Perspectives on technology education from across the pond

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Abstract

Since national goals, objectives and curriculum do not exist at the primary, elementary or secondary school levels in Canada, almost all disciplines within the K–12 curriculum have been developed at a provincial level, including Technology Education. As a result, a variety of interpretations and approaches to Technology Education have developed across Canada, many emerging from what were typically variations on Industrial Arts/Industrial Education programs. These changes have mostly developed in the past five years, and in many instances, full implementation has not yet been reached.

Specifically, this paper presents a brief overview of the Canadian Technology Education situation; shows how the curriculum is being organized; illustrates the processes of curriculum delivery; and concludes with a discussion of several current issues and trends that need to be considered as development and implementation take place.

Introduction

The rationale for a Technology Education program (as opposed to an Industrial Arts/Industrial Education/Shop program) within the public school system is sound. Few would argue that we are immersed in a technological world where the exponential growth in the use and development of technology is persuasive and dominant. In fact, it permeates all facets of our lives and is infused into our culture, influencing our daily living, the way we learn, how we perform on the job as well as our many recreational pursuits.

Technology is not new: traditional practises in schools have embraced technology in one form or another, albeit at times in perhaps more primitive forms. Most educators in this curriculum area are familiar with, for example, the shaping of materials, manufacturing of goods, aspects of power mechanics, and graphic communications. What has happened though, has been a shift in many countries from either an industry or craft based model of technology in school to one in which technology per se is revealed and studied as an integrated part of our lives and the dominant driving force in terms of both products and processes within a curriculum framework.

The response of the educational system has resulted in a plethora of technology based programs across many countries[1], some with a unified national curriculum (as in the United Kingdom), and others such as the United States with a wide variety of approaches. Canada falls into the latter group, with each of the Provinces exercising their constitutional autonomy with respect to education. This has resulted in diversity of content and organization across most disciplines, but especially technology education and whatever preceded it.

The overall intent of this paper is to briefly describe selected aspects of the emerging Technology Education in Canada, particularly with respect to its current developmental status; and then to examine the resultant issues and trends that need to be considered as this development takes place.

The Canadian situation

There is little doubt that Technology Education is gaining a strong foothold in the Canadian education school systems. The past five to six years have been a period of increased curriculum change designed to reflect current thinking in education. The change process has not been easy for many jurisdictions, and has been confounded by concurrent developments through the secondary curriculum designed to address revamped goals of education and a movement back to the basics in many Provinces.

Just as the craft movement in the United Kingdom has become Design and Technology, Industrial Arts/Industrial Education in North America, including Canada has generally moved to some form of Technology Education[2]. However, even though there may be some prevailing common themes and constructs through the new curriculum, there is also, as shown by the recent survey work of Sharpe and Hache[3], considerable diversity across the ten Provinces and two Territories that comprise Canada.

Although there is no Federal jurisdiction over educational matters for students in the secondary

school system, recent reports which address the status of the Canadian economy and future directions to increase prosperity across the nation specifically address the issue of technology and the need for a technologically literate population[4,5,6]. Such themes are typically echoed in provincial level documents[7,8,9] which, in turn, impact on goals and objectives of the educational system. This is particularly noticeable in provinces where the general aims and goals of grade one to twelve education have been, or are going through, a revision process. Generally, there is an overall concern for excellence in education, a concern for competence in basic academic "core" subjects (language, mathematics and science) and a desire to educate people for the 21st Century.

Current Provincial directions in Technology Education have some similarities yet are diverse in nature. As of 1992, all but two provinces were developing programs and moving away from the traditional Industrial Arts base. Most of the emerging program labels have incorporated the word "Technology", for example, Career and Technology Studies (in Alberta), Design and Technology (in Ontario), Industrial Arts Technology Education (in Nova Scotia) and simply Technology Education (in Newfoundland, British Columbia and Quebec). Such programs are in various phases of discussion or implementation. Generally, the goals of each vary, but address the need for students to become confident, competent, literate users of technology in the various aspects of their lives. Program objectives in each Province are more explicit with some of the more common themes being developing and applying problem solving skills, understanding technological systems and processes, becoming discerning consumers and becoming creative and intelligent users of technology. The actual curriculum is typically organized using combinations of such constructs as communications, manufacturing, production, construction, power and energy, transportation and integrated technologies in the various Provinces. Most programs are directed at students in grades seven through twelve (ages 13 to 18 years); with only three Provinces offering a program from grade one to twelve. Generally, programs in the primary and elementary grades stress awareness of technology through experiences integrated across the curriculum, while those in the middle school stress the exploration of technology through a specifically designed curriculum. The senior high years (16 to 18 year olds) tend towards more specialization within specific technological areas of study. Also across Canada, it is more typical for Technology Education to be part of the general curriculum (either as part of the compulsory core, or more frequently at the senior high level as an elective) in schools, although in at least one province (Ontario) Technological Studies is a senior high school vocational elective program with more specialized occupational content[10].

Current issues and trends

Issues and trends associated with an emerging Technology Education program will obviously vary from province to province in terms of importance given the locally prevailing contextual circumstances, but each will likely require some degree of consideration in each jurisdiction. Many could be construed as fundamental in almost any such curriculum change process whether they be on a macro level (country, province or state) or a micro level within a specific school system. The inputs, processes and outputs of Technology Education are all considerations at each level in the system.

Teacher Development.

Retraining current teachers in the new "basics" and developing an understanding of what Technology Education is all about, together with new skills that are not based on a "project" approach will, in many instances, require a fundamental shift in conceptualizing the teaching/learning process and in developing and organizing instruction. Many teachers will be required to change from, for example, unit woods or metals shops to Technology Education laboratories based on very different curriculum constructs. The traditional unit shops may still have relevance in situations where the curriculum is more vocationalized in the latter years of secondary education. However, the very nature of Technology Education suggests, for curriculum delivery, a multiple–activity environment that can optimize learning in many circumstances and situations. This implies acquiring new organizational and management skills alien to many teachers, along with a need to learn a range of technical skills and knowledge in several technological areas (such as communications, power and energy, and manufacturing) that might comprise the new curriculum.

It is also apparent that teachers from other disciplines (than the former Industrial Arts) are becoming involved with the teaching of Technology Education. With the spread or integration of Technology Education across the curriculum, teachers with different backgrounds may be attracted into, or simply assigned to teach, the new curriculum. Their needs may be fundamentally different in terms of developing appropriate competencies and must be considered in any developmental planning.

Pre–service teacher education programs also need to respond as Technology Education developments take place. In Provinces where new programs have been specifically identified and content clarified, initial teacher preparation can be more focused within Provincial universities. For provinces in a longer period of transition, preparing teachers is more problematic, especially in the shorter term.

Overall, teacher development is a most critical factor to consider in the implementation of a new program. The motivation, enthusiasm, knowledge and skills the teacher brings to the classroom are vital in the development of an effective learning environment. It is critical to address teacher uncertainty in the classroom as the old curriculum vanishes and is replaced by the new since not all teachers will willingly embrace the changes taking place.

Technology Education in the Curriculum.

The placement of Technology Education within the total school curriculum varies in each Province. National agendas suggest that it be an essential, compulsory component of the curriculum, however, it is seen as competing with the "three R's" in the back to the basics movement in some Provinces, and complementing such a movement in others. As a high priority subject, it is more likely to be allocated resources and experienced by many more students. In instances where it is an elective area of the curriculum (as appears to be the dominant case in Canada) then the consequences are obvious in terms of having to fight for scarce resources and student time during the school day.

Some students may be exposed to elements of Technology through other school subjects, especially through the earlier grades (primary and elementary). However, the consequences, use and impact of technology are legitimate areas of study within several subjects; and in science it is rapidly becoming a vehicle for program delivery. It is not unusual in several Provinces to see the label "Science and Technology" used in curriculum documents. Such trends are encouraging in terms of promoting a Technology emphasis in schools, but should not diminish the legitimate notion of Technology Education as a subject in its own right to be studied in the classroom.

Leadership.

Probably a more fundamental question to ask relates to why, given the overall national prominence of Technology Education and learning to live in a technological world, the discipline has not received, in all Provinces, the priority it may deserve. Overall, there is revealed a need for leadership at the local school level, at the school board level, and in some instances, across a Province.

Imposed curriculum by government is more difficult to implement, while teacher initiated developments from the field tend to be more readily accepted. This obviously ties directly into the teacher development issues described earlier. Developing ownership in curriculum change is vital in terms of effective implementation. An examination of processes within various Provinces show that combined efforts involving teacher groups, teacher specialist interest associations, school board initiatives, and well prepared and articulated provincial level documents are perhaps the most productive.

Part of the leadership issue also suggests that we should undertake a general awareness program in which a broader spectrum of educators are exposed to Technology Education, especially from the perspective of what it actually is, how it is delivered, and the implications for the curriculum. It is particularly important that those in administrative or leadership positions at all levels in the school system have a good grasp of the essentials of Technology Education and be prepared to support its development[11].

A Unified Approach.

There is some strength in diversity, and the provincial autonomy in education has the distinct advantage of being able to respond to local needs and flavour the curriculum accordingly. However, it can, and has led to many interpretations of Technology Education across Canada. Such a situation can also hinder the overall development of national educational outcomes in core subject areas, a movement that is in its infancy, but under recent consideration in terms of facilitating the transferability of school credit within groups of neighbouring Provinces. Subjects such as mathematics and science with more common elements will be much more adaptable to such changes compared to the prevailing (and developing) diversity of content that comprises Technology Education.

Teaching Methods.

Despite the different approaches and curriculum organizers apparent in various Provinces, the process of curriculum delivery appears to have a common element: that of problem solving. This has a versatility that others have recognized can be used in numerous different school circumstances[12]. It is moving the field away from the traditional project building approach and developing an emphasis of the various elements of the problem solving process, that in some instances, is comprised of many steps and stages and which can additionally incorporate

design, technological assessment and systems analysis as complimentary processes. The proposed British Columbia model is an example of this[13]. It is also described in an article by DeLuca[14].

However, problem solving appears to be a process phenomena in which the actual cognitive applications are yet to be fully understood. Superficially, it is considered to be an excellent vehicle for the teaching of Technology Education, with an apparent versatility which is embraced by many educators world wide. Such versatility is enticing for classroom teachers. However, it is a process that is correspondingly tough to evaluate in terms of intended student outcomes.

Another facet of program delivery is that of preserving a practical, "hands–on" approach in the classroom. As curriculum moves towards a study and use of processes, care needs to be taken not to move Technology Education into a merely cognitive process that results in mostly library research and written reports. The practical psychomotor aspects of the forerunners of Technology Education are probably a delivery element that can be preserved.

There also appears to be a risk of overemphasizing the use of computer technology in the curriculum, as indicated in a recent Technology Education curriculum framework document developed in Newfoundland[15], rather than recognition of the computer as a tool that can, as needed, facilitate various aspects of curriculum delivery and student learning.

Impact.

One final issue to be briefly discussed here is that of program impact. It is presumed that changes are made for the better and based on a sound rationale, as in the case of the development of Technology Education in Canadian Provinces. However, the impact of the new programs should, at some point, be assessed. The challenge to educators would be to examine the goals of respective programs and determine if they had been met to some degree. It is relatively easy to assess levels of competency in mathematics and other academic subjects, few attempts however, are apparent in Technology Education.

Summary and conclusion

Overall, it is evident that most Canadian provinces are committed to some form of Technology Education program. Both commonalities and differences are evident in the efforts. Given the current thrust world wide, and governmental priorities in education, the directions and initiatives being taken can only serve to enhance the education curriculum and give it relevance as we approach the 21 century. Such change, however, raises many issues which need to be addressed if we are to develop a fully functional, coherent, and responsive Technology Education curriculum and delivery system that is purposefully pursued by all the stakeholders of the educational system.

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