Student teachers’ perceptions of technical subjects

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Abstract
This paper explores the extent to which a cohort of student teachers studying for a one-year Post Graduate Certificate of Education in a Scottish university hold stereotypical views about subjects in the curriculum of Scottish secondary schools and of the pupils who select these subjects for study. In particular, a comparison between physics and technological studies is made. Technological studies, which is a relatively new area in the Scottish curriculum, was introduced in an attempt to provide a course with a high degree of academic content and was perceived to be of particular relevance to pupils intent on pursuing a career in engineering. Despite these intentions, uptake of the course in schools in the west of Scotland has shown a steady decline. It is suggested that the persistence of traditional stereotypes regarding the non-academic, skills-based nature of subjects in the technical curriculum may be a factor contributing to the demise of technological studies. The results from this small sample suggest that stereotypical views do exist, at least for the particular group of student teachers surveyed. These findings are discussed within the context of factors which have been found to influence pupil choice of subjects in secondary schools.

Keywords
choice, curriculum, stereotypes

Introduction
An extensive range of literature dealing with the topic of pupils’ choice of subjects in secondary schools exists. Factors affecting choice of subjects in all areas of the curriculum have been explored from the perspective of pupils (Hendley, Stables and Stables, 1996; Adey and Biddulph, 2001) and attention has been given to the influence of parents, guidance specialists and subject teachers in the process. (Reid, Barnett and Rosenberg, 1974; Nash, Allsop and Woolnough, 1984) Issues of gender, (Lightbody and Drundell, 1996; Roger and Duffield, 2000) ability, (Bell, 2001) and social class (Woods, 1984) have been explored in relation both to the way specific subjects are chosen and the means by which certain pupils are steered towards subjects considered suitable by the school. Although recent research into pupil perception appears to demonstrate that interest in and enjoyment of a subject, along with future career options, are the main criteria used in the selection of subjects, (Wikely and Stables, 1999) there is evidence to suggest that subtle influences may be present which can be an important determinant of choice. This was noted with particular reference to Scotland where subject options are made at the end of second year:

‘...the fact that the procedures carried out at the end of second year are referred to as ‘subject choice’ places the emphasis on choice rather than allocation to levels or streams and individual subjects rather than broad courses. Thus it is not immediately obvious that the procedures in question do involve a greater or lesser sorting of pupils.’

(Ryrie, Furst and Lauder, 1979: 3)

Perceptions of the status of certain subjects and ideas concerning ability may be transmitted by schools to pupils with the result that the notion of free choice which pupils appear to experience may, in fact, be an illusion. (Woods, 1984)

One of the less obvious factors affecting free choice may be stereotypical views of subject status which will in turn affect perceptions of the type of pupil who will traditionally select a subject. These stereotypes may influence parents, teachers and pupils in the process of choice.

This paper seeks to explore the extent to which stereotypical views exist within a group of student teachers completing a one-year Post Graduate Certificate of Education.
Certificate in Education and the implications of this for subject choices made by pupils within the Scottish secondary curriculum. In particular, a comparison between physics and the newer subject of technological studies is made.

**The Scottish system**

Pupils in Scotland transfer to secondary school after seven years in the primary sector. The curriculum at primary school and during the first two years of secondary is heavily influenced by the 5-14 Guidelines, which equate to the English Key Stages 1-3, and are designed to provide an education which has ‘breadth, balance, progression, continuity and coherence.’ (SOED, 1993: 6)

During the final term of second year, which is the equivalent of Year 9 in England, pupils make their choice of subjects to study for presentation at Standard Grade in S4, which is the equivalent of the English Key Stage 4. Awards are made at three levels. All pupils are presented at General Level. The more able are also presented at Credit level and the less able at Foundation level. Traditionally, pupils select eight subjects to study at Standard Grade. They may then progress to Higher Grade, with the new Higher Still examinations offering awards at different levels in a range of subjects.

At Standard Grade all pupils must normally study English, mathematics, a modern foreign language, a social subject (normally history, geography or modern studies) and at least one science subject selected from the discrete areas of physics, chemistry and biology, or a general integrated science course. Pupils studying the three discrete sciences are presented at Credit and General level only. Other subjects are arranged in groups or columns in order to encourage continued breadth and balance in the curriculum.

Technical subjects are provided as three distinct areas and comprise craft and design, graphic communication and technological studies. The absence of core and foundation subjects means, however, that it is possible for pupils to drop all three technical subjects at the end of their second year. Home economics, which is provided by a separate subject department in Scotland, can also be discontinued. The degree of autonomy afforded to schools, moreover, means that it is not necessary to offer the full range of available subjects. Throughout the period since its introduction, for example, technological studies has seen a year on year reduction in uptake. This has contributed to its demise in a number of secondary schools with the result that in the session 2000-2001, technological studies was an option on the curriculum at only eight of Glasgow District Council’s 29 secondary schools.

This represents a 50% drop over three years (Dakers, 2000: 42-46). Thus despite the contention of the Scottish Executive that ‘Pupils will be better equipped to live purposefully, productively, confidently and wisely in the world of today and tomorrow if they have been enabled to acquire and deploy a broadly based technological capability.’ (SCCC, 1999: 52) one of the subjects best equipped to offer this is in danger of disappearing from the Scottish curriculum.

Whilst it is evident that a complex combination of factors will affect pupil choice, it appears that in Scotland the traditional perception of technical subjects in general, along with perceptions of the type of pupil who studies technical subjects may be an important influence. It has been suggested not only that teachers may exert a subtle influence on the perceptions pupils hold of their own ability levels (Ryrie, Furst and Lauder, 1979), there is some evidence to suggest that unconscious stereotyping can exert a subtle yet important influence on self concept and subsequent ability (Kunda, 1999). These factors may have important implications for the uptake of technological studies.

**Methodology**

Questionnaires were issued to all students following the Post Graduate Certificate in Secondary Education at one Higher Education Institute in Scotland. The questionnaires were designed to gather information about subjects that the respondents themselves had chosen to study for Standard Grade (or equivalent) and their perceptions of a range of subjects, with particular emphasis on subjects included in the technical curriculum along with subjects which are traditionally perceived as rivals to the technical subjects in terms of student uptake, namely physics, art and design and computing studies. Particular emphasis was given to a comparison of physics and technological studies in terms of student uptake, namely physics, art and design and computing studies. Particular emphasis was given to a comparison of physics and technological studies in terms of knowledge or content of the respective subjects and stereotyped perceptions of students who might study these. 103 usable questionnaires were returned representing the views of 71 females and 32 males.

**Analysis of questionnaires**

Each student was studying one specialist curricular area. The specialisms being studied varied but covered the main areas of the Scottish secondary curriculum, namely English, mathematics, the sciences, social subjects, modern languages and business studies. The number of years since the respondents had last attended school also varied. Although all had completed a university degree in their main teaching subject, some had progressed from school to university to teacher education without a gap, whilst others had spent time in other careers. 61% of the sample, however, had attended school within the last 10 years.
Respondents were asked to rate subjects in terms of their perceived academic level using a five point Likert scale ranging from very academic to very low academic content. Whilst the range of subjects generally available for selection was included, for the purposes of the present paper, the area of interest is technological studies (which includes electronics, pneumatics, structures, mechanisms, and computer control) along with physics, which has been found in one study to be its main competitor in terms of curricular choice (Canavan and Doughty, 1998).

With physics, 66 students placed the subject in the most academic category, with a further 29 placing it at point 2 on the Likert scale. Thus 92% of the respondents rated physics as either academic or very academic. In contrast, only nine rated technological studies as very academic with a further 22 rating it as academic. Thus only 30% of the sample placed technological studies in the academic or very academic categories. Twenty-six percent also placed technological studies in the least academic categories whilst no one placed physics in these categories.

Respondents were also asked to list the subjects that they themselves had studied at Standard Grade, or equivalent. Again, whereas the main teaching subject of only three of the sample was physics, 45% had studied physics at school. In contrast, only two students who had been at school within the last 10 years had elected to study technological studies, with a further five from the group who had been out of school between 16 and 20 years having studied either technical or engineering drawing. A similarly low uptake was demonstrated for the other technical subjects, with only one respondent having elected to study graphic communication, and three having studied craft and design.

In terms of perception of subject content, whilst there was generally a firm grasp of what was involved in physics, there was a distinct lack of knowledge about what the technological studies curriculum involves. Significantly, 41% of the sample stated that they did not know what was involved in this area. Whilst it is to be expected that those who had been out of school for more than ten years would have little, if any, knowledge of this area, this lack of awareness was not confined solely to that particular group. Eighteen of those who had been at school within the last 10 years claimed to have no knowledge of the subject area. Furthermore there was evidence that those who professed knowledge of the subject did not have an altogether clear idea of course content, with common perceptions being that it comprised technical or architectural drawing, woodworking, metalwork, making tools or welding. Whilst 21 of the sample mentioned the use of computers, there was no mention of computer programming. Thus a common misconception appeared to emerge in which technological studies was linked to the traditional skills based, vocationally orientated technical curriculum.

Stereotypes
In order to determine whether stereotypical notions of the type of pupil attracted to particular subjects exist, respondents were asked to describe a pupil who might be chosen to play the part in a television drama and who might be typical of an average pupil found in physics and in technological studies. This question was designed to encourage as full a description as possible without influencing the type of detail selected.

First defined as ‘pictures in our heads’ (Lippmann, 1922), stereotypes can be viewed as cognitive structures that contain our knowledge and beliefs about a group. Although of particular relevance in issues of ethnicity, gender and social class, stereotypes can be applied to any group or subgroup with perceived shared characteristics and, when applied, can exert a subtle and often unconscious influence on behaviour. Whilst stereotypes can be regarded as being culturally induced, or arising from the deep rooted need to belong to a particular group or to feel superior to another group, they can also simply be regarded as a feature of ordinary cognitive processes of categorisation which help in making sense of a complex world. In this sense they are not necessarily negative. (Kunda, 1999) Whilst individuals may differ in the extent to which they make use of stereotypes, there is some evidence that stereotypes may be activated automatically without awareness or intention (Blair and Banaji, 1996), and that people who do not subscribe to a particular stereotype and indeed consciously find it unacceptable or even offensive, may nevertheless use that stereotype automatically (Devine, 1989). Once activated, stereotypes can have an effect on judgement and behaviour which in turn can influence the reaction of stereotyped individuals, thus encouraging them to behave in a way which appears to verify the stereotype. This has been found to lead to lowered performance in stereotyped groups and may have serious ramifications for schools:

‘The challenge is to create school environments that minimise stereotype threat and enable individuals to rise to their full potential.’

(Kunda, 1999: 378)
Twenty of the respondents in the present study expressed a concern with the idea of stereotyping and declined to complete this part of the questionnaire. However, the very awareness of the existence of stereotypes for different groups of pupils may, in itself, be significant in terms of the research discussed above.

Of the 81% who provided details of their view of typical pupils, a distinct pattern of differences between the two groups of pupils emerged.

One common factor in terms of the stereotypes which emerged was gender. Roger and Duffield (2000) argue that gender continues to be an issue in the uptake of physics and technology in Scottish schools. This is despite various initiatives designed to encourage girls into the area, including an increase in the recruitment of female teachers. The present study appears to confirm, at least to some extent, the stereotypical view of both physics and technological studies as male-dominated subject areas with 47% of those who completed this section of the questionnaire stating that a pupil taking physics was likely to be male and 48% giving this stereotype for pupils in technological studies. Although this clearly does not represent a majority of the total sample, the fact that the responses were made to an open question suggests that it was an issue for a significant proportion of the group. This perception, moreover, was evenly spread across the different age groups. Although, those in the older age group stated that technical subjects had not been an option for girls during their time in school, the perception of these subjects as male-dominated was by no means confined to this group. One of the youngest respondents, for example, noted that she had been the only female in her physics class.

Another important factor that emerged in terms of stereotypical views relates to the vocational – academic divide. Traditionally, technical subjects have been regarded as less academically and more vocationally oriented and this appears to have had an important effect on perceptions of technological studies in particular.

The stereotype of the physics pupil which emerged was of a highly academic, studious and introverted male who would also be likely to study mathematics and who would progress to university after leaving school. Typical terms used were ‘highly academic,’ ‘brainy’ and ‘high achiever’ Typical profiles were:

‘Brainy, middle class, introvert male. Good at maths. Plays chess.’

‘Very quiet, not much personality. Not very social with peers or others. Very serious. Not many outside interests.’

‘Very academic, studious, from a middle/upper class background. Predominantly males. Likely to go to further education institute like university. Interests might be technology/computing. Likely to work in research or science lab.’

The profile for a typical pupil of technological studies, on the other hand, had less emphasis on high academic ability and much greater emphasis on practical ability. Whereas 29 respondents suggested that a pupil studying physics would proceed to Higher Education, only two mentioned this in relation to pupils of technological studies. For these pupils the future was perceived in terms of a career in industry or in trades such as electrician or plumber. The profile which emerged was that of an average to low ability, practical ‘computer buff’, with some typical responses being:

‘Not very bright, working class male. Poor communicator. Hobby football. Profession, joiner or plumber.’

‘Not very academic male. Job prospects engineer.’

‘Male, looking towards a less academic future. Perhaps more manual than intellectual.’

‘Creative, good at planning, bit of a computer whizzkid. Likes making things.’

Conclusions
These limited findings suggest that stereotypes for pupils studying different subjects do exist, at least in this particular sample of future teachers. These stereotypes appear to conform to the traditional academic-vocational divide between the more theoretical and therefore more academically perceived science subjects and what is regarded as the skills based, practical and non-academic technical curriculum.

The implications of this lie in the potential of pupils being subtly steered towards particular areas of the curriculum depending on the category they appear to fit. Thus the quiet, studious, able pupil may be guided towards physics, whilst the pupil who is regarded as less able but who demonstrates an interest in computers and practical work is guided towards the less academically perceived technological studies. Indeed, it may be through stereotyping processes that pupils have acquired their particular abilities and interests in the first place. In this way, moreover, the academic-vocational divide is perpetuated.

The contention that ‘Historically, technological subjects in schools have been regarded as low status, craft orientated subject with a strong gender bias towards male pupils,’ (McCarthy and Moss, 1990: 207)
also appears to continue to be an issue today. This has particular implications for technological studies, which was initially designed to attract more academic students. Fears about the perceived low status of technological studies have, in fact, led to a recent decision by Scottish schools to present pupils only at Credit and General level of the Standard Grade exam. This is an attempt to place the subject on an equal basis with the discrete sciences. Whether this will halt the demise remains to be seen.

If stereotyping is indeed an issue, one potential problem for the future of technological studies may be found in the body of research which suggests that stereotypes can be resistant to change. Although individuating evidence can lower the extent to which a stereotypical view is held about a particular individual, overall impressions of a group may be maintained by subtyping the individual who appears to violate the stereotype as an exception to the norm (Kunda and Oleson, 1995). Particularly disturbing is the suggestion that inaccurate stereotypes may be particularly persistent in the face of counterstereotyping evidence:

‘…the more inaccurate our stereotype of a group, the less likely it is to change spontaneously following encounters with group members. This is because the more inaccurate our stereotype of a group, the more discrepant it will be from the typical group member.’

(Kunda, 1999: 390)

Furthermore, if the perception of the low academic status of technological studies is indeed a result of its association with the traditional technical curriculum, the recent introduction into the Scottish Higher Still curriculum of practical craft skills with its emphasis on prescriptive teaching and absence of design seems likely to compound the stereotypical view of both technical subjects and the pupils who opt for them

References
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