

Education Letter

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Technological Education

MESSAGE FROM THE EDITOR

Rosa Bruno-Jofré, *Queen's University*

Technological Education

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This issue of the Education Letter is devoted to technological education. The aim is to foster a broad understanding of the role of technology in human evolution, and to call attention to the relevance in our cognitive and cultural development of knowing how to design and create products for our physical spaces. Human history is interwoven with technology; therefore both its understanding and its practical dimension should have a place in the curriculum. Furthermore, practical specializations and their links to occupations are significant components of the educational process and an integral part of a creative and fulfilling life.

Disregard for practical knowledge, which has been embodied in conceptions of the educated person since Greek times, led to an incomplete educational development. It was reflected in the drastic and biased separation at the school level between academic and vocational programs. This issue gained relevance within the context of modernization, the process of industrialization, the development of applied sciences at the universities, and related educational reforms. Sociologists called attention to the intersection of class, race, and gender in the process of streaming students to what was known as vocational programs. The current technological revolution generated paradigmatic changes in practical knowledge, in the understanding of technology at large and, necessarily, of technological education. The reader of the Letter will notice that specialists in technological education have generated a rich agenda with new venues for its integration in the educational process. Technological education, its conception and implementation, is profoundly rooted in our understanding of education and issues of justice and a good life, as well as in our ethical and political views of the uses of technology.

We hope that you enjoy this issue of the Education Letter in which the authors, aware of contemporary critiques of the mechanization of life, bring a multifaceted contemporary approach to technological education.

Lessons in and for the Real World

KATHLEEN WYNNE, *Former Ontario Minister of Education*

Resources of Interest

For more about Specialist High Skills Majors, please visit:

<http://www.edu.gov.on.ca/morestudentsuccess/SHSM.asp>

"It is our responsibility to allow students to customize their high school education in order to improve their prospects for success in their careers and daily life."

Times have changed. That may sound like a cliché but since becoming Minister of Education nothing rings truer to me on a daily basis. It is no longer satisfactory to simply provide students with a good foundation of math, language and science... pass them through from grade to grade and encourage them to graduate and go on to post-secondary education.

The world has become much smaller. And Ontario is indeed a microcosm. We have people landing here every day who bring their own wealth of personal and cultural experiences and challenges. Families are no longer the stereotype of mom, dad and a couple of kids. Values have changed. Perspectives have changed. Expectations of schools have changed. And the path to starting a career has definitely changed.

It is rare, these days, to hear from a 30-something that they started in the mailroom of their current employer, and from there, have worked their way up to a management-level job that requires a niche skill-set. Our graduates need to begin expressing their interests in their chosen careers and building their work experience from a much younger age.

Students are arriving in Grade 9 having studied subjects in an interdisciplinary way. They have learned to organically think about things in a 360 degree manner. How does one issue, product or task interconnect with another? We have done a great job of this. And therefore the challenge at the secondary level has become increasingly steep.

There are students who have a strong instinct regarding their chosen career path. We need to be able to provide them with the opportunities to begin to build these skills and take their chosen career for a test-drive as soon as possible. This allows them to get ahead, if it is a good match for them. Or, change their course if the real-world scenario does not match up to their expectations or interpretation. High school should be a time to explore who you are and where your interests lie. There are no wasted opportunities. If presented properly, every opportunity should provide transferable skills.

It is our responsibility to allow students to customize their high school education in order to improve their prospects for success in their careers and daily life. That is why over the last five years, the government has increased co-op programs, dual credit programs and introduced Specialist High Skills Majors.

In addition to real-world work experiences, each of these programs also gives students a jump start on their earning potential – potentially getting them out into the workplace quicker than those who follow the more traditional paths of high school graduation to post-secondary.

Students enrolled in a Specialist High Skills Major complete a bundle of eight to 10 classroom courses, workplace experiences and sector-recognized certifications to receive a special designation on their diploma.

Even within a chosen major, this is not a one-size-fits-all approach. These programs allow students to focus on career paths that match their individual goals and interests and

benefit those who want to go to college, university, take an apprenticeship, or who hope to enter the work world directly.

We introduced this program in 2006, just three years ago. In the first year it served 600 students. This year, roughly 20,000 students are enrolled in the majors and more are anxious to participate.

To meet the growing demand, we have been expanding the program across the province. There are now 16 Specialist High Skills Majors. The focus of these programs vary widely — from Agriculture to Transportation, Aviation and Aerospace to Hospitality and Tourism. This year, there are more than 740 programs in about 430 secondary schools. Every school board with secondary schools is offering a Specialist High Skills Major in at least one sector.

By keeping students engaged and providing them with choice we have seen Ontario's graduation rate rise to 77 per cent in 2007-08 from 68 per cent in 2003-04. That's a great accomplishment but we need to keep the momentum going to reach our target of 85 per cent.

I firmly believe in the philosophy that students learn best by doing. As educators, we expect students to take responsibility for their learning and achievement. It is our job to provide enticing avenues for those who are willing to apply themselves — allowing them to go beyond the classroom or beyond the walls of their high school. By doing so, we will increase their motivation and ability to continually strive higher, graduate and become productive members of society and self-sufficient individuals.

That should be the ultimate goal of any educational system. We're well on our way.



Photograph by Bartłomiej Derski of Salvador Dalí's
Profile of Time sculpture

The Importance of Technology Education for Elementary School Children

GILL HOPE, *Senior Lecturer in Primary Education, Canterbury Christ Church University*



Fragment of painting by Chelo Sebastian, courtesy of the Duncan McArthur Hall collection

The word “technology” in common parlance is used for those products, services and processes at the cutting edge of human inventiveness and capability. If the word “technology” is entered in any computer search engine, the result will be a list of thousands of digital products. “Technology conference” similarly will produce a list of hundreds of opportunities to learn about (and probably purchase) the latest computerized developments. Yet this use of the term reflects only the most recent and most promoted products of human ingenuity. The whole of human civilization is dependent on technological innovation, even the most traditional societies. Simple tools in constant everyday use (knife, brush, basket, for instance) all represent designed technology. Someone, somewhere invented the first one, and other people refined it, and in the market economy, continue to design new forms to appeal to new customers. Advertising, distribution and retail systems, finance providers, industrial production, sourcing and supply of raw materials, all contribute to the arrival of the simplest product to our shopping trolley, whether real or virtual; the systems of internet shopping are themselves a form of technology. In such a market-driven economy, children need to become discerning consumers, not just for their own sakes and the health of their bank balance but, ultimately, for the health of the whole planet.

However, technology education, is not just about recognizing a good design and an ethical product when they see one, it is also about developing personal practical skills through hands-on experience and designing technological solutions to the problems of daily living. The skills of technology are gained through practical personal experience, rather than text-book learnt or found on someone’s Facebook. One cannot “Ask” how to acquire complex hand-eye co-ordination, see potential in materials or found objects, apply scientific principles to a specific novel situation or create an innovative design that has “Wow” factor. Neither do these complex capabilities appear suddenly, as if by magic, when young people reach a certain age. The life-stories of designers, inventors and innovators all seem to have one common feature: they started the process young, through designing and making things in childhood. Schools, as providers of a suitably equipped work-force for the next generation, need to ensure that all children have such opportunities to develop both design and practical skills.

Technological designing is not easy. Making something really work is much harder than having a bright idea. Needing to focus on producing something that works and also looks good provides a challenge that imposes its own intrinsic disciplines and possibilities. Children who find onerous the lessons dominated by skills of literacy and

numeracy may find satisfaction and achievement in practical hands-on problem-solving. Not a few inventors and entrepreneurs have told the tale of their school days as a wasteland of boredom, relieved only by the practical workshop experiences and the supportive teacher who fostered their talent. Most young children enjoy the experience of making things. Good teaching ensures that this natural creativity is challenged as well as encouraged, whilst also providing the expertise to support the development of a high quality product or problem solution.

Frequently in school, as in life, children do not work in isolation. Sharing, negotiating, evaluating and accepting other people's evaluations of their solutions, are all important life-skills. Listening to others, appreciating the perspectives and priorities of other people, both as team members and as users or clients, are equally important. One key aspect of technology education is that a product is to be made for a specific purpose or user, requiring as outcome a functional product that satisfies a specific design brief. Technology education allows children the opportunity to test their own plans against real outcomes and purposes.

Making personal choices and evaluating the results enables children to perceive in a very practical way the balance between freedom and responsibility that underlies living together in a democratic society. With younger children, this may be as simple as thinking about safety issues that affect themselves and others: where and how to leave a hot melt glue gun once they have had their turn of using it, or how to walk around the room with a craft knife in their hands. At a far more complex level, older children's higher order thinking skills may be extended through discussion of environmental or social issues underlying technological choices: where should a new out-of-town shopping mall be sited, what would be the environmental impact, the social impacts (both positive and negative), the traffic flow and public transportation needs? Thinking through these kinds of scenarios enables children to model systems solutions and develop the cognitive skills that tomorrow's ever more complex communities will require. Designing is essentially future orientated, concerned with thinking of possibilities and rehearsing alternatives. As this century progresses, we will need more and more people able to design workable, technological solutions to big problems. Teaching young people to think in innovative ways about technological solutions cannot begin too young or too soon.

"The whole of human civilization is dependent on technological innovation, even the most traditional societies. Simple tools in constant everyday use (knife, brush, basket, for instance) all represent designed technology."



Photograph courtesy of Patty Kenny, Queen's University

Why you cannot read the label on your prescription!!

Malcolm Welch, Associate Professor, Graduate Faculty, Queen's University

"Design should be the crucial anvil on which the human environment, in all its detail, is shaped and constructed for the betterment and delight of all." - John Heskett

"Design, in its purest manifestation, is devoted to the improvement of people's lives through the creation of objects that are both sensible and beautiful."

Why is pain medication for people with crippling arthritis in the fingers of both hands delivered in a bottle with a childproof cap? Does your milk jug drip? Why are homes built so close to a highway that a sound barrier wall must be erected to protect residents from disruptive (and unhealthy) noise? Why doesn't the tissue dispenser in a public washroom have a centre knob to advance the tissue when its end disappears? Why are these and myriad other instances of bad design so prevalent in our culture?

Designers play a fundamental role in shaping all aspects of your world: design affects every facet of your life throughout every moment of each day. As Csikszentmihalyi and Rochberg-Halton (1981) observed, "the transactions between people and the things they create constitute a central aspect of the human condition" (p. ix). If "things" are so central to our lives, why must we tolerate that so many are badly designed? This author's response can be found by considering three related questions: (a) What is design? (b) Why is design important? and (c) Why should all pupils learn to design?

What is design?

We encounter the word "design" on numerous occasions: good design, human-centred design, fashion design-er, and furniture design-er. Advertising and other mass media make frequent use of the word: design-er sunglasses, interior design-er, environmental design, floral design, design for sustainability, and modern design are common reference points. But what is design? Heskett (2002) provides the following quizzical sentence: "Design is to design a design to produce a design" (p. 5). This is an amusing and seemingly nonsensical sentence. Yet, Heskett explains:

Every use of the word is grammatically correct. The first is a noun indicating a general concept of a field as a whole, as in: 'Design is important to the national economy.' The second is a verb, indicating action or process: 'She is commissioned to design a new kitchen blender.' The third is also a noun, meaning a concept or proposal: 'The design was presented to the client for approval.' The final use is again a noun, indicating a finished product of some kind, the concept made actual: 'The new VW Beetle revives a classic design.' (pp. 5-6)

Design is concerned with the pattern on your sweater, the taste of your toothpaste, the lumens of light cast by a street lamp, the flow of traffic through a busy intersection and the flow of people through an airport, the functioning of a dialysis machine, clothes pegs, and space craft.

Why is design important?

Design, in its purest manifestation, is devoted to the improvement of people's lives through the creation of objects that are both sensible and beautiful. Henry Dreyfuss (2003), the American industrial designer, wrote:

[Designers] bear in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse. When the point of contact between the product and the people become [sic] a point of friction, then the . . . designer has failed. On the other hand if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded. (p. 8)

Unfortunately, the point of contact between the product and the user often fails (remember the pill bottle!). Yet functionality is not enough. Designers increasingly recognize that products go beyond simple considerations of form and function to become “objects of desire.” To achieve this, products must make pleasurable emotional connections with their end-users through the joy of their use and the beauty of their form. Look at the two bottle openers in Figure 1. The green Alessi opener works as well as, but no better than, the common bottle opener. But doesn't it make you smile just a little bit? Doesn't it engage your emotions? Increasingly, designers are engaging with “emotional ergonomics.” Website designers, for example, increasingly recognize the importance of “experience design” or “interaction design” (Moggridge, 2007).

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Figure 1. Emotional ergonomics at work

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Why should elementary and secondary pupils learn to design?

In an already over-crowded timetable, does learning to design warrant a place? Shannon (1990) posits that, “design is a subject with profound cultural implications that needs to be addressed by public education. . . . Designing the world we live in is everyone’s opportunity and responsibility [and] . . . design must become a basic attitude about living that shapes every person’s priorities” (p. 29). Hence, design education for a design-literate citizenry provides a sufficient rationale for its inclusion in the curriculum. Yet an even more compelling reason for its inclusion is the modes of thought related particularly to design ability (Cross, 1984).

Research at the Royal College of Art (1979) identified things to know, ways of knowing them, and ways of finding out about them that are specific to design thinking: there are “designerly ways of knowing.” Cross (1982) argued that: (a) design develops the innate abilities of the pupil to solve ill-defined or “wicked” problems that are quite unlike, for example, the well-structured problems tackled in mathematics; (b) design supports constructive thinking, distinct from the inductive and deductive reasoning common to the sciences and humanities; (c) design offers opportunities for the pupil to develop a wide range of abilities in nonverbal thought and communication. While the humanities and sciences rely on verbal, numerical and literary modes of thinking, design thinking relies on a range of modelling techniques that can be used to externalize ideas that develop in what Ferguson (1992) referred to as “the mind’s eye” (Figure 2).

To conclude, the not so simple fact of the matter is that we all live in a designed world and will not and cannot live in any other kind. Even satisfying one’s nostalgic longings to return to a “simpler way of life” would involve designing a range of products to cope with the simplicity, for design is one of the basic characteristics of what it is to be human. Consumer design shapes us. But design education can help pupils do more than use and interact with the designed world: it can equip them to make a positive contribution by providing them with designerly ways of thinking. Remember, designers making design decisions have determined whether or not you can read the instructions on your pill bottle!



Figure 2. Young children can engage with wicked problems and model ideas

Modelling, Designing and Technology Education

EDDIE NORMAN, *Professor of Design Education, Loughborough University, UK*

There is significant current research in the areas of evolutionary psychology and anthropology that link cognitive modelling, and the externalisation of such models, to the emergence of humans as the dominant species on the planet. Equally, brain research is exploring imaging and some of our more fundamental thinking processes. Modelling was a central concept in the work of the Design Education Unit at the Royal College of Art in London in the 1970s, and, in many ways, the writings of the late Professor Bruce Archer, who led the unit can be seen to be anticipating current findings (Archer et al, 2005). The work of this unit is often identified as being the origin of design education in the UK, which has been influential worldwide in the subsequent decades.



that humans employ in pursuing their technological endeavours. For the social determinists it is an expression of human volition. From a Neo-Darwinian perspective modelling, and its expression through designing, can be seen as one of the key drivers towards our destruction of our environment (Norman, 2007). So, some of us at least believe that understanding modelling is of vital importance to all our futures, and rather more important than the Science, Technology, Engineering and Mathematics (STEM) initiatives that are internationally popular responses to the current economic and environmental crises.

In England it led to 'craft, design and technology' and ultimately 'design and technology' becoming part of the National Curriculum. These curriculum models have been adapted and developed by other countries, for better or worse, as one aspect of the wider 'Technology Education' movement, which is now represented on every continent. However, one of the weaker areas of the ideas culture underpinning these developments is the understanding of the fundamental nature of designing. For the technological determinists, it is commonly seen as a strategy

Resource of Interest

To find out more about the Design Education Research Group, please visit:

<http://www.lboro.ac.uk/departments/cd/research/groups/ed/index.htm> or contact Dr Eddie Norman (E.W.Norman@lboro.ac.uk)

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Science, Technology and Citizenship

JOHN OLSON

Do science and technology education offer students the literacy they will need as citizens in a rapidly changing world in which many moral issues are at stake? The answer to this question depends on an understanding of the demands of rapid technological change on the process of becoming a citizen and the role education plays.

How can science and technology play a role in the general education of students, all of whom as citizens will have to deal with a complex technological change? One curriculum document (CMEC, 1997) notes that "[I]t is also essential to understand the values inherent to science, technology, a particular society, and its environment' (p. 11). According to the CMEC framework 'the chief concern of technologists is to develop optimal solutions that represent a balance of costs and benefits to society, the economy, and the environment' (p.9).

This statement, however, begs the question of the nature of those 'optimal solutions'. Who decides the costs and benefits? What kind of a framework is at work in assessing those issues? Where do politics enter this process? Do technologists work in isolation as a kind of technical parliament, representing the interests of citizens through delegation? Where do citizens get into the act? What acts do they get into?

Unfortunately students often are told to note the value of science in the economy and the contribution science will make to health and prosperity. Students are told how science will aid in the development of economies, especially in underdeveloped countries. But little is said about the need for and the existence of locally adapted technologies. Little is said about who profits from an emphasis on science-based high technologies and how many people are advantaged locally by such promotion.

Ana Jofré is a self-taught artist who has been hand building ceramic sculptures and making artful crockery since 1995. Ana is compelled by form, ranging from abstract geometry to the human form, exploring elements of universal aesthetics. She also produces conceptually driven works inspired by a range of interests and influences, some of which are documented in her diverse travels and formal studies. Born to refugees in Lima in 1976, Ana grew up in Canada, and lived in Calgary, Winnipeg and Toronto, completing her PhD at the University of Toronto in 2004, before her nomadic restlessness led her South through Washington DC and into North Carolina, where she currently teaches physics at the University of North Carolina at Charlotte, with a research program in Biophysics, where she verifies small elements of empirical truths.



Self-portrait sculpture by Ana Jofré

Government and business information supplied to schools often advocates support of science and technology funding and the uses to which science is put. But critical perspective on those undertakings is rarely provided. Indeed, it could be said the opposite is true: science is seen as awesome and magical. What then is needed to develop scientific and technological literacy sufficient for citizenship?

First the problem of scientism in schools must be addressed. Evidence of scientism in schools may be noted in the emphases in the curriculum and in textbooks on science as an encompassing way of understanding the world and on superior thinking skills said to result from studying science.

Furthermore, schools now draw on sources beyond textbooks that have not been subjected to any critical, disinterested review. Rather than sound an alarm the curriculum promotes the use of these materials. The worldwide web is often recommended in advice to teachers for its ease of access to such materials.

What might provide an antidote to scientism? I believe that the study of technology as a context for learning science provides such an antidote. It is important to see that technology reflects culture and so varies with cultural differences. To come to know something about technology is to come to know something about one's culture and the mores that inform it. It is to be better able to act in that culture.

The history of science illustrates that science has evolved within cultural contexts, has been shaped by those contexts, and has been worldwide. The history of science also demonstrates that scientific problems have arisen out of technological problems, and that scientific inquiry has depended on pre-existent technologies and has fostered new ones.

Science has been conducted by groups of inquirers greatly influenced by fashion, funding, and politics. Only by trying to see science as a detached logic machine does it become disconnected from culture and from its ultimate origins in relief of human suffering. As Taylor (1991) notes this ameliorative, humanistic view of science and technology has a long history:

He [Francis Bacon] proposed ... [instead of the sciences as they existed] a model of science whose criterion of truth would be instrumental efficacy. You have discovered something when you can intervene to change things. Modern science is in essential continuity in this respect with Bacon. But what is important about Bacon is that he reminds us that the thrust behind this new science was not only epistemological but also moral (p. 104).

Taylor notes that "what we are looking for here is an alternative enframing of technology.... [W]e have to come to understand it as well in the moral frame of the ethic of practical benevolence, which is also one of the sources in our culture from which instrumental reason has acquired its salient importance for us (p. 106).

Human beings have the means to destroy the planet by using machines to harvest nature. It is an uneven fight. Trees in western North America, for example, and fish in the

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Sculpture by Ana Jofré

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Mural by Diego Rivera

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east and the north and the south, are sucked up by machines without heed for the future. Science education has to help students see the dangers of such machines and systems out of control and imagine what might be the alternative. That is the challenge that faces science education as it does education as a whole whose aim is citizenship.

Science and technology courses cannot eschew the responsibility for making value contexts explicit, as Barnett (1994: 62) notes in the case of technology education:

... An arrangement by which responsibility for practical capability rested with Technology, and for critical awareness with subjects such as Social Studies, History or Religious Education i.e. where values had been driven into exile from out of Technology, would be undesirable. This would tend to confirm Technology as a ghetto for ingenious, specialist tinkerers and the Humanities as the natural home for anti-technologists.

Grappling with these life-issues is not science, and science will not teach one how to do it. In short, these requirements of citizenship will not be met by unalloyed science in the curriculum. Few doubt that. But there are parts of the scientific ethos that can contribute to a person's self-development: a significant list can be made of items for inclusion in a science-infused curriculum subject. The problem is to know in what context to lodge this study. One prerequisite for developing ethical engagement, Terhart (1999) argues, is the autonomy of the professional. Such engagement cannot be legislated, and it must start at the beginning of a teacher's career: during the first years of teacher-training.

Taylor asks teachers to see the science content of the subject in its moral richness as part of a curriculum of self-development. What are the implications of such a focus for teacher education? Sources of moral importance in school science must be discovered. This will require a critical approach to the subject informed by a strong awareness of the context of science.

Teachers have to learn the difficult skills of curriculum analysis for scientific and technological literacy: the analysis of subject matter for its educational and moral import, and the justification of possibilities in debate with others. This is a large challenge for curriculum and teacher education: to find the way for science and technology to best contribute to the education of the citizen.

Technological Education: A Curriculum of Opportunity for At-risk Students

ENA HOLTERMANN-DELONG, *Graduate Teaching Fellow, Queen's University*

For many learners, the Ontario school system works. Skills and knowledge are learned, social relationships are formed, and positive self-esteem and self-image as a learner lead to accomplishments such as a secondary school diploma, opportunities for further education, and futures filled with a litany of choices. For others diplomas are not forthcoming, nor are futures bright with hope and opportunity. Marginalized students in the academic stream at high school often experience school very differently than their academically successful peers. Effective programming for these at-risk students requires the collaborative efforts of educators, parents, and community members working together to address and meet their diverse and often complex needs.

As educators we grapple with how to create and implement curriculum at the secondary school level to keep at-risk students engaged and eager to learn. Students identified as at-risk are often those who do not fit the mainstream mold: their learning styles, learning disabilities, and/or life experiences may be factors which result in low achievement or in behaviour considered unacceptable within the context of the classroom (Kerka, 2003). In addition, the subject-specific disciplines of secondary school do not always have the implicit connections between subjects necessary for optimal learning. Students who struggle in school are often more negatively affected by such fragmented learning systems and require a different approach to curriculum and pedagogy. Curriculum and instruction for these students must address not only subject discipline fundamentals, but issues of engagement and motivation to maintain the learner's interest over time.

Technological education provides an alternative route to success for students who are not succeeding in the academic streams. Students enjoy improved social capacity through their achievements in these programs. As an example, when students in one technological education classroom built a bio-diesel motorcycle other students from their secondary school were impressed. The group, who had previously been treated as second class, were given due respect. Greater diversity among students in technological education classrooms, along with the approaches used, offer students at-risk opportunities for greater inclusion, allowing for students' learning diversities to be viewed as learning differences rather than learning deficits. When achievements are respected and differences are minimized social capacity is increased and students are better able to participate and learn.

Broad-based technological education courses encourage students to develop a variety of transferable skills as they address technological challenges in a project-based learning environment. These skills and processes include a problem-finding and problem-solving paradigm. For the student at-risk, developing the ability to define problems and seek out

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"Technological education provides an alternative route to success for students who are not succeeding in the academic streams."



Photograph courtesy of Angela Solar, Queen's University

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Vessel for your existential burdens sculpture by Ana Jofré

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solutions to complex problems using logical, practiced, and pragmatic processes provides a framework to approach life's challenges and demands beyond the classroom—a crucial skill for the student at-risk. Technological education requires a cooperative approach to learning, achieved through collaborative group work. Students exchange ideas, make plans, and propose solutions.

Through its interdisciplinary curriculum and holistic approach – rich in the combination of essential skill development, student-directed learning, and community placements – technological education influences the learners' desire to continue their studies. Real-world skill development through project-based, contextual learning is the central element of the technological education curriculum. The pedagogical and philosophical framework of broad-based technological education in the province of Ontario engages learners in student-centered, student-developed projects, enhancing the sense of meaning for classroom-related tasks. Students have a role in deciding what will be learned, and how they will go about learning it.

Technological education programs offer opportunities for at-risk learners to connect new learning to prior knowledge and incorporate authentic self-assessment and reflection, instilling lifelong learning patterns. Many broad-based technological education teachers employ a number of different approaches: just-in-time learning; life- and work-focused learning; and learning-while-doing linked to everyday situations. The pedagogy supporting the curriculum provides a creative and real-life approach to learning that is meaningful and relevant, offering at-risk students multiple opportunities to demonstrate their learning. Attention is paid to the importance of learner participation; interaction and integration of thoughts and feelings associated with the learning experience; the relevance of the subject matter; and a sense of purpose. The experiential nature of this curriculum allows students to have a variety of learning opportunities in the classroom and workplace.

At-risk learners make up nearly one-third of our secondary school student population. While factors placing them at-risk cannot be easily isolated or remedied, by examining the pedagogical and philosophical foundations used in technological education, educators may discuss, develop, and implement curricular and teaching practices that at-risk learners say makes their learning experiences better and supports their desire to continue their education. Technological education offers a curriculum of opportunity for students at-risk to experience success in secondary school alongside their peers.

Developments in Vocational Education for 16-19 Year-olds in English Secondary Schools - the new diplomas

JEREMY HIGHAM, *Professor, University of Leeds, and*
DAVID YEOMANS, *Principal Research Fellow, University of Leeds*

Over the past three decades English post-16 provision in secondary schools has had two principal characteristics. First, higher status is widely accorded to academic qualifications. At Advanced level, academic education has dominated through the traditional diet of subject-based A levels and the influence of higher education admissions. Vocational education is defined against and shaped by the status of this academic provision. In terms of Intermediate level provision, this has been predominantly vocational or pre-vocational with very limited general education provision.

The second characteristic has been that vocational provision itself has been subject of frequent change, mainly through the reform of qualifications which has been the favoured means deployed by policy-makers. Successive vocational qualifications have appeared and then disappeared since the mid-1980s. These qualifications have differed widely in terms of their philosophy and orientation e.g. the extent to which they emphasise specific occupational skills, the role of theory, the ways in which they are assessed, the extent and forms of employer engagement, their intended pedagogy and the ways in which they have been marketed to students. The constant instability of provision reflects deep uncertainty about what vocational provision at either advanced or intermediate level should be, and more fundamentally about the role of these 'middle track' curricula and qualifications within the English system (Hodgson & Spours, 2008).

The latest series of major reforms of education and training for 14-19 year olds has seen the introduction of the new Diploma qualifications, as well as the reinforcement of an Academic Track, a middle General Vocational Track and a Work-based track. The Diplomas, situated clearly in this middle pathway, are being progressively introduced from September 2008 and by 2013 are to be available to all 14-19 years olds in seventeen curriculum areas. The first fourteen of these diplomas cover broad employment sectors, for example: 'Hospitality'; 'Construction and the Built Environment'; 'Travel and Tourism'; 'Information Technology'; 'Society, Health and Development'. The final are in the more academic areas of 'Humanities and Social Sciences'; 'Languages and International Communication' and 'Science'.

The purpose and aims of these new diplomas have been outlined in a number of official publications and websites (Directgov, 2009; QCDA, 2009). They are intended to have the dual purposes of both preparing young people for employment or for further and higher education through engagement with broad vocational sectors. The official aims also place considerable emphasis on curricular and pedagogical innovation, different from 'academic' provision and

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Resources of Interest

<http://www.direct.gov.uk/en/EducationAndLearning/index.htm>

For more on UK government initiatives visit the Qualifications and Curriculum Development Agency

<http://www.qcda.gov.uk/>



Painting of Still Life with Fruit Dish and Mandolin by Juan Gris

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practical or applied learning experiences. The new diplomas are described by the Qualifications and Curriculum Development Agency, which has responsibility for developing and regulating the curriculum in England, as: 'an exciting new 14-19 qualification that will bring an innovative approach to learning. It will enable students to gain knowledge, understanding and hands-on experience of sectors that they are interested in, while putting new skills into practice'. (QCDA, 2009). However, the take-up of diplomas in the first year was considerably lower than had been anticipated and there was some evidence that diploma students had lower prior attainment than those not taking diplomas (O'Donnell et al., 2009).

Each diploma is available at foundation, intermediate and advanced levels. The government's stated intention is that by 2013 a substantial proportion of post-16 learners will be taking diplomas. When participation in education and training is made compulsory for all 17 year olds in 2013 and for 18 year olds in 2015 government policy anticipates that the diplomas will play a major part in catering for this increased participation (DfES, 2005).

Diplomas are intended to be provided by partnerships of schools, colleges, training providers and employers working together. Those intending to provide diploma courses are required to go through a 'gateway' process in which they demonstrate the strength of their partnership, including employer engagement. Thus there is an expectation that a range of community partners will contribute to each individual diploma course, perhaps by teaching different components or units.

Institutions taking on diplomas have received some limited additional funding but to a large extent are expected to provide the courses from their existing resources. Partnership arrangements are expected to ensure that a wide range of staff expertise and facilities are available, with the more specialist equipment provided through colleges and employers.

All diplomas have three main components. These are: (i) Principal Learning which provides the main sector-based content; (ii) Generic Learning which provides functional and wider skills; (iii) Additional and Specialist Learning which allows the inclusion of a wide range of specialist and other courses. The overall approach to diplomas therefore reflects the general approach to vocational education for 14-19 year-olds in England with its emphasis on generic employability skills, combined with vocational contextualisation, experience and employer involvement.

Much attention has been paid to the need to recruit employers able to provide ten days work experience, but while this 'cooperative education' will undoubtedly be a major challenge, the provision of a good supply of 'tasks, problems and situations' which provide realistic contexts for diploma work seems far more challenging. Diploma learning is also to include: learning through doing; interaction with other learners through group work; learning through the application of transferable skills.

The diploma places more emphasis upon internal assessment than is the case with academic courses, though internal assessment is subjected to what the awarding body refers to as a 'medium to high level of control' (OCR, 2008). At the time of writing very little actual assessment on diploma courses has taken place and therefore it is still too early to reach any judgements on the ways in which this may interact with curriculum and pedagogy to shape the learning experience.

So will the new diplomas fill the gap in the education of many young people in England? As we have seen above, vocational provision in England lacks identity and clarity of purpose - this is evident through the constant chopping and changing of qualifications over a long period of time. The aims and purposes of the diplomas remain subject to uncertainty despite, or perhaps because of, successive attempts by government to clarify these (House of Commons Education and Skills Committee, 2007). Given the complexity of the provision and its lack of coherence, it is not surprising that there is often limited understanding among students, teachers, employers and parents. Inspection evidence from the first group of diploma students suggests that many are not aware or do not understand the programmatic character of the diploma and focus only upon the Principal Learning (Ofsted, 2009).

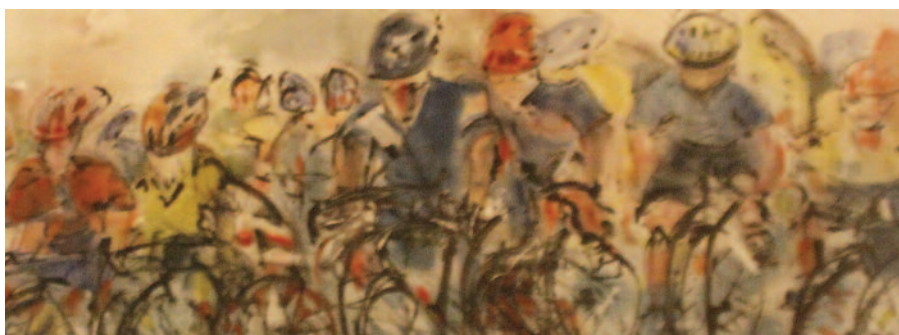
While there is heavy emphasis on pedagogical innovation through the attempt to blend applied and general learning through the diplomas, regrettably in the past the search for the parity of esteem of vocational education with academic provision has all too often resulted in persistent academic drift within vocational qualifications. Diplomas may well find it difficult to resist this force over a period of time with resultant changes to curricular and methods of assessment.

In England the track record of progression of young people on the middle, vocational, track to work, training or higher education is mixed to say the least and it has to be said that there are currently no grounds for thinking the diploma will necessarily serve the needs of this group, especially at Intermediate level, any better despite considerable policy and resource commitment.

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Chelo Sebastian works with watercolour and mixed media on paper and looks forward to the challenge that the medium presents. She likes to emphasize the play between representation and abstraction, with shapes and colours suggesting new possibilities and directions. She has participated in workshops conducted by artists such as Anne Meredith Barry, Telford Fenton and Jonh Bennett, and has exhibited work in Canada and in Spain since 1982. She has given watercolour classes and workshops since 1995 in Hamilton, Brantford, Cambridge and London, Ontario.



Fragment of painting by Chelo Sebastian, courtesy of the Duncan McArthur Hall collection

Enhancing Pathways for Technological Education Through School to College Initiatives

CHRIS WHITAKER, *President and CEO, St. Lawrence College*



Still life in a room where fish fly painting by Dr. Stephen Elliott

Stephen Elliott is an artist and educator. He currently serves as coordinator for the Artist in Community Education program and Dean of the Faculty of Education, Queen's University. As a recognized painter and printmaker, Stephen has a refereed portfolio of paintings and an extensive record of juried exhibitions and awards. His major topics of research include art criticism, aesthetics, art critiques, and art history.

In the modern economy characterized by rapid change and innovation, technological education is an increasingly important issue. As a society, we are challenged to ensure this important issue becomes a priority for policy and public investment. Opportunity exists for greater planning and collaboration between secondary and postsecondary education sectors in Ontario to ensure we are preparing students for success in a dynamic, knowledge-based economy. Dual credit programs between high schools and Ontario Colleges are demonstrating remarkable success in terms of providing pathways for students that facilitate transitions to a wide variety of technical careers.

Recent studies have articulated the need for increased focus on technological education from a number of perspectives. The Conference Board of Canada has identified a growing skills shortage due to the combination of retiring baby boomers, rapid technological change, and a shrinking pool of new entrants to the labour market. It is estimated that by 2025 in Ontario alone there will be a shortage of 364,000 workers. The study concludes: "Ontario needs to act proactively to mitigate future labour market pressures. One important way in which Ontario can help to relieve these pressures is to continue to develop and implement strategies and initiatives that develop skills and encourage higher labour force participation." Underscoring the strategic importance of our educational institutions in addressing these issues, the report suggests that 7 out of 10 new jobs in our knowledge based, or innovation economy will require postsecondary education. Although the types of occupations and skill sets demanded in the future cover the full spectrum of educational programs, references to skill shortages focus predominantly on careers requiring technological education.

While the broad based secondary curriculum in technological education provides a foundation to prepare students for postsecondary study, it is the choices students make regarding postsecondary destinations that largely determine how well our educational system is preparing students for success in the new economy. In Ontario after 4-5 years of secondary school, approximately 34% of high school graduates go to university, 20% go to college, and 6% pursue apprenticeship.

As part of the Ministry of Education Student Success strategy, dual credits have been established to allow students to participate in apprenticeship training and college courses. These credits can count towards their high school diploma as well as a postsecondary certificate, diploma, degree or apprenticeship certification. With funding made available

through the School-College-Work Initiative (SCWI), jointly sponsored by the Ministry of Education and the Ministry of Training, Colleges and Universities, most Ontario school boards and all 24 Ontario Colleges of Applied Arts and Technology (CAAT) are participating in dual credit.

Created to a large extent as instruments of labour market adjustment offering career oriented programs to provide skilled workers for a rapidly changing economy, Ontario CAATs are leaders in postsecondary technological education. Dual credit programs are typically delivered at the college campus and combine the benefits of exposure to college curriculum with the broader social experience of college life. Having grown in scope and enrolment, dual credit is viewed as having a positive impact on high school completion rates by providing challenging alternatives to traditional secondary credit offerings and developing student confidence and motivation to pursue postsecondary education. While open to all students, dual credit is targeted at students who may be at risk of not graduating from high school, as well as groups traditionally under-represented in postsecondary education.

Early research and evaluation of dual credit in Ontario is promising in terms of both student success in high school and increased postsecondary participation and completion rates. An analytical review of SCWI dual credit pilot programs in 2005-2006 encouraged further development and investment in dual credit. Among the key success factors were a focus on practical career destinations with clear expectations, and the collaboration of passionate and committed staff from both high schools and colleges in planning and delivery of the programs.

More recently, an evaluation of Ontario's Student Success strategy completed by the Canadian Council on Learning, made recommendations linked to the benefits of dual credit initiatives. It was suggested that schools should provide students with opportunities to explore the connections between what they learn in school and future employment or study including apprenticeship programs, cooperative learning opportunities, focused studies, and the chance to earn credits at both the secondary and post secondary school levels. It was noted that these opportunities should also combine hands-on and applied learning, which is a core feature of college education. It was also recommended that schools should accord equal respect to post secondary destinations, including immediate post secondary employment, apprenticeship and other forms of training, college study, and university attendance. The study notes that as a consequence of a variety of factors, secondary schooling has traditionally appeared to focus on the preparation of students who plan to attend universities rather than the students who intend to pursue other post secondary destinations such as work or apprenticeships and other forms of post secondary training.

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For questions, inquiries and comments

Carole Morrison
Queen's Faculty of Education
Duncan McArthur Hall
Kingston, ON K7M 5R7
edletter@queensu.ca
(613)533-6000 x75408



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FACULTY OF EDUCATION
Duncan McArthur Hall
Queen's University
Kingston, Ontario Canada
K7M 5R7

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In order to build on this recognition that secondary education should be responsive to both the needs of the minority of students who are university bound and the majority pursuing other pathways after high school, continued collaboration between secondary and post secondary institutions is essential. While all areas of the curriculum need to be incorporated in such considerations, technological education is of great importance given the looming skill shortage and the rapidly changing nature of our innovation economy. In this regard Ontario's "Learning to 18" student success strategy may be in need of reconceptualization as "K-16" to include K-12 plus the post secondary sector.



Painting by Paul Gauguin