The Problem with Transition in Technology Education: A Scottish Perspective

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Abstract

This paper is based on an evaluation of a pilot project using Nuffield materials which was carried out in two Scottish secondary schools and their associated primary schools. The pilot was intended to address problems identified at the transition stage from primary to secondary in design and technology. Interviews conducted with staff in both sectors highlight important concerns regarding transition.

The paper describes the Scottish technology education system, with particular emphasis on its similarity to the English Key Stages 1, 2 and 3. A discussion of the evaluation of the pilot project is given and issues concerning transition are considered and discussed.

Whilst the Scottish technology curriculum differs in some important aspects from the English system, generic and pertinent issues exist which have relevance in relation to the transition process in many countries

RESEARCH

Technology Education in the 5-14 National Guidelines

1993 saw the introduction of a new technology curriculum in Scottish primary schools. The intention was to introduce "purposeful, practical activity involving design and creativity" (SCCC, 1993) across the age range from 5-14 (that is from the first year of primary school until the end of the second year of secondary or roughly the equivalent English Key Stages 1, 2 and 3)

At secondary level, technology education was already well established. As part of the new 5-14 Environmental Studies curriculum, however, the intention was to develop an overarching concept of technological capability, which would lead to an "understanding [of] appropriate concepts and processes; the ability to apply knowledge and skills by thinking and acting confidently, imaginatively, creatively and with sensitivity; the ability to evaluate technological activities, artifacts and systems critically and constructively" (SCCC, 1996, p7).

Pupils in the first two years of secondary schools (S1 and S2) are required to follow common courses within Technical departments in line with the 5-14 National Curriculum guidelines. These courses are designed to provide pupils with opportunities to understand and implement the design process and to develop creativity, craft and graphic skills, in addition to developing confidence using machinery and equipment. Other areas considered important are an understanding of the role of technology and its impact on society and the ability to use technology to solve problems to meet human needs. The guidelines also recommend that pupils develop informed attitudes and a capacity to understand and question the social and ethical implications of technological change. Post 14, there is provision for choice. Technical departments generally offer either two or three courses at Standard Grade (equivalent of GCSE at Key Stage 4) selected from: Craft and Design, Graphic Communication and Technological Studies. Most Scottish secondary schools also teach Home Economics. The two areas, however, form quite separate departments in Scottish secondary schools (Dakers and Doherty, 2003)

The problems with transition

The problem of achieving curricular continuity for pupils in the transition from the primary to secondary sector is one which has exercised the minds of both educationalists and policy makers for many years. Although as early as 1931, the Hadow Report on Primary Education clearly highlighted the importance of continuity within the education system, the emphasis of subsequent reports on the same theme (Plowden, 1967, Bullock, 1975) and the existence of a body of literature emphasising the problems of transition are indicative of how difficult this continuity is to achieve in reality.

One factor identified as militating against curricular continuity was the openness of courses to a wide and varied interpretation (HMI, 1997b). The implementation of the National Curriculum in England and the 5-14 Curriculum Guidelines in Scotland, with their emphasis on "progression, coherence and continuity" seemed set to address, in theory at least, some of the traditional problems associated with transition. In practice, however, the problems appear to remain.

Several factors affecting the success of transition from primary to secondary school in relation to curricular continuity have traditionally been identified. These include:

- the existence of effective liaison procedures;
- a knowledge and understanding on the part of both sectors about the respective courses taught, programmes of work and teaching methods adopted;
- a willingness on the part of secondary teachers to value the work done in primary schools and to trust the primary teachers' judgements in terms of assessment, along with a willingness to use the information to provide a starting point appropriate for each individual pupil (Nicholls and Gardner, 1999).

Secondary teachers must also have commitment to a curriculum which builds upon the knowledge, understanding and skills appropriate to their subject which pupils have already acquired.

Whilst these factors are clearly important in all areas of the curriculum, it is perhaps in the area of the Scottish technical curriculum that the least progress in affecting a successful transition has been made.

In terms of continuity, coherence and progression, the report *Achieving Success* (HMIa, 1997) which reviewed the provision in S1 and S2 in Scottish secondary schools identified a particular problem with those areas which were regarded as presenting particular challenges in relation to course design. In the area of technical education in particular, the ways in which the course had developed in secondary schools since its introduction in 1965 had resulted in difficulties in establishing continuity between the primary and secondary sectors. This was an issue which clearly needed to be addressed.

At secondary level, there were further problems. The third *Standards and Quality in Scottish Schools Report* (HMIb, 1997) identified important weaknesses and unsatisfactory attainment levels in Technology in over 65% of Scottish secondary schools. Clearly, despite the introduction of curricular guidelines, the problems associated with curricular discontinuity between the sectors remained an issue.

In an attempt to address the issue of continuity and thereby address unsatisfactory standards in secondary schools, Glasgow City Council made the decision to pilot and evaluate a scheme which utilised *Design and Technology Materials* produced by the Nuffield Foundation. These materials had been specifically designed to cover the stages from the final year of primary school (P7) to the second year of secondary (S2) and were therefore ideally suited to address the identified problems with transition. The focus on common themes and pedagogies and the provision of opportunities for collaboration across sectors seemed particularly designed to provide the coherence, continuity and progression central to the principles of 5-14.

Two secondary schools and their associate primary schools were involved in the pilot which was conducted over a two year period from 1998 to 2000. Four secondary and sixteen primary teachers participated. The pilot was evaluated by means of questionnaires and in-depth interviews.

Four main issues emerging from this evaluation have particular implications for the smooth transition from primary to secondary in respect of technology education.

One issue concerns the confidence of primary teachers in dealing with technology in the primary classroom. A second concerns the confidence shown by secondary teachers in the ability of their primary colleagues to teach the subject in a way which will allow continuity in the secondary sector. The third concerns the opportunities for and the effectiveness of liaison existing between the two sectors necessary to address these concerns and the fourth concerns assessment.

Confidence of Primary Teachers

A necessary element of curricular continuity is for teachers in both the primary and secondary sectors to have confidence in their own ability to deal with the content and process of course delivery.

Research carried out to determine the confidence levels of primary teachers in the delivery of science (Harlen, 1996, Stables, 1997) had already demonstrated problems in this area by identifying a high number of primary teachers who had no background in science (65%). An investigation of confidence levels of both Science and Technology (Harlen

and Holroyd, 1996) had concluded, moreover that, in general, primary teachers had a low level of confidence in teaching these areas

The present research, which employed an adapted form of the instrument developed by Harlen and Holroyd (1996), demonstrated a similar situation in relation to Technology. Out of the 16 primary teachers involved in the project, none had any background in technology and there were similar low levels of confidence expressed in relation to the 5-14 Technology curriculum (Dakers, 2001).

Primary Teachers' General Perceptions of Technological Education

Another important element in achieving curricular continuity is a knowledge of course content which transcends the primary - secondary divide. The greater the degree of knowledge of primary teachers of secondary courses (and vice versa) the greater the degree of coherence, continuity and progression that can be achieved. The primary teachers in the present study, however, were in general, not conversant with the secondary Technology curriculum. When asked to stipulate the subjects taught in the secondary curriculum, most demonstrated knowledge which appeared to be based principally on the pre-1987 technical curriculum. Thus, Woodwork, Metalwork and Technical Drawing were mentioned in eleven instances. A further seven confused Technology with either Computing Studies or Art and Design. Although nine teachers were aware of Home Economics as a subject in the secondary curriculum, only two were aware of Craft and Design and one had an awareness of Technological Studies. As this question was presented in the second year of the pilot, this would appear to demonstrate a distinct lack of primary - secondary liaison or communication.

There was also evidence that primary teachers find it difficult to differentiate between the curricular areas of science and technology. When asked to differentiate between the two, a variety of answers was given in line with general misconceptions of the differences existing between these two areas.

The importance of the implications of this misconception for technology education is clearly illustrated by Frey who states:

> This misconception about the nature of science and technology and about the relationship between them can be misleading at best and fatal at worst for technology education. As educators advocate, promote, and implement technology education in schools, they may find that the new curriculum is equated with science or competes with science programmes. In either case the distinctive character of technology is misunderstood (Frey, 1991, p1).

Most teachers indicated that Technology involved a more hands on approach (active learning) whilst Science was generally regarded as more theoretical. Technology was thought to involve a more problem solving approach with greater emphasis on design. Technology was also seen to involve applications appertaining to society:

> Technology is how things work.

> Technology is finding out things, Science is things that are there.

This lack of clear delineation of the differences was further evident when teachers were asked what they considered the main aim of technological education to be. There was once again no clear focus or consensus. Nine mentioned practical skills, five mentioned design or creativity, five mentioned understanding of the world around us and there was one mention each of problem solving, working together and building confidence.

Prior technological experience

As knowledge of a subject may be acquired through prior experience in its delivery, enquiries were made about the areas within the 5-14 Environmental Studies National Guidelines, which comprise Social subjects, Science subjects and Technology subjects. Teachers were asked which of these subjects had been taught prior to involvement in the pilot. Eleven indicated that they had been involved in teaching all areas. That is, they had taught Technology as well as social subjects and Science. Among those who purported to teach all areas, however, there was a general feeling that the technology component had been tackled less thoroughly and with less success than other areas.

Comments included:

> I personally felt that technology was an aspect that you made a half hearted attempt at doing and I felt personally that I needed real guidance with it.

> Technology was very much the poor cousin.

Clearly, although almost all primary schools purported to teach Technology prior to the pilot, there was, and still is, evidence to suggest that most of the teachers are unclear about the precise nature of technological education. This was further crystallised in the fact that there was a general consensus that the guidelines issued to support the implementation of the subject were very difficult to follow. Whilst there was a general view that the other areas of Environmental Studies, such as social subjects, were easy to implement, Technology was considered difficult because of a lack of experience, training and appropriate accommodation and resources.

Liaison

Clearly, one way of addressing some of the problems encountered by primary teachers in the teaching of Technology could be addressed through greater opportunities to liaise with subject experts in the secondary school. This was an important area which the pilot study attempted to address.

Only three teachers indicated, however, that any liaison with other schools had in fact occurred and this appears to have been on an entirely unplanned and informal basis. Whilst lack of opportunity and lack of time for liaison were identified as the major issues, all teachers involved felt that the opportunity for liaison would have been a valuable. Several indicated that they had in fact felt very isolated during the course of the project which had added to the difficulties experienced:

> I was an island here. I had to get on with it because I didn't know the links. I didn't know what schools were involved. I didn't know which other teachers were involved.

Secondary Teachers' Perceptions

Technological Aims and Content

A similar lack of knowledge of course content and processes across the primary - secondary divide was evident in the secondary teachers interviewed. None had been aware of the technology subjects taught in the primary curriculum prior to involvement in the Nuffield project. Lack of time for liaison was identified as a contributory factor, although this was an area that it was felt was now being addressed. In one instance the reason given for a lack of liaison was a recent merger between secondary schools which had resulted in an increase in the number of associated primaries. Although traditionally, secondary schools in Scotland have had a maximum of five or six associated primaries, over the years a combination of the effects of school closures and the introduction of placing requests has resulted in this number rising significantly, with the result that it is no longer unusual for the number of primary schools who send at least some pupils to one secondary may be in the high teens or even twenties. This presents an obvious barrier to effective liaison both within and across sectors.

A shared awareness of the content and processes of curricular areas is an important aspect of continuity and coherence across sectors. In the case of responses to the distinctions existing between Science and Technology, similar views to those given by primary teachers were expressed. Thus Technology was variously regarded by secondary teachers as being involved with problem solving, real life situations, practical skills and activities and design processes, whereas Science was regarded as more theoretical or concerned with the application of technology:

> Technology is all encompassing - how things work in a sense, to make your life better. Science is the more specific application of technology.

There was similarly no clear consensus on perceptions of the main aim of technological education. Some teachers identified problem solving, whilst others regarded the acquisition of life skills, or the fostering of awareness of the influence of technology on everyday life as the main aim:

> I wouldn't go any further than problem solving. That's what I think it's all to do with.

> To be aware of the effects of technology and the influence it has on your life would be a first one.

In this respect, however, although there were clearly shared perceptions, this lack of clarity of purpose evident in both sectors may yet have significant implications for the identity of the subject in both primary and secondary schools.

5-14 Technological Delivery

If curricular continuity and progression between sectors is to be fully achieved then it is important that schools in both sectors take on board the principles set out in the 5-14 Guidelines. Prior to the pilot scheme, neither Technical department had incorporated the Technology component of 5-14 into their S1 or S2 curriculum. Both Home Economics departments had, however, incorporated at least some aspects. All departments, however, had the implementation of the 5-14 Guidelines as part of their existing school development plans. Thus the plan for the future was to ensure that the type of continuity provided by the guidelines would be addressed.

As with the majority of primary teachers, however, all the secondary teachers interviewed found the 5-14 Environmental Studies document difficult to understand. It was generally perceived as cumbersome, incorporating too many diverse and unrelated areas, and deficient in examples relating to specific subjects. One comment succinctly summed up the general view:

> The worst educational document ever published.

This document has since been rewritten in a new format, although there is evidence to indicate that teachers still find difficulty with its implementation. An important element in achieving continuity and coherence across sectors therefore may be the development of the type of guidelines which are clearly perceived as accessible to all. Without this type of support there is an increased likelihood of courses being developed in a personalised and ad hoc way which will clearly militate against any kind of cohesion within the system.

Opportunities for Liaison

While lack of time had prevented one department from offering support to the associated primaries during the course of the project, the remaining departments all indicated that they had been involved in offering advice or support in some form. This support had, in the main, been given during the training days with primary teachers being given the opportunity to try out equipment, although one secondary school had also given help with the construction of a puppet theatre which formed part of one of the Nuffield projects.

The perceptions of the secondary teachers of both the quantity and quality of liaison opportunities was slightly different from that of primary teachers who claimed to feel quite isolated during the project. This difference in perception is important in that it may reflect not only the lack of confidence which primary teachers feel in the teaching of Technology but also the mismatch between the type of liaison considered important by primary teachers and the type of support given by secondary schools. It is possible that, by regarding themselves as "subject experts," secondary teachers diminish the confidence of primary teachers, or in some way misunderstand the type of liaison which primary teachers would find most useful. It may be that in order to provide a better transition for pupils, more open dialogue about the type of liaison considered valuable by both sectors is required, along with a recognition that teachers from each sector have an equally important role to play in the delivery of the 5-14 curriculum. Each side has much of value to learn from the other in terms of supporting pupils across the transition. The types of structures which facilitate meaningful dialogue are therefore of crucial importance in achieving this.

Information from Primaries

Another important aspect of transition lies in the quality of information about pupils passed from one sector to another and the use to which this information is subsequently put. Only by the provision of quality information from primary to secondary teachers about the previous knowledge acquired and level of understanding reached by pupils at the stage of transition, and by the thoughtful use of this information to determine starting points for individual pupils, can the principles of continuity and progression, so central to 5-14,

be achieved. In this case although information covered literacy and numeracy levels only, most of the secondary teachers appeared to be satisfied with this. The consensus was, in fact, that a "fresh start" approach was preferable to ensure that pupils had the grounding in the basic skills.

This desire for a fresh start approach is partly an issue of trust. There was an evident lack of trust on the part of secondary teachers that pupils would make the transition with the knowledge and skills considered necessary to ensure progress in the subject area. There was a general expression of concern that primary teachers lacked both the resources and the expertise necessary for an understanding of the Technology taught in secondary schools. The appropriate training of primary teachers was identified as a crucial issue in this respect:

> We are asking people who are not trained to teach certain things. It doesn't work.

The kind of skills which secondary teachers felt important for pupils to have at transfer were, in fact, simply the basics of weighing and measuring and practice in such activities as handling scissors and threading needles.

Concern was also expressed that primary teachers were not necessarily using the same terminology as secondary teachers or that certain concepts were being taught in a different way resulting in confusion for pupils. As one teacher pointed out:

> Nutrition is such a difficult concept that there are many different ways of delivering it - from pyramids to plates to food groups. It makes it very difficult if they've learned to group foods in a certain way.

In this respect it was felt that more opportunities for liaison between primary and secondary teachers would be of benefit, although secondary teachers still clearly felt that many areas of the subject should be left to the secondary specialists.

> I found that a lot of primary teachers were feeling under pressure to teach nutrition where they didn't feel confident and didn't have the knowledge. ...(We would prefer if they)...just stick to the very basic guidelines so they have a background knowledge rather than get the facts wrong.

There is an important issue here about how jealously secondary teachers guard their subject specialism and how strong is the subsequent potential disadvantage for pupils.

The issue of building the confidence of teachers from both sectors in the ability of primary teachers to deliver these areas of the curriculum is clearly of crucial importance in this respect.

Discussion

Technological Identity

In order to achieve the type of liaison identified as important for a smoother curricular transition in the area of technological education, a number of important issues require to be addressed. One is the issue of developing a precise identity for Technology education which can be recognised by both sectors. At present a precise identity appears to be elusive. Prior to the pilot the vast majority of primary teachers had had no experience of technology whatsoever, either in their initial teacher education or subsequent CPD.

Because of this, primary teachers tended to have an outdated notion of the secondary Technology curriculum, perhaps based mainly on their own experience as pupils. This is not altogether surprising. Technology education has changed considerably over the years, from its traditional craft-based, non-academic, prescriptive, gender specific origins. The idea that the design and creativity paradigm, incorporating at its centre, technological capability, now forms the cornerstone of technological education is not evident to them There is clearly an important area for liaison in rectifying this. The current perceptions held may go some way towards explaining the apparent fears, or at least anxieties, that many teachers express towards this area of the curriculum.

Significantly a precise identity for Technology education was not clearly apparent in the secondary sector either. A very strong emphasis was placed on Technology subjects being of a more practical orientation, with technological capability being a secondary factor. This emphasis may be related to the presentation of Standard Grade subjects which

are more orientated towards knowledge and understanding and the development of skills, rather than emphasising technological capability through design and creativity.

Indeed the whole examination structure may mitigate, to a large extent, against the development of these important areas. Secondary teachers relate design and creativity more to the delivery of Craft and Design and Home Economics, and less so to Technological Studies and Graphic Communication. Although the design process is an assessable part of Standard Grade Craft and Design, assessment does not allow for the measurement of creativity, and the design process is delivered in the form of a taxonomy rather than an iterative process. That this is a common problem within the area and not confined to Scotland can be demonstrated by Atkinson (1995) who found that teachers "encouraged their pupils to go back over their design folders at the end of the project, to rework or pretty up existing work and fill in gaps in their design process....in an attempt to present the required evidence for assessment" (p 45). The need to consider more closely the role of assessment in encouraging this approach is further emphasised by Kimbell (1997): "There are no marks for innovation and creativity - especially when you do not demonstrate (step by step) where the ideas came from" (p 21).

Clearly consultation at all levels about what technology education is, what exactly should be assessed and how it should be assessed are important areas. Along with this there is a clear need for primary and secondary teachers to work closely together in the area of assessment to ensure that there is trust from both sides regarding the reliability of assessment procedures and the use to which assessment is put in determining continuity and progression in learning for individual pupils.

If the 5-14 technology curriculum, incorporating the philosophy of the *Framework for Technology Education in Scottish Schools*, is to be delivered effectively, and thus achieve a major aim for technical education (HMI, 1999), then it seems increasingly necessary that primary teachers be provided with courses which will develop their knowledge of the pedagogical issues relating to technological capability, before they necessarily receive development in the practical issues involved. An insight into the aims and objectives, or philosophy of technology education and its delivery, is suggested as a requirement, preceding technological subject knowledge and methodology. Teachers in both primary and secondary, moreover need to be given guidance to understand the link between the context of activities, the resources and the resulting design opportunities in the big tasks being carried out in this curricular area.

It is recognised that, for an Education Authority to instigate a programme of primary teacher development in this sense, is a formidable task. However, this research clearly establishes that primary teachers require a broader pedagogical range and understanding in technology education before they can be expected to deliver the subject in a way which offers technological clarity, and a clearly defined continuity towards the secondary stages for the pupils involved.

Following this, education in practical issues is seen as vital, particularly in the safe use of tools and machinery, health and safety and a broader understanding of the various materials used across the wide range of the Technology curriculum. By these means, the confidence of secondary teachers in the ability of primary teachers to deliver the subject will be raised and a more equal partnership established. In turn, a better experience in terms of progression and continuity for pupils may be assured

This is, however, unlikely to be fully achieved without some form of coherent, central administration. The type of help that primary teachers seek includes:

> in service courses, print based resources, time to think and prepare, more and improved equipment, a school policy on what to teach and when, advice from specialists, and improvement in support and co-ordination within the school (Harlen and Holroyd, 1996).

The first item identified by Harlen and Holroyd, that of in-service provision, in particular needs careful thought. The nature of the subject requires a hands-on approach as well as a theoretical base. By addressing this, the confidence levels of both sectors in the delivery of technology education may be raised.

The compartmentalisation into discrete subject areas in the secondary curriculum appears to be an important factor in preventing the implementation of a unified Design and Technology course within 5-14. Whilst the Nuffield materials used in the project did make provision for subject specific areas, secondary teachers expressed concerns about pupils being able to recognise the discrete components within the Scottish secondary curriculum. Secondary teachers perceived difficulties for pupils at the stage of making subject choices at the end of S2. A clear distinction between the areas of Craft and Design, Technological Studies, Graphic Communication and Home Economics was not regarded as apparent. The secondary schools were, as a result, extremely reluctant to deliver the Nuffield materials in a unified way. There was instead a tendency to "cherry pick" discrete areas and "teach towards the Standard Grades from S1"

This is understandable to an extent. The Nuffield materials were designed to offer continuity and progression across the Key Stages. Whilst the 5-14 Guidelines are holistic and designed to offer continuity and progression within the 5-14 age range, they do not articulate with the post 14 Technology arrangements which cover four discrete Standard Grade subjects, are very subject specific and are not perceived to have any clear common thread with the 5-14 Guidelines.

This can explain the desire of secondary teachers to implement a fresh start approach at S1, as they appear to have the prospect of discrete Standard Grades constantly at the forefront of their minds. This, however, is not an issue which closer liaison between the primary and secondary sectors can be expected to address. It is rather an area that requires to be addressed at policy level.

Progression and continuity at the point of transition are essential for the fullest development of interest and attainment of pupils in all areas of the curriculum. Whilst the rationale behind the 5-14 National Guidelines for Scotland recognises this as an issue of great importance, this research has demonstrated that problems remain, particularly in relation to the Technology curriculum

The Scottish curriculum is currently undergoing what may well turn out to be the most radical review in its history. The main focus of attention is the curriculum in S1 and S2, with particular emphasis on the transition from primary to secondary. In light of this, it is perhaps essential to the future survival of technology education that urgent measures are taken to address the kind of issues raised in this paper. The development of a clear identity and rationale for technological education which transcends the primary-secondary divide and in which structures are provided which will enable teachers from both sectors to work together in an atmosphere of mutual support, respect and trust are more than ever essential.

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