Investigating how children use language as a tool for thinking in design and technology at Key Stage 2

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Abstract
Design and technology has been acknowledged as being rich in its potential for developing language (DATA, 1999). Language can be used for a variety of purposes that have real meaning for children involved in design and technology, for example making suggestions, obtaining resources, negotiating with others, reflecting and planning.

This paper explores one important aspect of children's language use in design and technology: the use of language as a tool for thinking. It draws upon evidence of language gathered as part of an ongoing research project that is using a case study approach to explore children's use of language within design and technology at Key Stage 2 (pupils aged 7-11).

Keywords
Primary, Design and technology, Language, Thinking

Introduction
The notion of language as a 'tool for thinking' is not a new one. Vygotsky, writing in the 1930s, used the term to express the intimate relationship between language and thought (1962) and the Cox Report (1989) used it to describe one of the principal functions of language. The analogy of 'tool' implies that language is used for particular purposes, and studies of the language of young children show that they have already learned to use language for a variety of meaning-making functions by the time they start school (Halliday, 1975; Wells, 1986). These meaning-making functions are driven by the child's needs to communicate with others, to make sense of their world and to exercise some control over it.

The link between language and thinking is well established in the word-based culture of academic literature. However, it is not the intention here to suggest that language is the only way of thinking. Indeed in design and technology it is an explicit aim to develop other ways of thinking, such as visual and spatial thinking. Language is seen as being useful for particular functions, having different but complementary characteristics to other ways of thinking.

This paper attempts to identify some of the characteristics of language as a tool for thinking in design and technology that have emerged through the analysis of spoken and written language collected in a design and technology unit of work.

The links between language and thinking in primary design and technology
There is much variance in the literature about what thinking involves. For the purposes of this paper I am using the following statements from Fisher (1990) as a reference point:

> "thinking involves critical and creative aspects of the mind, both the use of reason and the generation of ideas"
>
> "thinking takes place in a social context, is influenced and moulded by our culture and our environment"
> (Fisher, 1990: 4)

Design and technology can be seen as providing opportunities to develop both critical and creative thinking in the socio-cultural context of the primary classroom. The four modes of language – speaking and listening, reading and writing – are all used to support learning in design and technology. Listening and reading give children access to information and experience beyond their own; speaking and writing enable children to express their own thoughts, ideas and opinions and communicate with others.

However, the notion of language as merely input and output is an over-simplistic one. We use language in a social world and we are constantly interpreting and reinterpreting our understanding of what we and others mean in a social context. It is in the complex interaction of the different modes of language and in dialogue with oneself and others that thinking goes on and learning takes place.

Collecting and analysing language
The following description of some of the characteristics of language as a tool for thinking in design and technology has been developed from an analysis of spoken and written language gathered from a design and technology unit of work in which children designed and made pencil cases. The children involved were a mixed class of 18 boys and 9 girls, aged 8-11, in a small rural school. More than a third of the children were identified as having special educational needs in language. The unit of work was taught by the teacher, with the researcher acting as participant observer. Data collection methods included classroom observation, tape recordings of the teacher and children working, and interviews with the teacher and children. Children's annotated drawings, writing and 3D modelling were also used for analysis.

The use of language as evidence of thinking is recognised as being problematic. Thinking is an internal process, hidden from outside view, and interpretation of meaning from language is always subjective. In attempting to interpret this data, care has been taken to consider the language in its very particular context. The presence of a researcher and recording equipment in the classroom is acknowledged as an influencing factor on the data.

Some characteristics of language as a tool for thinking in design and technology

In the case study, language was used in the processes of both critical and creative thinking. It was often used in conjunction with other forms of representation, for example when children added labels to drawings or discussed possibilities while working with materials. The following characteristics are offered as a selection rather than as a definitive list.

Language is inside our heads

One of the key aspects of language as a tool for thinking is the notion of 'inner speech'; the internal voice that regulates our actions. It is generally of a quicker pace than vocalised speech and plays a vital role in thinking. Vygotsky's theory (1962) suggests that inner speech is a development from the egocentric speech that accompanies young children's play. This speech takes on the attributes of the discussions that young children have with others as they play and perform everyday tasks together. As children develop, this speech is internalised and occurs away from view, although it reappears when a difficulty is encountered or deep concentration is required. This re-emergence of inner speech is familiar to most adults when they find they are talking to themselves in an effort to try to remember, to make a decision or perform a difficult task.

In the classroom situation, it is impossible to know the inner speech that goes on in children's heads. However, in the case study there are examples of utterances that may be vocalised inner speech as they appear to have the purpose of personal expression rather than communication: they were not directed at anyone else and there was no expectation of reply; and they were short and intermittent. For example, one boy made the following utterances while he was busily engaged in making a paper mock-up of his pencil case.

> "I know, I know what I... I'm going to have secret pockets on mine."
> (noise of scissors etc.)
> "I'm going to have two pockets, one here and one here, and then I'm going to have a secret compartment."
> "I just want to make sure that mine's the right size to fit pens in... Oh yeah, ample space!"

Language allows us to have dialogue with others

Language allows us to express our thinking to other people and enter into a dialogue with them that extends our original thoughts. In the case study there were many examples of short bursts of dialogue that illustrated this facility of language. Children talked with other children, the classroom assistant and the teacher.

The following example is an extract of talk between two boys evaluating a small collection of pencil cases. Their understanding is built through handling the

products and using language to draw attention to particular features and have a dialogue about them.

> B1: “Here, look, look, look, look! That zip goes RIGHT down to there... and look and...” (noise of zip)
> B2: (( ))
> B1: “What all the way down like that? That’s what this one does, it ain’t got one of those stopper things.”
> B2: “This one and that are the same really, only that one’s bigger.”

Examples of teacher-initiated dialogue have a different character. The teacher and pupil are not sharing dialogue on equal terms or for similar purposes and this shapes the nature of the talk. There is an unequal power relationship and the teacher plays a leading role in shaping the dialogue to meet particular educational or managerial aims. For example, most extracts of teacher and pupil dialogue are directed by teacher questions.

The nature of teacher talk is an important factor in determining the nature of children’s talking, thinking and learning. Studies of classroom interaction have concluded that teachers need to enter into other types of dialogue with children to enhance learning, rather than relying too heavily on questioning (Wood, 1998).

Language releases us from the limits of the here and now
The examples given so far have shown language being used to comment on something present in the immediate physical world. One of the strengths of any representational system is that it releases us from the restrictions of the physical present and allows us to think about the past, the future and the imaginary. In this way language enables us to stand back and to draw upon previous experience, to speculate, to imagine new possibilities and to plan ahead. It also allows us to reflect, to compare one thing with another and to make judgements.

Language enables us to make connections
The following statement illustrates language being used to make connections between two different aspects of experience. This process enables us to make sense of any particular experience in the light of existing knowledge; to see a particular experience as part of a much larger whole.

> “I am most please with my stiching because at home I am rubish.”

Language allows us to build up a sense of our achievements
Language enables us to reflect and to continually reconstruct our view of ourselves and our capabilities. This facility enables us to develop attitudes that in turn influence our thinking and our ability to learn.

> “I like my coat of arms most because it is coulerful and I tried my hardist on it. I didn't think I would be able to do it.”

> “I am most pleased with my coat of arms because I like the colours and the symbols that I used. I also thought it was good stitching. Well my best so far.”

Writing can be used as an aid to memory
Writing down our ideas can help to free the brain from the effort of remembering, so that it can concentrate on thinking of more ideas. In the case study, the children worked in pairs to write a list of different ways that they might present their plans.

The teacher also led a class discussion to identify common criteria for the design of pencil cases. This list was recorded on the blackboard and remained there for the children and teacher to use as a common reference point.

Writing can be used as a record of thoughts and a process of thinking
Writing provides an enduring record of language, but it is more than merely written down speech. Thoughts tend to be clarified in the process of writing. The process of writing takes longer than talking, particularly for younger children, and requires more physical effort and concentration. Written language uses a different symbolic system (i.e. letters rather than sounds) and it uses different structures as it often has to stand apart from other clues to meaning. This means that we are often required to think more carefully about what is written down. The following written comments were made at the end of the project. They typically show a more complex structure than the children’s talk, and illustrate children reflecting through language.

> Suggesting improvements:
> “If I made this pencil case again I would make a smaller slit in the pocket because I have made the slit too big.”
> “I would improve it by making the fabric stronger and using a different fastener rather than velcro next time.”
>
> Reflecting on process:
> “I found that the most helpful piece of designing work was the sheet where we kind of judges different pencill cases because you could see different peoples ideas and see if you where going to use them or not.”
> “I found making the mokup most helpful because we could try different ways till it was just right.”

Conclusions
Although in its early stages, this study suggests that language is an important tool for thinking and learning in design and technology. Design and technology requires children to use language for a variety of purposes and presents them with meaningful situations in which they have to think in different ways, for example to reflect, to generate ideas, to make decisions, to make judgements, to plan and to improvise.

A greater understanding of how children use language as a tool for thinking in design and technology might inform planning so that children could be supported in developing their skills. The evidence so far suggests that this would involve an emphasis on the processes of using language rather than language products. It also suggests that it is important to see language as one form of representation and way of modelling ideas that can be used in conjunction with others, such as drawing, working with materials and actions.

Further work might involve collecting and analysing language from other units of work, investigating individual differences, and investigating the effects of making explicit to children specific ways of using language that help thinking processes.

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