Primary Design and Technology in the United Kingdom

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This paper describes some in-service work with teachers in Primary Design and Technology at the University of Greenwich, London and the context in which it developed. The project was initially devised to increase the capability and confidence of local primary school teachers to deliver the National Curriculum for Design and Technology, which many still regard with concern. The same project has also been used to give Dutch teachers some understanding of this part of our curriculum and one approach to it. I hope this account will go some way towards doing the same for you. One Dutch institution, Hogeschool Katholieke Leergangen (Tilburg) has been sending teachers to the University of Greenwich for four consecutive years for a week of Primary Design and Technology that includes visits to schools. We also work with teachers from Groningen in the Netherlands. Roald Dahl's story 'Charlie and the Chocolate Factory' has been the main stimulus for our work. Teachers were asked to design a new machine for Willy Wonka, the Chocolate Factory's mysterious and magical creator. First, some of the background from which the project developed.

A national curriculum was introduced to England and Wales for the first time in 1990. Technology became compulsory in primary (and secondary) schools for the first time. Before this only a relatively small number of primary teachers had experience or training in the subject. Our locality was probably typical in that the same small bands of enthusiasts were turning up each time training was offered. This meant that their unseen colleagues were getting little, or more likely no training at all. Many teachers felt able to ignore technology until the National Curriculum made it compulsory, and then there was considerable anxiety about it. Wragg, Bennett and Carre writing in the year before the National Curriculum was introduced, give the results of two national surveys which asked teachers how confident they felt about teaching the National Curriculum subjects.

> In both surveys less than 35% of teachers felt competent to teach science, music or technology without substantial in-service support. In the case of technology only 14 per cent perceived themselves competent. (1)

Lever, writing in 1990, the year the National Curriculum was introduced, also comments on the lack of confidence among teachers and perhaps identifies one of the reasons for this:

> Teachers confidence and grounding in Science/Technology at primary level is very low. Less than 50% of them have had any in-service training in Science/Technology over the last two years. (2)

Some of those who might be expected to know about technology were also unhappy with the National Curriculum, but for different reasons. In 1992,the Engineering Council's view was that:

> Technology in the National Curriculum is a mess.....
> It is not delimited so we do not know what counts as technology. Defined as problem solving alone, most activities become technology. (3)

Since then some steps have been taken in attempt to improve the above situation and many believe we now have a much slimmer, clearer and more workable curriculum. The requirements are fewer and allow teachers more discretion. Debate continues of course, but most teachers (and teacher trainers) are probably relieved that the revised National Curriculum was introduced with the intention that no more major changes would be made for five years (4). My experience of teachers on courses and feedback from students after teaching practice, suggests that a huge amount of training is still needed. I have met many reluctant and unconfident primary school coordinators for D&T. This is all the more regrettable when one realizes that these are the subject leaders in their schools and often responsible for training their colleagues. The UK based Design and Technology Association (DATA) survey in 1995, highlights this problem:

> Sixty-four per cent of schools reported that most training had been carried out internally, a matter of some concern, when the lack of specialist support in primary schools is taken into consideration
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> ....while there is a clearly stated need for increased training in D&T, made more urgent by the introduction of the new Orders and the development of new technology, the evidence shows that the level of training is falling.(5)

The government has recognized the need to fund more training, though some would say that this should have been done earlier and that too little is being provided, for

too few. This makes it all the more important that teachers are given the right sort of concentrated experience of Design and Technology when they do manage to get access to specialist tutors in higher education. The University of Greenwich is among the institutions running government funded courses in co-operation with local authorities. Such courses can be accredited towards formal university awards if participants opt for further study. Teachers need to be prepared to deliver the National Curriculum programme of study for the children they are teaching. At the start of all the programmes of study (two in primary school and two in secondary school) is the same important statement:

> Pupils should be taught to develop their design & technology capability through combining their Designing and Making skills with Knowledge and understanding in order to design and make products. (6)

The 'Charlie and the Chocolate Factory' project described in the rest of this paper began as an attempt to promote confidence through developing our teachers personal capability in a subject of which many felt they had little experience. Although the project was developed before recent Design and Technology Association research, their findings endorse emphasis on 'hands' on practical experience and personal capability.

> The key training need in primary schools is the development of practical skills in classroom teachers. Further investigation of this issue clearly shows that it is a matter of lack of confidence in many teachers coupled with insecurity of what is good practice in an area of the curriculum in which they have very little experience. (5)

The 'Charlie and the Chocolate Factory' project was specifically aimed at addressing the above, including designing among the 'practical skills'. Since opportunities for training are rare, it was important to offer a rounded package addressing resource issues, management and other concerns also. Much of this could be done in the context of the project. The Roald Dahlstory was a good context because it allowed lots confidence-building experience of designing and making with an element of fun. The story also allowed familiarity with a wide range of technology and ample scope for covering much of the National Curriculum for Design and Technology. Another reason for the choice was that 'Charlie and the Chocolate Factory' is perhaps Roald Dahl's best known work and already familiar to Dutch as well as English teachers. This meant that Dutch teachers came to London with a good understanding of the context and were familiar with at least one aspect of what they were to experience. Roald Dahl can be used to stimulate work in a number of subjects. Pritchard (7) describes work across the curriculum in his article 'A Week of Roald Dahl'. Issues of 'political

correctness', equal opportunity and fairness could also be discussed if one was so minded. Are the Oompah Loompahs treated fairly – should they setup on their own and form a workers' co-operative!? Teachers seem to like the story because all the naughty children in it come to sticky ends! We concentrated on the Design and Technology potential of the story where the range of possible outcomes was considerable. We discussed developing and evaluating sweet recipes, making, packaging and marketing the sweets; designing chocolate moulds, dummy display chocolate bars, point of sale display stands and uniforms for factory staff. Creating new sweets for the Chocolate Factory would have been in keeping with our National Curriculum as work with food is required at primary level. These discussions were intended to show the variety possible – we didn't have time to do it all. The outcome chosen in practice was a new machine for Willy Wonka's Chocolate Factory. While designing and making their machines, teachers could learn about some important aspects of technology, particularly structures, mechanisms and electrics. The project allowed them to gain the practical capability to use cams, reed switches, conveyor belts and construction methods and materials. Energy sources, control (including computer control) and electrical circuits could all be included too. All this and more in a form appropriate to the primary classroom.

Before the Tilburg teachers came to London I had talked to them in the Netherlands. In an attempt to explain the intricacies of our National Curriculum (it was the old more complex version when I first went), I used videos and slides of my work with children. I also explained our curriculum by describing a project that might be done in school. Children noticing that their hamster is not as active as he used to be, put forward various ideas to improve matters. One idea is an adventure playground to stimulate and exercise the pet. My own children had designed and made such a playground and I described their work in National Curriculum terms. To bring the story to life I used a specially designed hamster soft toy. This had a 9v battery, buzzer, reed switch and capacitor circuit inside which caused the 'hamster' to whine when stroked with a concealed magnet. This 'broke the ice' as intended and the teachers gained some idea that technology might be fun after all. The 'hamster' and familiar and the 'fun' context of the story all helped to alleviate any lurking 'technophobia'. When the teachers arrived in London they were given a further introduction to Design and Technology, which included video of children working and actual examples of practical work. Readings from the storyand excerpts from the video 'Willy Wonka and the Chocolate Factory' were used as stimulus. The 'Inventing Room' sequence showing Willy Wonka's existing machines was particularly useful. Gradually the very polite and slightly reserved group began relax a little.

The teachers were not necessarily intended to transfer the project directly to their own classrooms but rather to recognize techniques and an approach aspects of which could be incorporated into their existing way of working. Technology is yet to become compulsory in Dutch primary schools so using the subject as means of furthering language, number and other basic skills was given some thought. Here the teachers could make a real contribution, which in turn seemed to foster confidence.

Before starting practical work teachers were given talks and demonstrations (inputs) to equip them for the task ahead. Had more time been available, tasks with key techniques as their core would have been set as preparation for the more open ended project itself. Preparatory tasks set for initial teacher training students include using a particular construction method as a basis for a simple mechanical toy or designing something for use in the classroom based on a pressure pad switch. Time did not permit this so techniques has to be learned on the more ambitious and open ended 'Wonka' project itself. Construction methods and materials were tackled first since a secure framework facilitates the success of mechanisms and other working features which follow. A range of construction kits were shown. Kits are specifically mentioned in the National Curriculum programmes of study for Key Stage 1 (5–7 year olds) and Key Stage 2 (7–11year olds)). Construction kits played a useful part in this project allowing the supporting framework of some machines to be set up quickly. Some kits e.g. 'Mini-Quadro', lent themselves to structures more than mechanisms with others the reverse was true. Providing a variety of kits helped teachers to explore their relative merits. Combining kits with parts made from raw materials and salvaged parts gave greater flexibility than using kits alone and helped avoid dependence on them. Many opted for wood sticks joined with cardboard triangles method which they were taught. The triangles were photocopied onto colored card to save time otherwise spent marking them out – the teachers did not need to develop their measuring skills. This construction method is often known in the UK as Jinks' construction after its creator. Making the frameworks in this way allowed time for design ideas to develop while they were being built. Having a framework in front of them seemed to facilitate the teachers' designing by making the problem more tangible. Creating this tangible 'canvas' still allowed considerable freedom as to what the final picture would be and the framework could always be modified if necessary. Mechanisms were also demonstrated along with ways to make them in the classroom. Conveyor belts proved particularly popular ingredients. Belts made from textiles were very successful especially when joined by elastic to create the right tension. These were often run on wooden dowel rollers covered in 'sandpaper' to prevent the belt slipping. Electrics included a variety of classroom made switches and cheap

commercial ones. Our output devices were buzzers, bulbs, motors and light emitting diodes. The National Curriculum for Key Stage 2 requires that:

> Pupils should be given opportunities to work with a range of materialsand components including stiff and flexible sheet materials, materials thatare suitable for making frameworks, mouldable materials, textiles, food,electrical and mechanical components and construction kits. (5)

The inputs offered meant that this part of the UK National Curriculum could be covered easily in the course of making the project. This is true of many other aspects of the Design and Technology programmes of study though there is not space to demonstrate this in detail here. Some teachers used computer control to enhance their machine. In school this would allow the teacher to cover some of the National Curriculum for Information Technology. At Key Stage 2 (7–11 years) for example, children should be given the opportunity to create, test and store sequences of instructions to control events.

Teachers worked in groups of four. This proved to be about the right number – enough for good progress and mutual support but not so many that they got in each others way. The small groups certainly allowed aspects of the programmes of study such as 'make suggestions about how to proceed' (Key Stage 1) to be covered. Although not every teacher used every technique, the group as a whole covered a very wide range and these were seen by all. Willy Wonka style 'sweet making' machines appeared in many forms and hues. Some designs were reminiscent of Heath Robinson's fantastic contraptions. Initially reserved teachers stood on tables and knelt on the floor as they worked, often accompanying their efforts with snatches of the Oompah Loompah's song. A tremendous variety of unique and ingenious machines are produced each time one of these in-service weeks take place. One memorable design included the slightly macabre touch of having Charlie's grandparents (made in fabric) turning on a kind of rotisserie. There was a less than savory suggestion that their waste products were being recycled into chocolate! The grand finale was when each group 'performed' with their machine for the benefit of the others. Some groups wrote special songs to accompany their demonstrations, adding language and music to their Design and Technology work. It has to be said that malfunctioning machines provided far more entertainment than those which worked first time. The classroom problem of who takes group work home did not arise. Despite their enthusiasm, few of the teachers relished the prospect of trying to get their large, brightly colored and possibly fragile contraption to the Netherlands by coach, ferry and train. One group however did design their machine in modules so that it could be dismantled and packed for export. A video recordings and lots of photographs were taken home.

School visits allowed teachers to see Design and Technology in practice in the classroom. Schools were carefully selected as good practice in this subject is by no means to seen in all. The Dutch teachers also had an opportunity to sample life in an English school in general. Evening excursions to London, including a theatre pub and a show, helped group members to get to know each other and no doubt encouraged team spirit during practical sessions. To see inspiring and amusing automata teachers visited Cabaret Mechanical Theatre in London's Convent Garden. Some visited the Design Centre, the Bethnal Green Museum of Childhood and still managed to do some shopping. Welcome and farewell buffets at the University all contributed to a pleasant and positive atmosphere. The social and domestic arrangement are important as poor accommodation or an unhappy time outside the taught sessions could soon have affected attitudes within them. Happily, since the inception of this project this has never been the case. The University of Greenwich is fortunate in having excellent accommodation provided by vetted local families. As well as giving visitors experience of an English home, the hosts even collect course members from the campus late at night after they have visited shows in central London. Our easy access to the centre (twenty minutes or so by train) allows participants to combine a professional experience with a cultural one. The weeks have been judged a success and our sixth group of Dutch primary teachers will be coming to the University of Greenwich this year.

In this paper I have tried to give an account of the in-service needs of primary teachers in the area of Design and Technology which was made compulsory by the National Curriculum for England and Wales in 1990. I have also sought to give some idea of the requirements that teachers have to meet by law and modifications that have been made to them.

A considerable part of this paper has been devoted to describing a project delivered in the University of Greenwich's Design and Technology Centre in an attempt to improve local teachers confidence and capability. Of particular interest to non UK readers may be the account of how Dutch teachers have been following the same project when they came to London for a week of in-service training in Design and Technology. We welcome inquiries from others interested in bringing groups to London for similar work.

References

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