

Links Between Beliefs of Pre-Service Teachers About Literacy and Numeracy Learning

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This paper describes the findings from three items of a 63-item questionnaire, which is part of an ongoing larger study. The larger study seeks to identify similarities and differences in the effective teaching of literacy and numeracy in the early years of schooling and includes identification of beliefs and intentions of fourth-year pre-service and experienced teachers in their teaching of literacy and numeracy. In this paper, pre-service teachers indicate similar intentions for aspects of their teaching of literacy and numeracy. In particular, they intend presenting an integrated curriculum, encouraging children to talk about contexts and using cooperative group work in both literacy and numeracy lessons.

In recent years, there has been much interest in improving student learning in the areas of literacy and numeracy in the early years. Two recent Victorian studies, the *Early Literacy Research Project* (ELRP, Hill & Crévola, 1997) and the *Early Numeracy Research Project* (ENRP, Clarke, 2001), raised teachers' awareness and knowledge of how children learn in these domains and each reported significant improvement in student learning. Similar in research design, both projects implemented a whole school model for improving student learning which included nine key elements: Beliefs and understandings; Expectations and targets; Monitoring and assessment; Classroom teaching programs; Professional learning teams; School and class organisation; Intervention and additional assistance; Home/school/community links; and Leadership and coordination.

Building on the findings of the two projects, this paper reports preliminary findings of a study exploring the similarities and differences of teaching and learning literacy and numeracy. More specifically, this paper reports pre-service teachers' beliefs about the similarities and differences of using three conceptualised areas namely, context, discussions and cooperative group work and integrated units in learning literacy and numeracy.

Perspectives About Learning

Some perspectives on learning are applicable for all aspects of the curriculum. New scientific insights emphasise that learning with understanding emerges from the culture and community of the learner (Bransford, Brown, & Cocking, 1999). Learning as a socio-cultural activity involves a process of enculturation (Lave, 1997) into a specific group where cultural tools, values, shared language and ways of being are learnt (Gee, 1997).

Learners belong to many communities (Lemke, 1997). Hence, they need to learn the expectations and practices of the group for each of the different contexts (Gee, 1997). Further, research in neuroscience indicates that learning is not only context specific: it is process specific (Anderson, 2000). Different parts of the brain are responsible for different processes which means that *declarative knowledge* - knowing about something - is different from *procedural knowledge* - being able to do it (Smilkstein, 1993). Connecting different types of knowledge requires reflection, metacognition and using the information via multi-sensory modes of learning (Smilkstein, 1993).

Lave (1997) used the analogy of an apprentice learning from a master craftsman to explain how knowledge develops. Apprentices learn holistically how *to be* for example, carpenters which involves knowing how to look, talk, think and act the part (Gee, 1989). Apprentices' daily activities promote the development of skills and knowledge in meaningful contexts. Their sub-skills interrelate contributing to a larger goal, such as, making a cupboard.

Consistent with socio-cultural perspectives of learning Johnson and Johnson (1995) argued that "education is fundamentally an interpersonal process" (p. 112) and involves two types of social interdependence: cooperation and competition. Cooperative learning occurs when individuals join together to achieve mutual goals. On the other hand, competitive learning assumes that in order for one to succeed another must fail (Johnson et al., 1995). Johnson et al. argued cooperative learning had positive effects on educational outcomes which fostered risk-taking behaviours in learning and therefore such opportunities be used throughout the day.

In sum, knowing about the context and making links between the learning of one context and another is an important part of learning. Working cooperatively and learning skills and knowledge situated in purposeful contexts allows learners to see the relevancy of sub-skills. Providing learners with tasks using an integrated curriculum fosters holistic learning. We would hope to see such perspectives in the response of both teachers and prospective teachers.

Perspectives About Learning Literacy

Some issues are specific to literacy learning. Contemporary authors suggest that learners actively construct language via a process of enculturation (Lemke, 1997). The ELRP teaching advice reflects this assumption.

Enculturation involves learning the language and social practices of groups to which we belong and determines behaviours, feelings, attitudes and values (Gee, 1989; Lemke, 1997; Luke, 1993). Luke argued that literacy is "a social practice which is done" (p. 8) and that being able to engage in social practices of specific social groups empowers individuals. Therefore learners need to know how *to be* in certain contexts which involves knowing what to do and say, how to do it, and recognise when it is appropriate to use certain behaviours (Gee, 1997). Hence discussing how contexts differ is an important aspect in learning literacy.

Luke (1993) argued that for students whose social practices differ from those experienced at school immersion alone would not suffice. Learners needed to see social practices modelled overtly and explicitly (Hammond, 2001). The ELRP, *Classroom teaching programs* (Hill et al., 1997) teaching advice reflect similar views and encourages the use of teacher modelling.

Using Luke's (1993) definition, literacy as a social practice suggests a need for authentic purposes. Therefore, when we need to communicate our thoughts formally we learn to write formal letters. Here, the use of integrated curriculum is implied and essential. Murdoch (2002) argued "we cannot effectively plan for literacy in isolation: we bring meaning and context to students' learning by consciously embedding literacy experiences across the curriculum" (p. iv).

While there are different definitions of cooperative learning Emmitt and Pollock (1997) advocate collaborative and non-competitive classrooms where learners support each other and take risks with their learning. These views highlight the importance of good role models of social practices and the need for authentic purposes in learning literacy.

Perspectives About Learning Numeracy

There are also perspectives of learning numeracy. One important perspective, constructivism underlies most discussions about learning numeracy in mathematics education including the ENRP. Steffe and D'Ambrosio (1995) argued that learners actively co-construct mathematical understandings by building on prior experiences, discussing, reflecting and emphasising relational learning. Activating prior experiences suggests discussing contexts.

Taking a different perspective, it has been asserted that constructivism "ignores the wider socio-political context within which learning occurs" (Zevenbergen, 1996, p. 97) and support mathematics learning situated in specific contexts. Lave (1997) described the mathematics used by participants of a *Weight Watchers* program as "learning in practice" (p. 34). Lave argued that participants weighed and measured ingredients as part of a process with an overall goal to lose weight, not as isolated tasks. Here, numeracy is embedded within a meaningful context and suggests a holistic approach to learning.

Boaler (1999) compared students from two similar schools in her three-year long study. In one school, students worked independently and manipulated rules to solve problems instead of trying to understand them. In the other school, students worked in mixed ability groups and were encouraged to discuss and challenge each other's strategies as a process for solving problems. In this case, it is difficult to know whether the definition for working cooperatively offered by Johnson et al. (1995) was strictly adhered to but certainly, associated behaviours of risk-taking and collaboration were evident. Nonetheless, students who worked in groups and discussed problem-solving strategies outperformed students from the other school.

A common feature of working cooperatively is having members share their thoughts and processes during group discussions. However, Sfard, Nesher, Streefland, Cobb, and Mason (1998) stressed that not all talk was equally valuable and getting quality discussions regarding mathematics was challenging. Effective discourses in the learning of mathematics allow participants:

- to talk without fear of being ridiculed but fosters an expectation that students will compare, reflect on, refute and justify conjectures;
- to have meta-cognitive or reflective shifts;
- to learn the formal mathematical language; and communicate mathematical concepts and processes (Sfard et al., 1998).

Insights about learning numeracy based on how experts work show that often mathematicians work independently not cooperatively. Mathematicians apply their full attention to the problem at hand and communicate their thoughts with others at specific times to gain feedback (Sfard et al., 1998).

These views highlight the need for authentic purposes and valuing the process of problem solving which involves specialised talk, dealing with abstract concepts and exploring various strategies.

Comparing Literacy and Numeracy Learning

This section summarises the similarities and differences regarding the three conceptualised areas: context, working cooperatively and using an integrated curriculum or holistic approach. The common advice to both learning literacy and numeracy suggests that teachers should:

- activate students' prior experiences and knowledge;
- elicit intrinsic motivation and actively engage learners;
- use tasks with authentic purposes situated in meaningful contexts;
- encourage reflection and metacognition; and,
- guide children through difficulties when they arise to achieve a bigger goal.

It is interesting to compare the similarities and differences further.

Literacy skills are social practices gained via a process of enculturation which are socio-culturally specific. Generally, educators acknowledge differences in social practices and are sensitive to the possible disparity in the literacy skills children use in and out of school. Numeracy as social practice is a relatively recent suggestion from authors concerned with the lack of socio-political awareness present in constructivism. Generally, educators are less aware of the disparity in the numeracy skills children use out of school, or, it may be more difficult to address in numeracy than in literacy.

Teachers model socially valued practices and discuss appropriate discourses within contexts overtly throughout the day across various curriculum. Teachers compare acceptable discourses: yelling at a sporting event and conversing with the principal. Some authors contend that learning numeracy at school does not reflect the numeracy skills used by society. Hence, children hear fewer prompts from teachers about numeracy, which reflect authentic situations.

A common feature of introductory sessions in literacy involves episodes of modelling. Teachers verbalise their thought processes and demonstrate how to use skills and strategies simply, for example, the steps of writing the report genre. Expectations of social practices within the school context are defined and explicit. In contrast, learning opportunities grounded in constructivism rarely begin with teachers modelling their strategies. Instead, throughout the session, children with their teacher explore, compare strategies and the lesson concludes with a summary of efficient approaches or shared understandings.

Integrating literacy across the curriculum is relatively easy because we need language to communicate what we know about the world. Integrating and extrapolating numeracy embedded in daily life examples is less frequently used.

Cooperative group work and discussions are strategies which improve comprehension (Palinscar, & Rupert, 2002) and all talk contributes to learning literacy. In contrast, talking mathematically and about mathematics is valued in numeracy (Sfard et al., 1998).

Mathematicians work independently and concentrate on their ideas in quiet environments. Perhaps, children need similar quiet and independent work times to enable them to concentrate on abstract ideas and work through a selection of strategies. In some

aspects, the nature of learning literacy and numeracy differ: it is interesting to investigate whether prospective teachers intend to accommodate these differences in their practice. In summary, this paper focuses on three key issues: the context, working cooperatively and integrating learning within units of work.

Talking about the context enables children

- to activate and build on students' prior knowledge and experiences;
- to recall similar learning activities or situations so that links can be made between learning tasks; and,
- to become more aware of the content-specific vocabulary of the context.

Discussions and participation in cooperative group tasks and enable children:

- to articulate their thoughts and ideas and receive feedback from others;
- to share the responsibility for completing tasks and gain insights into strategies and approaches other may use; and,
- to develop shared understandings for specific language and practices.

Integrating skills into the theme or integrated unit studied at that time enables children:

- to learn skills within meaningful contexts and achieve a bigger goal; and,
- to learn relationally.

Method

In order to identify the intentions of pre-service teachers about their teaching literacy and numeracy a survey was administered to pre-service teachers from two universities, enrolled in a compulsory education unit during the final weeks of their course. Participation in the survey was both anonymous and voluntary.

Prior to administering the questionnaires issues of reliability and validity were addressed. Informed by recent research in early literacy and numeracy the *Undergraduate Teacher Intention Questionnaire* (UTIQ) underwent multiple drafts following discussions with experienced researchers in both fields and five interviews with teachers in which the survey was piloted. In each case items were discussed to gain clarity and consistency of interpretation.

The UTIQ comprises 63 items divided into 14 sections. Participants consider items from both literacy and numeracy perspectives. By circling one of the values in the corresponding literacy and numeracy key participants indicate how often they intend to include a strategy and/ or practice in their lessons.

In ___% of lessons	Beliefs about learning	In ___% of lessons
Literacy	I intend to...	Numeracy
100 75 50 25 0	encourage children to talk about the context or situation because that's an important part of learning.	100 75 50 25 0

Figure 1. Beliefs about learning: item six.

For 11 of the 14 sections in the UTIQ the five-point scale enables participants to indicate how often they intend including a particular strategy within their literacy and numeracy lessons. The range incremented by 25% of lessons which spanned from 100% in every lesson, to 0%, that is, never.

Results

The results presented are those of pre-service teachers (PSTs). Three items from the UTIQ section: *Beliefs about learning* are included.

Item Six – Context.

When pre-service teachers were asked to indicate in what percentage of lessons they “intend to encourage children to talk about the context or situation because that’s an important part of learning” 61 out of 106 indicated their intention in every literacy lesson and 59 out of 106 for numeracy intend to do the same. A key issue is whether pre-service teachers’ intentions are the same for literacy and numeracy (see Table 1).

Table 1

Comparison of Responses of Psts (N=106) to Intended Frequency of Use of the Strategy Talking About Context in Both English and Mathematics Teaching

I intend to encourage children to talk about the context or situation because that's an important part of ...

		Learning Numeracy			
		25% of the time	50% of the time	75% of the time	100% of the time
learning literacy	50% of the time		5		1
	75% of the time	1	6	27	3
	100% of the time		1	4	55

The frequency 55 in the bottom right cell indicates that 55 out of the 106 PSTs intended to encourage talking about contexts in all of their literacy and all of their numeracy teaching. Indeed 89 of the PSTs intended to encourage talking about contexts in either 75% or 100% of their literacy and their numeracy teaching. This indicates that they see talking about contexts as very important and that the strategy is equally applicable to both literacy and numeracy. The results are so extreme from the expected frequencies in all cells that the use of formal test (e.g., χ^2) is neither necessary nor appropriate. The strength of their intention to talk about the context in both areas of the curriculum is surprising.

Item Seven – Discussions and Cooperative Group Work

When pre-service teachers were asked to indicate in what percentage of lessons they “intend to use cooperative group work and class discussions because they believe that children learn from each other”, 43 out of 106 indicated their intentions to do this in every literacy lesson and 45 out of 106 have the same intentions for numeracy. This is an interesting commitment to cooperative group work and discussions (see Table 2).

Table 2

Comparison of Responses of Psts (N=106) to Intended Frequency of Use of Cooperative Group Work and Class Discussions in Both English and Mathematics Teaching

I intend to use cooperative group work and class discussions because I believe that children learn from each other in...

		Learning Numeracy			
		25% of the time	50% of the time	75% of the time	100% of the time
learning literacy	50% of the time		8	4	2
	75% of the time	1	4	39	4
	100% of the time			3	39

Eighty-five of the 106 PSTs intended to use cooperative group work and class discussions in either 75% or 100% of their literacy and their numeracy teaching. The similarities in results were unexpected.

Item Twelve – Integrated Curriculum or Holistic Approach

When pre-service teachers were asked to indicate in what percentage of lessons they “intend to integrate skills into the theme or integrated unit being studied at that time 57 out of 106 respondents indicated their intention to do this in every literacy lesson and 42 out of 106 have the same intentions for numeracy. This suggests pre-service teachers value presenting skills within an integrated curriculum. A key issue is whether they intend to do the same in both literacy and numeracy Table 3 compares this information.

Table 3

Comparison of Responses of Psts (N=106) to Intended Frequency of Use of Integrating Skills Into a Theme or Integrated Unit Being Studied in Both English and Mathematics Teaching

I intend to integrate skills into the theme or integrated unit being studied at that time for ... learning numeracy		25% of the time	50% of the time	75% of the time	100% of the time
learning literacy	50% of the time		6		1
	75% of the time	6	6	29	
	100% of the time	3	3	10	40

Seventy-nine of the 106 PSTs intended to integrate skills into a theme or unit being studied at that time in either 75% or 100% of their literacy and their numeracy teaching. Again, their similar intentions for literacy and numeracy are intriguing.

Discussions and Conclusions

Findings from three UTIQ items discussed in this paper indicate that for this group of pre-service teachers those who intend talking about the context, using cooperative group work, class discussions and presenting content within an integrated approach find these equally important and applicable to learning both literacy and numeracy. To some degree, pre-service teachers’ intentions best reflect views of how children learn language and literacy that are different from common current advice about learning numeracy from mathematics education research. One would anticipate these intentions suggest a promising future for their learners in literacy. However, learners will benefit on both fronts if pre-service teachers survive the realities of the classroom and indeed use integrated units incorporating authentic purposes for literacy and numeracy as indicated by their responses.

Furthermore, while establishing collaborative environments in which learners are encouraged to share thoughts and take-risks are valued (Boaler, 1999; Emmitt & Pollock, 1997) providing opportunities for children to work independently, as mathematicians do, may also be necessary (Sfard et al., 1998). One of the related challenges facing all teachers is promoting purposeful discussions for exploring and comparing contexts and encouraging children not only to talk about mathematics but to talk mathematically (Sfard et al., 1998).

A notable difference between learning literacy and numeracy worth remembering is that literacy involves knowing how to be: replicating appropriate observable social practices (Luke, 1993) and requires good teacher modelling. On the other hand, numeracy involves

seeing abstract concepts embedded within everyday situations (Boaler, 1999) and applying problem solving strategies to gain information. Here explorations of efficient methods are necessary. This suggests different roles for teachers and learners in literacy and numeracy – an interesting issue requiring further research.

Finally, referring back to the ongoing, larger study, a comparison of responses from pre-service and experienced teachers may provide useful information for pre-service literacy and numeracy educators but it is unlikely to find a perfect model for teaching both literacy and numeracy.

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