# The Role of Conversation in Technology Education

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## Abstract

This article investigates recent literature in the area of classroom conversation and dialogue with the aim of gaining a better understanding of the role that classroom conversation and dialogue plays in learning. It also investigates literature on the constructivist, collaborative nature of technology education and suggests that to enhance our understanding of how children learn in technology it is necessary to understand the impact that clearly focused conversations of children, amongst themselves and between children and their teachers while undertaking technological practice, has on advancing thinking and understanding. It also suggests that by understanding the full impact of classroom conversation and facilitating its use in the classroom, teachers can greatly enhance learning in technology education. Conversation with and between students allows teachers insight into the impacts of previous and specifically targeted learning experiences on learning in technology. Classroom dialogue can also enhance understanding of how learning occurs in technology and how interaction with peers and teachers advances thinking around technological concepts and components of practice.

A related study currently being undertaken investigates the nature of conversation in the primary technology classroom with the aim of facilitating and developing teachers' understanding to better enhance learning for children in technology education. It is the author's intention to submit the results of this study to this publication in the future.

## Key words

learning conversations, technology education, interaction, dialogic teaching

## Introduction

This article explores literature on quality interactions in the classroom and constructivist theory to argue that to enhance learning in technology teachers need to facilitate and develop quality conversations with and between their students about technological practice, knowledge and the nature of technology.

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 the 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 of the curriculum that contribute to the development of technological literacy for students.

There is clear evidence that due to the practical and socially situated nature of technology education in New Zealand, *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 that has emerged from literature (Daniels, 1996; Fleer, 1995) suggests that focused conversations and quality interactions between children, their peers and or their teachers greatly enhance learning.

A constructivist curriculum does not necessarily have its primary focus on content knowledge, but rather it promotes a way of learning or teaching process as an integral part of the programme leading to autonomous thinking and reasoning (De Vies & Kohlberg, 1990). It must be said however that content knowledge is taken very seriously. Learning begins with the child's thinking about how he/she thinks and constructs his/her understandings within the social and cultural context of the specific content knowledge to be taught (De Vies & Kohlberg, 1990).

## Technology, Constructivism and Conversation

Technology is described in *The New Zealand Curriculum* (Ministry of Education, 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 undertaking technological practice (Ministry of Education, 1995). Students 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).

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Technology must be introduced to children within a meaningful child orientated context (Fleer & Jane, 1999, p. 13) and it should explicitly deal with the 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) recognise that technology is increasingly interdisciplinary and requires technologists to work in an integrated manner. Quality technology education programmes using authentic learning (Turnbull, 2002) offer an excellent model for inquiry-based learning allowing 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 are given authentic opportunities to measure, speak, discuss, write reports, and consider all manner of issues (Turnbull, 2002).

Undertaking technological practice has been shown to provide students with the opportunity to collaborate with others and make a difference to their own lives and 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 with children taking ownership of their learning and technological outcomes clearly situates quality technology education programmes within socially constructed or constructivist learning.

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. Technological knowledge is socially constructed 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 (Compton & Jones, 2004).

## 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 to a state where performance can be carried out independently. This means an expert is guiding 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 of a toddler participating in hand-washing after visiting the toilet or before eating. This ritual is practised by the child's family and hence is a part of accepted behaviour patterns known to the child. However the child may not necessarily fully understand what this action means. Vygotsky (1978) 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).

Alterity 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 an 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, eliciting it in one form or another. 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.

Nuthall (2007) discusses the role of language in the process of building a 'mental model'. A mental model develops as interaction with the physical world facilitates intellectual development. Working with and using a mental model to engage with the world occurs through language, an internal version of language or talking to oneself. With

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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 oneself (Burr, 1995). As people interact they are constructing their worlds hence the justification for language to be considered as a form of action.

Bakhtin (1986) coined the phrase 'utterances' as the real unit of speech communication. He states that speech exists in reality only in the form of concrete utterances of individual speaking people. He suggests 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. Multiplicity of meanings are inherent in any piece of text or speech (Burr, 1995; Nuthall, 2007). 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 actual prior experience of the listener (Bakhtin, 1981; Burr, 1995; Nuthall, 2007) 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 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 and read, and what they say and how they

interact. These are not static and may change as people read, experience, observe and adapt to new situations.

Dialogue is 'the discussion that takes place during the course of education activities' (Mercer & Littleton, 2007, p. 1). It 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) and Nuthall (2007) agree as to the importance of dialogue in learning. Mercer & Littleton (2007) suggest that 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* (p. 4).

When people work together in problem solving situations they do much more than just talk together. They 'inter-think' by combining shared understandings, combining their intellects in creative ways, and 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 discouraged in schools (Mercer & Littleton, 2007). There are very clear implications here for technology given the collaborative and problem solving nature required to develop technological outcomes.

## Conversations between Children and Adults

It is argued that students need to engage in quality dialogue with teachers and parents to help them make sense both cognitively and experientially of the world in which they live and work (Mercer & Littleton, 2007; Shields & Edwards, 2005). Mercer & Littleton (2007) 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 children. 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) termed 'dialogic teaching'. When teachers model and scaffold useful language strategies to extend children's thinking and dialogue with adults and peers children can be challenged and encouraged. When children are given ample opportunities to think and use language to seek and compare points of view, debate and reconcile questions, their learning can be taken beyond a level that requires only answers to teachers' factual questions. Language provides both the process and the product for cognitively focused interactions; we can therefore say that learning is a social process and takes on a theoretical perspective of *socially constructed learning* (Fleer, 1995). Spoken language is one of the tools children use to make sense of the world and is a teacher's main pedagogical tool (Mercer & Littleton, 2007).

Dialogic teaching differs from other conversations in that it allows focus on the role of the teacher in classroom talk (Mercer & Littleton, 2007). In dialogic teaching both students and teachers make substantial and significant contributions which sees the children's thinking on a specific theme or topic move forward. Drawing from Bakhtin's work (1981), Alexander (2008) has developed this concept of dialogic teaching through a multi-national study and suggests a number of key indicators: questions are structured so as to provoke thoughtful answers; answers provoke further questions and are seen as the building blocks of dialogue rather than terminal; and the individual exchanges and teacher-pupil or pupil-pupil conversations form coherent chains of inquiry.

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 (Fleer, 1995). 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 (2007) 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 (Fleer, 1995).

Interactional patterns between adults and younger children vary greatly. Research has shown that a great deal of adult interaction with children is 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 offer assistance in understanding critical theoretical assumptions relating to interaction between children and teachers (Fleer, 1995).

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 (Schegloff, 1991). This intersubjectivity is not always a smooth process. However, talk can be organised and strategies developed that contribute to the shared understanding between participants. Other theories that give insight into the interaction between teachers and children and between children include Symbolic Interaction, Sociocultural Conflict Theory and Grounded Theory.

Symbolic Interactionism (Mead, 1934) 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 how an individual thinks and acts is determined by others and the roles that are predetermined for them or just their predetermined roles.

Socio-cognitive conflict, originally based on Piagetian theory sees conflict (Alterity) as an essential ingredient of any joint involvement to bring about cognitive change. This is similar to Doise and colleagues (Doise & Mugny, 1984) who 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 coming up against an alternative point of view (not necessarily the correct one) forces the child to co-ordinate 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) co-ordinations to facilitate inner co-ordinations. Technology education typically involves children in problem solving situations which are done collaboratively and co-operatively 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 (Clark & Brennan, 1991). This common understanding is called *grounding*;

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its purpose is to ensure "what has been said had been understood" (Clark & Brennan, 1991, p. 128). Grounding is defined by Clark and Brennan (1991) 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. It 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, teleconferencing 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. This technique however, is not often used in keyboard teleconferencing as it is difficult to time its addition without interrupting the typist's flow of conversation.

## Implications for Technology Education

It has become increasing obvious that conversation between children and their teachers is critical to advance thinking in technology education because of the practical and collaborative nature of technology in the classroom.

During practical sessions teachers are more easily distracted by the organisation of activities and management of the children's behaviour. This article highlights the need for quality conversations, with peers and teachers about learning to engage them in critical thinking and learning.

Teachers need to be disciplined to ensure management and organisation does not distract them from engaging the children in conversation 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, perhaps more excitingly, from the thinking of their peers. This situation offers teachers unique opportunity and insight into their students' thinking. One small illustration is described which occurred when the author was working with a group of six year olds who were asked to design a car for their future (Illustration 1). Isabella a very quiet classroom member, who rarely contributed orally in class, designed a car which had wings rather than wheels. On first glance Isabella's car looked quite unremarkable. It was only in conversation with Isabella that the researcher was able to understand her design. Isabella discussed how the bubble wrap attached to the bottom of the car was a replacement for the wheels, and was a set of wings as she determined that in the future cars would be able to fly. Dialogue between the researcher and Isabella allowed an insight into her forward thinking and understanding that previously had not been identified by either the researcher or the classroom teacher.

This is just one small example of how conversation between teachers and children give insight into learning. Being aware of children's design decisions is a critical aspect to understanding the development of their technological literacy. The practical nature of technology



*Illustration 1. Isabella and her car with wings*

education means that the reasoning for decisions made is not always obvious to an onlooker. For this reason it is critical that teachers engage children in focused conversation giving them the opportunity to explain and discuss their designs.

## Conclusion

This paper discusses recent literature on conversation and language theory to determine the influence interaction with peers and teachers has on a child's learning. It also discusses the very practical nature and constructivist foundations of technology education and therefore allows us the draw the conclusion that interaction between teachers and learners and between learners is critical for the development of quality technology in our schools.

It presents us with the challenge 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. A related study currently being undertaken by the author investigates more closely the actual nature of conversation in the primary technology classroom with the aim of facilitating and developing teachers' understanding to better enhance learning for children in technology education.

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