What is the Place of Conversation in Learning Technology?

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Abstract

This paper investigates literature on the role of classroom conversations and dialogue in learning. It also reviews literature on technology education to argue that to enhance our understanding of how children learn in technology it is necessary understand the impact clearly focused conversations of students, amongst themselves and between them and their teachers while undertaking technological practice has on advancing thinking and understanding. It is the author's hope that this paper will give insight into the impact conversation with peers and teachers has on learning, enhance understanding of how learning occurs in technology and how interaction with peers and teachers enhances understanding of technological concepts and components of practice. It precedes a study that will investigate quality and types of conversations technology teachers need to understand to facilitate and develop learning for children in technology education.

Key Words: learning conversations, technology education, constructivist learning theory

Introduction

In 2007 New Zealand released a new national curriculum which includes a new national statement for technology education (J.R. Sharrat, 1991, cited in Ministry of Education, 2007). The statement advocates a holistic approach to the development of technological literacy through understanding of and participation in authentic technological practice and situated understanding of technological knowledge and the nature of technology. These aspects;

technological practice, technological knowledge and the nature of technology form the newly identified strands which contribute to the development of technological literacy.

There is clear evidence that due to the practical and socially situated nature of technology education in *The New Zealand Curriculum* is based on a constructivist paradigm. Conversation with peers and 'experts', about learning is an integral aspect of socially situated constructivist learning. Evidence emerging from recent literature suggests that focused conversations and quality interactions between students and their peers or their teacher greatly enhances learning.

This paper reviews the recent literature on technology education and quality interactions in the classroom to argue that to further enhance learning in technology teachers need to facilitate and develop quality conversations about technological practice and knowledge and the nature of technology. It precedes a study that will investigate the types and quality of conversations and dialogue that best enhance learning for students in technology education.

Technology and Constructivism

Constructivist theorists such as Vygotsky (1978), Bereiter (1992), Bruner (1996), Blythe (1998) and Murdoch (2004) claim that people construct knowledge through interaction with others in the sociocultural environment.

Technology is described in *The New Zealand Curriculum* (2007) as intervention by design: the use of practical and intellectual resources to develop products and systems (technological outcomes) that expand human possibilities by addressing needs and realising opportunities. It gives students challenging and exciting opportunities to build their skills and knowledge as they develop a range of outcomes through technological practice. They bring together practical and intellectual resources in creative and informed ways to engage with the many technological challenges of today's world and of those in the possible future (Keith, 2007).

Technology must be introduced to students within a meaningful child orientated context (Fleer & Jane, 1999, p. 13) and it explicitly deals with technological processes of investigating designing, making and appraising technological solutions to identified problems or recognised opportunities within any given social and cultural context (Fleer & Jane, 1999, p. 73). Compton and France (2006) (2006) recognize that technology is increasingly interdisciplinary and requires technologists to work in an integrated manner. Quality technology education programmes that use authentic learning offer an excellent model for inquiry-based learning because they allow integration of numerous curriculum areas (Fleer et al., 2006). In the classroom technology topics can become 'vehicles' for learning from which students can engage in 'worthwhile exploration of meaningful content that relates to and extends [their] life experiences and understanding of the world' (Murdoch & Hornsby, 2003, p 19). Within this sphere of learning, and within technology education, students can be given authentic opportunities to measure, speak, discuss, write reports, and consider all manner of issues.

Undertaking technological practice has been shown to provide students with the opportunity to collaborate with others and make a difference to their own and others' lives and contribute to developments in their immediate community. This results in high levels of student engagement and allows students to take increasing ownership of their learning and to feel empowered to make decisions regarding the nature of their outcomes. This collaborative approach situates quality technology education programmes within socially constructed or constructivist learning.

Technological knowledge is socially constructed (V Compton & Jones, 2004; Pacey, 1983) because the social and cultural values of particular groups of people influence the technological advances made at any one time. Technological activity accordingly is embedded in the 'made world' and is influenced by social, cultural, environmental, economic and political influences. The embeddedness of technology within the social and made worlds implies a heavy reliance on social interaction and conversation.

Technologists, people who participate in technological practice, typically work using a collaborative approach, with conversation critical to ensure colleagues, stakeholders and clients are fully informed. Investigation of conversation and interaction theory will therefore enhance our understanding in how technological practice is enhanced through quality interaction.

Theories of Language and Interaction

Language and social interaction are vital components of working collaboratively and therefore fundamental components of learning in technology. There are two opposing tendencies that may be seen as characterising social interaction. These are 'Intersubjectivity' and 'Alterity'. Daniels (1996) suggests both are always at work within social interaction. Vygotskian accounts have tended to focus on Intersubjectivity which is the dialogue between the novice and the expert working towards a shared definition of a situation and to move the novice from a state which performance can be carried out independently (Daniels, 1996, p. 119). The practical nature of technological practice lends itself to an apprenticeship model of instruction with an expert- often the teacher guiding learners (novice) through their technological practice, moving the novice from the interpsychological plane of understanding to the intrapsychological plane. The idea of two planes of learning suggests that initially interaction appears between the child and another person as an interpsychological category and then within the child as an intrapsychological category (Daniels, 1996; Lave & Wenger, 1996; Vygotsky, 1978; Wertsch, 1981). Fleer (1995) gives an example to explain the interpsychological and intrapsychological planes.

Vygotsky also argued that children participate in social activities without necessarily understanding what they mean. A further example is that of a toddler participating in hand-washing after visiting the toilet or before eating. This ritual is practiced by the child's family and hence is apart of accepted behaviour patterns known to the child. However the child may not necessarily fully understand what this action means. Vygotsky termed this social behaviour as occurring at an *interpsychological* level of functioning- at a social

level of functioning without understanding. It is when the child understands why she/he is washing her/his hands that the child is said to be operating at an *intrapsychological* level of functioning. Learning occurs when the child moves from one level of functioning to another (Fleer, 1995, p. 21).

An example in technology education might be when children are taught safety procedures for the use of equipment, while not fully understanding the implications of the safety precautions taken or why they are needed.

Alterity, on the other hand occurs when discrepancy or conflict of opinion or perspective between one's own and another's view sparks cognitive development. Alterity is concerned with the distinction between self and others, within thought generating tendencies (Resnick, Levine, & Teasley, 1991). The listener perceives and understands the meaning and simultaneously takes active response to it, either agreeing or disagreeing, partially or completely; augments it, applies it and prepares for its execution. Any understanding of live speech is imbued with response and elicits it in one form or another. Practical problem solving of design issues through dialogue and modelling, a major component of technological practice, illustrate this as children may gauge the success of their ideas, rightly or wrongly by interpreting the reactions received from others. With interaction between people as a central aspect of cognitive, social and cultural development within a constructivist paradigm it stands to reason that language is more than a way of expressing ourselves (Burr, 1995). As people interact they are constructing their worlds. Wertsch et al. (1999) report in their study of joint problem solving that debate is a major force in cognitive development and occurs through the interaction with socioculturally defined tools. Language provides both the process and the product for cognitively focussed interactions. In technology through a practical problem solving approach children need to be given ample opportunity to discuss and debate their ideas. By experiencing 'Alterity' students have their design ideas tested and challenged which can in turn lead to a greater understanding of relevant concepts and ideas.

Bakhtin (1986) coined the phrase 'utterances' as the real unit of speech communication. He stated that speech exists in reality only in the form of concrete utterances of individual speaking people. Bakhtin (1986) states that behind each text strand lies a language system and that all text is repeatable and reproducible. Everything that can be given outside the text (the given) conforms to the language system but at the same time each text (utterance) is different and unique as it is revealed in a particular situation and in a chain of texts. Burr (1995) suggests there is multiplicity of meanings inherent in any piece of text or speech. As communication takes place people are involved in the process of constructing and reconstructing themselves. Language is not a system of set meanings which everyone agrees with. Single utterances can mean different things to different people implying that there is potential for conflict and disagreement (Burr, 1995). The significance of any given utterance is understood against the background of language and its actual meaning is determined against a background of other utterances and actions (Bakhtin, 1981). Habermas (1970 cited in Cohen, Manion, & Morrison, 2000) also argues that utterances are never simple and their meaning derives from a social context. He also suggests that any utterance has a double structure: propositional content - 'what is being said' and performatory content -'what is achieved through the utterance'.

Bakhtin (1981) suggests that when in everyday dialogue the speaker regularly considers the listener and his or her response giving the speaker insight into perceived discourse (variability of meaning in language with a focus on identity, selfhood, personal and social change and power relations). When the response is aligned with that of the speaker's understanding of discourse the conversation is enriched. On the other hand when perceptions of discourse differ the speaker can sense resistance. Discourse informs ways of thinking and therefore consideration of situated means and how social languages are constructed influences the way participants use language to represent themselves (Young, 2004). It is the beliefs, values and attitudes held that inform the way people act, read and what they say and how they interact; they are not static and may change as people read, experience,

observe and adapt to new situations. Teachers can use dialogue for formative assessment purposes as they engage students in conversation about their technological practice and may use this to determine whether their students' level of understanding allows movement on to next step learning without necessarily being explicit about their possible shortcomings. The practical nature of technology means that it is vital teachers have a very clear understanding of children's expertise particularly, for safety reasons, when dealing with equipment and tools.

Dialogue is 'the discussion that takes place during the course of educational activities' (Mercer & Littleton, 2007, p. 1) and can be described as much more than talk. It is complex and dynamic and often involves very different cultures, perspectives, ideas and people. It generally involves the use of words and requires engagement with people (Mercer & Littleton, 2007; Shields & Edwards, 2005). Shields and Edwards (2005) suggest that dialogue can bring moments of intense connection with another person with feelings of remarkable openness, deeply affirming moments which can be highly exhilarating. Mercer & Littleton (2007) and Shields & Edwards (2005) agree as to the importance of dialogue in learning. The place of dialogue in learning is considerably more important than has been demonstrated in schools in the past. "A sociocultural perspective raises the possibility that educational success and failure may be explained by the quality of educational dialogue, rather than simply by considering the capability of individual students or the skill of their teachers" (Ministry of Education, 1995, p. 4).

When people work together in problem solving situations such as developing technological outcomes to meet identified needs, they do much more than just talk together. They "inter-think" by combining shared understandings, combining their intellects in creative ways often reaching outcomes that are well above the capability of each individual. Problem solving situations involve a dynamic engagement of ideas with dialogue as the principle means used to establish a shared understanding, testing solutions and reaching agreement or compromise. Dialogue and thinking together are an important part of life and one that has long been ignored or actively discourage in

schools (2007). There are very clear implications here for technology given the collaborative nature of the problem solving often required participating in technological practice and developing technological outcomes. Students are advantaged if they are given opportunities for dialogue, and teachers need to structure programmes to allow students to verbally engage with peers, teachers and experts in the field of practice about their learning and understanding. Whether working individually or in groups in technology teachers must ensure students have the structure and skills to participate in such conversations. Students also need to be made aware of the place and role dialogue has in their learning.

Conversations between Children and Adults

It is argued that teachers need to engage in quality dialogue with students and parents to help them make sense both cognitively and experientially of the world in which they live and work (Mercer & Littleton, 2007). Mercer and Littleton (2007) and Shields and Edwards (2005) found ample evidence that teachers make a powerful contribution to the way children think and talk. Teachers convey powerful messages about thinking by the way they structure classroom activity and talk to the students. To increase children's ability to use language as a tool for both collective and solitary thinking they need to be involved in "thoughtful and reasoned dialogue" (Mercer & Littleton, 2007, p. 56). This type of teaching Bakhtin (1981) is termed 'dialogic teaching'. When teachers model and scaffold useful language strategies to extend thinking children are given ample opportunity to practice using language to reflect, enquire and explain their thinking and actions to others. They are then able to seek and compare points of view and use language to compare debate and reconcile questions which takes their learning beyond a level that requires only answers to teachers' factual questions. Language provides both the process and the product for cognitively focussed interactions, we can therefore say that learning is a social process and takes on a theoretical perspective of *socially constructed learning* (Bakhtin, 1981). Spoken language is one of the tools students use to make sense of the world and is a teacher's main pedagogical tool (Fleer, 1995). The nature of technology

education allows children, individuals or groups of children to develop multiple technological solutions to meet any one technological need or issue, for this reason it offers teachers a unique opportunity for dialogue and observation of dialogue as children identify, discuss and attempt to solve issues as they arise during their technological practice.

Many people have tried to describe quality interaction between adult and child. There is no one ideal way of interacting with children. Interactions are context bound and specific to the immediate situation (Mercer & Littleton, 2007). Fleer (1995) found that in many cases children are not given time to think about what they are doing in relation to the wider situation or previous learning and experiences. Mercer and Littleton (1995) suggest that many children are not taught useful ways of using spoken language as a tool for learning and working collaboratively. High quality interaction is best exemplified when teachers engage the philosophy that all children are unique individuals. Teachers need to engage children taking into consideration their special interests and temperaments (Mercer & Littleton, 2007). Interactional patterns between adults and younger children vary greatly. Research has shown that a great deal of adult interaction with children in about management rather than learning (Fleer, 1995) and as a result many learning opportunities are lost. Social construction learning theory can help empower teachers by introducing more than just practical implications but offering assistance in understanding critical theoretical assumptions relating to interaction between children and teachers (Fleer, 1995) .

This is particularly relevant to technology education because of the hands-on practical nature of many of the lessons when teachers are easily distracted by organisation of activities and management of the children's behaviour. Teachers need to be disciplined to ensure these things do not distract them from engaging the children about their learning and practice. Technology education allows children to use creativity and innovative thinking, to move in directions very different from current thinking or thinking of their peers, offering teachers unique opportunity and insight into their students' thinking. This was illustrated (See Illustration 1.1) recently when the author was

working with a group of six year olds who were asked to design a car for their future. Isabella a very quiet classroom member, who rarely contributed orally, designed a car which had wings rather than wheels. Dialogue between the researcher and Isabella allowed an insight into her forward thinking and understanding that previously has not been identified by the researcher or the classroom teacher. She had identified that cars in the future might have wings instead of wheels.

Illustration 1.1: *Isabella and her car with wings.*

Other theories give insight into the interaction between teachers and children, between children, and observation of children and teachers working in the classroom. Symbolic Interaction, Sociocultural Conflict Theory and Grounded Theory all add strength to the argument of the importance of conversation in learning, particularly in technology.

Symbolic Interactionism makes a significant contribution to the understanding that knowing, thinking, believing and notions of self have origins in social interaction and that the mind is inseparable from the social process. Consider whether how an individual thinks and acts is determined by others and the roles that are predetermined for them or just their own predetermined roles. What impact does this have on technological practice? Decision making within a field of technological practice will be influenced by not only clients and

stakeholders but also by those who are working with the students: their peers and teachers.

Socio-cognitive conflict, originally based on Piagetian theory sees conflict as an essential ingredient of any joint involvement to bring about cognitive change. Doise and colleagues (cited Fleer, 1995) have demonstrated that children working in pairs solve problems at a more advanced level than those working by themselves (regardless of the ability of the partner). These studies reveal that when coming up against an alternative point of view (not necessarily the correct one) forces the child to coordinate his or her own viewpoint with that of another child. The conflict can only be resolved if cognitive restructuring takes place and therefore mental change occurs as a result of social interaction. Thus the social interaction stimulates cognitive development by permitting dyadic (people working in pairs) coordinations to facilitate inner coordinations. Technology education typically involves children in problem solving situations which are often done collaboratively and cooperatively with their peers and key adults, and naturally involves the discussion of conflicting thoughts and ideas.

For two people to communicate both participants need to contribute to the conversation. To be able to do this both must have common understanding of the exchange that is taking place or is about to take place (Doise & Mugny, 1984). This common understanding is called *grounding,* its purpose is to ensure “what has been said had been understood” (Clark & Brennan, 1991). Grounding is defined by Clark and Brennan (Clark & Brennan, 1991, p. 128) as a collective process by which participants try to reach a mutual belief of understanding about what a contributor means. Clark and Brennan (1991) suggest that grounding is a basic component of and essential to communication and all other collective actions and is shaped by two main factors, *purpose* and *medium*. People engaged in conversation normally establish a collective purpose for the conversation. To do this a number of techniques are employed which typically change according to the purpose and content of conversations. There are many different media used for communication some of which are constantly changing: telegraph, telephone,

video, email, fax, post-it notes, personal face-to-face communication, tele-conferencing to name a few. Techniques employed to establish clear purpose must differ according to the media used. One technique discussed by Clark and Brennan (1991) is the technique of "least collective effort" which suggests that people do not like to put in any more effort than required. This means that exchanges are brief and often lead to short cuts when communicating. The use of the term "okay' is a technique often employed in 'face-to-face' conversation and telephone conversations to ensure the speaker does not say more than necessary; as it indicates that the listener has enough information for understanding however this technique is not often used in keyboard teleconferencing as it is difficult to time its addition without interrupting the typist's flow of conversation.

Clark and Brennan (1991) suggests seven of medium or modes of personal communication suitable to dialogic communication. Table 1.1 summarises the characterisation of these modes of personal communication through the identification of constraints associated with it. Note that transcription of the conversations may appear to add 'reviewability' and 'revisability' to face-to-face conversation, however these constraints only effect the researcher as the conversationalists will not have free access to their recorded conversations as they might in email or telephone answer machines.

Table 1.1: *Seven Media and their associated constraints*

Medium	Constraints
Face-to-face	copresence, visibility, audibility, cotemporality, simultaneity, sequentiality
Telephone	audibility, cotemporality, simultaneity, sequentiality
Video teleconferencing	cotemporality, audibility, sequentiality, simultaneity, visibility
Terminal teleconferencing	cotemporality, sequentiality, reviewability,
Answering machines	audibility, reviewability,
Electronic Mail	reviewability, revisability
Letters	reviewability, revisability

(Clark & Brennan, 1991, p. 142)

One of implications for technology is that conversations or dialogue about thinking and learning do not always need to be face to face, teachers are able to employ a range of media to help children engaged with peers, and significant adults.

Socially shared cognition is critical in the direct interaction between two people. Shared understanding of what went before and what actions lie ahead determines the viability of the interaction between participants (1991). This intersubjectivity is not always a smooth process however talk can be organised and strategies developed that facilitates contribution to the shared understanding between participants. Again the implications for Technology are that teachers need to know and understand strategies for developing shared understanding across and within groups of children working within technological practice. Children need to be taught and encouraged to challenge their thinking and that of their peers and they need to be taught to listen to and discuss challenging ideas with their teachers and each other. Technology education has a number of tools available to it such as: functional modelling and prototyping which will aid students in their thinking and dialogue by allowing them to illustrate their thinking in a practical concrete way.

Conclusion:

Technology education in New Zealand has undergone significant change in recent years and our challenge is now to ensure that teachers have very good understanding of the necessary processes knowledge and skills imbued within holistic technological practice within a new curriculum. These understandings include that of key competencies: thinking, using language, symbols and texts, managing self, relating to others, participating and contributing; of values: excellence, innovation, inquiry and curiosity, diversity, equity, community and participation, ecological sustainability, integrity and respect; and of pedagogies: creating a supportive learning environment, encouraging reflective thought and action, enhancing the relevance of new learning, facilitating shared learning, making connections to prior learning and

experience, providing sufficient opportunities to learn and teaching as inquiry, as stated in The New Zealand Curriculum (2007).

As is suggested with the inclusion of values, competencies and pedagogies this curriculum does not necessarily have its primary focus on content knowledge, but rather to promote a way of learning or teaching process as an integral part of the programme leading to autonomous thinking and reasoning (Schegloff, 1991). It must be said however, that content knowledge is taken very seriously. Learning begins with the child; thinking about how they think and constructing their understandings within the social and cultural context of specific content knowledge taught (De Vies & Kohlberg, 1990). This is most successfully done within an authentic context (Turnbull, 2002). Technology education because of its practical and collaborative nature is strongly and comfortably situated within such a curriculum.

On closer inspection of the competencies, values and pedagogies one can see the very strong positioning of communication. This paper reviews literature in a number of communication theories to determine the very strong the influence interaction with peers and teachers has on children's and indeed all students' learning. The very practical foundations of technology education allows us to draw the conclusion that quality interactions between teachers and students and between students is critical for the development of quality technology in our schools. It presents us with the challenges of determining what quality conversations look and sound like, when they are most effective and how we can teach our children to not only engage in, but initiate interaction with peers and teachers that will most enhance their learning in technology.

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