

Technology Teacher Socialisation Patterns in Germany, England and Canada: A comparative analysis

Abstract

Technological education teachers are a unique group. Their socialisation is complicated by conventions of teaching and learning in schools and by how schools are organised and politicised. Their lives are further complicated by the ubiquitous role and mission of schools. Through a comparative analysis of technology teachers and secondary school sites from within the three countries, Germany, England, and Canada, the problems these teachers face are examined and illuminated. Technology teachers, it was found, spend their careers unconsciously resisting a way of learning and behaving in their schools that, to them, is dysfunctional. As such their socialisation into the profession is problematic.

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The technology teacher socialisation context

Technology teachers, unlike most teachers in other subject areas, typically come to the profession after extended periods of time working in a trade or in industry where they were already established and to which they were well socialised. Teacher education and the ensuing school milieu is quite different and often an alienating experience for these teacher candidates. As such their socialisation experiences when they do make the transition to the teaching profession provides a rich area for research. Adding to this richness is the juxtaposition which emerges when two forms of education (practical and academic) are required to function in one type of school (the comprehensive secondary school). The implications may reach much further into hallowed educational theory, policy, and practice than one might expect.

Canadian technology teachers, especially in the province of Ontario, are stigmatised by a widespread preference by students, teachers, administrators, and parents for academic over technical subjects. That such a hierarchy of subjects exists, according to Medway (1989), should come as no surprise. 'Society and education prize humanistic and aesthetic pursuits above practical and commercial activity.' (p. 1) Although technology subjects

currently enjoy a period of high status in Canada, especially in the province of Ontario, the pedagogy associated with the various technology courses (a work related pedagogy) stands in stark contrast to the didactic pedagogy practised in academic subjects. Among other things, this results in a subtle but prevalent tension which may impact negatively on the socialisation of new teachers responsible for this area of study. Goodson (1987) writes about the plight of technical subjects in England. Because they [technical subjects] are not examinable, he claims, they will never hold the same status as academic subjects. The case in Germany, where education and training in the trades and technology have always been highly valued, is quite different. In Germany the subject enjoys an importance and place which would be envied in England or Canada, at least so it would appear.

Compounding the subject status problem is the nature of schooling and of schools themselves. Technology teachers from one research study in Ontario, Canada (Hansen, 1992) repeatedly referred to their adjustment within the school as being a greater problem than their adjustment within the classroom. A technology teacher in England echoes the same sentiments. 'My (to date) varied career in education has taught me that it is often the institutional culture of a workplace which requires time for adjustment, possibly to a greater degree than the actual daily demands of the job.' Does this institutional adjustment problem exist for technology teachers in Germany? What adjustment problems, if any, exist in that culture?

In spite of the differing levels of prestige associated with technological education between and among these three countries, there is some evidence which suggests a less known but nonetheless significant difference between academic and technology teachers awaits attention. Many technology teachers from England and Germany who were interviewed provided evidence of a disjuncture between methods of learning, in academic classrooms and technical workshops. The problem, while not documented very clearly in the education literature may be best described as one of 'differing discourses'. Academic teachers have a linguistic orientation to teaching and learning; technology teachers function with a combination of mental and manual skills, a 'technological or experiential discourse'. The distinction is highlighted and discussed here.

The backdrop to this complex and perplexing teacher development context is professional socialisation research. What is teacher

socialisation and how is it successfully achieved in the teaching profession? Zeichner and Gore (1990) suggest it includes: good relations with kids, ability to inspire kids and help them learn, and participation in matters of a professional association nature. Zeichner and Gore (1990) define socialisation as the adjustment a person makes when becoming a member of the profession. With respect to research design, Zeichner and Gore point out that teacher socialisation research is complicated by a number of factors. For example, they suggest such research needs to be qualified and institutional cultures taken into consideration. They ask; into what are teachers being socialised? The institution known as the secondary school, according to Zeichner and Gore, is an entity which by itself presents a challenge in analytical and historical terms. Consider how technology teachers are often isolated from the main stream of school life (in basements or tech wings). It may be that successful socialisation for technology teachers, in terms of the school culture, is a matter of institutional evolution as well as individual adjustment.

Given these teacher development and enculturation issues and a context for them, the goal of the paper is to document what a comparative analysis reveals about each area (subject status, academic milieu, differing discourses). Included is a discussion of the implications of the adjustment technology teachers make within the profession? The purpose is to better understand the world of technology teachers and to contribute to the literature on technological teacher education. If the stigmatisation of technology teachers and the low status of technology as a subject is evident in Canada, perhaps it is evident in other countries. If so, how does it manifest itself in the education systems of those countries? If not, what are the mechanisms within those systems which work for or against the full integration of this subject and the full socialisation of these teachers? Furthermore, what is it about learning that technology teachers do or do not know? Does this knowledge and the discourse behind it deserve critical analysis in the education research arena? This paper works from the premise that educational structures and forms of knowledge are inextricably linked to the lives of technology teachers across most western societies.

The methodology

There is considerable literature about the comparative research as a methodology (Halls, 1990; Holmes, 1981; Thomas, 1990). Thomas, in particular, has looked critically at comparative research across several fields including education. He concedes that

comparative research methods are controversial. 'When and under what conditions', he suggests we ask, 'is it appropriate to make comparisons?' (p. 278). At the same time he concedes that comparative research can serve a useful function: 'We compare to make choices, to engage in debate, to better understand ourselves, our lives, and the environment about us. Comparison can help us to understand, to extend our insights, and to sharpen our perspectives. If we wish to know something well, many writers tell us, we must examine it in comparison' (p. 277). Comparison, he concludes, is a way of thinking which enlarges our visual field.

In spite of the controversy, comparative education is chosen as a methodology in this study. The preliminary purpose of the visit to Germany and England for the author was to uncover whether or not anything of practical or theoretical value could be learned from the study of technology teachers in other systems of education. The problems facing technology teachers seemed to 'fit' the questions comparative education researchers typically address in their research. One technique used in such research is the 'problem approach'. It involves the selection of one or more themes or topics and the examination of the persistence and variability of those themes across the countries being studied. Comparative researchers will often begin their studies by setting up a juxtaposition then search for a unifying concept and hypothesis to illuminate it. This is followed by a simultaneous treatment of the countries and people being studied (Bereday, 1962).

The research in Canada (province of Ontario) involved 11 teacher candidates from the University of Western Ontario who were interviewed on three separate occasions over a one-year period. They were also asked to keep journals. The data were collated and analysed by a team of researchers who sought an understanding of the problems facing technology teachers in the Ontario schools and in the teacher education phase of each candidate's career (Jones, 1983; Lincoln and Guba, 1985; Miles and Huberman, 1984). In England and Germany, 25 technology teachers were interviewed, 15 schools visited (10 in two regions of England – Newcastle, and London, and five in Germany – Schleswig-Holstein). Three university education faculties were engaged. In all cases the author interviewed each participant and encouraged follow-up correspondence. This field work took place over a four-month period in the two countries. The important follow-up work took two years.

The main assumptions guiding the research and reporting are: that professional development and behaviour is a complex multi-variate process involving personal self-concept or self image, school organisational culture, and professional association expectations and requirements; that teacher capacities, preconceptions, and tendencies are major determinants of successful socialisation into teaching; and, teachers are not strangers to classrooms so some resocialisation is necessary, especially if new ways of learning in schools are to be fostered.

Technology teachers in Germany, England and Canada: A narrative account

In England the technology teacher interview process proved to be quite frustrating. In spite of a questionnaire which had been carefully thought out and mailed in advance of each interview, the early interviews generated very little information. The questionnaire proved to be too vague. While the interviewees were polite about it they did not understand what I was getting at when I referred to teacher socialisation. Even the idea of teacher adjustment was difficult for them to understand. I kept referring to the adjustment a teacher makes as he/she matures into a professional teacher – both in the classroom and in the school. I broached the subject of the reflective practitioner as someone who learns from practice not by osmosis but by deliberately thinking, keeping track of different ways of doing things, and trying out new ways of helping students learn, maybe even keeping a journal over time periods so as to monitor one's daily or weekly practice. Sensing that this failure to communicate was my shortcoming and my need to learn of the deeper culture at work in England's schools and in teaching technology, I altered the interview instrument. I discarded the questions I was using and developed a simple one-page worksheet. The motive for designing a worksheet and making it accessible to the interviewees was to gain their trust and to give them some ownership of the interview process. Among the questions on the worksheet there was one that proved to be the most effective in uncovering the feelings and reflections of technology teachers about teaching and learning and about school institutional life. I asked if there were any themes related to their teaching which would in some way characterise an adjustment or maturation within the profession to date. I used examples like the importance and place of the technology curriculum in schools, social class, and sexism to prompt discussion. [My notion was and is that teachers who are well socialised within the profession are able

to articulate what it is about themselves and their professional development that does or does not equate with successful practice]. What I wanted from the question was evidence of a capacity or capability to reflect, on the interviewee's part, and if possible, identification of the sources of that ability. What happened to give you that ability, I would ask. Two of the 15 technology teachers interviewed met my expectations and more. This is not to say the others were not successful teachers. The purpose of case study research is not to generalise to larger populations but rather to illuminate, describe, and enlighten. Furthermore, quality of individual anecdotal material is more important than response rate. Defining and measuring success in a complex endeavour like teaching is, at best, a difficult business. The following comments from two unique teachers provide evidence of a particularly substantive level of professional maturity. Follow-up correspondence with these teachers helped generate the depth of reflection documented here. The return rate of post-interviewee correspondence was discouraging with the exception of these two accounts.

Janet (a pseudonym) was a technology teacher in a London girls' school. When asked about themes that characterised her development as a technology teacher she demonstrated she had thought about the importance and place of technology in the curriculum.

How do young people learn [she asked rhetorically]? Why did I teach CDT and not science? How important is the design and making process in assessing young peoples' progress? Why do I feel I can assess aspects of design and technology though never really English or science...even though typographical, grammatical, and spelling mistakes in school publications offend me deeply!

When asked to rate herself with respect to having her achievements as technology teacher recognised and valued she was equally reflective.

I'm modest because I'm well aware of the progress I need to make with i) my knowledge base and ii) provoking/promoting student thinking methods.

When I probed into her interest in student learning her honesty, modesty, and intuition as a professional shone through.

I think it is all about the fact that I never had an urge to be a teacher...I just wanted to learn about this new subject area called Craft, Design, and Technology because they were all aspects of my life which were

strong and purposeful. As I did my BEd (CDT) I found it so fascinating I did grow to want to teach once I'd found some means to an end.

The passion Janet felt for the importance of learning by doing and her understanding of it was captured when I asked her about a turning point in her career as a technology teacher. She mentioned how after eight years of teaching she realised that what she was able to do in her classes was recognise and separate out learning which was meaningful from learning which was rote. When I asked her to identify the source of that capability she referred to her passion and affection for crafts and her life's learning whenever it was memorable, lasting and significant.

Paul (a pseudonym) was a primary science teacher and technology teacher educator in London, England who had similar feelings for the roots of his learning through practical means.

As a child, I was an obsessive designer-maker. In addition to the traditional construction toys, I consumed vast quantities of cardboard and sticky tape in grand projects to construct whole model towns, suits of armour and life-size robots.

One can sense that at an early age in Paul's life he yearned for immediate and real experience with any materials he could find. His mind was alive with scenarios to be explored and ideas to be put into practice. Unfortunately, he lamented:

I had comparatively few opportunities to exercise my making skills at school. One notable exception was the teacher who, in 1968, involved my class in making papier maché electric guitars and drum kits, in order to mime along to the Beatles recently issued Sergeant Peppers album.

He expressed his disappointment about the formal education system a second time.

At my selective state grammar school, an outlet was provided for a limited form of artistic expression in the context of traditional fine art classes. The situation with regard to designing and making was, however, very different. The 'craft workshop' in which our woodwork and metalwork lessons took place was a small prefabricated hut at the far end of the playground, a situation indicative of its low status within the academic hierarchy of the school. No mention was ever made of the words 'design' or 'technology' and it was clear that, unless we were to take the 'technical drawing' O' Level, our brief and occasional visits to the craft workshop

would soon cease. Instead, my studies were channelled along traditional academic subject routes, with an emphasis on the sciences; regarded as having the highest status of all.

Paul's desire for making and doing was not recognised or valued in his schooling. He was, advertently or inadvertently, not given the chance to develop his apparently natural and deep tendency to 'design and make' while in school. How many cases of such denial are to be documented? How significant are these examples and what do they say about our understanding of how children learn? During the university preparation for the profession, Paul's experiences were equally compelling.

The one highlight in an otherwise disillusioning experience was a project at the end of our first year [of physics] intended to introduce us to the design and manufacture of experimental apparatus. We were given a short metalwork course in the departmental technicians' workshop, and the brief to design a sun-sensor to enable a satellite to orientate itself in orbit. The selected design was to be built by the technicians for demonstration to succeeding years of students. My design was chosen, and I felt again the tremendous sense of satisfaction which designing had given me as a child. Again, fleetingly in my final year I had the opportunity of designing a wave energy collection device, sparking an enthusiasm for alternative energy sources which was to be frustrated by the lack of research funding for such 'trivial' projects.

The fact that Paul's story is one of unease with the formal school system in which he and perhaps many like him endure, is telling. To what extent does every young learner possess the same instinct and tools to learn? To what extent are those tendencies extended or denied within the formal school curriculum? In England, thanks to the adoption of design and technology as a mandatory school subject, young children are being given the chance to study technology and to build upon their learning capabilities. What remains undocumented is the relation between these learning capabilities and technology programming. In Paul's case his desire and capacity to learn through experience (an essential feature of learning in the practical world), while dampened and stifled in his formal schooling, is very much a constant in his informal learning. The acquisition of new experiences and the complementary activity of learning associated with those experiences are delicately and usefully balanced. His disposition to learning

is existential – it is fresh and on-going. His disposition to learning uses divergent as well as convergent thought processes to comprehend, inductive as well as deductive learning methods to reflect/contemplate.

The adjustment problems Janet and Paul endured as they grew in their respective careers were numerable. Colleagues who perpetuated the didactic pedagogy ingrained through schooling were always present. To their credit, Paul and Janet were not discouraged from their own beliefs and continued to practice using an experiential pedagogy in their teaching and learning.

In all of the research cases, English technology teachers emphasised the difference between the act of helping others learn in a workshop setting versus a classroom. 'When actually doing practical work', one stated, you can't kid about how to do something. You can't fake it or exaggerate the truth'. In retrospect this statement is revealing. Is a different kind of discourse used when showing students how to do something? Is it possible, in such learning situations, to communicate using signs and symbols alone? What happens when a teacher demonstrates how something is done? Harre and Gillett (1994) explain this learning and/or instructional distinction in terms of discursive psychology. They conclude that learning a language, i.e. learning signs and symbols, does not give human beings the sense of physical location and subsequent self-esteem that academic studies purport to do.

Human beings, they suggest, live in two worlds. One world is essentially discursive in character; that is, it is a world of signs and symbols...The world of symbols is organised by the norms and conventions of correct symbol use. The other world in which we live, the physical or material world, is structured by causal processes. Our language is our main means for managing in the world of symbols, our hands and brains are in the material world. It is characteristic of human beings to live in these two worlds. (p. 100)

Harre and Gillett conclude that the sense of self associated with learning generally and with one's self-esteem, is developed through the latter world, similar perhaps to what Janet and Paul experienced as learners themselves and as professional teachers.

These aspects of the sense of self – physical location, temporal continuity, and agency – are learned through manual skill. These senses of unique location are the salient features of self-hood. Learning a language is not what is responsible for our

having a sense of physical location. It is the learning of perceptual and motor skills that is responsible for that. (p. 111)

The implication of Harre Gillett's work for all technology teachers or perhaps all teachers and learners is that learning may involve a multiplicity of discourses, not a single one. And, furthermore, learning for everyone may necessarily require a balance of these discourses rather than a steady diet of one over another. An aesthetic, feminist discourse would be another example for exploration and application.

Carter (1990) suggests attention in teacher education has traditionally been focused on what teachers need to know and how they can be trained, rather than on what they actually know or how that knowledge was/is acquired. The cases of Janet and Paul underscore this issue. These technology teachers were very much in touch with the nature and course of their own learning and education.

The interviews undertaken in Germany were more awkward than those in England, partly because of the language barrier but also because there were as many similarities as differences to discover between Germany and the other cultures. Teacher development and socialisation for technology teachers, I began to realise, is a rich area for research. Despite the translation problems involved in interviewing German technology teachers, one observation was consistently evident. As a collective they were/are at ease in their work. My expectations that they might be stressed out over curriculum changes and financial cut-backs were unfounded. They seemed at peace with themselves and satisfied in their role as technology teachers in their classrooms/workshops and in the schools. They were capable professionals. In this instance I did not encourage as much follow-up correspondence so the gathering and formulation of evidence on socialisation or lack of it is less formal and the reporting without anecdotal material.

The use of the term 'wetvorstellungen' in German, helps explain the calm I found among German technology teachers. The term in the German language means 'value conceptions' and it provides some insight into the German school system and into the mindset of its teachers and perhaps even the German people. An example of a value conception is one's perspective on the relation between one's own needs and wants and the needs and wants of a larger system in which one works or lives. It is said in Japan, and perhaps this is the case in Germany, that people conceptualise their existence in terms of the larger society around them rather than

in terms of individual desires and betterment. By comparison, such a conception is not well understood, much less practised, in North America. All of the German technology teachers I interviewed were 'systems' people. They accepted the policies which govern the conception and on-going development of the schools in Germany. The unwavering allegiance might also explain why there seemed to be so little involvement by teachers in curriculum development or school change. In one sense these teachers do not enjoy as many curriculum-related freedoms as teachers in Canada especially, but also England. In another sense, they don't perceive a need to have those freedoms.

Every technology teacher interviewed agreed that subject status was not a problem in Germany. One teacher, a former school principal, indicated there was a problem of this nature in some German cities. The evidence most gave to support this claim was that technology was an examinable or 'testing' subject (at the grade 10 level). By comparison, physics, chemistry, and biology are not testing subjects in Germany. Another teacher referred to his upbringing as a child: 'I was socialised as a child to appreciate diversity [referring to diversity in people, and institutions], and a big percentage of teachers who have this value teach in the 'fachschule' [an academic school with a technical focus]. Yet another technology teacher indicated that technology students in Germany regularly receive scholarships. 'One of my students received a patent', one teacher exclaimed!

The goal of a technical education in Germany is to help students be productive in their careers. The idea of nationwide technological literacy, a more popular curriculum and policy objective in England and Canada, is not as much of a concern in Germany, at least not in the province of Schleswig-Holstein. One teacher mentioned how unmotivated some technology teachers and students were because of a depressed job market, providing further evidence of how serious German technology teachers and students take this part of their role. Could it be that something like subject status is considered dysfunctional in this society? I wondered. This teacher more than implied that there were no 'politics of difference' in German society and that such a notion serves no useful purpose.

With respect to the academic milieu of the schools and the adjustment technology teachers make to that milieu, Germany is unique. There are a variety of high school types in Germany, few of which would resemble what educators in Canada or England would call a comprehensive

secondary school. As such, there does not appear to be an opportunity for a distinction to be made. Each school type, and there are several, has a purpose in meeting the diverse needs of students and the German economy/society. The school which prepares the 'university bound' student is called a 'gymnasium'. It serves approximately one-third of the student population. The 'berufsschule' ('beruf' translated into English means 'professional') serves approximately 50 percent of the students, those bound for the workforce. The remainder of students in Germany are served by other specialty schools. Another feature of the German school system is that access to each of the school types is guaranteed by law. If a student graduates from one type of school and wishes to attend another, he/she may do so. It is recognised that student needs and maturity levels fluctuate dynamically in the adolescent years and that a range of school programs and options are necessary in order to accommodate those changing needs.

Enquiries I made into student learning and the discourse used in technology classrooms/workshops produced some interesting responses. The word 'discourse' in the German language is similar in meaning to the English word. No evidence of a disjuncture between a didactic pedagogy and an experiential pedagogy was found to exist. This does not mean that a disjuncture is non-existent. One teacher mentioned that he preferred to teach technology because of the human development potential it provided. There is also a concept in Germany called 'arbeitslehre' which means 'teaching through projects'. Beyond these two observations and a passionate reference by one veteran technology teacher to the book *Zen and the Art of Motorcycle Maintenance*, evidence of any known or hypothetical distinction between the way young adults are taught in academic versus practical subjects was not articulated.

An exploration of the curriculum in technology revealed two other interesting findings. When asked about the inclusion of the 'social significance of technology' in the curriculum the response was consistent. Such subject matter in German schools 'is taught in social studies'. I thought perhaps the teaching of technology using themes might be emerging as a feature of the curriculum. It was not, with one exception. Science educators at the Institute for Pedagogic Study, the University of Kiel and several cooperating schools in the area are working on an integrated curriculum project known as 'PING' which aims at emphasizing the social and environmental implications of science and technology. In this instance the definition of

technology focuses on the social and environmental issues related to technology. One technology teacher was quite adamant about his pedagogical preference. 'I don't like open projects,' he stated. 'It takes too much time to develop materials for them. I must have control and I must have an aim'. This comment stands in stark contrast to experimental programs in Canada and England where open-ended problem-solving and design are a central pedagogical feature of the emerging technology curriculum. It may be that compartmentalisation of school subjects is a strongly held and cherished feature of the secondary schools in Germany and that a stricter adherence to long standing and conventional school subjects will remain a prominent characteristic of German secondary curriculum design.

The lives of technological education teachers in Canada cannot be easily characterised nor can generalisations be readily made. Each province has its own curriculum and teachers are recruited, prepared, and certified in quite different ways. The following reflection about teaching from Michael (a pseudonym) brings some insight to the learning preferences theme, in the province of Ontario.

Now that I am a technology teacher I try to find the best way to 'teach' students so that they truly comprehend and remember what is being learned. One event that happened recently has left me wondering if everyone remembers information through experiencing it and then recalling the event later on in life when they need the information again. I was introducing a unit on electronics and giving a note on some electronic components while passing them [the components] around the class. Ninety percent of the class busily wrote down the note while very briefly, if at all, looking at the components as I passed them around. The exception were the four students who were social outcasts of the class. In my opinion they are decent kids but very weak 'academic' students. As I handed the resistors to these four boys they immediately dropped their pencils, grabbed the components, and began telling me where they had seen them before (broken radios, TVs...) all the while comparing parts amongst themselves. Was this due to the fact that all the other students had never seen resistors before, or, was there a fundamental difference in the way these four preferred to 'learn' about the world around them?

For myself I am more convinced with every passing year that I will only recall information if there is an event or story

that goes along with it. I tend to retain information that was 'imputed' through all my senses rather than through sight alone. I am capable of learning through reading but this information rarely stays with me for more than a few days. For example, I have disciplined myself to read a manual before attempting to work with or on a piece of equipment. I know, however, that I will not retain any of this information for long if I do not apply it physically to the machine in a hands on manner. I do think these experiences have some relevance as to the way I tend to learn or remember things. It would be very helpful to know if all people remember in the same way so that I could base my teaching on this premise. If, however, we do not all learn in this manner then different teaching strategies must be used to help different individuals learn.

In the province of Ontario technological education, teacher candidates are admitted to the profession based on a minimum of five years work experience in their technical field and secondary school graduation. Most candidates enter the teaching profession from the community college system, a few have university degrees. The median age of these candidates is approximately 30, and they have, on average, 10 years experience in business and industry. Interviewees in the Ontario case study were intimidated by the different status accorded subjects in the school curriculum, technology being the least recognised and valued subject in the curriculum. 'There is so much we can take from my field and apply', one pre service student proclaimed in frustration. 'It is important for kids to respect you, both for technical knowledge as well as professional teaching experience,' claimed another! One teacher candidate felt that some faculty members at the Faculty of Education, The University of Western Ontario, undervalued the views and experiences of technological studies students. In short, the technology teacher candidates studied were surprised by the dominant academic milieu they found in the schools and in the university, and by the politics associated with life in schools generally. Comments regarding the relative value of an experiential versus didactic pedagogy were a persistent issue in the Ontario context.

Implications and reflections

The socialisation of technology teachers as an area of study reveals a number of interesting opportunities for reflection. The three themes investigated in this comparative analysis (the status associated with technological education, the importance and place of academic versus technological study, and discourses which lead

to student learning), provide an alternative perspective from which to examine teacher development, and the two variables which are so closely linked to successful socialisation of technology teachers, namely school culture and learning.

Compiling and analysing evidence from comparative education research is a complicated task. Applying it in three very different cultures, further complicates the process. There are, nevertheless, benefits. Research design into the socialisation of technology teachers is itself informative/enlightening. Zeichner and Gore's point that teacher socialisation studies need to consider the institutional culture into which these teachers are being socialised is particularly germane. By contrast the evidence that some teachers pay greater allegiance to their disciplines and fields than to their schools (Hansen and Olson, 1995) implies that a broader perspective is unnecessary. Finally, the ways in which race, social class and gender inform one's analysis is subtle but important for technological teacher education research.

Reviewing the socialisation patterns of technology teachers in two European systems which have a long and rich history of technical education policy and practice provides insight into a way of learning and a schooling culture which requires further scrutiny and analysis. Canada, a younger society with its 'colony-like' school systems, has much to learn. Technology teachers with their experiential, non-discursive learning methods pose a challenge to the advocates of the long cherished linguistic orientation characteristic of didactic learning methods. Margaret Donaldson (1978) wrote of the schooling process: 'the better you are [the school student] at tackling problems without having to be sustained by human sense the more likely you are to succeed in the educational system, the more you will be approved of and loaded with prizes' (p. 78). How do children construct meaning in school subjects which are so often abstractions and which are so often taught in modes different from everyday informal learning? Do students need to experience something for themselves in order to retain it? What helps them gain self-respect and physical location as human beings? Are schools espousing learning in a multiple discourses environment but perpetuating a single and exclusive one? What are the necessary and sufficient conditions for individual learning and development to occur? Do school-based/knowledge-based learning environments always foster these conditions?

Technology teacher development and subsequent socialisation, for analytical purposes, needs a wider context than a simple reconciliation between the informal and formal cultures of the school in which one works. That broader context was not recognised by the technology teachers interviewed in any of the three countries. Moreover, it was not understood. It may be that technology teachers as a collective are a part of a larger and long standing problem which has never been explicated in the education literature but which festers and manifests itself every day in the lives of these teachers and others from different subject areas. The goals and content of learning in schools may be, in reality, too constructed/artificial. It may also be that teachers, technology teachers included, have little time or interest in looking critically and constructively at their practice and their institutional cultures.

The themes identified in this study can be viewed in different ways and from different perspectives. The subject status issue is one example. In German society, for all its strengths and weaknesses, matters of status do not overtly or covertly distinguish themselves. The value of a practical education is deeply embedded in the social fabric of the people and in the policies governing education. In England the status issue has a 'silent crime' element to it. Most technology teachers prefer not to acknowledge that such a problem might exist, perhaps for fear of revealing the contradiction between the egalitarian aims of the schools and the sorting function they actually perpetuate. In Canada this contradiction is evident. Canadian educators politely avoid discussion of a problem, even in the university where it should be illuminated and debated.

The issue of a dominant academic milieu in schools presents an interesting learning opportunity for technology teachers and researchers. As a rallying cry for change aimed at school leaders as well as for leverage in securing greater curriculum resources, this issue has potential, especially in England and Canada. More significantly, however, it may need to be exposed as a school role issue. The key question which is not asked clearly or often enough is this: What kind of learning is synonymous with meaningful human development? Have schools across the developed countries of the world been harbouring a classic curriculum which may have been defensible at the beginning of the 1900s but which is now dysfunctional?

The matter of a pedagogy which matches with how young adults learn rather than with what

educational psychologists theorise about how they learn, is overdue. Technology teachers as a collective are one group of teachers in our schools today who know from experience how students learn. The evidence from all three countries reported on in this paper is consistent; technology teachers practise a method of learning which is distinctive. The 'learn-by-doing' methodology may be one of the most unheralded in education. It deserves to be celebrated and studied more than it is currently. If this preference for learning were better understood and valued within the profession the adjustment technology teachers make within the profession might be far less problematic.

The concept of discursive versus manual skills as a locator for self-development is helpful to understand. The view of discursive psychologists is that learning in schools, a discourse of signs and symbols, is narrow. It is narrow, as Harre and Gillett point out, because it does not give human beings a sense of physical location and therefore self-esteem. Is the discourse we have adopted in our schools too discursive in character and, equally important, is it governed by norms and conventions as set down by an elitist few who have designs on how human beings should communicate and behave most effectively? Vygotsky's view that the learning of manual skills is just as much a necessary condition for acquiring a sense of self as the learning of verbal skills, supports the Harre and Gillett position. Have teachers, for over a century, been conditioned by a conception of human development that limits rather than enhances personal development?

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