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# GRANDPARENTS SUPPORTING CHILDREN'S THINKING IN TECHNOLOGY

**Beverley Jane and Jill Robbins**
**Monash University**

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Increasingly Australian grandparents are assuming an active and significant role in the lives of young children. Shared experiences and interactions are potentially mutually beneficial, enjoyable and educational in nature. In particular, through everyday, spontaneous cooperative activities, many grandparents are fulfilling an important function in supporting the technology thinking and learning of their grandchildren. This paper, informed by sociocultural theory, will report on a pilot project that is seeking to document the important, robust and mutually enjoyable cooperative learning and co-construction that is occurring through these informal interactions, and to highlight the significance of this in relation to children's emerging skills, dispositions and understandings in technology. In turn, implications of these factors for teachers working in technology education in early childhood and primary school classrooms will be briefly mentioned.

**Keywords:** Technology education, early childhood, primary teaching, sociocultural theory, intergenerational relations, co-construction

## INTRODUCTION:

Increasingly Australian grandparents are assuming an active and significant role in the lives of young children (Gonski, 1994; Goodfellow & Laverty, 2003). These grandparents 'are from all age groups and walks of life but share a common commitment to the grandchildren' (Grandparents Australia, Inc., 2004: 3). Positive features that are commonly mentioned about being a grandparent include:

> …the feeling of being wanted, the ability to communicate with and receive affection from their grandchildren, and the process of sharing in the good times as well as the benefits of seeing a child grow up for the second, in some cases, third time (Grandparents Australia, Inc., 2004: 4).

The shared experiences and interactions between grandparents and grandchildren are potentially mutually beneficial, enjoyable and educational in nature. However, as Kornhaber (2003: 1) states 'Sadly, most people today, including grandparents themselves, vastly underrate their ability to serve as a valuable resource for children'. We contend, however, that through everyday, spontaneous cooperative activities,

many grandparents are fulfilling an important function particularly in supporting the technology thinking and learning of their grandchildren.

In order for teachers to find out what children know and can do in technology they need to organise open-ended technological experiences and record how individual children plan, make and evaluate with materials. See for example the 'Lonely Creature' case study in Fleer and Jane (2004), which shows that the teacher, Wendy, documented her children's engagement in an open-ended activity. 'Wendy's description of her children's learning offered a window of opportunity into children's thinking processes in terms of designing, making and appraising with materials' (p. 66). Wendy generated a profile for each child, and used these to plan technological experiences that would build on individual children's existing knowledge and skills. Although the DMA approach has its critics, nevertheless it can provide access to individual children's thinking, particularly when children explain how they came up with their design, how they made their products, and the problems they solved to complete the task.

Studies have shown that learning occurs when the technological activities are authentic. Murphy and Hennessy (2001) identified two kinds of authenticity in the context of technology. Firstly, authenticity can be in terms of the activities being personally meaningful, and secondly, they are set in culturally authentic contexts. To facilitate the personally meaningful dimension, teachers can set open-ended tasks that shift the control from the teacher to the students. Open-ended technological activities also provide opportunities for collaboration between peers.

We know that girls and boys gain knowledge from contact with parents and other family members, as well as friends and teachers in specific contexts 'For students … knowledge arises out of their experiences and these experiences are expressed in terms of activities undertaken, projects performed, and for girls in particular, by means of verbal exchanges' (O'Loughlin, 1994 cited in Venville, Rennie & Wallace, 2004: 117). The social and environmental context within which learning occurs is important. However, the role of grandparents in encouraging children's learning in technology is rarely acknowledged.

This paper will report on a pilot project that is seeking to document some of the ways in which grandparents are supporting children's learning in technology. The study is designed to map some of the informal experiences young children engage in with their grandparents, in order to better understand how technological thinking and understandings are being constructed across contexts. The data generation and data analysis of the project are informed by socio-cultural-historical theory, in particular Rogoff's (1998) three foci of analysis.

## SOCICULTURAL INFORMANTS FOR RESEARCH:

Sociocultural theory (cultural-historical or socio-historical theory), originates in the ideas of Vygotsky and his Russian colleagues who attempted to reorganise psychology on Marxist fundamentals in the early decades of the twentieth century (Blanck, 1992; John-Steiner & Mahn, 1996; Woodhead, 2000). More recently an increasing number of Western educationalists, psychologists and other scientists have

become interested in this theoretical approach (Lompscher & Hedegaard, 1999). It is an approach that emphasises relationships between people, contexts, actions, meanings, communities and cultural histories (Edwards, 2000). Elhammoumi (1999) states that

> It is important to bear in mind that the core of sociohistoricocultural theory is its ability to keep in its picture the Marxist tradition which focuses its primary concern on understanding human mental functions within socially-organised, concrete life (Elhammoumi, 1999: 213).

Sociocultural theorists argue that thinking and understanding are not individually constructed, but are fundamentally related to participation with others in socioculturally/sociohistorically relevant activities. Rather than being a universal skill, thinking is very much contextually specific, guided by others, and mediated by particular cultural tools and artefacts (Robbins, 2004). As Rogoff (2003: 50) affirms 'the efforts of individuals are not separate from the kinds of activities in which they engage and the kinds of institutions of which they are a part'. This represents a paradigm shift from more traditional ways of viewing thinking - moving from thinking about cognition 'as a property of individuals to thinking of cognition as an aspect of human sociocultural activity' (Rogoff, 1998: 679).

Importantly, Vygotsky argued that higher mental functions in humans, as well as consciousness and activity, are embedded in historically organised human activity (Elhammoumi, 1999). Marx and Engels (1846/1970, cited in Elhammoumi, 1999) state that

> History is nothing but a succession of the separate generations, each of which exploits the materials, the capital funds, the productive forces handed down to it by all preceding generations, and thus, on the one hand, continues the traditional activity in completely changed circumstances and, on the other, modifies the old circumstances with a completely changed activity. (p.57) (Marx & Engels, 1846/1970, cited in Elhammoumi, 1999: 208).

Therefore, according to Vygotsky, to study the structure of human consciousness, thought and personality, it is necessary to attend to "its historical context, social milieu, social positions and cultural environment" (Elhammoumi, 1999: 208).

One of Vygotsky's (1978) important ideas was that learning occurs on two planes – first, on the social plane (that is, *between* people engaged in joint sociocultural activity) and later, on the individual plane (that is, *inside* the child).

> In Vygotsky's theory, learning is a social process that takes place between people. He conceptualized learning as internatisation of social interactions in which communication is central. Learning takes place in social interaction in a specific context which comes internalised by a person. By internalisation, Vygotsky did not mean copying but transforming the external interaction to a new form of interaction that guides the child's actions. Internalisation does not directly mirror the external social relations; it is a transformed reflection (Hedegaard, 2001: 16-17).

Thus in researching children's development of technology skills and understandings, it is important to examine how children are learning through participation with others in culturally relevant, everyday activities, and further to examine the important social interactions and cultural-historical factors that are constituted with and by that learning.

In his work on studying the formation of concepts, Vygotsky paid considerable attention to the effects of formal school instruction on the development of thinking. He maintained that instruction that takes place in schools differs considerably from the spontaneous learning that occurs in everyday contexts, but that both are important (Panofsky, John-Steiner & Blackwell, 1990). Vygotsky used the term *scientific concepts* to refer to ideas that have explicitly been introduced by teachers in school (Van der Veer & Valsiner, 1993). Scientific concepts are systematic, generalisable, removed from concrete experience and exist within a hierarchical network of related concepts (Lee, 2000). They are taught, or transmitted by others, and presented within a conceptual system that allows children to use ideas that they can not see or that are not intuitively apparent (Bodrova & Leong, 1996).

These concepts contrast with *spontaneous*, or *everyday*, *concepts* which refer to concepts acquired by the child outside of explicit instruction, usually through social interaction with adults and/or through practical activity (Rieber & Carton, 1987; van der Veer & Valsiner, 1993). Everyday, or spontaneous, concepts take their meanings from perceptual, functional and contextual factors (Panofsky, John-Steiner & Blackwell, 1990). They are used to denote or refer to objects, but are not integrated into a broader structure or system of concepts (Bodrova & Leong, 1996). For example, a child using the term *fish* is doing so to refer to a specific object that has been encountered that was labelled *fish* or to a generalised idea of 'fishiness', including anything that swims. The child does not, though, have in mind the strict biological definition of *fish* as part of a scientific classification system (Bodrova and Leong, 1996).

However, Vygotsky saw the two types of concepts as interdependent. The development of scientific concepts in school depends on a previously developed set of word meanings stemming from the child's everyday experiences, and this spontaneously acquired knowledge mediates the learning of the new scientific concepts (Panofsky, John-Steiner & Blackwell, 1990). For example, children will not readily understand scientific concepts such as *systems* if they do not have the everyday concepts of things such as *computers* and *switches*, or *music boxes* and *levers*. When children learn scientific concepts, their understanding of *switches* and *computers*, *music boxes* and *levers*, changes.

> Scientific concepts are not assimilated in ready-made form, but undergo development, which essentially depends on the existing level of a child's general ability to comprehend concepts. This is also connected with the development of spontaneous concepts, in working their way 'upward' toward greater abstractness, clear a path of scientific concepts in the downward development of greater concreteness…Only when both concepts merge do you develop mature understanding (Edwards, 2004: 3)

As Vygtosky (1987) emphasised that everyday concepts are embedded in children's life experiences and natural conversational contexts, it is important for researchers

and teachers to attend to activities children participate in at home and in the community, and to the significant relationships, artefacts, meanings, actions and histories within those contexts and activities. In doing so, a useful research tool that can be employed is Rogoff's (1998) three foci of analysis, where personal, interpersonal and community/institutional issues of any activity can variously be foregrounded. This enables the focus of the research to centre on individual or groups of children (and/or adults) and how they are *transforming* or learning as they participate in everyday activities. It also enables the consideration of factors such as *shared* understandings and the important interpersonal relationships that are structuring and supporting these understandings. Additionally, particular community constructions of technology and the value that is placed on technology within that community can be highlighted, as well as specific cultural tools or artefacts available (or not available), and the history these tools and the social players themselves bring with them to the activity. While one of these foci can be foregrounded the others remain within the background, and therefore are part of the analysis. Importantly, the multiple pathways to learning within the community can be highlighted (Rogoff, 2003).

**THE STUDY:**

The particular study reported here is a pilot project that aims to capture the important, robust and mutually enjoyable cooperative learning and co-construction that occurs through informal interactions between grandparents and their grandchildren. In addition the study seeks to highlight the significance of these intergenerational interactions in relation to children's emerging skills, dispositions and understandings in technology.

At the time of writing this paper, there are ten sets of grandparents (and their grandchildren) involved in the study. Most, though not all, grandparents reside in Victoria, Australia, but some interstate and overseas relationships also exist. As in the study conducted by Grandparents Australia (2004), relationships are complex, partly because of the level of contact, and also because of the reasons for contact (varying from occasional contact in the form of social outings to major or joint childcare of their grandchildren).

In this first stage of the project, participating grandparents were given disposable cameras to take photographs of everyday experiences that they engaged in with their grandchildren which they believed represented technology and/or science activities within the home and community. They were also invited to keep brief journal jottings of key features of the activities in which they engaged and the interactions that occurred. Photographs were developed and analysed using Rogoff's (1998) three foci of analysis – personal, interpersonal and community/institutional. Initial findings have been followed up with informal conversations with some of the grandparents. Examples of instances where grandparents have encouraged children's curiosity and science learning can be found in Jane and Robbins (2004).

**THE FINDINGS:**

A sociocultural analysis of the data generated to date indicates that there are a number of ways in which grandparents are supporting young children's technological thinking

and learning in significant, collaborative and mutually enjoyable ways. Through Rogoff's (1998) personal lens we can see that both children and grandparents are transforming (investigating, designing, creating, posing problems, questioning, experimenting, analysing, learning new concepts and techniques…) through participation in the activities. Through the interpersonal lens we are able to highlight the supportive interactions, communication, shared understandings, the mutual enjoyment and support in participation that is occurring through simple activities such as making, mending, cleaning, cooking, gardening, listening, and watching. Through the community/contextual lens we can foreground the tools and artefacts that children and their grandparents are using, and reflect on the cultural-historical implications of these. We are also seeing how participation in simple technological activities is valued by grandparents, and in turn their grandchildren.

In this paper, some of these are addressed in the following sections:

- Ways in which grandparents are supporting children's technology thinking and learning
- Benefits for children
- Benefits for grandparents
- Aspects of collaboration

**Ways in which grandparents are supporting children's thinking and learning in technology:**

It is evident that young children not only engage in many technology experiences in their everyday lives, but that grandparents often support young children's technological thinking and learning. Some examples are given below.

Oliver (5.9 years), during a visit from his grandparents from England, engaged in activities such as fixing a camera, polishing brass, and showing them how to log on to a computer and send each other emails.

> *He showed us the computer and we were surprised that he knew how to log onto the computer for himself. He said that Mummy had showed him but that he wasn't allowed to go on the computer by his self. We are going to let him log onto the computer for us when we record our journal* (Grandparents Peter and Kathleen)

Through this activity Oliver is demonstrating that he has learned about processes and systems, and, like many five year olds, he has developed certain technological understandings. Conversations with Oliver's mother revealed that through the interactions Oliver shared his knowledge of the *computer* and *switches* with his grandmother. Even very young children can demonstrate this type of capability, as is evident in the following incident noted by two-year-old Annika's "Nana".

> *Each visit to my parents' (great grandparents) home, Annika carefully will bring this piano music box over to my father to hold. She then opens the top, stands with hands behind back and listens. After a few minutes she will (with her index finger) press the small lever to stop the music. My father has only pressed the lever once, to show her how it stopped; she obviously remembered.*

Experiences such as these involving Oliver and Annika, are not only important in themselves for developing everyday concepts such as those of *computers* and *switches*, *music boxes* and *levers*, but more broadly they lay important foundations for their later understanding of abstract, scientific concepts such as *systems* encountered in technology classes at school.

Annika, too, is already showing the beginnings of other technological thinking and problem identification in the following episode with Nana:

> *Annika spotted my lollypop pink sock through the hole in my slipper. I also stubbed my toe and my 'runner' has a small hole in the toe. She said 'Oh dear, hole'. Stood back and had a second look*

Here she has identified a need, which within a supportive intergenerational context is likely to be validated and acted on. Through the support of her grandmother she may begin to think about creatively solving this problem, and learn about culturally relevant tools which can assist in solution finding. This is also evident in the following episode noted by Evie's (also two) grandmother.

> *Evie has learnt how to move the small step, place it beside the hand basin – right way up – and run her hands under the tap.*

The following example demonstrates four year old Ethan's thinking about technology. Ethan talked with his grandmother about his "Thomas the Tank Engine" trains using technological terms. When his grandmother asked him about the meaning of these terms, Ethan excitedly replied,

> *Coupling rods' they join the wheels so they can go around together; a 'snow plough' helps the engine move the snow; the Fat Controller puts the 'buffers' on the track so that the engines can back up to them.*

The sharing of these meanings thus assisted his grandmother's understanding about trains, and thereby establishing shared understandings.

A further episode, incorporating designerly thinking, involves Stella (5.5 years). Everything she writes, draws or creates is done independently, and then she loves to 'show and tell' to her grandmother. In the example reported here, Stella used her imagination to design and make a tug boat using recycled materials.

> *Stella made a tug boat entirely by herself, from a shoe box and an Australia Post 'cylinder'. The cork at the top of the cylinder denotes the smoke. Holes in the box are portholes, and she covered the box with used Birthday paper with teddy bears on it. She called it the 'Teddy Bears Tug Boat'*. (Grandmother Bette)

**Benefits for children**

Although the study is still in its early stages, already it is clearly evident that children are developing rich everyday concepts and creative thinking through their participation in real-life activities with their grandparents. Through participation in simple but meaningful activities such as gardening, cooking, mending, cleaning, playing in the sandpit, going to the beach, walking in the park, having a picnic, children's understanding is being developed and transformed through participation in mutually enjoyable and relevant activities. These everyday, spontaneous concepts provide the concrete experiences necessary for activating the scientific concepts they will encounter at school.

Increasingly academics are considering the importance of dispositions in learning. Among others, Katz (1999) speaks of intellectual dispositions which include such things as

> …the dispositions to analyze, hypothesize, and sythensize, to predict and to check predictions, to strive for accuracy, to be empirical, consequences (sic) of action, to persist in seeking problem solutions, and to theorize about cause-effect relationships, to predict others' wishes and feelings (Katz, 1999: 7-8).

Through intergenerational encouragement and support these children are developing positive dispositions towards creative, technological thinking, problem posing and solution seeking.

**Benefits for grandparents**

Intergenerational interactions can benefit grandparents as well as grandchildren, as Gribben (2001: 18) describes 'When we are there for the journey, alongside our grandchildren's formative years, we will surely be enriched as we would like them to be.' Furthermore, the building of cooperative, sharing relationships can be extremely important to grandparents, as the following example shows.

> *Jack is acknowledged as grandfather's 'best buddy' and as such fosters a cooperative relationship to share in things* (Introduction to the journal kept by Grandparent Field)

Positive grandparent-grandchildren interactions can be stimulating to the mind and a time to exercise imagination (Gribben, 2001). Such sharing times can be a form of relaxation and enjoyment for the grandparent, and reinforces feelings of 'being wanted', as indicated earlier in the paper. In addition, by also observing what the grandchild does during these times together, the grandparent can gain insights about the child's thinking.

> One of the intense delights of being a grandparent is that it gives us the opportunity to relax and just enjoy being with the children and observing how they approach things and slowly start making sense – or nonsense – of their world. (Gribben, 2001: 85)

In the context of technology, guided by their grandchildren, grandparents can revisit and explore technology in a new and fresh way.

**Aspects of collaboration:**

Learning occurs when the technological activities are authentic. The learning that is occurring within these contextually relevant and collaborative intergenerational activities involves investigating, identifying needs and areas for improvement, seeking solutions, using tools, learning language, and creative and innovative thinking, among other things – all important in technology education. Importantly children are developing a rich range of everyday concepts of phenomena and

language related to technology. Much of this may not have occurred without the support, encouragement and collaboration with grandparents.

We found that in their collaboration grandparents commonly appear to be targeting their interactions within the child's zone of proximal development (Vygotsky, 1978), where the child works as an active participant with a more competent partner to solve a problem (Gauvain, 1998). Here, '…the more experienced partner encourages and supports a child in using his or her current capabilities to extend the child's skill to a higher level of competence' (Gauvain, 1998: 81). Rather than instructing the child in how to complete tasks beyond their capabilities, grandparents in this project appear to be asking children 'to do only those things that they can already do reasonably well, thereby ensuring the child's ability to participate legitimately' (Gaskins, 1999: 55). Importantly, grandparents are giving their grandchildren agency in the activities in which they engage.

> *Foam clock on tray. This is a clock puzzle made from craft foam. My parents (great grandparents) purchased it for the great grandchildren. Annika is with her grandfather who is helping her pulling it apart and then putting it back. There is always some 'fiddling' as the hands of the clock need some adjusting on the central knob. My parents understand that the number sequence is not understood by her but she will put the central section together. This is a clown's face divided into several pieces.*

What is also evident in several of the journals written by grandparents is the cultural-historical nature of children's everyday thinking and activities. As a child actively participates in cooking with grandparents (or in some cases, great grandparents), reads a book together with other family members, or fixes a camera, the child draws on previous experiences undertaken with grandparents, and the conceptual links made directly with experiences the parent had as a child, or indirectly through the stories told by grandparents about when the child's parents were younger (Fleer & Robbins, 2004). The 'voice' of the grandparent can also be heard in the voice of the parent – even when the grandparent, or great grandparent, is no longer living or, as in this study, lives interstate or overseas. Likewise patterns of behaviour can often be seen across generations.

> *I pulled apart my Russian doll and Annika sat for several minutes, trying to put them back together. She placed them in a line with the 'head' parts in a*

*row. This reminded me – when Anthea (Annika's mother) was this age she would line all her dolls and soft toys around the walls of the lounge room.*

Another important issue in collaboration was that of time. Not constrained by some of the crippling time factors which increasingly appear to impact on interactions between *parents* and children, grandparents more frequently had the time to engage in unhurried activity with their grandchildren.

> *The big difference with grandchildren is time. There isn't the same rush to get things done as there is when your own children are young. I think that the older you get the more you realise that you have to appreciate the time you have with them. It's great to see Oliver gowing up. We can see our daughter in him, but ourselves too. It's easier to take a step back and see the bigger picture*
> (Grandparents Peter and Kathleen)

**CONCLUSION:**

In the introduction of this paper we identified that technology is an area of learning that is not clearly defined. Though the majority of the grandparents in this study had elementary ideas of what constitutes learning in technology, they all were engaging in many varied activities with their grandchildren that were technological in nature.

In the study reported here grandparents took photographs of their grandchildren as they engaged in everyday activities. In their journals the grandparents recorded descriptions of what the children were doing and saying as they participated in these activities. Many of these intergenerational, interactive activities were child initiated and took place in a range of contexts. We argue that these are valuable for establishing important everyday concepts.

We believe the findings have several implications for the teaching of technology. Children do not come into classroom unskilled and unknowledgeable – especially in technology. Young children develop many spontaneous concepts through their engagement in real-life experiences. Often the understandings they develop are actively supported and scaffolded by others. As these shared understandings develop through mutual involvement in culturally appropriate activities, it is important for teachers to consider that important interpersonal relationships (both proximally and distally) exist for children, and that shared understandings have potentially been developed with significant others in their lives, especially grandparents. By

acknowledging the prior learning and skills that children bring with them to school, and discovering the 'windows of opportunity' into children's thinking processes, teachers can build on these existing understandings and skills, and importantly *help them make the connections between the concrete and abstract* in technology.

Hedegaard (1999: 30) suggests that 'an issue of school teaching must be to connect the subject matter concepts with everyday concepts in a way that widens and develops the children's abilities in…non-schooled situations'. Teachers have an important role to play in helping children to overcome the gap between thinking within and outside school contexts, and between everyday and scientific concepts.

> As Vygotsky points out, the formal abstract concepts a child learns in school do not become active until they become functional in the person's daily life. This implies that the aim of teaching must be to teach children concepts that can enrich their understanding and capacity for action in the life they live outside school (Hedegaard, 1999: 31)

In technology education practical and applied knowledge is required as well as theoretical understanding. As mentioned earlier, learning occurs when the technological activities are authentic. The activities described in this paper are authentic in that they carry personal meaning for children and because they are set in culturally authentic contexts. Through everyday cooperative activities many grandparents are fulfilling an important function in supporting the technological thinking and learning of their grandchildren

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**Beverley Jane** is a Senior Lecturer in the Faculty of Education at Monash University. Her research interests include science and technology education, intergenerational studies, children's spirituality, and mentoring.

Email: Beverley.Jane@ education.monash.edu.au

**Jill Robbins** is a Senior Lecturere in early Childhood Education at monash University. Her research interests include young children's understandings of natural phenomena, the role of grandparents in supporting young children's learning in science and technology, and sociocultural theory and its application to research and teaching.

Email: Jill. Robbins@ education.monash.edu.au