The Technological Knowledge of Early Childhood Pre-service Educators

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With the current introduction of new national and state Early Years Frameworks and the increased interest and activity in educating early childhood educators, it was timely to investigate what knowledge, if any, early childhood educators had when it came to design technology. Although not prescriptive around technological understanding, the new Framework highlights children’s learning related to “creativity”, “exploration”, “collaboration”, and “problem-solving”, in the context of connecting with people and technologies. This small pilot project asked 20 pre-service educators a number of questions designed to elicit both their understanding and their practices relating to technology. Responses were recorded and from those given, it was apparent that the Early childhood educators not only included technological activities in their daily practices with children, but generally had a basic understanding of technology, differentiated from other forms of learning activities.

Introduction

With the current introduction of a new national Early Years Learning Framework (EYLF, Birth – 5 y.o.), the Victorian Early Years Learning and Development Framework (VEYLDF, Birth – 8y.o.) and the increased interest and activity in educating early childhood educators, it was timely to investigate what knowledge, if any, pre-service early childhood educators had when it came to design technology. Although not prescriptive around technological understanding, both new Frameworks highlight children’s learning related to “exploration”, “creativity”, “collaboration” and “problem-solving”, in the context of connecting with people and technologies. For example, in the VEYLDF (State of Victoria, 2009), pre-school children “use play to investigate, imagine and explore ideas”. They additionally “apply a wide variety of thinking strategies to engage with situations and solve problems and adapt these strategies to new situation”. Children in the age group 5-7 years old, “understand that people use creative, imaginative and inventive thinking to help them meet human needs and wants.” and they “play with and manipulate materials/ingredients in both a few and focussed manner to foster development of their design and technical skills”. Similar statements can be found in the EYLF (Commonwealth of Australia, 2009) when pre-school children “explore the purpose and function of a range of tools, media, sounds and graphics; manipulate resources to investigate, take apart, assemble, invent and construct and experiment with different technologies”. Highlighted within the Frameworks is the importance of the role of the educator – the need for the educator to support young children’s use of technologies and the products, systems and processes as part of that technological development.

Theoretical Underpinnings

The Importance of Technological Understanding in Young Children

Young children display much interest in the world around them. They are curious about the phenomena they observe and often interact with objects and situations in an effort to gain more information. They are trying to make sense of what they see, what they touch, what they taste and what they smell. Children are exposed to technology from the time they are born. This can occur through the machinations that are part of their day – such as an electronic toy which makes noise or the design of a high chair which can be folded to a low
chair. Even in the daily routines in which they are involved, very young children can relate to systems. For example, knowing that a bath follows from dinner and going to bed follows that. Simple routines are simple systems. However, the range of technological experiences children have had can influence their capabilities for technological play. Most young children have opportunities to make things and to appraise what they have made. They are capable of making judgements about the qualities they expect to see in their construction or product. “They have not yet started school but already they understand that their environment is a made environment. They have taken the first, instinctive step in engineering.” (Harrison, G. 2000, p11). The ability to manipulate materials, to think creatively and to develop purposeful items are all tenets of technological design. Fleer (1996) provides insight into the technology experiences of very young children in their homes. This research found that children could not only remember their daily routines but also demonstrated a capacity to plan within specific contexts. In constructing and making things children came to understand the material and equipment they were using. Overall, the findings indicated that very young children were involved in planning and making, but usually restricted to systems and materials. Children rarely had the opportunity to appraise what they had done.

Rogers and Russo (2003) observed children during construction activities using blocks. They found that children used a large number of process skills such as sorting, classification, and comparisons when working with blocks. In addition, the children demonstrated other capabilities such as planning their construction, organising their space and planning their construction. Children were also able to describe their construction plans and build and modify their constructions, however, none made any attempt to record (through drawing) what they were planning. Jane and Robbins, (2006, p61) discussed the social elements of technological play commenting “…learning is intrinsically related to participation with others in socioculturally relevant activities…”

Kimball, Stables and Green (1996) commented that children’s learning is enhanced by technology experiences, particularly construction and evaluation of their products, in which p children begin to understand their own creative thinking and decision-making. Children engage in a range of different play scenarios such as drama, symbolic play, exploration and construction when exploring their environment and undertaking their own technology tasks (Chalufour & Worth, 2005, p7). Howitt, Morris & Colville (2007) believe that the EC educator must “…acknowledge the importance of play as a platform for learning…”

It is crucial in our rapidly advancing technological world, that we provide opportunities for all children to advance their technological skills and capabilities – right from birth. It is the role of the Early Childhood practitioner to enhance children’s learning experiences by providing opportunities for children to explore the world around them. According to the EYLF (2009, P15) “Early childhood educators take on many roles in play with children and use a range of strategies to support learning. They engage in sustained shared conversations with children to extend their thinking. They provide a balance between child led, child initiated and educator supported learning. They create learning environments that encourage children to explore, solve problems, create and construct.” In the safe caring environment of an Early Childhood setting, children can interact with their world, ask questions, and discover for themselves. Play is the vehicle for learning and practising. A large part of a child’s world is constructed and in the strongest sense, children will often interact through construction and the process of technology. The Early Childhood
practitioner should recognise the importance of, and provide opportunities for, advancing children’s technological capabilities through play.

**Technological Understanding of Educators**

Previous research in England (Benson, 2008) indicated that over 90% of the pre-school teachers sampled, had “little understanding of design and technology” and “had little relevant continuing profession development, if any”. This extensive research evaluated the technology which was in place in pre-school settings and found that most it consisted of free play with construction materials and other recognisable creative ‘artistic’ applications. The development of children’s investigation skills in relation to the manipulation of materials was not apparent, nor were there any opportunities provided to children for developing their evaluative capabilities. This is in contrast to the general belief that even very young children are quite capable of making decisions, and can plan and appraise their own work if given the opportunities (Fleer & Jane, 1999). Fleer and Jane (1999) also state “…many free-play opportunities (and teaching modelling) of two and three dimensional planning/designing may be necessary if children are to feel successful in the design, make and appraise with materials, information and systems.” In an earlier study of four independent settings by this researcher (Campbell & Jobling, 2008), it was found that whilst educators had some idea of technology, it was limited in scope and application. There was some valuing of construction and block play for creativity and the development of manipulative skills, but the knowledge of the full benefit of technology and technological play was not exhibited by the case study educators. In addition, the processes, such as investigating materials for a particular purpose, or appraising something which had made, which facilitated higher order thinking, such as creativity or analysis, were absent from most pre-school centres. The pre-school educators admitted to knowing very little about design technology, but all showed and interest in furthering their knowledge (Campbell & Jobling, 2008). Further research in Australia by Robbins (2010) confirms this as she states “some early childhood professional demonstrate limited knowledge of what constitutes technology and technology education”. Robbins found that most early childhood educators believed that technology was simply high technology. These research results, that technology education is not well understood, is to be expected. As stated previously, technology as an area of study is relatively new and most qualified and/or experienced early childhood educators would have had little exposure to it in any form.

With this in mind, it was decided to investigate the understandings of pre-service early childhood education students. Apart from a small percentage of mature-age students, most would have been through an Australian secondary system in the last 20 years (since technology education became part of the curriculum). The research question asked was: What understandings do pre-service early childhood education students have about technology education and practice?

**Methods of Practice**

Data was gathered to describe the overall perceptions of pre-service educators about technology education in pre-school settings and to illuminate any distinctive aspects. A written questionnaire which sought opinions and attitudes related to a qualitative approach.

Two cohorts of students undertaking a Bachelor of Early Childhood Education course by mixed mode were approached at the conclusion of class and invited to participate in the
research questionnaire. There were 24 students in the first cohort and 12 in the second. From those present, 20 completed the questionnaire, so the sample size is limited. One of the cohorts (the larger group) had undertaken one technology task in class previously, the second cohort hadn’t. The mixed mode of course presentation did not allow much opportunity for hands-on exploration and the physical time for face-to-face engagement was limited to a total of 9 hours. Students undertook activities on a weekly basis in their base pre-school centre, but none of the activities was specifically labelled as technology education.

Results
The comments from the questionnaire have been extracted, sometimes ‘verbatim’, sometimes as condensed statements of multiple similar comments.

Table: Preservice Educators’ Comments

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<thead>
<tr>
<th>Question</th>
<th>Responses and sample comments</th>
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<tr>
<td>Question One</td>
<td>No 6/20, Yes 14/20 ‘Yes’ comments were elaborated with examples of computers, cooking, woodwork, collage, block corner, science concepts, range of structured and natural material</td>
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<tr>
<td>Is technology (design, create &amp; evaluate) actively taught at your centre or any centre you have had experience in?</td>
<td>Examples of experiences included – construction activities using recycled material, use of digital camera, light table, magnifying glass, making playdough, cooking, water play, wood work, collage, nature, technology, animals, plants, vegies, garden, making ice, floating and sinking, human body, Lego blocks, mixing paints, magnets. Approaches taken – discussion on design ideas, teaching construction skills, allowing children to design; resources made available to chn, teacher guidance; topics may be extended if children show interest. Emphasis more on process not product. Extension of ideas encouraged.</td>
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<td>Question Two</td>
<td>Using computer programs to design, construction kits to build specific items, box construction, food technology, animal enclosure, ppt story, robots, computer games, brain training devices, making slime, blocks, construction using recycled materials, electronic equipment use, magnets within sawdust, building an aluminium boat to float and carry weight, computers, questioning, systems - rules to generate an outcome, material investigation.</td>
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<tr>
<td>What experiences are made available or what approach is taken?</td>
<td></td>
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<tr>
<td>Can you provide an example of a technology experience which you have provided for children?</td>
<td>Only through undergraduate course (4). No (9). Reverse Garbage ran some construction classes. Yes -</td>
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<td>Question Four</td>
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Have you had the opportunity to undertake any professional development in the area of technology education in ECE centres? If so, where and what?

I did a science workshop at Lady Gowrie. There is a belief that the director talking about certain subjects is sufficient. Director giving handouts to read is ‘training’. (2nd comment)

Question Five

If technology professional development has not been undertaken, could you please indicate the reason?

Not offered (?). Not thought about. Thought technology was creative art. Lack of resources and skilled educators. Lack of resources, time, unstable routine and class size. Unsure why it is not offered. Unsure why my centre does not allow this as they have the resources. Previously not interested but now do. Rural – limited opportunities

Other comments

PD required in the use of high tech items. See the usefulness of design and evaluation aspects. More technology training should be provided. All ECE need PD in order to keep up with curriculum.

Discussion of Results

From the responses to the first question, it can be seen that most pre-service educators believed that design technology education was taught and they illustrated this with the types of activities which were part of the pre-school setting. To further strengthen the fact that the pre-service educators were discussing technological activities, when asked to describe the approaches they had seen or undertaken (Question Two), all could comment on some aspect. However, a significant number of responses (5/20) mentioned only computers as the technology. A further 5/20 mentioned computers, but within the range of other design technology activities. It was also clear from one or two responses that several educators were not differentiating between science and technology. However, overall, most pre-service educators seemed to have an understanding of some design technological tasks. What is not clear from their responses is any indication that they are aware of the process of design technology. One person mentioned ‘design’, another mentioned planning. Yet another thought that technology was what she called ‘creative art’. So the more in-depth understanding of technology was missing from their answers. Without an understanding of the technology design process, early childhood pre-service educators do not realise the potential of technological tasks for enhancing children’s higher order thinking and overall learning. Most considered construction activities creative but rarely interfered with the children’s activity. As is usual in EC settings, the child’s interests tend to dictate the path of learning, with most EC educators reluctant to intercede. This is slowly changing as education of EC educators is providing them with the information that guiding children and scaffolding their learning is much more advantageous to the child. In particular, the two Early Years Frameworks both advocate a three-pronged integrated approach to children’s holistic learning. These were: child-directed play and learning, guided play and learning and Adult-led learning (State of Victoria, 2009, p12)
In referring to Benson’s research (2008), it was found that EC educators were not developing children’s understanding of discernment when it came to materials assessments, nor were they enhancing children’s abilities to appraise final products based on pre-determined criteria. So, in looking at design technology education in all its complexity, the responses of the pre-service educators indicated that children were missing out on substantial learning opportunities. By referring to some of the earlier statements from the EYLF (Commonwealth of Australia, 2009) whereby children are given the opportunity to “explore the purpose and function of a range of tools” or “manipulate resources to investigate, take apart, assemble, invent and construct and experiment with different technologies”, we can see that the answers provided by the pre-service teachers do not specify this level of technological understanding.

Questions four and five related to the professional learning of early childhood educators in terms of technology education. Most had not experienced it except through the degree they were undertaking and, as explained earlier, not all pre-service educators had not been provided with any exposure to technological thinking or tasks. This was a surprising result as it was expected that some of the group would have had technology in secondary school and most should have had it in primary school. With evidence of lack of prior exposure to technology education, we need to consider the implications of this for our Early Childhood training courses or professional learning experiences offered to practising educators. One mentioned an experience with the Reverse Garbage group which highlighted ways to recycle old material into ‘creative’ products. Two mentioned that they received their professional learning only through the Pre-school Director – telling them about new developments (Would technology education be considered new?) The language used in the descriptive account of this form of learning was indicative that the receiver did not consider it adequate. So from the responses, we can determine two things. Firstly, that professional learning ‘in the field’ in technology was almost non-existent. This was due to a number of factors related to time, cost, location – many of the typical answers given when lack of professional learning becomes a topic of discussion (Campbell & Jobling, 2009). Secondly, those who were aware of design technology, felt that there should have been opportunities for professional learning and that they had not known of any. So the dilemma is two-fold – even if the pre-service educators could find the time or resources to attend a professional learning experience in design technology, none seem to exist for them.

Concluding Comments

The research has highlighted a gap in knowledge and time. Many older practising preschool educators, undertaking the bulk of their schooling before 1990, would not have been exposed to technology education in any of their schooling. Those coming through Early childhood education courses now, still seem to have missed out as technology education in both primary and secondary schools was a developing curriculum area. Previous research (Campbell, 2006) indicates that “Whilst technology education has a visible presence in curriculum documents, the integration of technology is not very obvious in schools”. Students coming through education systems in the last ten years have been subjected to the ‘back to basics’ approach to curriculum with much of the school time spent on literacy and numeracy to the exclusion and detriment of other curriculum areas. So we have many educators without an appreciation of the holistic nature of technology education and its capacity to enhance learning of children.
This research project was initiated as a ‘taster’. The sample size limits the application of the findings to ‘all’ educators, and obviously limits the confidence with which generalised statements can be made. Taking this into account, and working with the data collected, we can still make general statements which can be confirmed through the application of a larger study.

If we now return to the research question “What understanding do pre-service early childhood education students have about technology education and practice?” we can answer it based on the responses of the pre-service educators surveyed. We can state that the understanding they have is limited in depth and scope and that opportunities for changing this are almost non-existent. So the onus is placed back on those of us involved in design technology education and the education of pre-service early childhood teachers. What can we do about it? One thing we can do is to ensure all training courses contain design technology content. We can ensure that the emphasis which is detailed in the Early Years Frameworks, state and national, is highlighted to our students so that they cannot ignore its role in their early childhood settings. We can teach design technology enthusiastically so that pre-service educators realise the potential of design technology for not just enhancing children’s learning, but also for motivating them and engaging them in learning which has relevance to their own world.

References


