# Exploring Teacher Activity in Primary Design and Technology Lessons

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**Abstract**
This paper illustrates actions and behaviours employed by English primary school teachers in teaching design and technology in the present context of the statutory National Curriculum framework for primary design and technology. It considers perspectives relating to general pedagogy, teacher activity and the possible contribution of learning theory and factors which influence choice of teaching methods. A number of sources of evidence are utilised including school inspection reports, teacher interviews and lesson observation. Two contrasting lessons, which illustrate some of the tensions faced by teachers, are considered and aspects of relevant statutory and non-statutory curriculum and guidance documents are explored. Based on a small non-representative sample this research sought to illustrate and explore teaching activity, a larger sample would be required to confirm the findings. A source of tension is identified in that teachers are charged with delivering specified knowledge and skill based outcomes, whilst at the same time developing pupil creativity. Suggestions of alternative approaches to the categorisation of teaching methods, including a form of taxonomy of primary design and technology methods, are made.

**Key words**
primary, design and technology, teaching methods, learning, pupil autonomy, teacher direction

**Background: Primary Design and Technology Education**

Design and technology was made compulsory for children aged 5 to 14 years in England and Wales in 1990 (DES, 1990). Thus the UK government made a bold step (Layton, 1991) but difficulties were soon encountered in relation to its implementation (NCC, 1992; Smithers and Robinson, 1992). Principal concerns reflected what Wragg et al (1989) and Anning (1997) identified as limits in the confidence and knowledge base of primary teachers. The National Curriculum for design and technology both in its original form and its later versions (DfEE/QCA, 2000), prescribes content and whilst three forms of pupil task are indicated i.e. Investigate and Evaluate Tasks, Focused Practical Tasks and Design and Make Tasks, there is little detail about pedagogy. Non-specialist primary teachers have received little if any design and technology education themselves (Wragg et al, 1989). Concerns relating to how design and technology was being taught energized the need for the publication of a non-statutory national scheme of work (QCA/DfEE, 1998). Whether an instrument of support or control this document has resulted in considerable uniformity in the organisation and content of a subject some would typify as creative. One significant contribution of this and other published resources (Nuffield, 2001) has been to assist primary teachers by suggesting pupil design and technology tasks. In the Nuffield scheme Barlex (2001) details small and big pupil design and technology tasks with a further contribution through an emphasis on design in the form of pupil design decisions. Whilst the stipulation or recommendation of particular tasks may imply the use of particular teaching methods, there is almost no explicit description of teaching methods.

Currently the design and technology National Curriculum (DfEE/QCA, 2000) encompasses two domains: the teaching of planning, communication and evaluation of design ideas; and the teaching of skills and knowledge associated with tools, equipment, materials and components (pp.92-95). The examples below are typical of the expectations.

Teachers should teach five to seven year old pupils to:

a) select tools, techniques and materials for making their product from a range suggested by the teacher;
b) explore the sensory qualities of materials;
c) measure, mark and cut and shape a range of materials.

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In the section on evaluation the document states that five to seven year olds should be taught to:

a) talk about their ideas, saying what they like and dislike;
b) identify what they could have done differently or how they could improve their work in the future.

Is there some contradiction within the statements above? They assert that pupils should be active, for example selecting, exploring and talking. However, is this active involvement devalued by the assertion that these things "…should be taught to:.."? Does this imply that the teacher is the purveyor of knowledge? Such behaviourist language may well contribute to tensions in a subject such as design and technology which has at its heart a need for creativity (Norman et al, 2004). In an attempt to promote a dialogue about teacher activity in design and technology lessons features such as task design have been referred to as 'teaching variables' (Cross, 2000).

**Aspects of Teacher Activity in Design and Technology Lessons**

Design and technology in primary education, and in particular the way it is taught, has received comparatively little attention from researchers (Kimbell et al, 1996 p.9; Cross, 2000). Explanations for this might relate to the perceived status of the subject and its relative priority. Perhaps the teaching of design and technology is viewed as unproblematic or simply seen as necessitating simple demonstration to pupils of, for example, the safe use of tools followed by opportunity for them to practise the skill.

In order to examine the teaching actions and behaviours of teachers it is necessary to consider underlying ideas, theories and assumptions which may influence their views and approaches. Primary education in England has seen a number of major changes in recent years since the introduction of the Primary National Curriculum (DfEE/QCA, 2000). Some of these, such as the National Numeracy Strategy, have explicitly sought to affect pedagogy (DfEE, 1998; DfEE, 1999) and have involved a move to what some would deem to be more traditional teaching methods in mathematics (Mujis and Reynolds, 2001). Any such judgement about change in primary design and technology teaching is less straightforward as the subject, introduced in 1990, has only a short history.

Teaching can be viewed as a natural human activity (McNamara, 1994) although few would deny it is a complex activity (Stenhouse, 1975; Gipps et al, 2000, 4). Dialogue about teaching has in the past been somewhat limited in England (Simon, 1981). This is exemplified and compounded by the considerable variety in the use of terms such as 'teaching', 'teaching style', 'teaching methods', 'pedagogy', 'didactics' and 'instruction'. Stenhouse (1975) defined the term 'teaching' as encompassing any strategies utilised by a school to promote learning. Gipps et al (2000) usefully defined teaching as: "a presentation in various ways of adult-decided knowledge, skills and understanding". One form of presentation, instruction, is an important part of teaching as it includes the giving of commands or teaching a "correct and non-negotiable way of doing or going about something" (Gipps et.al., 2000, 39). Stenhouse saw limitations of instruction as an exclusive approach "Teaching is not merely instruction, but the systematic promotion of learning by whatever means." (Stenhouse, 1975, 24). Alexander's (1992) distinction between components of pedagogy including teaching methods and classroom organization proved to be influential in this study. He divided what he called the observable practice of teachers under four subheadings as follows:

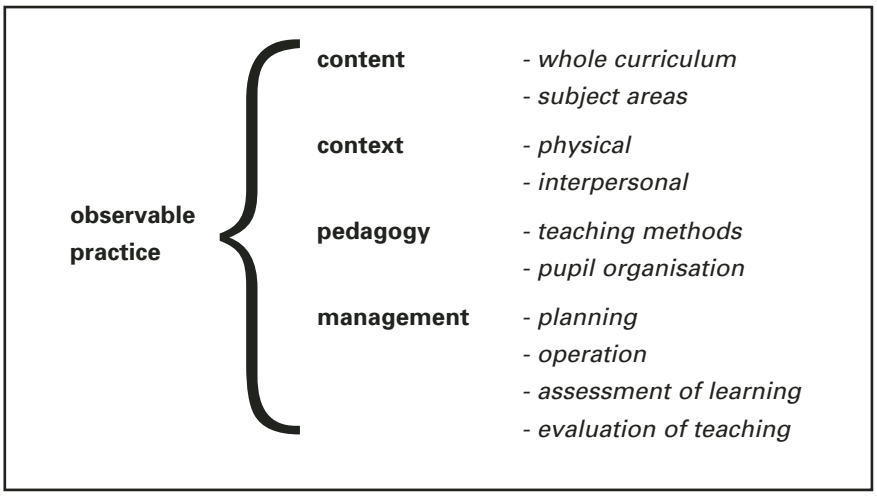


***Figure 1: Part of Alexander's Conceptual Framework of Educational Practice (Alexander, 1992 p. 198)***

Our thinking about teaching is influenced by our understanding of the nature of learning and knowledge. Traditional approaches to teaching see it as a process of transmission; one in which the teacher, the expert, passes on knowledge to the learner. The learner in this model is seen as passive. Such a positivist view of teaching may therefore assume that if the teacher accounts fully for each learner and for each concept to be taught then learning is guaranteed. Such a view ignores the involvement of others in the activity, most notably the pupil and his or her peers. Social constructivism offers a more balanced perspective in that it seeks to account for teacher, learner and social setting. However, as Gipps (1992) acknowledges, constructivist approaches offer little guidance in terms of a clear pedagogy and therefore teaching behaviour.

The significance of social interaction is seen in some of these observations and has been recognised by others (Rowell, 2002; Hennessy and Murphy, 1999). Hennessy and Murphy link this to the nature of design and technology recognising the potential for the use of open-ended activities which have, they suggest, the potential to increase independence or autonomy.

In the small sample reported here there was a clear difference in the amount of pupil interaction. For example, in the first lesson which was less open and more tightly controlled by the teacher, there was less pupil interaction.

In order to discuss and describe the complexity of classroom teaching of design and technology three categories have been suggested (Cross, 2000) to distinguish between teaching behaviours:

a) teacher activity where the teacher is directly engaged in teaching;
b) use of media which enable teaching;
c) the pupil task or activity.

The first of the three categories above is broad and involves the teachers' utterances and behaviours. The second category, the media employed, would include all the features of teaching methods which might vary, i.e. resources, time, materials, tools, artefacts etc. The third category, task, is considered to be a teaching behaviour as the teacher will have designed or at least selected the task with the learning in mind.

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**Teaching and Learning Design and Technology**

According to constructivist theory (Piaget, 1962) pupils learn by actively making sense of knowledge, by making meaning and by networking, connecting new knowledge to existing sets of ideas or schemes. Whilst this accounts for certain aspects of a subject such as design and technology, it may be less useful for aspects of the subject where, for example, pupils learn to design in teams. Recently, more account has been given by social constructivists to the social setting of learning and how interaction with others and the prevailing culture assists and influences learning (Von Glaserfield, 1989). Traditional teaching approaches employ predominantly didactic methods of demonstration and explanation whereas social constructivists (Vygotsky, 1962) would advocate more use of active involvement of the learner including genuine discussion, group work and collaboration.

Vygotsky's (1962) ideas, which emphasise language and interaction with others, may be of considerable use to teachers of design and technology wishing to account for and further utilise the contribution of language. Vygotsky commented that a teacher "...working with the school child on a given question, explains, informs, inquires, corrects, and forces the child himself to explain." This occurs within what Vygotsky (1962) called the *Zone of Proximal Development* (ZPD), a transition area of capability where the pupil is able to achieve with the aid of a capable other en route to a state of independent capability. The ZPD appears to have meaning for learning in design and technology and consequently the teaching of the subject.

Other perspectives exist which draw on such ideas. Situated cognition views knowledge as inseparable from context and learning as fundamentally social (Lave and Wenger, 1991). Process knowledge is almost certainly best developed in a context which is meaningful to the learner. The very best contexts may be those in which the pupil can perceive the needs of the client or user of the product. Whilst not perhaps unique to design and technology, this may be particularly important in design and technology.

These ideas link with the notion of cognitive apprenticeship (Coy, 1989) which has some relevance here. This is different to traditional apprenticeship based on extended periods of training under a master craftsman. Cognitive apprenticeship is concerned with a situated approach to learning and cognition requiring the learner to learn through guided experience and to externalise processes which are normally carried out internally (Conway, 1997). Such ideas reflect Vygotsky's ZPD. As with much of this discussion about learning, its relevance to design and technology has yet to be fully explored.

**The Study**

As the research would draw from a small evidence base it was decided to utilise evidence from a range of rich sources (subject leaders, inspectors of design and technology and teachers) in the field of primary design and technology (Patton 1987, 52).

Firstly, semi-structured interviews (Maykut and Morehouse 1994, p.81) were conducted with a sample of five primary school subject leaders of design and technology, chosen to be representative of a cohort that had recently attended a design and technology INSET course (the questions used as a basis for the interviews is provided in Table 1). Secondly, the sections of thirty-four primary school inspection reports which dealt with the provision of design and technology were examined. The sample of inspection reports included a range of large and small schools in both urban and rural settings. Only the longer three to five day inspection reports were utilised as these aim to evaluate all subjects including design and technology. These were read and reread with notes made each time under headings relevant to the teaching of design and technology. Finally, four lessons were observed and video recorded. There is not space here to examine all the evidence in detail, so summaries are provided. In the case of the classroom observations, two contrasting lessons are utilised as illustrations.

**Introduction**
Introduce myself, refer to our previous telephone conversation and the follow up letter. Explain the focus and nature of the research. Assure the teacher that he/she will remain anonymous and that this interview will last for around 40 minutes. Ask if it will be possible to use the tape recorder.

**Biographical Questions**
What is your teaching qualification?
How many years have you been teaching?
Do you have any other qualifications relevant to the teaching of design and technology?

Have you attended any INSET for design and technology?
For how long have you been subject leader?
What age range are you currently teaching?

**Design and Technology Teaching**
For how long have you taught design and technology in your classroom?
Can you tell me how you teach design and technology?
Could you please outline a typical design and technology lesson?
How do other design and technology lessons vary from this if at all?
Are there things which have to be taught explicitly by you?
Would you say that design and technology is a cross-curricular subject?
If so how does this affect the way that the subject is taught?
Has there been any specialist teaching of design and technology in your school/experience?
How is design and technology presented/initiated by you as the teacher?
In the classroom, who decides what will be designed and made?
When teaching design and technology would you:
- provide written instructions?
- provide a picture or a diagram?
- ask pupils to make X and then to improve it in their own way?
- allow free play?
- give some freedom/choice to design and build a product?
- intervene and give direction? How much?
- teach skills of designing? Of making?

Do you wish to add anything else to your responses?
Thank you.

***Table 1: Interview Questions for Subject Leaders***

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**The Design and Technology Subject Leaders**
Five primary school teacher-subject leaders of design and technology were interviewed about the teacher behaviours employed in primary school design and technology lessons. The responses of the subject leaders varied but included several references to design and technology tasks set for pupils. They described a high degree of teacher control over the context, timing, grouping of the pupils and selection of tools and materials. Two of the subject leaders described their practice of saving good examples of pupils' work from previous years.

> *"I saved an example from last year... ...it's the only way to show them the quality that I am looking for." (Subject Leader)*

Their responses reflect some of the tension referred to earlier, indicating an understanding that pupils ought to have some autonomy in design and technology but that this does not necessarily complement other objectives.

> *"But I tell them what the product will be..." and "They have some freedom but there are always limitations." "Giving freedom has in the past... ... led to poor results." (Subject Leader)*

There was considerable emphasis on the beginnings of lessons from the respondents. These included a range of activities: walks, visits, examination of existing products, instruction, discussion and researching. Several school teacher-subject leaders spoke of different ways of giving instructions to the pupils:

> *"I use verbal and written instructions."*
> *"Written instructions and diagrams."*

Discussion was used to focus attention and involve the pupils:

> *"We will start by discussing the resources."*
> *"In the discussion, I lead..."*

Teacher demonstrations were referred to more than once:

> *"I use demonstration to teach skills."*
> *"An initial demonstration to half of the class..."*

These were related to the use of a previously constructed example:

> *"They copy one which is already made."*
> *"Recently in a topic on... I brought one in that I had already made."*

Each interview included discussion concerning the degree of autonomy given to pupils and the extent to which the activity was teacher directed. This was most often articulated by the teacher-subject leaders in terms of the pupils having choice, most frequently in the areas of materials, tools, working partners, techniques and finish or decoration. One teacher-subject leader referred to "some freedom but within tight parameters." This somewhat contradictory remark appears to involve the teacher giving choice in some aspects of the activity whilst maintaining overall control.

When asked about teaching design and technology, the interviewees all referred to teaching the skills and knowledge associated with making. They referred to the teaching of design only if prompted. A common point was the frustration felt when pupils designed something on paper and proceeded to make a model bearing little or no resemblance to the design. A system was described where the pupils were given four cards and asked to produce a design on each. The pupil would then have to select from four ideas.

One subject leader was "...very unhappy with my teaching here [of designing]." Several of the teacher subject leaders referred to the tasks set for pupils when asked to talk about teaching. They appeared to suggest that tasks would, to some extent, substitute for teaching.

For three of the five subject leaders personal subject knowledge of design and technology and lack of ability in relation to making skills, were areas of serious concern. It was interesting that when asked, home DIY was cited as a relevant qualification. These responses yielded a mixed picture from a group of teachers who might be considered to be well informed about design and technology when compared to colleagues.

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**School Inspection Reports**
A set of thirty-four school inspection reports were read. As the sample consisted solely of the longer (typically three or four day) school inspections, this ensured that the inspectors were under an obligation to report on all subjects and thus that this research would potentially have the largest number of references to design and technology. Relevant comments and judgements were identified, grouped and reviewed. A number of comments about perceived strengths and shortcomings in the teaching of design and technology were noted. Difficulties were ascribed by inspectors in the main to teachers' lack of subject knowledge.

Inspectors had very little to say about teaching methods, focusing instead on the evaluation of the tasks given to the pupils. The dearth of comments about teaching was noticeable given that it is a specific item which inspectors are asked to report on. The seven brief comments made about teaching methods in the thirty-four reports included "careful questioning", "clear instructions given", "a lack of direct teaching", "demonstration of skills…," "…development of good discussion", "pupils involved in selecting… [and] …evaluating", "pupils encouraged to plan" and "most teaching was well organised". Reinforcing this pattern were the twenty-seven reports which contained no direct reference to teaching methods, even where design and technology was judged to be unsatisfactory.

Most relevant to this study is concern expressed by inspectors about the quality of class teaching referred to in fourteen of the thirty-four reports. Three reports mention a lack of direct teaching. In two cases, when there was teaching of the subject, inspectors felt that it was not taught in a systematic way. Five reports referred to wide variation in the teaching of the subject throughout the school.

Three reports spoke of opportunities missed, typified by comments such as "too few opportunities to learn skills and to explore the properties of materials" and "few opportunities for discussion". On only three occasions did inspectors refer to teaching which was "well organised and well matched". Six of the thirty-four reports mentioned some features of best practice observed in the schools. These references often spoke of the nature of the task: "clear purpose, interest and challenge"; "tasks well related to pupils' experiences"; "…designing and making for a specific purpose".

**Classroom Observations**
Two of the classroom observations are exemplified below. The five classrooms were chosen in an opportunistic sample through personal contact of the researcher with teachers who had attended courses at the University. The volunteers were relatively confident about their teaching of design and technology. Owing to the timing of the observations and the need to observe teaching methods, the observations focused on the first forty minutes of lessons as it is in this part of the lesson that most teaching behaviour is displayed. The contexts utilised as the basis for the design and technology lessons were quite different across the classrooms and included Christmas decorations, a pirates' treasure chest, bridge building, making a model of a rat trap and learning different joining techniques. This variety in the contexts was matched by diversity of teaching methods. The following examples illustrate the variety seen.

***Classroom 1 (8-9 year olds)***
The teacher emphasised the importance of suitable templates for Christmas decorations which were to be constructed using fabric. She began by referring to a briefing sheet.

*"The sheet says, 'design your Christmas tree decoration'. You've got to draw a picture of your design. Now, to give you some idea (holds up a snowman template), you might want to do a snowman."*

Other examples of suitable templates were shown to the group by the teacher, who went to some trouble to explain that the decorations should be of moderate size.

*"…as you've got to sew it, if it's too small, it could be fiddly and so you need a simple design."*

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Another example was shown of a simple design which would present few problems with sewing. The teacher went on to talk about an aspect of construction.

*"We are not going to sew all the way round, we're only going to sew part of the way round (partly circles template with finger) because we're going to fill it."*

Thus the pupils were given direction in using skills which were either new or of which they had little prior experience. The pupils were then given some time to design a shape and to pin and cut out the shapes. The eight pupils concerned selected only from those shapes suggested by the teacher. The teacher gave two further short sets of directions, these utilised a questioning approach which sought to make a number of teaching points:

| | |
|---|---|
| Teacher | What will I do with the piece of card Rachel? |
| Pupil | Fold it in half? |
| Teacher | Right, good, if I fold it in half (holds up a folded square of card) where am I going to draw my shape? Am I going to draw it here (points to the non-folded side) or here (points to the folded side)? Lee? |
| Pupil | Along the fold. |
| Teacher | Right… |

This lesson was concluded with a check on progress made, one or two pupils showing their work and reminder about when the work would be continued.

The teacher employed a predominantly didactic approach as she sought to teach the pupils a number of stitch craft techniques and skills. The only opportunity for choice by the pupils was in the selection of the shape of the template. The fact that they all selected shapes presented by the teacher illustrates the power teachers have to influence and perhaps limit choice through direction.

***Classroom 2 (6-7 year olds)***

This class lesson was conducted over one morning. The teacher first reminded the thirty-four pupils of two books she had recently read to them about pirates and then, with the use of the books, drew the attention of the class to the pirates' need for a treasure box.

| | |
|---|---|
| Teacher | …and he's sitting on his treasure chest, can you see? It's not a box; it's not a straightforward box like a cuboid, is it? |
| Pupil | No |
| Teacher | What's it got on it? [Pause three seconds.] |
| Pupil | A lock. |
| Teacher | It's got a lock on it, why do you think it has got a lock on it? |
| Pupil | So that nobody can get into it. |

The pupils were then given a task involving the deconstruction of a box in order to examine its construction and note its shape or net.

*"The first thing that you are going to do is work with a friend on your table; you can choose and undo a box…"*

This was followed by reconstruction of the box with the addition of parts in order that it became a model of a pirates' treasure box.

*"..sit down and think carefully about what materials you are going to use, how you are going to do it and what you need your treasure box to look like."*

The teacher drew the pupils' attention to a large collection of construction materials including a range of cards, papers and adhesives.

*"You can choose the way that you are going to join it together."*

The contribution of the pupils was largely confined to responding to teacher questions, although some opportunity was given for offering suggestions and posing questions. This was directed and brief. A child suggesting that weight might be important received little acknowledgement.

Having moved to the deconstruction of the box and subsequently to design and making, a change was noted. More time was available for experimentation and discussion. The pupils made choices about the type and colour of paper, the shape and position of handles, the operation of the lid etc. However, the teacher retained direction by regularly reinforcing the characteristics she had identified for treasure box construction. She did this by stopping the whole class to remind them, by speaking with groups and on a one-to-one basis with pupils.

These two lessons illustrate different approaches. The first was directive and focused on teaching basic skills of stitchcraft. The teacher asked the pupils to design a decoration, but devoted little time or emphasis to design by pupils within the lesson. When selecting a motif for the decoration the pupils were highly influenced by the examples shown by the teacher. The second lesson was also highly structured but included, in different sections of the lesson, some variation in the level of teacher direction.

**Discussion**

The school subject leaders identified a wide range of methods used in the teaching of design and technology. These included specific teacher activity such as explaining, describing, demonstrating and leading discussion. There was also a broader use of strategies by the teacher for example, grouping the pupils; providing leadership with regard to the context of the design and technology; tailoring timing within a lesson and varying the choice of tools and materials. The variation in these features appears to allow teachers to direct the attention and activity of pupils.

The thirty-four inspection reports rarely commented on teaching methods explicitly. This is in itself significant. Why would the articulation of the teaching of design and technology by the inspectors be limited? Gray and Wilcox (1995), in a study of inspection reports, found that most comments from inspectors focused on organisational and managerial aspects of teaching. The authors state that there is little reference in reports to direct teaching of pupils.

In the reports considered here the school inspectors tended to refer to the tasks set for pupils, in particular their extent and suitability. The teacher-subject leaders who were interviewed for this research used a different term referring to pupils' activities. The focus, however, was the same, what does the teacher ask the pupil to do in design and technology lessons? Is there a subtle difference between a task and an activity? In this context, both task and activity are a means by which the teacher directs the actions of the pupils. Do questions need to be asked about the nature of such tasks? About, for example the extent of openness of a task?

A consistent theme that appears in each set of evidence, interviews, analysis of inspection reports and observation of lessons, was the role of language. In 1996 Kimbell et al concluded that language was significantly more important to the learning of design and technology than they had originally assumed. This research tends to support a crucial role for language, including speaking, listening and writing by pupils and teacher. The whole question of dialogue and discussion in design and technology lessons requires exploration and clarification if the full potential of language is to be realised. Such a view has implications for the place of social interaction in design and technology.

That teachers used tools, materials and artefacts to support teaching in the lessons observed is clear evidence that communication goes beyond words. This may be particularly important in design and technology when trying to describe the workings of, for example, a clamp or demonstrating back stitch. Kimbell, Stables and Green (1996, p23) emphasis the need for a 'concrete' language.

> *"The language of technology is indisputably a concrete one – of images, symbols and models. Without this language it is just not possible to conceive of technological solutions."*

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These two lessons were typical of the others seen as the teachers chose to direct pupils to some extent. Different degrees of teacher direction were observed. In the first lesson, for example, when the teacher was quite directive about the shape of the decorations and in lesson two, where the pirates' box was modelled by the pupils. Here the teacher gave an increasing level of autonomy within a highly structured lesson. Such an example may be contrary to a view that would see pupil autonomy increase only as teacher direction decreased. In this case the teacher structured the session highly, appearing to utilise the degree of her direction as a variable factor of her teaching. The result was opportunity for increasing autonomy in the pupils. What was perhaps most interesting was the change in pupil autonomy which occurred during the lesson. The initial discussion between the teacher and the pupils was highly directed by the teacher, as was the first practical activity.

Until this point the pupils were led by teacher questioning, instruction and illustration. The pupils were then asked to select materials and later to generate ideas for handles and locks for the boxes. Guidance was however still required: "think about the size you'd like… …choose what way you're going to join it together…". This example indicates that the degree of pupil autonomy is not necessarily determined in a straightforward way.

Teachers may need to consider more carefully how their words, actions and examples can influence pupil autonomy. Are these tensions unique to design and technology? It may be that whilst different teaching methods may be employed by many subjects such as demonstrations in mathematics and physical education, there might be something unique in the combinations and relative proportions in which these are employed in design and technology. Demonstration may be utilised more. There may also be something unique in the nature of the various demonstrations used, for example, the way in which concrete examples are featured. These examples communicate a great deal. One subject leader touched on this by saying: "I try to keep an example from the previous year. It's the only way to show them the quality I'm after." Medway (1992) suggests that "the developing artefact becomes an object of shared cognition." Thus the artefacts employed and created become very powerful educational tools for the teacher.

In Cross (2000) a distinction was drawn between three sets of teaching behaviours. Examples have been taken from all five lessons observed and placed in Figure 2 to illustrate how these categories might distinguish teaching behaviours. Following the lesson observations, two of which were outlined above, the three categories are expanded in order to illustrate their meaning. An additional distinction is included, based on Alexander's (1992) framework illustrated in Figure 1 which distinguishes between the organisational aspects or variables of a lesson and teacher behaviors which can also be seen as variables. The usefulness of these categories is open to question as they are unlikely to be comprehensive or sufficiently sophisticated. However a framework or taxonomy of some kind which is directly relatable to design and technology may be of use in assisting for example non-specialists. The greatest potential contribution may be as a reflective tool for teacher self-review. Figure 2 illustrates an initial step towards such a framework which might encourage teachers to distinguish between the various features or variables in a lesson.

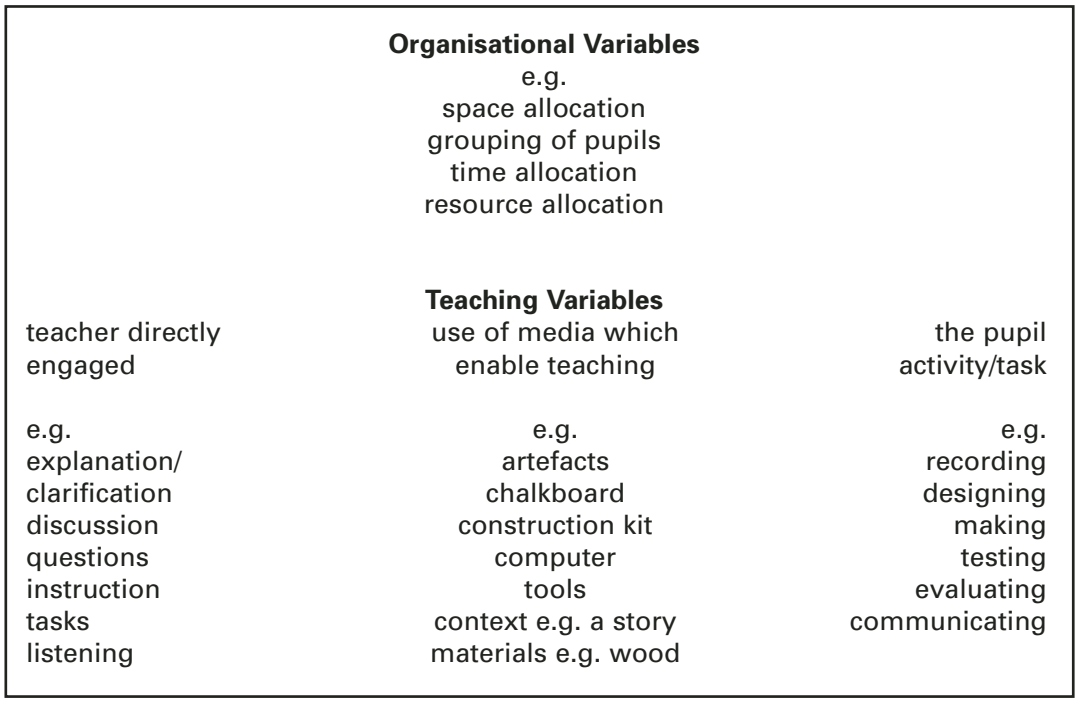


***Figure 2: A possible framework for the consideration of aspects of teaching in design and technology***

In order for teachers, in particular non-specialists, to cater for this relatively new practical subject and the different learning styles of pupils, consideration of teaching methods in design and technology may offer considerable benefits. Whilst useful in some ways, those employing any such reductionist approach must be alert to the dangers associated with attempts to atomise teaching. Teaching can be seen as far greater than the sum of a series of competencies. For Brophy and Evertson (1976) teaching was an orchestration of many factors. The inadequacy of any such framework is revealed when, for example, the social context of the classroom is considered. Davies and Elner, (2001) and others (Rowell 2002; Hennessy and Murphy 1999) emphasise the need to go beyond the utterances and behaviours of the teacher when considering the teaching of design and technology. The significance of the social context, including verbal and non-verbal interactions between the lesson participants is increasingly being recognised. Teacher behaviours are part of this context. They are powerful forms of communication. It is hoped that greater understanding of their detail will assist all those interested in teaching of design and technology.

**Implications**

How teachers teach design and technology remains a relatively unexplored area. In England, the subject has suffered from a number of policy changes made in rapid succession, a teaching workforce in primary schools who lack specialist knowledge and a curriculum based on nine subjects which results in limited time being devoted to design and technology.

What is apparent is that by discussing this teaching with primary teachers and observing their behaviour in design and technology lessons interesting features appear, for example, in the extent of autonomy provided in lessons. There remains considerable scope for the articulation of teaching in the subject and

for an exploration of the relevance of theory and ideas which have been proposed about teaching and learning. The scope for research also includes the extent of the knowledge required by teachers and in particular the pedagogical knowledge required. Importing unadapted ideas about teaching from other subjects may not be appropriate. An example may be constructivism which has been widely employed by teachers of science, its potential contribution to design and technology has not been explored fully.

This paper represents a small scale piece of research. Whilst similar small scale studies might reveal different details, it is hoped that a comparable range of teacher activity would be evidenced. For any country or educational system wishing to implement design and technology as a subject in the primary curriculum there are important questions to address about how the subject is taught and how teachers will be trained to teach the subject well. For the wider educational community there are further considerations about the nature of subjects such as design and technology and the value of describing teaching behaviours. Any such consideration should be prepared to accept complexity.

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**Bibliography**

Alexander, R. J. (1992) *Policy and Practice in Primary Education*, London: Routledge.

Alexander, R. J. (2000) *Culture and Pedagogy: International Comparisons in Primary Education*, London: Blackwell.

Anning, A. (1997) Teaching and Learning: How to Design in Schools, *The Journal of Design and Technology Education*, Vol. 2, No. 1, 50-52.

Barlex, D. (2001) *Primary Solutions in Design and Technology: Teacher's Handbook*, London: Nuffield Curriculum Projects Centre.

Bennett, N. (1976) *Teaching Style and Pupil Progress*, London: Open Books.

Bowen, R. (1996) Quality Teaching in Primary School Design and Technology, *The Journal of Design and technology Education*, Vol. 1, No.1, 12-23.

Brophy, J. E. and Evertson, C. M. (1976) *Learning From Teaching: A Developmental Perspective*, Boston: Allyn and Bacon.

Cohen, L. and Manion, L. (1989) *Research Methods in Education*, London; Routledge.

Conway, J. (1997) *Educational Technology's Effect on Models of Instruction* web http://copland.edel.edu/~jconway/EDST666.htm

Cross, A. B. (2003) Teacher Influence on Pupil Autonomy in Primary School Design and Technology, *Research in Science and Technological Education*, 21, 1, 123-135, 2003.

Cross, A. B. (2000) *Pedagogy and Curricular Subjects*, University of Manchester, Unpublished Thesis, Manchester.

Cross, A. B. (1992) Designing an Place in the Curriculum, *Design and Technology Teaching*, Vol. 24, No. 2, 22-24.

Coy, M. (1989) *Apprenticeship: from theory to method and back again*, Albany: Albany State University Press.

Design and Technology Association (2002) *Survey of Provision for Design and Technology in Schools*, Wellesbourne: DATA.

Dewey, J. (1938) *Experience and Education*, New York: Collier Macmillian.

Davies, T. and Elner, R. (2001) Learning in Design and Technology: The Impact of Social and Cultural Influences on Modelling, *International Journal of Technology and Design Education*, 11, 163-180, 2001.

Department of Education and Science (1990) *Technology in the National Curriculum*, London: HMSO.

Department for Education and Employment (1995) *Design and Technology in the National Curriculum*, London: HMSO.

Department for Education and employment (1998) *National Literacy Strategy*, London: DfEE.

Department for Education and Employment (1999) *National Numeracy Strategy*, London: DfEE.

Department for Education Employment/ Qualifications and Curriculum Authority (2000) *The National Curriculum: Key Stages 1 and 2*, London: DfEE/QCA.

Eggleston, J. (1992) *Teaching Design and Technology*, Buckingham: Open University Press.

Gipps, C. McCallum, B. and Hargreaves, E. (2000) *What Makes a Good Primary School Teacher? Expert Classroom Strategies*, London: Routledge/Falmer.

Gipps, C. (1992) *What We Know About Effective Primary Teaching*, London: Institute of Education.

Gray, J. and Wilcox, B. (1995) In the Aftermath of Inspection: The Nature and Fate of Inspection Report Recommendations, *Research Papers in Education*, 10 (1), 1-18.

Harlen, H., Holroyd, C. and Byrne, M. (1995) *Confidence and Understanding in Teaching Science and Technology in Primary Schools*. SCRE. Research Report No. 65. Scottish Council for Research in Education.

Hennessy, S. and Murphy, P. (1999) The Potential for Collaborative Problem Solving in Design and Technology, *International Journal of Technology and Design Education*, 9, 1-36, 1999.

Kamii, C. (1975) Pedagogical Principles derived from Piaget's Theory: Relevance for Educational practice in Golby, M. Greenwood, J. and West, R. (1975) *Curriculum Design*, Croom Helm: London.

King, R. (1978) *All Things Bright and Beautiful? A Sociological Study of Infants' Classrooms*, Chichester: Wisley.

Kimbell, R. (2001) Design and Technology in a Knowledge Economy, *The Journal of Design and Technology Education*, Vol. 6, No. 2 Summer 2001, 120-124.

Kimbell, R., Stables, K. and Green, R, (1996) *Understanding Practice in Design and Technology*, Buckingham: Open University Press.

Kimbell, R. (1982) *Design Education: The Foundation Years*, Routledge and Keegan Paul.

Layton, D. (1991) *Aspects of National Curriculum Design and Technology*, York: National Curriculum Council.

Layton, D. (1993) *Technology's Challenge to Science Education*, Buckingham: Open University Press.

Lave, J. and Wenger, E. (1991) *Situated Learning: legitimate peripheral participation*, Cambridge: Cambridge University Press.

McCormick. R. (1992) Procedural and Conceptual Knowledge, *International Journal of Technology and Design Education* 7, 141-159, 1997.

McNamara, D. (1994) *Classroom Pedagogy and Primary Practice*, London: Routledge.

Maykut, P. and Morehouse, R. (1994) *Beginning Qualitative Research*, London: The Falmer Press.

Medway, P. (1992) Constructions of Technology: Reflections of a New Subject in Benyon, J. and Mackay, H. (eds) (1992) *Technological Literacy and the National Curriculum*, London: Falmer Press.

Mujis, D. and Reynolds, D. (2001) *Effective Teaching: Evidence and Practice*, London: Paul Chapman Publishing.

Murphy, P. and Hennessy, S. (2001) Realising the Potential – and Lost Opportunities for Peer Collaboration in a Design and Technology Setting, *International Journal of Technology and Design Education*, 11, 203-237, 2001.

NCC (1992) *National Curriculum Technology: The Case for Revising the Order*, York: NCC.

Norman, E., Spendlove, D. Grover, P. and Mitchell, A. (eds) *Creativity and Innovation*, Paper Presented at the DATA International Research Conference 2004, Wellesbourne: Design and Technology Association.

Nuffield (2001) *Primary Solutions in Design and Technology*, London : Nuffield Curriculum Projects Centre.

Patton, M. (1987) *How to Use Qualitative Methods in Evaluation*, London: Sage.

Piaget, J. (1926) *The Language and Thought of the Child*, London: Routledge and Keegan Paul.

Qualifications and Curriculum Authority/ Department for Education and Science (2000) *Design and Technology: A Scheme of Work for Key Stages 1 and 2*, London: QCA.

Rowell, P. (2002) Interactions in Shared Technology Activity: A Study of Participation. *International Journal of Technology and Design Education*, 12, 1-22.

Schulman, L. S. (1987) *Knowledge and Teaching: Foundations of Reforms*, Harvard Educational Review, 57, 1-22.

Simon, B. (1981) 'Why no pedagogy in England?' in Simon, B. and Taylor, W. (Eds) *Education in the Eighties*, London, Batesford Academic and Educational Ltd.

Smith, H. W., (1975) *Strategies of Social Research: Methodological Imagination*, Prentice Hall, London.

Smithers, A. and Robinson, P. (1992) *Technology in the National Curriculum: Getting it Right*, London: the Engineering Council.

Stenhouse, L. (1975) *An Introduction to Curriculum Research and Development*, London: Heinemann.

Turnbull, W. (2002) The Place of Authenticity in Technology in the New Zealand Curriculum, *International Journal of Technology and Design Education*, 12, 23-40, 2002.

Vygotsky, L. (1962) *Language and Thought*, New York: Wiley.

Von Glazerfield. (1989) Learning as a Constructive Activity in Murphy, P and Moon, B. (1989) *Developments in Learning and Assessment*, London: Hodder and Stoughton.

Ward, H. (2002) *The Forgotten Joys of Making and Doing*, Times Educational Supplement, November 1st.

Watofsky, M. (1979) *Models, representation and scientific understanding*. Boston: Reidel.

Wells, G. (2002) *The Role of Dialogue in Activity Theory*, Mind, Culture, and Activity, 9 (1), 43-66.

Williams, P. (1985) *Teaching Craft Design and Technology – Five to Thirteen*, London: Routledge

Wragg, E., Bennett, N. and Carre, C. G. (1989) Primary Teachers and the National Curriculum, *Research Papers in Education*, Vol. 4, No. 3, 17-45.