Literacy and Numeracy in the Early Years

Prepared by the Royal Children's Hospital Education Institute for the Victorian Literacy and Numeracy Secretariat and the Early Childhood Strategy Division, Department of Education and Early Childhood Development

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Introduction

In Victoria, the Department of Education and Early Childhood Development (DEECD) is delivering a significant reform agenda. Through the Blueprint for Education and Early Childhood Development, Growing, Learning and Thriving, and the Council of Australian Governments (COAG) National Agreement and National Partnerships, the reform agenda focuses on improving outcomes for children and young people by driving service quality.

In order to deliver on the reform agenda the Minister for Children and Early Childhood Development, Maxine Morand, recently released the Victorian Early Years Learning and Development Framework (VEYLDF) which describes common outcomes for children aged birth to eight years and common principles for practice. This Framework supports continuity of children's learning and development from birth to eight years. This is further supported by the Transition: A Positive Start to School initiative.

Literacy and numeracy are core life skills, the acquisition of which has profound consequences for individuals, families, communities and nations. In the Western world, literacy and numeracy are aligned to skills needed in employment and linked to work-related objectives, productivity and socio-economic development (OECD 2002:12). Yet literacy and numeracy are not acquired automatically. The achievement of the functional levels of literacy and numeracy required for success in our complex society needs significant investment—both by the child and family, and within the wider societal context.

Widely diverging levels of literacy and numeracy skills can be seen in the Australian adult population. Closing the educational achievement gap for the next generation requires significant commitment and investment to ensure that all children and young people can fulfil their educational potential. Such investment must be shaped within the context of the continuous nature of cognitive and non-cognitive development that is so important for a child's future success in school and in life (Heckman and Masterov 2007, p. 487). It is the everyday activities and environments through and in which young children from birth to age eight grow and develop that contribute to early literacy and numeracy. These early experiences scaffold the child's later learning of the formal literacy and numeracy skills (Vygotsky, 1986).

The literature on early years literacy and numeracy is vast and a comprehensive review of both fields is beyond the scope of this paper. Instead, this discussion paper examines the broadly-based issues of emergent literacy and numeracy for children from birth to age eight. It also looks to the multi-modal and new literacies that are required by the next generation of children for life in the information society.
New and traditional literacies and numeracy

Where we are doing well in traditional literacy and numeracy

National testing data (NAPLAN results) from 2009 indicate that of the 95% of Victorian Year Three students (with an average age of 8 years and 9 months) who undertook the NAPLAN reading tests, 95.2% were reading at or above the national minimum standard. This is above the national average, and second only to NSW in the state average scores.

Similarly in numeracy, of the 94.4% of students who participated in the testing, 95.6% were at or above the national minimum standard, again higher than the national average.

Where we could do better in traditional literacy and numeracy

A closer look at the NAPLAN data shows that the 5% or so of children who are not meeting the national minimum standard share some particular characteristics.

In reading testing, children who are less likely to be meeting the national minimum standard:

- are boys
- are of Indigenous background
- have a language background other than English
- have less educated or unemployed parents.

These results hold true across the other areas of literacy which are tested under NAPLAN (writing, spelling and grammar and punctuation) as well as for numeracy.

The building blocks of contemporary literacies include the ability to decode and interpret meaning, and then to use and re-use that information in new and different ways. One useful way of thinking about this is through the Four Resources Model in literacy education (Freebody and Luke, 1990). This model aims to overcome the divides between proponents of whole language, phonics, critical literacy and others. It addresses the need for people to attain all the competences which make up literacy:

- coding competence (phonics, or the ability to decode text)
- semantic competence (comprehension or the ability to make meaning from the whole language context)
- pragmatic competence (every day, functional literacy, i.e. reading the newspaper, understanding health information, filling out a job application)
- critical competence (the ability to critically select and analyse texts).

The model makes clear that no one of these resources is sufficient but that each is essential and all are related. Nor are the resources meant to indicate a sequence of instruction or an order of acquisition (Freebody and Luke, 1990). Critical awareness of the uses of language, as well as of mathematical and number skills, can be taught to young children well before they are able to read and write for themselves.

More recently, work on multiliteracies has begun to tease out the ‘knowledge processes’ of experiencing, conceptualising, analysing and applying knowledge (Kalantzis, Cope and Clonnan 2010, p. 72). Such an approach builds on children’s own experiences (linking the known and the new). It uses the metalinguage of naming and theorising to help students conceptualise the issues they are learning about; teaches functional and critical analysis of content; and offers opportunities to apply knowledge appropriately and creatively (Clonnan, 2010). Such an approach moves pedagogy and teaching practice beyond engagement with and assessment of instrumental skills, towards a more holistic approach to literacy and numeracy learning and comprehension.

Acknowledgement of the richness and diversity of young children’s understanding and use of communicative practices—for example gestures, speech and language, visual and non-verbal cues—is reflected in the VEYLDF. This describes literacy in the early years as going beyond English language competence, to include ‘a range of modes of communication, including music, movement, dance, story telling, visual arts, media and drama, as well as talking, viewing, reading and writing.’ Victorian Early Years Learning and Development Framework (VEYLDF), 2009: 52

Numeracy: ‘...broadly includes understandings about numbers, patterns, measurement, spatial awareness and data as well as mathematical thinking, reasoning and counting.’ Early Years Learning Framework (EYLF), 2009:46

Definitions

Literacy: ‘Literacy is the capacity, confidence and disposition to understand and produce the English language accurately, fluently, creatively, critically, and effectively in a range of modes and digital settings, and in texts designed for a range of purposes and audiences.’ DEECD, 2009a: 4

Numeracy: ‘Numeracy is the capacity, confidence and disposition to understand and apply mathematical concepts, problem solve, collect and analyse data and to make connections within mathematics to meet the demands of all learning at school, work, home, community and within civic life.’ DEECD, 2009a: 4

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Similarly, the foundational skills of early numeracy include the ability to ‘decode’ mathematical information in areas such as measurement, chance and data, space, number and working mathematically; to analyse and interpret this information; and to be able to use it to solve problems and build knowledge (DEECDa 2009, p. 14). Mathematics also has a fundamental role in ‘empowering individuals as critical citizens in contemporary society’ (DEECD 2009c, p. 44). It enhances problem-solving, advances cultural, social and technological change and improves people’s understanding of the human and natural world (DEECD 2009c, p. 44).

Mathematical thinking and reasoning underpins learning processes in a range of domains, through strategies such as problem-setting, problem-solving, investigation and modelling (DEECD, 2009c, p. 45).
Research has consistently shown a strong link between children's early language skills and literacy (Catts et al., 2002) and their ability to communicate with peers, socialise and establish relationships. In a language-rich environment, children will normally acquire language at approximately the same rate and in the same developmental sequence. Explicit teaching is not required for this to happen, but exposure to stimulus is (CCCH 2004, p. 3).

The central roles played by parents and early years educators in both the development of children's language and monitoring and identifying language impairment or delay (Skeat et al., 2010; Zhang & Tomblin, 2000) suggest that it is vital that they have a common understanding of the importance of language and language development. Similarly, numeracy research has identified the importance of improving the perceptions of parents and educators in regard to mathematics (EYNP 2001). However, recent Victorian-based research indicates that parents and early years professionals hold different types of knowledge regarding early literacy and numeracy and that a shared understanding is lacking (Skeat et al., 2010).

Oral language

Although there is a high degree of variability in the language abilities of very young children up to the age of four years, from about five years language use stabilises. At age five, approximately 85% of Victorian children demonstrate normal, or typical language development, 7% show language precocity and a further 8% show some language delay or impairment (Ukoumunne, 2009; Reilly, et al 2009). Up to 90% of children with persistent language problems at five years have been found to have poor literacy outcomes ten years later (Stothard, Snowling, Bishop, Chipchase and Kaplan, 1998).

Clear trajectories of development can also be discerned in which, regardless of initial language ability, children from higher socio-economic groups tend to improve their language use over time. Children from lower socio-economic groups, regardless of starting point, tend to show a decline in oral language skills over time (Ukoumunne, 2010).

What do literacy and numeracy look like in the 21st century?

From earliest infancy, children are developing communication skills through face-to-face interaction with family members and others, through facial expressions, sounds, gestures and bodily movements. Yet, as children grow and develop, the written word and symbols become (for the time being at least) a critical means of communication across many dimensions of human interaction.

However the contexts in which literacy and numeracy take place are rapidly changing, particularly in children's worlds. Increasingly, reading takes place on a screen rather than on paper. Even the canonical works of literature are now available in Kindle or other e-reader formats, as well as online through portals such as Google books. Whilst traditional skills in print literacy still form the basis for understanding such information and as foundational skills are as important as ever, in other ways new contexts require substantial changes in the way text users approach information (Kalantzis, Cope and Cloran, 2010, p. 62).

An understanding of printed text as a linear construct needs to be replaced by an understanding of how networked information is linked and hyperlinked. The inclusion of visual, graphic, video and sound content within and amongst print needs to be understood and interpreted; and the increasingly interactive nature of online communication requires critical skills in both content creation and the ability to successfully and safely navigate a variety of communicative contexts (Edward-Groves and Langley 2009, p. 2).

The rapid technological advances which are fundamentally altering our understanding of contemporary literacy play out equally strongly in the context of numeracy skills. Calculators, computers and other mathematical tools are present in early childhood settings and classrooms. They are increasingly also in common use at home, even by very young children. Understanding mathematical and scientific knowledge as socio-culturally constructed rather than, or at least as much as, innately given helps us to understand that young children acquire their numeracy skills in ways that are mediated by environment as well as technology (Zevenbergen 2000, p. 11).

The ability to grasp new concepts, to apply numerical concepts to real world problems (English and Watters 2005, p. 58) and to increase understanding by building on existing frameworks are all numeracy skills which go far beyond the ability of the calculator or computer to 'give us the right answer'. The implementation of the Victorian Essential Learning Standards (VELS) and the VEYLD are indicators of this movement towards a focus on thinking skills and critical analysis within broader literacy and numeracy education.

Growing up in a digital environment

A recent Australian study into computer use by four and five year-olds found that 95% of this cohort has access to a computer, with the vast majority having access to a computer in their own home (Zevenbergen and Logan, 2008). Computer-based activities included playing educational and non-educational games, drawing, writing activities and free play (Zevenbergen and Logan 2008, p. 40–41). These activities form the basis of a new digital literacy (Lankshear and Knobel, 2008).

Despite high levels of access to a digital environment for many children in the West, not all have access to digital riches—and this can amplify inequalities.

In Victoria, the Ultranet, implemented in 2010, offers children and young people in years P-12 ‘an online learning platform designed to meet their current and future learning needs’ and provides ‘educational tools that will engage them and remain relevant to their lives and future careers’ (DEECD website). Such tools include web 2.0 innovations such as blogs, wikis, polls and message boards. Access to such interactive tools should enhance the acquisition of digital literacy skills, particularly for those children without access to the technology at home.

While little empirical research has been conducted into the effectiveness of introducing new technologies into classroom pedagogical practices, Lankshear and Knobel's review of the research literature found that the initiatives which had been evaluated generally reported that the interventions resulted in significant improvements for the children who undertook them (Lankshear and Knobel, 2003).

As schools and early childhood settings increasingly import new technologies into classrooms there is clearly a pressing need for more research into the roles and effects of interactive, screen-mediated learning for young children.
Linking home learning with early childhood and school settings

Recent research into literacy acquisition demonstrates the critical importance of the home as a site of early learning. Factors such as mother's educational level and household socio-economic status impact significantly on children's developing literacy skills in the early years (CCCH, 2004). However home literacy and numeracy learning takes place across a wide range of formal and informal situations, very often in culturally specific ways. Research suggests that even from infancy, children learn best from parents when their interactions involve:

- responsiveness and encouragement
- patterns of turn-taking
- rhythmic games, simple language, singing, shape and number games, and word play
- limiting other distractions.

(Fleer and Raban 2005, p. 19). Such early home practices can be encouraged in new parents regardless of socio-economic or cultural background. Yet the increasing cultural and linguistic diversity of multicultural Australia (Cope and Kalantzis 2000, p. 5) does impact on educators' practice. The VEYLDF addresses numerous issues which are affected by the language skills of young children, and recognises that "maintenance of first language is important for children's identity, wellbeing, communication and learning" (VEYLDF, 2009). The idea of teaching children literacy solely within a standard national language canon no longer applies. Promoting and maintaining bilingualism in young children has positive effects on self-esteem, identity, attitudes to learning, cognitive functioning, problem-solving and academic achievement (Fleer and Raban 2005, p. 14). Evidence also suggests that children who are multilingual have higher cognitive function than those who are not (Clarke, 2009) as well as being less likely to be developmentally vulnerable in most of the early development domains (AEDI 2009, p. iv).

All children, whether from culturally and linguistically diverse (CALD) background or not, have unique experiences and strengths which form part of their literate identity. Children coming to early childhood settings and school bring what Thomson (2002) describes as their 'virtual schoolbag' that is, their spoken language/s, understanding, capacity and knowledge from their homes and lifeworlds. Teachers who look to unpack children's 'virtual schoolbags', making connection with children's out of school literacies, have had great success in 'turn around pedagogies' (Comber and Kamler, 2004) to enhance learning outcomes.

In work that interrogated the ways in which unequal outcomes are produced and re-produced in schooling, Comber and Kamler (2004) placed teachers as central in shifting the 'deficit' view held by teachers that children who are poor, slow, in the bottom ten per cent, non-English speaking will inevitably end up with poor education outcomes. They advocate for the use of practices that disrupt cycles of failure by re-designing and 'turning around' pedagogies, informed by home visits to families in order to truly understand the way children and their families live their lives. This knowledge of child and family interests and practices is then harnessed to 'turn around' teaching practices that successfully connects 'at risk' children with literacy, schooling and education.

The continuous nature of children's literacy and numeracy development starts before birth and continues across the entire life course. The factors that influence a child's ability to learn are myriad and interrelated in complex ways. Therefore there cannot be a single intervention or simple solution which will suit all learners, or indeed all educators.

**Life course outcomes**

The evidence is very clear that low literacy has a strong negative impact on the broader life course of an individual, and even contributes to the intergenerational transmission of poverty and social disadvantage. Increasing literacy in contemporary society has been amply demonstrated to improve life chances for individuals in diverse domains including health, housing, employment, income, civic participation and involvement in crime. Improving literacy rates across the population also brings national benefits in human capital and social productivity (OECD 2002, p. 15; Dugdale and Clarke 2008, p. 6-8; CCCH 2004, p. 11).

Communication between child, parent and educator is a critical, three-way process to establish the optimal learning conditions for the child. As Nobel Prize-winning economist James Heckman contends, the best way to improve performance is to enhance the early learning environments of children (Heckman and Masterov 2007, p. 448). This includes the home environment, pre-school and care environments and the early years of schooling.

Families as first educators

Families are educators of their children's literacy, language and numeracy (Skew et al., 2010). However, parentschild and setting childhood, school and life experiences of literacy and numeracy are low may be rightly concerned that their past will negatively affect their children developing literacy and numeracy and potential as young learners (Lees, Stackhouse and Grant, 2009). Evidence from the United States shows that at ages as young as three, significant differences are beginning to open up in the areas of vocabulary and IQ between children of middle class professionals and children whose parents are on welfare (McKinsey Report, 2007).

Increasing social inequalities in Australia mean this scenario is increasingly likely to apply here. This suggests a need for a two-pronged approach to intervention: in the first instance to support parents in the very early years (0–3) in ways which allow them, in turn, to be able to support their children's early learning; and in supporting early childhood settings and schools to identify children at risk and to offer remediation where required (for example the model used in Finland offers high level additional educational support across all educational settings). The kinds of nationwide investment advocated by economists like Heckman and Masterov (2001) to enhance the life chances of socially disadvantaged children from the earliest years, though perhaps beyond the scope of this discussion paper, offers promising outcomes.

Hattie (2008) in his synthesis of over 800 meta-analyses relating to student outcomes (including outcomes such as influence from home) suggests that when parents learn the language of schooling, benefits are passed on to children's own learning and love of learning. Research by Comber and Kamler suggests that the converse of this is also true: when teachers change their language about poorly-performing students and their families—especially when they move away from the deficit model of child underachievement being based on familial deficits—improved performance can often result (Comber and Kamler, 2004).

The concept of 'funds of knowledge' (Gonzalez, Moll and Amanti, 2005) links pedagogies to learners' lives. Emerging from longitudinal research in socially disadvantaged neighbourhoods, the concept of 'funds of knowledge' works from the premise that children and their parents have knowledge and strengths from their life experience, regardless of whether these knowledges are socially recognised or valued in the school environment. These 'funds of knowledge' can become resources for teachers and, when incorporated into their practice, raise possibilities for positive pedagogies (Gonzalez, Moll and Amanti, 2005).
The importance of supporting children in the early years

Early brain development

'Ve now know that the neural (brain wiring) connections and pathways are laid down very early in life and that these are crucial to effective learning. We also know that brain development occurs in response to genes as well as environments. This research, in turn, has helped us understand how risk and protective factors can impede or enhance brain development. For example, high levels of cortisol in early childhood are associated with stress, and may impede the child's capacity for learning and the formation of memory. As the capacity for learning and memory are important factors in school success, continuing highly stressful experiences and environments negatively impact upon school readiness. By contrast, relationships that are nurturing and responsive to the infant/child are protective: they reduce the effects of stress, and help build the healthy brain development that provides a strong foundation for learning, behaviour and health.'
Farrar et al. 2007, pp. 5-6

Literacy and numeracy skills are developed from birth in concert with fundamental socio-behavioural, emotional and cognitive development. They also build on a lifetime foundation of specific development in the fields of language, number and cognition. The quality of a child's early experiences across these and many other domains translates very strongly into improved outcomes across a range of educational and behavioural domains (Fleer and Raban 2005, p. 4).

High quality environmental and learning experiences from birth can drive educational achievement for all children. Exposure to experiences with caring, responsive adults, stimulating environments and predictable situations builds the early childhood attachment on which all later learning is founded. Improving these experiences for disadvantaged children can profoundly influence later outcomes. The research is clear that high quality, responsive pre-school programs for children aged four to five years—whether delivered within childcare settings or in stand-alone services—confer educational advantage on those who attend them, with proportionally better outcomes for those most disadvantaged to begin with (Wise et al. 2002, pp. 182). Interventions at a later age such as Reading Recovery for year one children can also help to overcome early disadvantage, before achievement gaps become more firmly entrenched (Skinner 2010, p. 14).

Early childhood professionals are well placed to identify children at risk of underachieving in the core educational skills of literacy and numeracy. Indeed, some researchers have identified the educator as the most important variable in making a difference to unequal educational outcomes (Chall, cited by Comber & Kamler 2004).

The research into life course effects of low numeracy has been less extensive, but one Australian study found that students who acquire sound mastery of literacy and numeracy during school tend to be successful academically and to be successful elsewhere. They are more likely to enter university; they are more likely to find jobs; and they are more likely to earn higher incomes'. Conversely 'young people who do not gain adequate mastery of literacy and numeracy skills don't get into university; they are more likely to experience unemployment; and they end up with lower wages'. Additionally, poor numeracy performance in early high school for girls and poor literacy performance in early high school for boys are both strongly predictive of poorer outcomes at school leaving. Lamb, 1997

Early years curriculum and pedagogy

Curriculum is currently a key focus in the education of Australian children. The implementation of the national Early Years Learning Framework is now underway. (The EYLF has) a strong emphasis on play-based learning as play is the best vehicle for young children's learning, providing the most appropriate stimulus for brain development. The Framework also recognises the importance of communication and language (including early literacy and numeracy) and social and emotional development. DEEWRR, 2009.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) is leading the process for the development of a world-class, national K -12 curriculum for the 21st century, in partnership with state and territory governments. The curriculum for students between five and eight years of age will give priority to foundational skills, knowledge and understanding that all children are expected to achieve to enhance their opportunities for continued learning, with priority to English and literacy and mathematics and numeracy. The curriculum will be designed to accommodate the varied learning experiences that children experience prior to school' (ACARA 2009).

According to Fleer and Raban, regardless of the early childhood care or educational setting, best practice is attained when partnerships are initiated in which:
- there is a focus on cognitive interactions which lead to sustained conversations
- educators have sound pedagogy and subject matter knowledge
- educators guide children’s play with appropriate questions
- there are discipline and behaviour policies that are based on talking through conflict
- there is encouragement of home involvement in learning.
(Fleer and Raban 2005, p. 22).

Research conducted in Western Australia (Louden et al., 2005) provides useful evidence of the importance of teaching practice in the literacy outcomes of young children. While the literacy activities undertaken by teachers in this project (as assessed by student achievement between first and second years of formal schooling) were more or less the same, the practices which teachers used to carry out these activities differed (Louden et al. 2005, p. v). There were distinct qualitative differences in the approach taken by the ‘effective’ and ‘more effective’ compared with the ‘less effective’ teachers. The former two categories of teachers used very clear explanations, linked phonics activities to real world situations so that the use and purpose of the phonics was clear, and provided careful scaffolding and guiding of student learning to ensure that concepts were properly understood (Louden et al. 2005, p. vi).

The characteristics that differentiated the ‘more effective’ and ‘effective’ teachers from the ‘less effective’ teachers included:
- highly developed classroom management skills
- the use of a variety of motivating strategies
- creation and use of a rich literacy environment
- concentrating on significant literacy concepts and skills
- persistent scaffolding of literacy learning
- differentiated levels of challenge within the class
- instructions and tasks for individual needs
- structured phonics instruction within the context of a wider topic or subject being taught.
(Louden et al. 2005, p. 5)

Louden et al.’s differentiation between more effective and less effective teachers is worthy of scrutiny for its application to early childhood settings. Similar research has been carried out with teachers of early numeracy, though on a smaller scale than much of the literacy research. In the UK a study into the
effectiveness of teachers of numeracy found various similar conclusions. Both the more and less effective teachers used a similar range of activities in the classroom such as whole class question and answer teaching styles, individualised and small group activities and use of the same published mathematics schemes. However, numeracy educators’ beliefs and understandings of the mathematical and pedagogical purposes behind particular classroom practices seemed to be more important than the forms of practice themselves. Highly effective teachers believed that:

• being numerate requires having a rich network of connections between different mathematical ideas

• children need to be able to select and use strategies which are both efficient and effective

• almost all children are able to become numerate

• children develop strategies and networks of ideas by being challenged to think, through explaining, listening and problem-solving

• discussion of concepts and images is important in exemplifying the teacher’s network of knowledge and skills and in revealing students’ thinking

• it is the teacher’s responsibility to intervene to assist the child to become more efficient in the use of calculating strategies.

These beliefs translated into a set of practices which improved their students’ numeracy outcomes. Conversely, educators who gave higher priority to students acquiring a collection of standard mathematical methods than to establishing understanding and connections produced lower numeracy gains; while those who were satisfied with students using any method—irrespective of whether the method was efficient and effective—and who delayed the introduction of more abstract ideas until they felt a child was ready for them, also produced lower numeracy gains (Askew et al., 1997).

Children learn best when they are engaged, motivated, and see the relevance of the content (VEYLD 2009, p. 9). If a child enters pre-school or school being unfamiliar with books or paper-based text, yet familiar, comfortable with and excited by multimedia screen-based content, then educators have an excellent opportunity to scaffold early home learning of screen-based literacy into new experiences with paper-based content (McLean, 2009). Teachers teach best when they recognise the different needs and experiences of different children, have high expectations of all children, recognise prior competency, and scaffold experiences to build new knowledge (Fleer and Raban, 2005, p. 22).

Our understanding of children’s development in the early years, as well as the context of early literacy and numeracy learning in the early years, has shifted significantly in recent years. Since many early years educators were trained and educated in pre-computing days and pre-early brain research, it is important that educators are working with this knowledge and that they incorporate it into their pedagogical refurbishments. Ongoing early years professional learning can have a significant effect in improving children’s educational outcomes (Louden et al., 2005, p. 13).

Conclusion

This paper has brought together broad understandings of what it means for children to be literate and numerate in the 21st century. The research clearly shows that education cannot be separated from the other developmental domains of young children; and that best practice pedagogy incorporates a holistic understanding of the many literacies children in the early years require and the settings across the home–early years–school spectrum.

While recognising that there is much that is being done well in Victoria, a great deal is still to be understood in order to ensure that all of the contexts which contribute to children’s learning keep pace with rapid social, cultural, economic and technological changes. Rapid change certainly brings many challenges, but it also brings great opportunities to rethink what we do and how we do it.

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