

Establishing a Numeracy Culture in a Distance Education Learning Environment: A Case Study

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This investigation examines the role of the home supervisor (a parent) in the development of children's numeracy in a distance education learning environment. The case study explores the relationship between home and school partnerships as young students make sense of mathematics outside of a "more traditional" classroom context. The learning materials provided by the school were more likely to be used in flexible and dynamic ways if the supervisor initiated the (re)construction of learning activities. Although the home supervisor had the most dramatic influence on the teaching and learning processes being implemented to support young student's numeracy development, it is argued that new advances in technology may provide opportunities for classroom teachers to become more involved in the learning process.

It could be argued that learning and doing mathematics is an act of sense making and consequently involves cultural, social, and cognitive phenomena that cannot be separated (Schoenfeld, 1989). If designed in a manner that considers these "learning dimensions," mathematics activities can be personalised in ways that provide opportunities for enhanced mathematical meaning. Unfortunately, school mathematics rarely considers the social and cultural contexts of learning (Lowrie, 2004a) since most engagement is based around whole-class activities that fail to consider authentic elements of problem solving (Lowrie & Clancy, 2003). Although the planning of in-school activities to align to students' out-of-school mathematics experiences can be challenging (Masingila & de Silva, 2001), the authenticity of such experiences can lead to powerful and rich learning contexts (Lowrie, 2004b) and transform students' beliefs about problem solving and alter the culture of mathematical engagement.

Numeracy Engagement in Different Contexts

Some educators have commented that mathematics experiences in and out of school can build on and complement each other (Masingila, Davidenko & Prus-Wisniowska, 1996) when various learning cultures are recognised and celebrated. The home environment is one such out-of-school context that can foster and develop students' learning and practice. It is certainly the case that families are the fundamental educators of children. Although family, home and community connections are both important and essential in the education of all children, such relationships are vitally important to the education of children in rural and remote areas. The home supervisor/tutor plays an influential role in the development of students' learning outcomes (Loudin & Rivalland, 1994) as "home, school and community represent the major overlapping spheres of influence in children's education and development" (Goos & Jolly, 2004, p. 280). Collaboration with families and communities can lead to the provision of a curriculum that is culturally and individually relevant (Gestwicki, 1992). Moreover, school initiated partnerships with parents and the community can lead to shared decision making and the promotion of social justice and equity (Bloom, 1995).

Goos and Jolly (2004) maintained that distance education is one of the longest running partnerships between schools, homes and communities in Australia. Although Distance Education (DE) outcomes and syllabus documents are identical to that of regular schools, the context in which learning takes place is quite different to traditional school settings. These settings tend to range from formal classrooms (where designated areas are created in the home to mirror regular classrooms) through to informal arrangements (where students learn seamlessly throughout the day through interaction with learning materials and engagement with their supervisor). These learning materials are distributed from a Distance Education Centre (school) each fortnight, with a supervisor (usually a parent) responsible for establishing a learning environment and providing an opportunity for students to complete the designated activities over the two week period. The classroom teacher, who physically could be thousands of kilometres from the student, relies on satellite communications to interact with individuals and small groups of children for approximately two hours per week. Consequently, the supervisor plays a significant role in the delivery, construction and modification of learning activities. It is important to note that the term supervisor is used to describe the parent (rather than parent or teacher) despite the central role they play in the learning process.

This investigation examines the role of one home supervisor in supporting the numeracy development of rural distance education students in the early years. This supervisory role is extremely influential in the development of students' numeracy understandings (Goos & Jolly, 2004) since the supervisor is both a parent and a curriculum innovator. Cairney's (2000) desire to raise the profile of the family as partners in education is explicitly embodied in the distance education context. Moreover, the research literature that suggests that parental involvement benefits children's numeracy development (e.g., Epstein, 2001) can be explored in a context where the interaction between student, teacher, parent and community (Askew, 2004) are closely aligned.

Context of the Study

The Participants

The Hayden family live on a relatively large rural property in NSW, Australia. Farm productivity includes both grazing and crop production. One of the fundamental reasons the Hayden's have elected to participate in DE schooling is because of the travelling time to the nearest school. Although there is a school bus stop within twenty kilometres of their home, with a long bus trip to follow, the actual time taken to get to the school is viewed as both too far to travel and too tiring for the children. The children do make this trip once per week (on a Friday) and they are absolutely exhausted by the end of the day.

There are four children in the Hayden family. The eldest, Georgia, has been involved in this form of schooling for four years. The twins, Paige and Holly, are in Grade 1 while the youngest, Alexis, will begin pre-school one day per week next year. The children primarily go to the "local" school as a form of socialisation and in order to allow the supervisor (mum) to undertake work and house related duties that would otherwise not be completed if the children were at home doing their school work.

The Setting

Although the children enjoyed catching up with their friends each Friday, they much preferred engaging in literacy and numeracy activities at home rather than at the local

school. The twins were highly articulate girls who were at ease discussing comparisons and contrasts between the two settings. It seemed that they enjoyed the flexible nature of the DE mode and had already begun to develop important skills of independent learning despite their age. They thoroughly enjoyed the learning environment that had been established at home. The Haydens purchased a demountable building three years ago (at a cost of \$5000) which has subsequently been refurbished into a wonderful classroom. The twins commented on how they had helped to paint the classroom, with a colourful display of worksamples and paintings displayed around the room. The supervisor commented that it was important to have a defined space for the classroom so that there was an obvious barrier between home and school. The girls indicated that mum even had to lock the room in the school holidays because they wanted to go into the room outside school hours. It was clearly evident that the girls enjoyed being taught by their mother and had a vibrant and passionate “love for learning”. Moreover, it was also evident that as a supervisor, Mrs Hayden had a sound understanding of pedagogy and the distinctive learning needs of her children.

The site is well equipped to take advantage of the DE provider’s satellite initiative. In fact the residence is classified as a dual site—which meant the satellite dishes on the property has two sets of connectivity hardware (including computers, scanners, modems and writing templates). They also have another computer specifically designated for software utilization (eg CD ROMS). Although the satellite initiative has only been in place for nine weeks, the twins have embraced the technology in an enthusiastic manner. They thoroughly enjoyed their lessons and it is fair to say that they regarded the interactive half-hour lesson as a highlight of the week.

The School-Home Partnership

The School has recently become involved in a program to offer satellite communication to all primary-aged children studying in a distance-education mode. This exciting initiative provided families with a satellite dish and appropriate computer hardware to ensure that lessons can be transmitted from the school to the home through digital streaming of information. Presently, 164 sites have been established with a two megabyte link connected to each home. The technology offered rapid download and transfer speeds of text and images—allowing students, supervisors and teachers to engage in forms of pedagogy not available without such technology. There is an ongoing commitment from the Department of Education and Training to ensure that the satellite program (at a cost of approximately \$6000 per site) will be maintained for the duration of each student’s primary schooling. The Hayden family are entitled to two satellite connections.

The “classroom” that the teachers used to present the satellite lessons was quite small. It was apparent that the twins would only be able to view their teacher as a “talking head”. The room contained a desk that stored computers, a large monitor, microphones, and other audio equipment. In fact, the room looked more like a studio that would be used by a radio announcer. There were cameras positioned in two corners of the room. It was evident that a teacher had to be extremely well prepared in order to present the typical half-hour lesson. When delivering a lesson, the teacher had to monitor forum posting (that all students on the network could access and read), respond to individual email from students and ensure that all children were posting responses to questions. These forms of communication were in addition to the traditional auditory correspondence that was woven into the lesson. Understandably, the students were highly engaged in the lesson—with the presentation

infinitely superior to the lessons conducted through radio communication. Although still a relatively novel experience, the teacher who presented this lesson was able to encourage all twelve students to represent and communicate information, pose questions, solve problems and interact with other members of the class.

The majority of resource materials were purchased from Queensland Distance Education in the early 1990's. These resources have been modified and adapted to keep abreast with initiatives and perspectives relevant to the state's syllabus documents. For example, mathematics units and activities have been modified to account for the ideologies of the Count Me in Too framework. Nevertheless, most of the numeracy units are at least ten years old. Consequently, the learning activities presented in these units do not match the stage-based outcomes and indicators articulated in recent syllabus documents. There was a strong view that a substantial amount of effort would be required to modify and develop these units to bring them in line with new syllabus requirements—which in the case of mathematics becomes mandatory in 2005. Not surprisingly, most recent professional development experiences have been concerned with the delivery of teaching activities through satellite communications or the notion of changing pedagogies with new technologies.

The Learning Context in the Home

The learning culture fostered at the home site was very impressive. The supervisor is "at ease" with her role in her children's learning. She indicated that the DE program provides the children with the opportunity to learn independently, be in control of their own learning and engage in personal research interests. She is conscious of ensuring that her children developed a range of life skills with applications that interested them. She appreciated the fact that many of the numeracy units had a rural focus that allowed the children to build upon understandings in practical ways. Interestingly, Mrs Hayden maintains that she learnt a great deal about the DE program with her first child and has found it much easier to make decisions about what work needs to be introduced and what activities can be approached in different ways now that she was more experienced. As an example, some of the measuring activities used to develop volume and capacity concepts were introduced to the twins while she is baking a cake (as occurred a few Saturdays ago). Mrs Hayden attempted to promote these naturalistic experiences rather than introducing the learning experiences out of context. As supervisor, Mrs Hayden does not have a set timetable for the school day. Nevertheless, they begin at 9:00am and have a literacy block in the morning. After a period of "free time" they have numeracy session with other learning areas ordinarily presented in the afternoon. Although Mrs Hayden attempted to create an identifiable learning context in the classroom it was evident that school-based learning was an integral part of their lives. For example, the children often enjoyed listening to literacy tapes or rehearsing numeracy facts while driving to town.

Establishing a Learning Culture

It was clearly apparent that Mrs Hayden was able to take learning ideas and teaching strategies outlined in the program units and present them in ways that were stimulating and challenging for her children. She was conscious of the fact that the twins required different forms of engagement, but at the same time recognised that it was advantageous for the girls to bounce ideas off one another in order to stimulate learning. Most of the learning materials that were supplied by the school were revitalised through a learning culture that

promoted questioning and deep thinking. It was certainly the case that the learning culture was fundamentally shaped by her capacity to contextualise and personalise learning activities rather than the design and sequencing of the packaged materials.

Notions of Numeracy

Mrs Hayden is very happy with the mathematics program that was used to support her children's DE learning. She appreciated the fact that the program provided comprehensive documentation and support materials for the Supervisor—both in relation to the description of the learning activities and the rationale for using particular content. These materials can only be described as a “crucial” form of support for the supervisor and the most influential form of pedagogical engagement that occurs in the development of numeracy outcomes. Although the teacher-supervisor partnership remained the strong catalyst for learning, these materials shape the content, learning strategies and assessment decisions on a daily basis. It is important to note that the classroom teachers do not have the time to write these materials and presently do not have the flexibility to even modify written materials to support the needs of individuals—although the teachers are able to select particular units of work for students they are unable to modify any units in order to contextualise learning. Consequently, the only prospect for the development of authentic learning experiences is through the supervisor.

Mrs Hayden was pleased with the fact that there were several content-based activities that had an agriculture or farming theme incorporated into the learning activities. She suggested that this provided her with the opportunity to develop a range of life-experience activities that were both very practical and meaningful. From a numeracy perspective she suggested that “DE gives children the ability to learn independently and undertake their own research...while setting them up for a range of life skills”. She challenged the twins to undertake investigations that were open-ended in nature (both cooperatively and individually). These investigations were adapted from the packaged materials and included measurement activities that involved constructing enclosures for pets and spatial activities that required the positioning and orientation of objects in the backyard and farm paddocks.

An increased familiarity with the program had allowed Mrs Hayden to become more discerning in relation to the type of learning activities used to develop numeracy outcomes. With added confidence she began to apply mathematical ideas to the sorts of experiences readily available to the twins in a rural context. Such engagement seemed to promote authentic learning in deep and meaningful ways. Increasingly, she became less reliant on the learning activities presented in the learning packages. She indicated that the children were exposed to so many mathematical ideas in “our surroundings” that she was able to link many naturalistic experiences to the intended content of the school's program.

As a supervisor, she had recognised that the distance education materials could be used as a guide to the learning that should occur—something she indicated came with increased confidence and the knowledge of “what comes next”—her eldest child had already completed Year 1. Previously, she had laboured through all activities presented in the DE materials and found it difficult to make meaningful connections because the work was presented in fortnightly instalments with no reference for building on knowledge and understandings. She felt that it was important for the twins to move from completing worksheets to using those skills to solve problems that occurred naturally. Mrs Hayden was certainly encouraging the twins to make sense of mathematics in a range of cultural and social contexts.

The Role of Technology in Numeracy Development

Significantly, the way in which the family engaged with technology had changed dramatically this year. The school had provided the family with two new satellite technology stations that allowed the twins to interactively engage with other members of their class through video and audio streaming. Interestingly, this development had already changed the partnership arrangement between family and school—Mrs Hayden conceded that the twins had embraced the technology with a great deal of enthusiasm and had quickly moved beyond her understanding of the technology. The children undertook keyboard practice session each week and often published their stories on the computer. They had begun to use email to communicate with their teacher (including “online” forum responses with the class) and were becoming increasingly familiar with the screen environment used for satellite broadcasts.

Although Mrs Hayden has made clear distinctions between school and home contexts, the twins learning experiences were certainly related to their lived experiences. As Supervisor, she is able to provide support for engagement in learning situations that were directly related to the DE unit but could also seamlessly move to investigations that have meaningful applications.

As the twins get older they will need to develop skills that will allow them to retrieve, interpret and disseminate information with increasing amounts of sophistication in this technological age. In order to use the satellite facilities to best effect, the children will need to acquire these skills. Professional development opportunities will need to be offered to the supervisor in order for the students to obtain these skills—the infrastructure costs have been considerable for this satellite program however ongoing support is necessary in order to ensure that the resources can be effectively utilised. The supervisor is the critical link between the technology potential and the children’s skill development.

Discussion

It was evident that the home supervisor had a dramatic influence on the teaching and learning processes being implemented to support young student’s numeracy development. The dynamics of the learning environments were significantly different to traditional classroom-based contexts—with the supervisor having the strongest influence over the way in which pedagogical practices and learning outcomes were presented to children—particularly when you consider the dual role (that of also being a parent) these individuals shared. A clear delineation of the school “space” was constructed to separate parenting and teaching roles and to overcome the dilemmas associated with these dual roles—which were viewed as an ongoing issue in Mrs Hayden’s relationship with her children. Nevertheless, there was also a sense of learning being intuitive, flexible and an important ingredient to solving daily problems. The supervisor was able to establish strong connections between in and out of school engagement (Masingila & de Silva, 2001) and actively attempted to create such contexts even though the blurring of these boundaries created other challenges. The shared decision making that was negotiated and established within this distance-education context (Bloom, 1995; Goos & Jolly, 2004) was highly influential in the twin’s numeracy development.

The learning materials that were provided to the students varied in quality and impact—with the supervisor’s capacity to work with the material often the predictor of the materials relevance and success. Interestingly, school supplied learning materials were more likely to be used in flexible and dynamic ways if the supervisor initiated the

(re)construction of learning activities—rather than the classroom teacher encouraging such modifications of content. The advent of a more flexible learning environment—the satellite communications technology—may shift the degrees of influence in the distance-education context. Presently, the supervisor (usually a parent) has the most dramatic impact on the social, cultural and cognitive components of learning context. It may be the case that the classroom teacher will become more influential, and change the dynamics of learning partnership, if the supervisor does not have the confidence or capacity to move into a new technological age. Mrs Hayden indicated that the twins had already moved beyond her knowledge of the Internet. The fact that the student will be able to “see” their teacher weekly, rather than listening through the poor radio communication previously offered, may also shift the learning dynamics. Moreover, these technological advances allow for learning materials to be represented in a number of multimodal forms which will more than likely have a dramatic impact on learning (Lowrie & Clancy, 2003).

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