needs of individual students;
- the diverse nature of schools and their communities; and
- the range of teaching and learning styles that are necessary to serve a heterogenous community.

### The development of literacy and numeracy benchmarks

The Year 3 and Year 5 benchmarks are important elements of the National Plan. Key factors in developing the Benchmarks are to ensure that they are:

- capable of measuring student performance against all State and Territory assessment programs;
- able to demonstrate the level of mastery of literacy and numeracy required by students to make sufficient progress at school and to properly equip them for future education and employment;
- expressed in terms which are meaningful to parents and employers as well as educators.

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The Commonwealth is working collaboratively with States and Territories in developing national benchmarks in literacy and numeracy through the Benchmarking Taskforce. The Benchmarking Taskforce reports to the Ministerial Council for Employment, Education, Training and Youth Affairs, (MCEETYA). Literacy and numeracy experts from education authorities, universities and the Commonwealth have been consulted about the most appropriate way of defining benchmarks. The benchmarks will consist of a minimum acceptable standard of achievement, the level of which is to be determined.

The Benchmarking Taskforce is currently focussing on formulating draft benchmarks for Years 3 and 5. The Taskforce will report to Ministers in June 1997 on proposals for draft benchmarks which will measure minimally acceptable standards or mastery. The assessment and reporting elements of the National Plan are contingent on benchmarks for Years 3 and 5 being in place for 1998. Draft benchmarks will be developed for Years 7 and 9 by June 1998.

### **The importance of reporting on literacy and numeracy outcomes**

There is a high level of concern among parents and the community over the inadequate literacy and numeracy skills of young people.

Openness in education is essential. The Government believes that parents must be fully informed about their children's education. The dissemination of information about educational outcomes is central to building the parental and community support for schools without which schools cannot meet the expectations placed on them, and without which there will never be adequate community recognition of the role of the teaching profession.

To deny parents clear information about literacy and numeracy outcomes at their child's school is to weaken the capacity of parents to fully support the teaching at the school.

State education department assessments of literacy and numeracy achievement in primary schools should allow:

- parents to learn about their own child's achievement compared to States percentiles as well as about the individual school's performance in relation to other comparable schools; and
- schools performing well to explain how value has been added for the benefit of other schools.

## The role of the non-government sector

The non-government education sector receives a large proportion of financial support from governments. The Commonwealth provides about 38% of non-government schools' total funding and States and Territories provide 18%. The remaining 44% comes from private sources.

Non-government schools, like government schools, have a civic obligation to prepare young Australians for participation in society. Non-government schools are accountable to parents and the wider community on the educational performance of students in their care in the same way as government schools are, and should make information about educational outcomes publicly available.

Implicitly, Commonwealth, State and Territory Ministers have agreed to implement the National Plan for all school students, government and non-government. It is important that Catholic and independent education authorities make early literacy their first priority for funding and endorse the National Plan and Goals.

### Implications for non-government schools

Implementing the National Plan will require Catholic and independent schools to:

- move towards assessment of all students in their sectors against the benchmarks using State-based assessment procedures; and
- provide support for teachers in their task of identifying children not achieving adequate literacy skills and intervening as early as possible to address their needs.

The Commonwealth recognises that non-government school authorities will have to make judgements about the use of resources in addressing these fundamental priorities.

## Commonwealth's role in supporting national literacy and numeracy goals

The delivery of literacy and numeracy education in schools including screening and the identification of students *at risk*, intervention to meet their needs and assessment of students' achievements, are essentially responsibilities of education authorities but are of concern to all Governments. The Commonwealth has a significant role in school education which includes:

- promoting national collaboration and co-ordination to achieve overall improvements in literacy levels among Australian school children

— the 1996 National School English Literacy Survey (NSELS) reported and

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assessed the reading, writing, viewing, speaking and listening achievements of a national sample of Year 3 and Year 5 students;

- providing seed funding for appropriate teacher professional development to support national literacy and numeracy goals
  - \$7 million will be provided from the National Strategies and Projects strand of the Commonwealth's Literacy Program specifically for professional development purposes. This will assist education authorities to move quickly to implement the National Plan and develop key projects and strategies for teachers,
  - \$7.5 million will be provided over four years to the Education Centres Network, of which a significant amount will be linked to professional development for teachers to support the National Plan;
- promoting and funding literacy and numeracy research (85% of school literacy and numeracy research is funded by the Commonwealth). Over the next three years funds will be provided for research in a range of relevant areas such as
  - training packages for volunteers and parents to work with school to enhance literacy skills,
  - identifying teaching practices which are most effective for particular groups of students,
  - evaluating different literacy approaches and development of screening tools,
  - the place of literacy in the primary school curriculum,
  - literacy development for students with special needs,
  - a community awareness program to promote the importance of parents involvement in their children's literacy and numeracy development;
- actively participating in the process of developing agreed literacy and numeracy benchmarks in Years 3 and 5 by June 1997 and in Years 7 and 9 by June 1998.

## Release dates for reports related to literacy and numeracy

A number of national and international reports are expected to be released in 1997–1998. They are briefly described below.

<b>DATE</b>	<b>REPORT</b>
May 1997	Australian Bureau of Statistics (ABS) Survey of Aspects of Literacy: Profiles and Perceptions: <i>release of preliminary data on profiles and self perceptions in adult literacy ability (aged 15–74).</i>
June 1997	Draft Benchmarks for Literacy and Numeracy in Years 3 and 5 for consultation and trialling: <i>approved by Ministers.</i>
July 1997	Third International Mathematics and Science Study (TIMSS): <i>release of international and ACER reports for 9 year olds achievement in mathematics and science.</i>
August 1997	ABS Survey of Aspects of Literacy: Profiles and Perceptions <i>release of assessed skill levels report containing objective assessments of Australians' literacy and numeracy skill levels (aged 15–74).</i>
September 1997	National School English Literacy Survey: <i>release of results.</i>
September 1997(not confirmed)	Teacher Education Standards and Guidelines: <i>currently being prepared by the Australian Council of Deans of Education</i>
February 1998	TIMSS: <i>release of international and ACER reports for Year 12 students in mathematics and science.</i>

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# Appendix 3

## Project outcomes

The following outcomes for the project are extracted from the contract.

1. Drawing on the discussions and developments of the 4 day meeting, and taking account of Commonwealth and State and Territory initiatives, a Conference Report will be developed which will include:
  - a) An initial statement of the current research base in the provision of numeracy education in primary and secondary schools in Australia and the related views of the area;
  - b) An initial descriptive data-base of initiatives in numeracy education that are being undertaken in Australia, particularly focusing on primary and secondary schooling and including initiatives in early intervention of 'at risk' students and early intervention strategies;
  - c) Recommendations on the research and development agenda for numeracy education to inform state and national initiatives;
  - d) Recommendations for effective professional development strategies;
  - e) Recommendations for an effective national communication and dissemination strategy in relation to numeracy education;
  - f) An evaluation of the availability and suitability of data on numeracy achievement to inform Commonwealth and State and Territory thinking in relation to the proposed national numeracy survey;
  - g) Recommendations for consideration regarding numeracy education strategies which take account of current initiatives and present possibilities for future action.

After approval by DEETYA, the Conference Report will be provided to systems and other stakeholders.

*Performance measure: A Conference Report with these features is presented to DEETYA according to the proposed timeline.*

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2. The Commonwealth and other stakeholders will have a richly informed resource on which to base responses to the issues in numeracy education and the need to address these through effective programs.

*Performance measure: The key recommendations are taken into account in policy and action (where appropriate and possible)*

3. The initial work in identifying and actioning the suggested strategies in relation to numeracy education will be based on broadly based input and, as far as is possible, consensus between stakeholders.

*Performance measures: Participants report satisfaction in relation to their involvement and the valuing of their input. Informal networks of cooperation form, and are sustained.*

# Appendix 4

## Conference program

### NUMERACY EDUCATION STRATEGY DEVELOPMENT CONFERENCE

*Esplanade Hotel  
Fremantle  
20 – 21 May 1997*

TUESDAY MAY 20	What is numeracy?
8.30	Coffee
9.00 – 9:15	Welcome and introduction
9:15 – 10:30	Numeracy in school and out
10.30	Conference Opening Ms Cheryl Vardon Director-General Education Department of Western Australia
11:00	Morning Tea
11:30 – 12:00	Numeracy stories
12:00 – 1:00	Some ways of talking about numeracy?
1:00 – 2:00	Lunch
2:00 – 3:40	So what does a numerate person look like?
3.40 – 4:00	Afternoon Tea
4:00 – 5:00	Resonance, dissonance, issues and questions.
5:00	Close

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**WEDNESDAY MAY 21**

**What can/does school contribute?**

8.30

Coffee

9.00 – 10:30

What can school communities do to enhance student's numeracy?

10:30

Morning tea

11:00 – 12:30

What is needed to achieve this?

- research and development
- policy
- communication

12:30 – 1:30

Lunch

1:30 – 2:30

What are our roles?

- the school curriculum
- working with teachers
- working with parents and others
- surveying, assessing and monitoring

2:30 – 3:15

Where to from here

— together and moving forward

3:15 – 3:30

Afternoon tea

3.30 – 4:00

Closing remarks

Ms Dianne Kerr

Executive Director Education Services

Education Department

of Western Australia

4:00

Close

# Appendix 5

## Current initiatives

The project sought information from workers in the field about current initiatives in numeracy education. To date (end of August 1997) there have been 20 responses to this call for information. This Appendix contains an overview of the kinds of initiatives that have been submitted, summaries of each of the entries and the form used to collect information. The full details of the initiatives is available on the AAMT website (<http://www.aamt.edu.au>).

### Overview

There are several categories for these initiatives:

*Mathematical underpinnings development programs* — projects which build on knowledge about students' learning of mathematics (mostly in the number area) and equip teachers with materials and skills to assess problems and means for effective intervention.

*Cross-curricular numeracy research and development programs* — initiatives which are exploring the teaching and learning issues around viewing numeracy as a cross-curricular issue.

*Assessment and evaluation programs* — these are systemic testing and monitoring initiatives, some of which are of long standing, and programs which seek to evaluate the effectiveness of curriculum and teacher development projects.

*Undergraduate teaching programs* — numeracy subjects are increasingly being implemented in undergraduate teacher education courses.

*General* — information seeking projects which seek to guide future actions.

There is also a range of initiatives which focus on Adult Numeracy, most often under the banner of a literacy project. Rather than duplicate effort, interested readers are invited to contact Language Australia (phone 03 96140255) for information about access to a database of projects in this area.

## **Form used to collect information**

### **NUMERACY INITIATIVES DATABASE**

*The development of this data base is part of the Numeracy Education Strategy Development Conference, a joint project of the Education Department of WA and the Australian Association of Mathematics Teachers which is funded by the federal Department of Employment, Education, Training and Youth Affairs. For more information contact the AAMT Office, phone 08 8363 0288*

**Name and contact details of person(s) providing this information**

Title of project/initiative

Name of any associated products

**Purpose of project/initiative**

(Brief — less than 50 words)

**Key words to describe the project/initiative**

(circle those applicable)

Policy	Pre-school	Teachers	School-based
Research	Lower primary	Parents	Systemic
Curriculum guidelines	Upper primary	Early Intervention	Statewide
Assessment	Lower secondary	At risk students	National
Pre-service program	Post compulsory	Special learning needs	
Classroom materials	Post school	Cross-curriculum	
Reporting	Vocational		

Add others

**What does the project/initiative hope to achieve?**

**Who are the participants in the project/initiative?**

**Developer of the project/initiative**

(circle the applicable category /ies)

Individual school  
System  
Tertiary institution

Cluster of schools  
Professional association(s)

Region  
Volunteer individual teachers

**Location**

**Total budget**

**Source of funding**

**Website address if information about the project is available on the Internet**

**Project timeline**

**Start**

**Finish (estimated)**

**Contents of any package**

**Contact person — name**

**address**

**phone**

**fax**

**email**

**This person can**

(circle the best option)

Answer any queries

Supply basic information

Arrange sales and distribution only

**Any other relevant information**

## **Description of database items (as at August 1997)**

*Note: The entry for each initiative has been chosen from the material provided to give the best description. Hence there is some inconsistency in the headings.*

***Title of project/initiative***

Flying Start Evaluation — Numeracy

***What does the project/initiative hope to achieve?***

Monitor progress in numeracy of students in Flying Start Program to evaluate effectiveness of program. May obtain information on processes used by young children.

***Name and contact details of person(s) providing this information***

Andrew Smith  
Office for Educational Review  
DECCD  
116 Bathurst St  
Hobart Tasmania 7000

***Title of project/initiative***

Maths in Schools

***What does the project/initiative hope to achieve?***

Maths in schools is a professional development program involving schools and networks working with university staff on an issue or curriculum focus in mathematics education identified by the school or network. The National Mathematics Statement and Profile, and its Victorian adaption the Curriculum and Standards Framework, provide a basis for the program which is supported by materials developed in previous years and training for key teachers. The Mathematical Association of Victoria (MAV) coordinates the program and maintains certification arrangements.

***Name and contact details of person(s) providing this information***

Diane Siemon  
Mathematical Association of Victoria  
phone (03) 93802399



*Title of project/initiative*

Mathematics Modules for an Aboriginal Bridging Course

*What does the project/initiative hope to achieve?*

The project hopes to equip Aboriginal students who are in their pre-university year with basic mathematical knowledge and skills so that they can develop confidence to use mathematics and learn mathematics in their current studies and in the mainstream university courses they intend to join. The modules aim to address the learning style of Aboriginal students. The emphasis is on mathematics that is relevant to the students' needs and interests.

*Name and contact details of person(s) providing this information*

Joy Scott, Jacqui Hodder and Kerry Rotamah  
University of Western Australia

*Title of project/initiative*

National Professional Development Program South Australia Consortium  
1996

*What does the project/initiative hope to achieve?*

The South Australian Consortium will address the following objectives:

- encourage teachers to address their professional development needs within the context of the emerging national priorities including
  - the use of the curriculum statements and profiles,
  - teaching approaches, methods and assessment practices that arise from the key competencies, with opportunity to critically reflect on these;
- implement a range of professional development modules using a variety of delivery modes including work-based learning;
- develop a significant, integrated program of continuing professional development which will provide accreditation opportunities for teachers who complete assessment requirements towards the award of graduate certificate or equivalent qualification from participating universities.

*Name and contact details of person(s) providing this information*

Ron Moule  
Mathematical Association of South Australia  
phone (08) 83624332

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### *Title of project/initiative*

Numeracy

### *Purpose of project/initiative*

Numeracy is a system priority. In this initiative a DECCD description of numeracy has been developed, key outcomes described at years 2, 5 and 8, reporting (to parents) issues addressed and school programs are to be established.

### *Name and contact details of person(s) providing this information*

Howard Reeves  
DECCD (Tasmania)  
phone (03) 62337178

### *Title of project/initiative*

Numeracy 3–10 Research and Development

### *Purpose of project/initiative*

This project provides the opportunity for research and development which will support all teachers 3–10 to make comprehensive assessment of students level of numeracy achievement against a broad range of indicators.

In response to initiatives in numeracy, at both federal and state level, DECS has initiated a project which aims to:

1. Enable participants to develop an understanding and appreciation of their own numeracy ability, develop strategies to identify and diagnose skills in numeracy and identify teaching and curriculum strategies for supporting numeracy development.
2. Provide resources and curriculum materials which support the effective teaching and learning of numeracy and professional development support for teachers of years 3–10.
3. Support the implementation of numeracy benchmarks in years 3 and 5.

### *Name and contact details of person(s) providing this information*

Kath Ireland or Grant Small  
Department of Education and Children's Services (South Australia)  
phone (08) 82261000

*Title of project/initiative*

DART MATHS — Developmental Assessment Resource for Teachers

*Purpose of project/initiative*

A developmental assessment package that addresses the National Profiles Outcomes to report student achievements, that gives reliable individual measures from whole class activities that is thematic and models good teaching practice, and that can be used as a one-off assessment program or as the basis of an extended classroom unit.

*Name and contact details of person(s) providing this information*

Eve Recht  
ACER  
phone (03) 92775629

*Title of project/initiative*

The Commonwealth's Literacy Program

*What does the project/initiative hope to achieve?*

To foster the acquisition by all students of appropriate literacy and numeracy skills.

The Commonwealth's Literacy Program has two funding strands:

*Grants to Schools to foster Literacy*

The Commonwealth will provide \$579 million over 1997 to 2000 to be paid to government and non-government education authorities who will select appropriate strategies and programs to achieve Literacy Program objectives in the areas of numeracy and literacy. Further details are provided in program guidelines.

*Grants for National Literacy Strategies and Projects*

This strand of the Literacy Program will provide \$18 million over the 1997 to 1999 period to identify, research and implement strategic national initiatives and developments in literacy and numeracy, including \$7m to support professional development in support of the National Plan (refer to item 'National Plan for numeracy and literacy').

*Name and contact details of person(s) providing this information*

Linda Collings  
Location Code: 432  
GPO Box 9880  
CANBERRA ACT 2601

## **Numeracy = everyone's business**

### **Title of project/initiative**

National Plan for Numeracy and Literacy

### **What does the project/initiative hope to achieve?**

At the March 1997 meeting of the Ministerial Council of Employment, Education, Training and Youth Affairs (MCEETYA), the Commonwealth, State and Territory Ministers of Education agreed to new national literacy and numeracy goals:

- *that every child leaving primary school should be numerate, and be able to read, write and spell at an appropriate level.*

Ministers also agreed on a new literacy and numeracy sub-goal:

- *that every child commencing school from 1998 will achieve a minimum acceptable literacy and numeracy standard within four years (this recognises that a very small percentage of students suffer from severe educational disabilities).*

The Commonwealth, State and Territory Governments also endorsed a national plan to support the national literacy and numeracy goals. In summary, the National Plan provides for early assessment and identification of at risk students, early intervention, regular assessment against agreed national benchmarks, national reporting of student achievement and recognition of the importance of professional development in improving literacy and numeracy learning outcomes. (more — see Appendix 2)

### **Name and contact details of person(s) providing this information**

Linda Collings  
Location Code: 432  
GPO Box 9880  
CANBERRA ACT 2601

### ***Title of project/initiative***

Flying Start Program (Numeracy)

### ***Purpose of project/initiative***

A project focusing on literacy, numeracy and social skills for children birth to 8 years. Decreases pupil teacher ratios to provide enhanced opportunities for students, early intervention, professional development for teachers and encourages parent participation.

### ***Name and contact details of person(s) providing this information***

Carolyn Mackel  
phone (03) 62337208

**Title of project/initiative**

Use of integrated learning systems (ILS) in developing number and language concepts in primary school children: a longitudinal study of individual differences.

**What does the project/initiative hope to achieve?**

The research project will examine the effects of Integrated Learning Systems (ILS). The evaluation will focus on ILS children and control children within each of four participating schools in the ACT. The major concern is identifying the children who most benefit from ILS and suggesting topics in the areas of literacy and numeracy that need to be developed or modified for Australian children.

The project involves a controlled longitudinal study of children's growth in numeracy and literacy through the use of ILS over a four year period; it will consider individual differences and other quantitative indices of change

**Name and contact details of person(s) providing this information**

Linda Collings  
Location Code: 432  
GPO Box 9880  
CANBERRA ACT 2601

***Title of project/initiative***

Introduction to Language, Literacy and Numeracy is a 4.5 pt compulsory subject for 1st year preservice Bachelor of Education (Primary/Junior Primary) students.

***Purpose of project/initiative***

This subject focuses on introducing students to the concepts of literacy and numeracy, explore their own literacy and numeracy, explore literacy and numeracy in schools. The students explore and construct their own views of numeracy and literacy through workshop experiences and discussion and by engaging with key materials and readings. Numeracy as a social construction and is culturally biased is a key focus point.

***Name and contact details of person(s) providing this information***

Mike Chartres, University of South Australia, Underdale Campus  
Kerry Hugo, University of South Australia, Magill Campus

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### **Title of project/initiative**

School based Professional Development for teachers of Mathematics

### **What does the project/initiative hope to achieve?**

Continue and extend the work of identification of maths pd needs by teachers in schools. Provide for school-based pd through key teachers; distribution of the publication of case studies written by teachers. Conference to enable teachers to become more familiar with and use of Student Outcome Statements in mathematics.

### **Name and contact details of person(s) providing this information**

Wayne McGowan  
phone (08) 93216800

### ***Title of project/initiative***

Enhancing Partnerships for Implementing Effective Literacy, Numeracy and Key Competencies Practices in Central Queensland

### ***What does the project/initiative hope to achieve?***

This project seeks to engage teachers in critical reflective inquiry to identify, make explicit and map their teaching practices in literacy, numeracy and key competencies. Such a process will provide a basis for reconceptualising these practices in relation to national Statements, Profiles and Key Competencies, so that teachers can confidently identify their own needs and pathways.

### ***Name and contact details of person(s) providing this information***

Pat Moran  
Central Queensland University

### ***Title of project/initiative***

Numeracy across the curriculum

### ***Purpose of project/initiative***

To provide a description of numeracy.  
Develop an approach to numeracy which will help teachers recognise and develop sound classroom practice.

### ***Name and contact details of person(s) providing this information***

Mark Jeffery  
Murdoch University

***Title of project/initiative***

The place of literacy and numeracy in the primary school curriculum

***Purpose of project/initiative***

To gauge the event of change in primary school curriculum.

Obtain perceptions on adaption to these changes and the impact on literacy and numeracy outcomes.

Obtain accurate data on time, effort, resources devoted to specific instructions.

Document 'case studies' of successful schools.

Make recommendations on how schools may deal with a crowded curriculum.

***Name and contact details of person(s) providing this information***

Chris Cameron

President APPA

phone (06) 2055644; fax (06) 2055615

***Title of project/initiative***

Count Me In Too

***Purpose of project/initiative***

Count Me In Too is an early numeracy project operating in NSW. It is the first phase of an early Numeracy strategy.

Count Me In Too focuses on professional development for teachers in the early years, resulting in improved students' learning outcomes. Innovative features of the project included the use of a learning framework in early number based on research and undergoing further development in classrooms, an emphasis on increasing the sophistication of students' methods of solving problems and the underlying model of professional development.

***Name and contact details of person(s) providing this information***

Peter Gould

phone (02) 98867625

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### *Title of project/initiative*

Year 9 Numeracy Assessment and Monitoring Program

### *Purpose of project/initiative*

Large scale assessment package of 4 tasks (multiple choice, constructed response, extended investigation) to test numeracy in Year 9 students. Associated questionnaires for teachers/students cover pedagogy, time etc. CD-ROM reporting package. Internet delivery trial.

### *Name and contact details of person(s) providing this information*

Rosemary Callingham  
DECCD (Tasmania)  
phone (03) 62337295

### *Title of project/initiative*

Contextualising Mathematics

### *Purpose of project/initiative*

Provide training and support for teachers in SA's Aboriginal schools to provide students with opportunities to learn mathematics within a supportive contextual framework. (The focus will shift away from Aboriginal schools to other schools with Aboriginal enrolment in 1998.)

### *Name and contact details of person(s) providing this information*

John Bleckly  
DECS Aboriginal Education  
phone (08) 83436500



# Appendix 6

## Record of discussion — What it means to be a numerate person

Much of the consideration about numeracy was done through thinking about ‘a numerate person’. Key attributes were identified and have been sorted into the important aspects of numeracy identified in Section 1.2. The material serves to elaborate these categories.

### Chooses and uses mathematics

A numerate person:

- chooses some mathematics appropriate to purpose;
- is able to analyse, visualise, formulate and work with mathematical generalisations;
- knows ‘what is reasonable’ (evaluates appropriateness of a result);
- uses mathematical ideas to communicate with others;
- recognises when maths can (and can’t) help in a situation, and to what extent its use contributes;
- works efficiently and fluently (in terms of the ‘mathematics’) within a familiar context.

### Disposition<sup>14</sup>

A numerate person is:

- comfortable and confident using their mathematics, at least in familiar contexts;

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<sup>14</sup> The term ‘disposition’ is used to summarise affective components, in a manner similar to that of Mathematics Curriculum and Evaluation standards (NCTM, 1989), among others.

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- confident to engage 'mathematically' or 'numerately' with situation, interrogate, question, seek assistance;
- willing to 'have a go' and take risks in using mathematics, accepting that not all attempts and approaches will succeed;
- adaptable (in approach); improvises, poses questions, persists;
- will 'have a go' at trying different ways of approaching a situation, if necessary;
- is disposed towards the spontaneous use of mathematics;
- is oriented towards transferring between contexts (from familiar to less, or unfamiliar);
- values mathematical approaches and sees the 'point' of them;
- is not unduly daunted when confronted by, and confronting, new and familiar mathematical situations in their everyday life;
- is confident in transferring mathematical procedures from informal to formal situations;
- comfortable (i.e. not embarrassed) when seeking advice or assistance.

## **General thinking and doing skills**

A numerate person:

- uses skills of reflection, evaluation;
- is inclined towards making 'informed' and rational judgements;
- can choose and use appropriate technology (calculators, measuring tools, computer programs...);
- communicates findings informed by numeracy in effective ways.

## **Mathematical content and process intertwined**

A numerate person:

- has number sense; but also spatial and visual 'sense', data, measurement and 'formula' — that is, has breadth in the mathematics available to underpin and inform numeracy;
- has depth within their mathematics as well — having 'more mathematics'

does not imply that one is 'more numerate', but it can be a factor;

- recognises, and can work towards, an appropriate level of accuracy;
- can accurately compute and calculate when required;
- interprets and analyses maths presented in a range of media;
- has skills in making approximations and estimations;
- can readily differentiate between data that is useful and that which is unnecessary or unreliable;
- is skilled in evaluating the appropriateness of strategies and solutions, and in judging the reasonableness of a result.

## **Purpose**

A numerate person:

- can use mathematics to further understand issues and make choices and judgements;
- is able to make informed decisions in their vocational, personal and civic lives;
- is able to be critical — both to critique results and critique the perspectives and assumptions of the 'discourse';
- can organise information for themselves or others to, for example, assist decision making.

## **Context**

What is for one person a familiar, or even routine context in which numeracy skills are applied almost 'automatically' can, for someone else, be quite unfamiliar and make significant numeracy demands. At one level, 'context' is merely the situation in which a person is working. Other considerations are possible as part of considerations of context. These include questions of the impact of social and collaborative contexts and 'whose context' (i.e. from whose perspective). There is a sense in which the range of contexts in which an individual is able to function numerately is an indicator of numeracy.

Developmental work in numeracy education will need to attend to the issue of 'context' in order to illuminate the interaction between what we are currently calling 'context' and a person's numerate (or otherwise) performance.

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# Appendix 7

## Record of discussion — On numeracy at different ages

In order to illuminate the development of numeracy with age and experience, conference participants spent some time outlining their expectations — or perhaps hopes — for students' numeracy at several ages. The ages looked at were the start of schooling (age 5), about year 3 (age 8/9), towards the end of primary schooling (age 11/12) and at the end of (compulsory) schooling (age 15/16). The descriptions at different ages all contain elements in common with the description of 'numerate adults' contained in the previous Appendix. The kinds of attributes identified reflect an expectation of general increases in what young people know and increases in their social and intellectual sophistication as they grow.

Groups approached the task in a range of ways and time for discussion was limited. A detailed summary of the discussions follows.

### **A five year old**

Given that children of this age are in transition from home to schooling, the attributes identified will be dependent to a large extent on home experiences. The group concluded that it was not desirable or possible to define particular expectations for a five year old. Instead it was felt that awareness of 'indicators of progress' in three key aspects of numeracy:

- disposition and attitude, including confidence, persistence and awareness of the 'usefulness' of maths
- 'choosing and using'
- some mathematical knowledge and skills

would be most beneficial to assist teachers to plan learning programs for children from these diverse backgrounds. The teacher's role would be to build initial 'pictures' of what children bring in each aspect. This is consistent with good practice for very young children — what is potentially helpful is the identification (and eventual elaboration) of the domains indicated above.

## **An 8/9 year old**

Children of this age were considered from two viewpoints. Firstly, general attributes of an 'average' student were identified. Then, by way of emphasising the contextual nature of numeracy for young people, there was a focus on the attributes of an 8/9 year old child living in a traditional Aboriginal community. This conversation was led by a teacher with extensive and current experience in such a community.

### **General<sup>15</sup>**

Students of this age are likely to be able to use a range of mathematical strategies for routine problems. These include multiplication or repeated addition to count arrays, counting by 2s, 3s, 4s, 5s, 10s to 120 from any number and generally to have a facile knowledge of whole number arithmetic and be able to use it. They can solve problems involving simple fractions in discrete or continuous situations. They can recognise the net of a 3D object or a 2D drawing of it, from their knowledge of the conventions involved.

In order for these mathematical skills and knowledge to be useful, students need the ability to spontaneously access them in a range of contexts. This includes initiating and making mathematical interpretations in all Key Learning Areas (for example, to draw people in proportion to a house) and to articulate, reflect on and justify solutions.

Some examples include:

- using numbers in games and sport to record scores;
- using a map, give directions to locate objects (short cut for a friend to visit their home);
- using informal strategies to measure (length of bicycle chain with string);
- deciding what is 'fair' in their social dealings (taking turns).

### **In a traditional Aboriginal community.**

Given the much more precise definition of the context in which this child lives, it is possible to be much clearer about numeracy expectations. The fundamental expectation, and the response to the 'dual worlds' these children inhabit, is that they

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15 The focus in this discussion was very much on the mathematical underpinnings due to time constraints.

are moving towards being comfortable using both the western mathematics and the Aboriginal mathematics of their community.

- basic understanding of kinship system;
- understanding of, and understanding of how to use, money (e.g. to buy single items);
- understands local seasonal time i.e. hunting;
- has capability with mental computation in the context of card games, sporting games etc.;
- has knowledge of such things as processional order, dance protocol, order and pattern of events in the conduct of relevant ceremonies;
- has facility with traditional counting 1, 2, many, big many as well as western counting and processes;
- recognises and can produce symbols in artwork;
- uses the language of comparison, particularly in relation to measurements;
- has and uses sense of direction;
- has knowledge of homeland;
- uses language of relative position in a ceremonial context.

## **An 11/12 year old**

The two approaches taken when discussing early adolescent children were similar to those for the younger age group. General characteristics were one focus; the other was to identify ways they might work with a particular task.

### **General**

Children of this age have an increasing ability (unprompted and independently; and in more abstract ways) to

- interpret data;
- use time;
- locate in space;
- use, and plan the use of, money.

## **Numeracy = everyone's business**

They have an increasing ability to use mathematical language with accuracy and precision and are able to choose a variety of strategies to seek solutions. These may not be the most efficient; the verification and evaluation skills which would assist in deciding on efficiency and efficacy are generally yet to develop. Numeracy skills make a particular contribution to planning in many contexts, both within other Key Learning Areas and in students' life outside of school. A non-exhaustive list of attributes follows:

- in comparing, can use more than add and subtract notions;
- appreciates quantity and measurement benchmarks;
- recognises and uses data presented in a variety of forms (obvious ones) e.g. tables in Studies of Society and the Environment;
- uses a flexible and appropriate range of mental computation strategies;
- begins to branch out from the familiar to the unfamiliar (can use their maths to deal with new but related situations);
- knows that 'you can draw on mathematics';
- starts to be prepared to challenge others' use of mathematical information (e.g. 7 out of 10 people agree... 'but I didn't, so what are they saying...?');
- shows the ability to listen and use mathematical reasoning (recognises when a situation is mathematical and when it is not, at least in familiar contexts);
- can discuss what they are doing and thinking mathematically;
- begins to initiate flexible use of mathematical forms to communicate (e.g. if I put this information in a table, it will be easier to understand);
- displays the confidence to have a go and shows perseverance, with an expectation that using mathematics in some situations may take time;
- when something (including the teacher's explanations or conclusions) doesn't make sense from a numeracy or mathematical viewpoint the student says so.

### **Particular task (looking at a map of Australia: planning a trip)**

Again, the clarity of context made it easier to identify particular attributes and skills etc. In undertaking this task a student of 11/12 years of age might:

- show awareness of relative magnitude of larger numbers;



- link and evaluate relative (possibly subjective) importance of distance, time and cost in the overall scheme of things;
- consider and evaluate the effects of time or seasonal differences and time zones on planning;
- determine what they want and need to know and researching to obtain relevant data;
- make choices and look at options in relation to means of transport and routes;
- provide justification of choices;
- consider alternatives by asking and answering 'what if...' questions;
- employ effective collaboration and group skills;
- present findings in suitable ways.

## **15/16 year old**

A person of this age is in transition to adulthood. She or he is progressively taking on greater independence and is being expected to take on greater responsibility for themselves.

Their world has two different aspects and they engage at different 'scales' within them, from the personal to the 'global'.

### **In school and training**

*In class/in their learning of subjects (Physical Education, Drama, Geography etc.)*

Students appreciate, acknowledge and use the numeracy integral to success in the subjects they are studying.

For example:

- spontaneously use this numeracy in constructing an argument in, and the discourse of, Geography, Health Studies, the Arts etc.;
- meet practical demands of subjects and courses through learning and employing the particular aspects of numeracy that are relevant to the context.

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### *In schooling in general*

Students use their numeracy to understand what schooling is about.

For example:

- knowing about the Tertiary Entrance Ranking and what it does to them;
- evaluate the impact of time away from school against the benefits of sporting commitment or work experience;
- estimating effort required and enacting effective time management in relation to meeting work requirements.

### **Out of school**

#### *Personal social*

Further learning, personal independence and responsibility are supported by students' numerate judgements and actions.

For example:

- arrange to get across town to meet someone and get home on time and safely;
- manage their personal finances;
- assess health and safety risks in their behaviours;
- have a 'can do' approach to working with (new) technology (e.g. calculators, learning something new such as Excel, using digital equipment in education or work settings...);
- able and willing to learn new things and within new contexts;
- demonstrate time management by making decisions appropriate to sequence of events, duration, starting and finishing times;
- read and interpret graphs, tables ...relevant to their interests (e.g. surfer, sailor uses weather maps to gain needed information; scuba diver, fisherman uses tide charts; sports people (or those interested) can read tables etc. in media).

#### *Personal engagement with the community (including their part-time work)*

Students are able to use their numeracy to participate in situations (work in a shop, membership or leadership in clubs, church etc.) where important consequences exist.

For example:

- at a range of decision points in their part time work, each of which could result in dismissal if the decision and subsequent action fails;
- to think ahead and plan (e.g. ensuring that there is a clean shirt for work);
- for effective time management;
- knowing when accuracy is important and what the consequences of not meeting requirements might be;
- acknowledge that personal safety and health is informed by numeracy;
- in their sport and recreation, which are often very 'mathematical'.

### *Participating in the wider society*

Students' use of numeracy informs and enables their operation and participation in society.

For example:

- obtain and use a driver's licence;
- obtain and use a bank account;
- read a newspaper and figure out what it is actually saying;
- knowing about being 'ripped off' as a consumer or as a worker.

### *A a citizen*

Students use their numeracy to develop informed opinions, and to formulate their critique and action as citizens.

For example:

- have an opinion about immigration;
- awareness of relationships and connections being important;
- use mathematics to contribute to a reasoned argument.

**Numeracy = everyone's business**

# Appendix 8

## Record of discussion — On numeracy for schools and schooling

Numeracy is effectively using mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life. This Appendix summarises discussions about schools and numeracy.

To further assist readers to make sense of the record, entries have been broadly sorted into categories:

- Mathematics curriculum and teaching
- Numeracy as a cross-curricular learning
- Assessment and assistance in relation to numeracy learning
- The general teaching and learning environment
- Teachers skills and developmental needs and opportunities
- Community involvement and support.

### **In schools we need to keep:**

#### Mathematics curriculum and teaching

- School mathematics needs to provide students with knowledge of basic mathematics.
- Specific mathematics teaching must remain to ensure conceptual development within the discipline.
- Activities and learning experiences in which students have vested interest in doing and through which they can (and want) to accept responsibility for their mathematical work.
- Open-ended tasks so that children can exhibit their understandings.
- Acknowledgment of the importance of 'language' in mathematics.
- Sensitivity to local needs in relation to what mathematics is learned and the ways this can best be done.

## **In schools we need to keep (cont.):**

### Numeracy as a cross-curricular learning

- Wide range of activities within the school with a view to considering each of these with a numeracy focus. For example, continue asking questions like 'What demands on students' numeracy does the school fair make?'
- Maintain emphasis on skills and process development in relation to planning through the various cross-curricular frameworks such as the Key Competencies, Essential Skills and Understandings (South Australia) etc.
- Teachers to maintain clarity of focus on the important mathematical development and outcomes in an integrated curriculum.
- Structured and planned use of 'thematic' approaches.
- Use of contexts across the curriculum where maths occurs to link with other maths learning. (Implies a need for PD for teachers to facilitate this).

### Assessment and assistance in relation to numeracy learning

Nil<sup>16</sup>

### The general teaching and learning environment

- Teachers who 'teach' and who are influenced by images of good practice in classrooms.
- Teaching practices which provide students the opportunity to negotiate within a task (in mathematics or other curriculum areas).
- Activities which develop a classroom community of 'resources' and 'problem solvers' in addition to those which focus on individual knowledge and performance.
- Teaching practices which are responsive to developmental needs of children.
- Technology — keep the emphasis on maintaining and improving the children's accessibility to relevant technology.

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16 The lack of comments about aspects to KEEP in relation to assessment could be taken as general dissatisfaction with current assessment and assistance regimes. This is reinforced in later sections where these issues do have a significant profile.

## Teachers' skills and developmental needs and opportunities

Much of this is assumed in other headings — the current skill levels are inherent in maintaining these aspects.

## Community involvement and support

- Maintain efforts aimed at keeping parents informed about what the school is doing in relation to numeracy.

## **In schools we need to change:**

### Mathematics curriculum and teaching

- Recognise that mathematics is of vocational value for most students and that academic depth is not always needed in this context.
- The perceived 'creeping' reintroduction or emphasis on decontextualised algorithms and skills.
- Place school maths in genuine contexts that are relevant to the students in the class and school.
- Take the notion of 'context' seriously and avoid seeing contextual mathematics seen as maths only for mathematically challenged students through such things as Maths for Living type courses.
- Achieve a whole school approach to teaching maths with consistency through common understandings.
- Ensure that teachers feel comfortable teaching maths, know how to teach it and are informed by their own understanding of how children learn mathematics.
- Curriculum emphasises to include more focus on mental mathematics strategies, less procedural mathematics, knowing when to choose estimation and when to choose accuracy.
- Greater use of technologies to assist maths learning.

## **In schools we need to change (cont.):**

### Numeracy as a cross-curricular learning

- Increased focus on cross-curricular approach to include information-exchange between teachers and curriculum areas to note, encourage, make explicit, build on overlaps and possibilities for integration as part of increased cross-curricular planning.
- Build on students' out of school activities to develop numeracy skills and link with maths learned.
- All teachers in all subject areas accept responsibility for the development of numeracy.<sup>17</sup>
- Teachers as a group to better identify the opportunities being provided to learn mathematical concepts across the learning areas and when the concepts being developed in a learning area are dependent on mathematical understandings.
- Increased integration between curriculum areas is one strategy to increase the use of appropriate contexts to enhance student engagement and hence their numeracy development.
- Teachers of mathematics to increase their knowledge and understanding of other learning areas and learn how mathematics manifests itself in work, in their own lives and in students' lives.
- All teachers need to recognise the numeracy demands within learning areas and subjects and deal appropriately with them by taking opportunities to develop and enhance students' numeracy within the learning area and subject.

### Assessment and assistance in relation to numeracy learning

- Better (more thorough) safety nets for students who 'slip' through the numeracy network and who have unacceptable achievement.
- Assessment strategies need to change and better reflect aims and needs.

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<sup>17</sup> Although this seems an ambitious goal, the suggestion is made in the context of substantial systemic efforts around the country to achieve precisely this in relation to literacy.



- Ensure assessment reflects a variety of contexts where numeracy occurs.
- Governments and systems need to move beyond objective-style external testing (basic skills etc.) as the valued assessment information.

### The general teaching and learning environment

- All teachers need to exude the confidence we recognise is needed to use mathematics effectively as a numerate person.
- Cease using mathematics as a punishment (e.g. writing time tables and extra exercises).
- More use of calculators in schools — at all levels.
- Schools need to seriously engage with numeracy, i.e. investigate current practice, seek information, reflect and try new ideas etc.
- See learning more holistically.
- The general profile of numeracy needs to be raised.
- Similar attitude to numeracy (maths) as there is to literacy — e.g. 600 teachers at a maths conference.
- Emphasise vocational education in secondary.
- Diminish unnecessary and unhelpful differences in approaches (learning and teaching) between primary and secondary schools.

### Teachers' skills and developmental needs and opportunities

- Teachers need to become more flexible in their teaching approaches.
- Many staff in schools need to develop a more positive attitude towards technology — one which is welcoming, forward thinking, creative and embracing of the potential.
- A changed emphasis in current and planned curriculum initiatives and PD programs would the numeracy awareness.
- Ensure that developmental efforts focus on challenging teaching, administrative and curriculum practices through reflection rather than a singular emphasis on materials.
- Tertiary institutions and courses to promote a common message about numeracy.

## **In schools we need to change (cont.):**

### Community involvement and support

- Increase public and systemic focus on development of numeracy across the curriculum, focussing on where and how it develops.
- Ensure that numeracy is seen as an essential cross-curricular issue in the thinking of schools, the community, teachers, etc.
- Improved communication with parents to change attitudes about what matters in mathematics and perceptions about numeracy (numeracy does not equal maths) and to help them understand their own numeracy and the diverse ways of students may demonstrate their numeracy in their lives.

## **In schools we need to adopt new 'initiatives':**

### Mathematics curriculum and teaching

- Serious and systematic means for acknowledging children's informal mathematics.

### Numeracy as a cross-curricular learning

- Embedding numeracy 'across the curriculum' and gaining recognition of the importance of this.
- Remove partitions between the different subjects or learning areas and evaluate alternative curricular organisers.
- Extend the principles of middle schooling into lower secondary education to, in particular, reduce the number of specialist teachers, facilitate the integration of the curriculum and take a focus on placing learning in a real context.
- Ensure that there is clear and explicit understanding of the numeracy demands of the subject.
- Provide more planning time for groups of teachers to ensure that implementation of integrated programs and a cross-curricular view of numeracy.
- Ensure there are critical numeracy elements to the content in all areas students are dealing with — this provides numeracy for citizenship by empowering the learner rather than merely giving the 'nuts and bolts'.

## Assessment and assistance in relation to numeracy learning

- Australian Primary Principals Association survey on literacy and numeracy across Australia (1200 primary schools) currently being developed.
- Clear guidelines (indicators) for teachers to help identify degrees of numeracy in children and then guide 'where to next'.

## The general teaching and learning environment

- A focus on the affective domain, including such things as taking a risk, developing and maintaining confidence, positive disposition and persistence.
- Collaborative planning between teachers in relation to numeracy development, with appropriate time provided.
- Make explicit the relationship between 'western mathematics' and the traditional Aboriginal world view and its inherent numeracy.
- Whole staff agreement on key elements such as what numerate behaviour 'looks like', common language to talk about it, approaches to developing numeracy, strategies to support numeracy and the identification of opportunities to learn mathematical concepts in the context of other learning areas.

## Teachers' skills and developmental needs and opportunities

- Teachers need to develop an enriched concept of numeracy and to consider broad, relevant numeracy issues through discussion, sharing and informed debate which enhance both confidence and competence.<sup>18</sup>
- There need to be compulsory literacy and numeracy studies in all pre-service education of teachers.
- Inform teachers on how children process problems outside the classroom — i.e. when it is not 'school maths' and how this impacts on the relevance of what they are practising in schools.

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18 It is important for employers to signal their valuing of this major professional development initiative by making it a priority and funding it accordingly, in addition to the Commonwealth's contribution.

## **In schools we need to adopt new 'initiatives' (cont.):**

### Community involvement and support

- The wider school community needs to be carefully and well informed of the 'school's' (system) current and developing view of numeracy, and related expectations through vehicles such as newsletters, parent information evenings, open classes, forums, parent helpers and report systems.
- Parents need to be involved at the school level in the development of children's numeracy in a two way process of information giving and receiving.
- Campaigns (at all levels from systems down) need to promote numeracy as a life skill and encourage parent participation in helping to develop this attribute in our young people.
- Schools need to take an active role — providing information to parents and teachers and disseminating information about numeracy in 'parent friendly' language.
- Parental understanding and involvement may be best enhanced through an initiative similar to the Family Maths Project Australia (FAMPA), but with an emphasis on numeracy rather than mathematics.

## **In schools we need to find out about:**

### Mathematics curriculum and teaching

- Students' perceptions of what makes learning mathematics valuable.
- Means for enabling the acknowledgment of children's informal maths.

## Numeracy as a cross-curricular learning

- Whether numeracy can be 'taught' and whether it is developmental.
- What is currently going on (research, models of best practice) and ways to ensure that numeracy education has a high profile within these.
- How technology (calculators, computers, Internet, communications) impacts on numeracy, and how it can be used to enhance it.
- Models which enable teachers to make explicit and model the mathematics being used in all curriculum areas, and to model their use of mathematical understandings in their own lives.
- Monitoring of 'integrated teaching programs' to ensure they are achieving appropriate outcomes.
- Ways to enable secondary schools to take a more cross-curricular approach, and to ensure that numeracy plays a vital role in this development.

## Assessment and assistance in relation to numeracy learning

- Need to know more about what might help students 'at educational risk' overcome learning difficulties — would a focus on numeracy (as distinct from mathematics) be more effective and what might such an emphasis look like.
- State testing programs should 'give the big picture', but it is not clear that they reflect aspirations for numeracy, nor what better programs might look like.
- There is a lack of knowledge about present student levels of numeracy and this needs to be addressed.
- Need to develop assessment methods that encourage students to engage in new experiences, keep options open etc. — the techniques for this need to be developed.

## **In schools we need to find out about (cont.):**

### The general teaching and learning environment

- An understanding (or at least an informed prediction) of what will today's students will need for the year 2010 is needed to influence our discussions, decisions, plans and policies.
- Identify and learn from schools which have been successful with dealing with numeracy issues (contexts, cross-curriculum, multiple responsibilities) by making their experience available as case studies for other schools considering change.
- Need to develop awareness of the impact that technology is having on our students and children.
- Explore the impact of restructuring high schools and primary schools and other aspects of school organisation on the development of children's numeracy.
- Identify the impact of different socio-linguistic background on development of numeracy, and the development of maths skills.
- Develop strategies which attend to access issues for ESL students when the language demands increase as mathematics is placed in context.

### Teachers' skills and developmental needs and opportunities

- Identify existing and previous models of professional development that have been successful and establish ways of integrating attention to numeracy into school and across-school PD programs.
- Build confidence of teachers so they can teach in a 'student oriented' way
- Providing clear advice to teachers about reasonable expectations along the continuum of numeracy and what implications there are for planning, assessment and reporting in the light of any continuum.