

«I don't think I can do it; I can't work it out for myself»

The importance of providing primary children with thinking skills for their future lives

With the introduction of the National Curriculum in 1989 in England, came a continued belief and emphasis that with primary aged children, the process, not just the product, of learning was important. It was recognised that simpler forms of learning alone, for example passive knowledge acquired by drill exercises, were not preparing children for the changing world of work. The ways in which subjects such as science, maths and design and technology were being developed allowed children the opportunities to investigate, to analyse, to solve problems and to think creatively and critically.

What are thinking skills?

There has been, and obviously will continue to be, much debate relating to the area of thinking skills. Defining thinking skills is complex, partly because it is an abstract concept. When assessing primary aged children, it is relatively easy to define and assess their physical skills of making as the teacher can see the child using them. However, when a child is using thinking skills, so much of the process can be hidden. Thinking skills certainly are needed to help children try to make sense of the world. Children need to respond to, and process, information which they have gathered through interacting with their environment. They need to think during any mental activity which helps them to solve a problem. The brain obviously is central to the processing of information. The idea that the brain has two hemispheres-the right one which focuses on creative aspects and the left which focuses on the logical aspects-has been accepted, although recent research suggests that the divisions are not as absolute as has been argued. Moreover, different types of thinking involve both creative and critical aspects of the mind and it is the synthesizing of these two aspects which help children to think through and solve problems successfully.

The importance of thinking skills

Robert Fisher (1990) has put forward the notion that reproductive learning was sufficient in the past. Children acquired a fixed body of knowledge, accepted skills, fixed outlooks, methods and rules necessary for dealing with known and recurring situations. This type of learning supported the status quo; whilst it is still important it is not sufficient for today and the future. It certainly appears that the changes in our society at the present time are more rapid than in any previous age. Technological advances change our way of life instantly, and acquired knowledge quickly becomes outdated. Globally, business and industry are looking for young people who are flexible, are able to organise and apply knowledge. Through analysing requirements for a range of jobs for graduates, it is only too apparent that companies want new employees to have a range skills, not a particular knowledge base. In addition, young people need to be able to think for themselves in other aspects of their lives. As our ideas of the world of work change and part time working, working from home and working in flexible teams takes over, it is essential that young people can question, can plan, can reflect on what they want to do with their own lives. It is essential therefore that young children are equipped to live in such a world. If the curriculum which they experience at school is mainly knowledge based, with an emphasis on rote learning of facts, they will not be able to process new knowledge effectively. Knowledge on its own is not enough. They may have knowledge of how a circuit and switch works but unless they know how to organise

and sequence the use of the components, materials and tools, it is unlikely that they can find and repair a fault in the circuit as, for example, an electrician does.

Children need to be able to determine for themselves what knowledge is important and how to acquire it. Without the development of thinking skills, they will be unable to do this. This foundation needs to be developed in the early years and children need to understand that thinking skills are to be valued by themselves and others. Ideas and values are set early and if children do not understand the importance of these skills early in life, they will become too close minded as they reach adulthood to develop them.

The development of thinking skills

Thinking skills are not just something that happen. There have been a number of different theories as to how children think and learn, but a common thread throughout is that children need to be engaged in a task, to be active not passive, if they are to develop their own thinking skills. For example, Piaget (1956) placed learning how to act on the world and the subsequent consequences at the heart of thinking; Vygotsky (1978) argued that social environment was important and that a child's thinking develops through social experience and cultural interaction; and Bruner's work (1966) highlights the importance of language and through its use, how children take control of their thinking. Binet (1908) was one who believed that it was possible to develop thinking skills through the use of certain techniques. Moreover, it is crucial that children are given opportunities through which to use and apply creative and critical thinking skills in order that they can demonstrate that they have the ability, for example, to reason, to question, to be part of a team, learning from, and contributing to others' ideas. It is part of a teacher's responsibility to try to enhance these skills.

In England recent national documentation has supported the idea that the development of thinking skills is an important part of a child's education. The Curriculum 5-16 document (1985) includes references to the importance of developing the child's ability to question, to argue rationally and to be able to develop a reasoned argument. In the reports on drafts of the National Curriculum (1988) and National Curriculum (1995), all subjects included references to the development of skills such as questioning, evaluating, testing, analysing and planning. Programmes, such as Top Ten Tactics (1990), have been developed which teachers can use to develop thinking skills. Robert Fisher (1990) breaks down creative and critical thinking into a number of parts and offers a range of suggested activities which will offer opportunities for children to develop different aspects of thinking skills. However, children's learning needs to take place in a context and the importance of motivation to stimulate thinking is crucial to its development (Binet 1908). Design and technology is an acknowledged motivator of children. The Office for Standards in Education (OFSTED) which monitor the standards of education in schools in England have identified the motivational factor of design and technology in their reports. In the 1996 report, it was the only subject in which almost all children found enjoyment. From information gathered from 131 teachers on design and technology courses at the University of Central England, 94% indicated the children in their classes enjoyed the subject, were motivated and often this was the only subject in which certain children excelled. Furthermore, successful design and technology requires the provision of opportunities to develop a range of thinking skills as these are fundamental to the subject. It is possible to split thinking skills into two categories-creative and critical thinking. If creative thinking is to flourish, a child needs to have psychological safety and freedom (Carl Rodgers 1961). This means that the child needs to be accepted as an individual and to be allowed to express their ideas freely. Certainly, in design and technology the ideas of the child are crucial and it is the generation of their ideas which is fundamental to the whole process. Whilst teachers mediate with the children, discussing their ideas and actions, this should always be within a positive context, where children know that their ideas are valued. Children are encouraged to think

creatively about a variety of possible solutions and not to adopt the first idea that they have. In fact, the creative process mirrors to a large extent the process which designers experience when designing and making.

creative process

stimulus
exploration
planning
activity
review

design process

identifying a need/purpose
generating ideas
clarifying ideas
planning
making
evaluating

Of course, the design process is not linear or circular but iterative, with the designer moving backwards and forwards through the differing processes.

Children's imagination needs to be active to think creatively. An examination of some of the techniques which are carried out to develop creative thinking shows that all these are integral to design and technology. Alex Osborn (1963) and Edward de Bono (1970) have provided some well known techniques. Osborn devised a list of questions which should lead to the generation of ideas. Examples include What can be added, modified, changed? for example colour, form, shape, motion. What other material, mechanism, structure could be used? De Bono's ideas have been explained in his CoRT thinking programme which has been designed to improve planning and decision making. Throughout the whole process of designing and making children are choosing. They decide on the best idea, the type of materials and tools they will use, the joining techniques they will select and the finish they will apply to their product. Planning too is crucial if their product is to be completed successfully. They need to plan to take account, for example, of the time and economic constraints for their project.

Critical thinking involves the child in learning how and when to question and what questions to ask. They need to be able to reason, to be open minded, to see differing points of view and make a decision based on an evaluation of evidence. They need to be able to see that they may be wrong without taking away the confidence in themselves. As the ability to question is integral to successful critical thinking, it is important to use a range of strategies to develop this ability. Through the constant development of a child's curiosity, he/she will learn to ask, not to accept. A case study will exemplify this.

Case study

A class of six year olds were going to design and make books for their library. They were encouraged to ask questions when examining a range of pop-up books; when an author visited their classroom; when they went to the library; and when they disassembled a range of mechanisms and moving joints and tried to find out how they worked. The teacher was always careful not to 'tell' them the answer but to turn the question round. Examples included «What do you mean by...?», «What do you think?», «I wonder whether..?». Throughout the activity, the teacher was careful to say «I don't know» if there was a question she could not answer and «Let us try and find out.» It is so important that children realise that it is acceptable to admit that they do not know something. It is crucial that they have the skills to find out the answer.

The ability to reason is another aspect of critical thinking. This involves sequencing, predicting, classifying, judging and understanding oneself and others.

Case study

A class of ten year olds were making sweets for Diwali festival.

During initial activities to examine a range of sweets, they classified them in different ways; groupings included those they liked/disliked; those made with chocolate/those without; those traditionally made in India/those that were not. When they were deciding what sweets to make

for a party for the nursery class, they needed to find out the children's preferences, understanding that children have different preferences and that this is not good or bad, just different. The children needed to plan out in a sequence the actions what they needed to do to make the sweets. Throughout the activity they were understanding themselves and others as they found out why Diwali sweets were important, what the festival was about, what different tastes, colour and shapes the nursery children liked and what they themselves liked. None of the activities were created in isolation to develop particular aspects of thinking skills. All of them arose naturally as part of design and technology, highlighting the value of the subject area in providing appropriate contexts in which children can develop these skills.

There have been many attempts to define critical thinking skills by for example Robert Ennis (1962) and to identify cognitive learning goals such as those identified by Bloom (1956). Robert Ennis identified twelve key aspects, all of which are integral to any design and technology activity. Children need to consider, for example, whether something is meaningful, clear, precise, accurate, justified and well defined. Bloom's taxonomy is one of the most widely used throughout the world and again all the six categories are integral to design and technology activity.

Case study

A class of 6 year olds were making a vehicle.

1. Knowledge

They discussed what they knew about vehicles and what they knew about mechanisms to make the wheels move.

2. Comprehension

The children then researched vehicles using books, CD Rom, construction kits and examining vehicles parked in the school car park.

3. Application

Having explored a collection of vehicles, they discussed why different designs and different ways of attaching wheels had been used.

4. Analysis

They disassembled different vehicles made from construction kits and saw how the parts fitted together in the way they did, what materials have been used and why.

5. Synthesis

During their designing and making the children discussed what vehicle they might make, how might make it, and what materials they might use. They planned out what they needed to do and in what order. They identified certain problems such as how to attach the wheels to the axle and discussed a variety of solutions.

6. Evaluation

Having made their vehicle, the children looked back at the original criteria for it and made judgments relating to these. Did the vehicle have four wheels? did the wheels go round? could it move? does it look like the vehicle that I wanted to make? what might I do to improve it? It is evaluation which is the highest of the six thinking skills and is integral to all design and technology activity. Children are engaged in activities to evaluate made products, their own products and their way of working.

Conclusion

If it is accepted that thinking skills are an essential part of young children's education, then opportunities to develop these skills in the curriculum must be identified. It has been shown that children need to be active, to engage with materials and objects, to be given experiences which allow them to be involved in thinking about a range of solutions, decision making, working with others, asking questions and learning about their own and others' values. It is also important that these opportunities are not delivered to the children in isolation. They need to be in a context which motivates and is meaningful. It has been shown that design and

technology is without doubt the only subject area which can provide children with these opportunities. In England, there now has been ten years in which to evaluate the value of design and technology in all primary schools. Whilst there have been concerns relating to, for example, lack of resources and subject knowledge of teachers, it is hard to question the enormous contribution which the subject has made in providing exciting opportunities through which children's thinking skills can be developed.

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