The elephant in the room: the influence of prevailing pedagogical practice on the integration of Design and Communication Graphics in the post-primary classroom.

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Abstract
Senior Cycle Technology subjects in Irish post-primary schools have recently been updated. One subject, Technical Drawing, has been replaced with a new subject called Design and Communication Graphics (DCG). The new subject is quite different in content and is also quite different in its focus highlighting an emphasis on communication and design. This paper aims to explore the influence of prevailing pedagogical practices on the integration of the new DCG syllabus. The paper firstly examines the current pedagogical practices within Irish post-primary classrooms before moving on to discuss some of the emerging challenges and opportunities in light of this evidence. The paper argues that without challenges to prevailing societal attitudes towards technology education in schools it is unlikely that the changes in pedagogy required to fully embrace the philosophy of the new syllabus will be achieved.

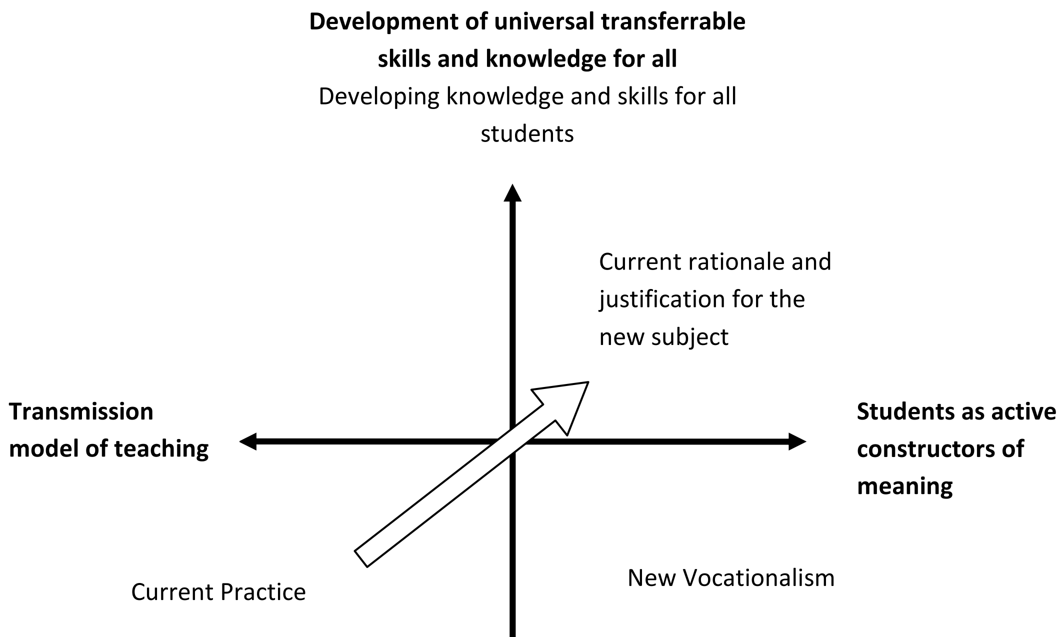
Introduction
The suite of technology subjects in Irish post-primary schools has recently undergone considerable changes. These changes mark a shift from the traditional focus of the subjects, aimed at developing craft skills and technical competence, to one that focuses on the development of transferrable knowledge, skills and attitudes. This shift mirrors an international move 'from the transmission of facts or the demonstration of skills towards the development of active, autonomous learners' (Dow, 2006, p. 309).
This paper aims to examine the challenges to this curriculum change in the Irish post-primary education system and in particular in the context of the new subject of Design and Communication Graphics (DCG), the replacement to the Technical Drawing curriculum. The paper firstly aims to explore the current pedagogical practices within Irish post-primary classrooms before exploring the influence of these teaching approaches on the subjects of Technical Drawing. Following this, an exploration of the new philosophy and thinking behind recent curriculum changes will be outlined. The paper then aims to discuss some of the emerging challenges and opportunities which lie ahead and attempts to highlight possible outcomes of these ongoing changes.

Pedagogical practice: from content to experience
Technology education has always faced the challenge of keeping abreast with emerging technologies and practices. The history of most technology curricula are dotted with changes to subject content, influenced by the emergence of new technologies. From the development of the microprocessor to the growth of computer-aided design (CAD), technology education has tweaked and changed the content of syllabi to incorporate these elements. These changes reflect the traditional vocational nature of technology education where preparation for the specific sectors of industry and business was a high priority. However, while in general syllabi have adopted changes in content, pedagogical approaches have remained the same. Current international attempts to reform technology education

have been driven by concerns over the prevailing pedagogies used as much as the relevance of course content. Owen-Jackson (2000) notes that from their inception, all technological subjects at post-primary level were '*concerned only with the passing on to pupils traditional knowledge and skills [where] Pupils were required only to learn the knowledge, not to understand it, and to copy and practise the making skills'* (p. 5). Banks (2000) notes that this was achieved by adopting a pedagogy '*not so very different to the 'master-apprentice' model of the medieval guild'* (p. 151). These practices remain influential today (De Vries, 2002) and reflect the historical emphasis on developing knowledge from experience. However teaching strategies focused on experiential learning, where the knowledge acquired is seen as tacit, are increasingly being called into question since there is an absence of critical engagement and a deep understanding of the practice. These approaches are also seen to encourage passivity and conformity rather than encourage creativity and critique. Writing about the influence of this type of pedagogy Dakers (2005a) writes that;

> … learning in this narrow model is linear and instrumental and to all intents and purposes, not meaningful learning at all. It is more concerned with the assimilation of the young into an already established value system which has more to do with control than it has to do with liberation. (p. 113)

Current curriculum reforms attempt to '*encourage the active involvement of pupils in authentic and meaningful learning experiences'* (Dow, 2006, p. 307) through the integration of more collaborative practices. Such approaches place a premium on problem solving, critical thinking, teamwork skills and creativity. In this context the role of technology education is not to pass on a set of technological skills transmitted in a behaviourist mode (Dakers, 2005a) but to create experiences where students can engage as autonomous learners solving real-life problems on their own or in collaboration with their peers. This process is supported by relevant technological tools and artifacts and the solutions are carefully considered with cognisance of their potential social and environmental impact (McGarr, 2010). It could be argued that the creation of these types of learning experiences free technology related subjects from their initial vocational focus since exposure to this type of practice can develop important transferable skills for success in life regardless of the careers chosen by students. On the other hand, it could also be argued that such approaches are a new form of vocationalism equipping students not only with the technical knowledge but also with the broader transferrable skills needed in industry today. Figure 1 below outlines this shift in thinking.



Regardless of the underlying rationale for these changes, '*changing pedagogical practice in technology and science within the European context will clearly not be an easy task*' (Dow, 2006, p. 319). In exploring best practice in science and technology education across Europe Dow (2006) recognized the conserving influence of prevailing pedagogical practices, not only on curriculum reform initiatives, but also on newly qualified teachers that may enter the teaching profession with alternative understandings of the value and purpose of technology education. This thinking may be quite different than the thinking underpinning reform attempts. Hansen (2008) also highlights the conforming influence of past experience on teachers practice;

> Most general studies teachers adopt some variation of a transmissive model for teaching. Such teachers believe, partly as a result of their university training and partly out of conditioning from their own schooling, that learning in schools is exclusively about ''knowing'' rather than ''experiencing''. They perpetuate a system of teaching into which they were successfully indoctrinated when they were students in high school. (p. 195)

In this context it is worth exploring the prevailing pedagogical context within Irish classrooms in order to examine its possible influences on recent changes in curricula to the suite of technology subjects at post-primary level.

Pedagogy in the Irish post-primary classroom

Concerns have been raised for several decades about the nature of teaching and learning in Irish post-primary schools. These concerns highlight the dominance of a transmission model of learning with little emphasis on evidence-based methods. While research into classroom practice is limited, the studies that have been conducted all consistently report similar practices. One of the earliest insights into classrooms, conducted by the OECD in 1991, found that teaching and curriculum were largely determined by examinations requirement and that there was a strong emphasis on 'a didactic approach' (OECD, 1991, p. 55). Later in the decade, research by Callan (1997) into the use of active learning, a key element of the Junior Certificate programme, found that despite the emphasis on active learning methodologies outlined in the new curriculum, practices remained largely teacher centered.

Similarly, research by Mackey (1998) into post-primary classrooms found that classrooms were dominated by teacher talk and that;

> Pupils were expected to work independently and to remain silent apart from when responding to a teacher's questions. On occasions during Science practicals pupils did work together, this was not done to promote deliberate interaction between pupils, as pupils were directed on the procedures to be followed and were admonished for talking to one another. Apart from these Science practicals, group work did not feature as a classroom/teaching strategy. Each class was taught as a whole group unit. (p. 288)

Mackey concluded that teaching subject content was the main concern of teachers and that 'teaching methodologies they employed aided lower to middle level cognitive development' (p. 290)

A large-scale study by Lyons et al (2003) into how pedagogical styles impacted on students' attitudes to, and experience of, learning mathematics, found very similar teaching approaches. The research found that there were three prevailing themes in teachers' discourse in the mathematics classroom. The first was a preoccupation on teaching for examinations, secondly maths was presented as being either hard or easy and finally students' answers to questions were defined as being right or wrong. In describing the nature of the teachers' pedagogical practice they noted;

> Classes were strongly teacher directed, with teachers generally using a didactic approach to the presentation of material. Teacher initiated interactions with students comprised 96 per cent of all public interactions in the twenty mathematics classes observed. Teachers were far more likely to use lower order than higher order questioning, and to use drill and repetition rather than discussion-type questions, to teach mathematical concepts. The work programme of the class therefore was strongly teacher determined, with a resultant lack of student participation in the organisation of their own learning. (p. 147)

In a similar vein, the most recent research, the international OECD Teaching and Learning International Study (TALIS) report on Ireland, published in 2009, found that 'Teachers in Ireland were somewhat less supportive of constructivist beliefs, and somewhat more supportive of direct transmission beliefs than their counterparts in all five comparison countries' (Shiel et al, 2009, p. 6).

Pedagogies in the drawing studio

The high level of consistency across these studies suggests that this teacher-centred transmission model of learning is deeply embedded in practice and common across most subjects. It has been argued that technology subjects tend to be more student-centred, since students are constantly challenged with the design and manufacture of an artefact. However this has not been the case in the traditional Technical Drawing subjects where the teaching approaches tend to focus on a more teacher-centred transmission model. In general terms the teaching approach adopted in these drawing labs have their roots in the past. The original subject of mechanical drawing was originally established in the vocational school system in the 1930s to prepare students as draughtsmen. In this context the role of the subject was to develop a high level of neatness and accuracy in the completion of quite abstract graphical problems. Very often the completion of the 'problem', rather than a deep understanding of the concepts and principles that underpinned the solution, was seen seen as the goal of the exercise. A 'show and copy' approach was seen as the most effective teaching method to achieve such an outcome and therefore such teaching approaches became deeply embedded in the subject. In addition to the nature of the subject, in Ireland vocational schools were largely associated with economic and social disadvantage as well as with preparation for manual employment (Trant and Geaney, 2000). Although these schools are now integrated into the mainstream post-primary school system (and indeed many have amalgamated with secondary schools in their locality) they nonetheless maintain many of the historical residues of the past. For example, the technology-related vocational subjects continue to be dominated by males and continue to attract a greater proportion of students from lower socio-economic backgrounds. In many schools they continue to be seen as subjects for the 'less able' students, as preparation for manual employment and as an alternative to more traditional 'academic' subjects. Such views of the subjects, and of the students studying them, have also contributed to an absence of critical engagement with course content. Trant and Geaney (2000) also note that vocational education has low prestige because it is perceived as lacking the qualities traditionally associated with the more traditional classical liberal education. Within schools where vocational subjects compete with the more traditional liberal subjects similar comparisons are made.

DCG and the new philosophy

The new Design and Communication Graphics (DCG) syllabus, launched in 2007, was not significantly different than its predecessor, Technical Drawing, in terms of its content but the rationale for its inclusion on the curriculum was quite different. Rather than the vocational justification of the Technical Drawing course, the new syllabus set the subject in a much broader context linking it as an important part of a broad comprehensive educational experience for the student. It also recognised the contribution the subject could make in the development of a broader set of skills and competencies;

> The Design and Communication Graphics course makes a unique contribution to the student's cognitive and practical skills development. These skills include graphicacy/graphic communication, creative problem solving, spatial abilities/visualisation, design capabilities, computer graphics and CAD modelling. (NCCA, 2007, p. 4)

Having at its centre a focus on design and communication was a marked change from technical drawing. This change in emphasis was also accompanied by the inclusion of a significant CAD component on the new syllabus.

Challenges to integration: prevailing 'folk pedagogies'

As with all attempts at curriculum reform, change is complex and in many cases the actual outcomes of the change process can be very different than the intended goals. In relation to the new DCG syllabus, and its focus on shifting the subject to a more design orientated experience, the process of change is complicated by parallel attempts to upgrade course content with the latest technological advancements. In light of the prevailing pedagogical practices within the traditional drawing studies, what impact will the proposed changes have in the long-term? Will it be seen as a slight computerised approach to existing practices? Is it realistic to expect that the substantive changes in the focus of the subject will be achieved? What, of value, may be left behind during this curriculum change? What happens when one maps on proposed changes in pedagogical approaches to an existing transmission model of practice? Dakers (2005b) outlines the influence of prevailing 'folk pedagogies';

> Whilst some teachers may accept the received wisdom of policy makers, a considerable number will subvert policy to suit their own particular implicit theories, based upon their own interpretation of the meaning of technology and thus, technology education. These deviations from policy may be based upon their own implicit beliefs about what constitutes technology education in particular, or even education in general. For example, a rationale for technology education may espouse, as a central tenet, the need for creative enterprise. However, the adoption of this rationale may be problematic for some teachers depending on their implicit theories, not only of technology, but of creativity in particular and learning in general. (Dakers, 2005b, p. 76)

Teachers' existing pedagogical practices are informed by their knowledge of the subject, the pedagogical skills they possess and their beliefs and attitudes towards education and in particular their specialist subject areas. Knowledge and skills can be addressed through appropriate professional development and in-service activities; however, challenging deeply held beliefs that underpin practice is more complex. Past programmes of in-service paid little attention to beliefs and attitudes. Dow (2006) for example notes that in relation to technology education, teachers' underlying assumptions about the nature of effective teaching and learning has been given insufficient attention by policy makers in the past. Many in-service programmes have operated on the belief that through exposure to the practices associated with the new syllabus the pedagogical practices would be incorporated into teachers' practice. This perspective sees the 'mechanical' adoption of these practices as leading to deep and meaningful changes in beliefs and attitudes. Over time it is believed that the teachers' practices will begin to align with the philosophy of the intended changes. Yet there is little evidence to support this view. For example, research into previous attempts to embed active learning with the Junior Certificate has shown that teachers can subvert and neutralise the intended changes. In exploring the use of active learning in the Junior cycle 7 years after its launch, Callan (1997) found that while changes in the content of the Junior Certificate programme were implemented, the pedagogical approaches that accompanied the changes, namely an emphasis on active learning, were not implemented.

Folk pedagogies do not exist in vacuums. They are informed and sustained by the prevailing beliefs and attitudes of both teachers and society. These include beliefs held by teachers in relation to the rationale for the inclusion of the subject on the curriculum, teachers' beliefs in the purpose and value of the subject and beliefs about who the subject is for. Similar beliefs exist within society where it continues to be seen as a masculine subject and suited to more 'non-academic' students and those that are increasingly more disengaged with school. Challenging these beliefs requires a strategy that focuses on challenges societal assumptions as much as the professional development of teachers. From the teachers' perspective future professional development opportunities therefore need to raise awareness of the role played by the subject in developing important transferrable design, analytical and problem solving skills. Practicing teachers need to have knowledge of how the subject can contribute to the development of these skills and how different strategies and pedagogical approaches can facilitate their acquisition.

From a societal perspective, changing the public perception of these subjects is a critical task in raising the status of the subject. The subject of DCG, and at a wider level all technology subjects, need to be portrayed as an educational experience for all students and a vital part of a broad comprehensive curriculum. At present it appears to have a low status within the education system. For example, while concerns are expressed nationally and internationally about the low uptakes in science and technology, initiatives to address this problem primarily focus on uptake of maths and science. There is however a growing recognition of the educational value of technology education as reflected in the increasing research in this area in Ireland. This research will play an important part in highlighting the educational value of such subjects as part of a broad and balanced educational experience for students. The increasing research output can also inform practice and ensure that future policy, and subsequently practices, are soundly evidence-based.

Conclusions

Technology education, and in particular DCG, has an enormous contribution to make to the post-primary experience of students. As part of a broad and balanced educational experience it can enhance the students' overall learning experience in school and can play an important part in developing visual spatial abilities and nurturing creativity. The subject is also unique in that it provides an educational experience that blends both cognitive challenges with more artistic and creative elements. However, this value of the subject and the potentially unique contribution it can make to the student's learning experience, will not be realised if it is continually viewed through its past manifestation both by the public and teachers. What is required in this context is a complete reconceptualisation of the purpose and rationale for the subject. This process begins with a critique of existing pedagogical practices within the classroom and the attitudes and beliefs that underpin this practice. Otherwise, 'technology education will remain a narrow and limited curricular area, restricted to the production of a technologically subservient and compliant underclass' (Dakers, 2005a, p. 113).

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