

1. THE INTERNATIONAL APPLICABILITY OF THE US STANDARDS FOR TECHNOLOGICAL LITERACY

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Although the Standards for Technological Literacy were developed and validated for the USA, having been done under the auspices of the International Technology Education Association and with an international reference group, there is the possibility of international application. This presentation will outline the Standards current use and their applicability for further use internationally in a postmodern and postcolonial context.

The International Technology Education Association (ITEA) is the professional educational association for technology educators in the USA. It is “devoted to enhancing technology education through technology, innovation, design, and engineering experiences at the K-12 school levels” (<http://www.iteaconnect.org>). Its membership is mainly from the USA, but it does have members in over 45 countries.

The ITEA seeks to meet the professional needs and interests of its members as well as to improve public understanding of technology, innovation, design, and engineering education and its contributions.

In 1994 the ITEA created the Technology for All Americans Project (TfAAP) through funding from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). The first phase of the project culminated in a document entitled *[Technology for All Americans: A Rationale and Structure for the Study of Technology](#)*. This document, published in 1996, articulates a philosophical foundation for the study of technology in schools aimed at developing technologically literate citizens.

The next phase of the project, *[Standards for Technological Literacy: Content for the Study of Technology \(STL\)](#)* was published in 2000. It outlined the content considered essential for the attainment of technological literacy from both a conceptual and practical perspective.

The final phase in 2003 was the production of *[Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards \(AETL\)](#)*. This document describes a means for implementing *STL* in schools by addressing topics such as student assessment, professional development, and program enhancement.

Initial input to the content of these publications was provided by classroom teachers, supervisors, technology teacher educators, elementary administrators, and representatives from mathematics, science, technology, and engineering. An advisory group guided the development of the project. The standards define what these groups consider students should know and be able to do in order to be technologically literate, but does not suggest a curriculum to achieve these outcomes. The twenty standards are organized into five groups:

Understanding of the nature of technology

1. The characteristics and scope of technology
2. The core concepts of technology
3. The relationships among technologies and the connections between technology and other fields.

Understanding of technology and society

4. The cultural, social, economic and political effects of technology
5. The effects of technology on the environment
6. The role of society in the development and use of technology

7. The influence of technology on history

Understanding of design

8. The attributes of design
9. Engineering design
10. The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving

Abilities for a technological world

11. Apply the design process
12. Use and maintain technological products and systems
13. Assess the impact of products and systems

Understanding of a designed world

14. Medical technologies
15. Agricultural and related biotechnologies
16. Energy and power technologies
17. Information and communication technologies
18. Transportation technologies
19. Manufacturing technologies
20. Construction technologies

While the ITEA mainly serves the needs of US technology educators, it does have a developing international outlook. The organization changed its name from the American Industrial Arts Association in 1985, the rationale for the change being an attempt to refocus technical education in the US to technology rather than industry, and to an international rather than a parochial orientation. While in some areas the focus on international technology content remains significant, the ‘international’ in the term ITEA has come to indicate the breadth of membership of the organization, an orientation that is increasingly a focus of the organization.

The organization does have international aims, and is active in a number of ways to promote international involvement. It periodically surveys international members to seek feedback on how best to meet their professional needs, it has cooperated in the establishment of international centres in twelve countries, it hosts the international PATT conference in conjunction with the annual ITEA conference in the US and publishes the proceedings on its web site. It is hosting the International Conference on Technology Education in the Asia Pacific Region in 2007 and hosts the “Hemisphere” listserv as a forum for discussion from around the world. The listserv is moderated by members from The Netherlands, Scotland, New Zealand and Australia.

The use of the US Standards in countries other than the US can be placed in the broader context of a philosophy of the international transfer of education. The modernist focus on the development of the “grand narratives” (Boyne & Rattansi, 1990) through the export of educational systems by powerful nations prevailed up to the 1960’s. The colonial powers used education as a tool in the armoury of colonialism, and its export, including the total package of teachers, curriculum and texts, was designed to promulgate the metanarrative form of civilizing culture perceived to be utopian at that time.

The imposition of a predetermined form of utopian culture was not only attempted through education, of course. This modernist focus permeated the government and civil services, had a particular affinity with religious organizations, and coincided with the enterprising objectives of industry and technology. Religious missions became an embedded part of the front line assault on the indigenous populations, and the transfer of inappropriate technology both developed then reinforced the existence of colonial dependence. In many instances, even after national independence, technological dependence extended colonialism through a reliance on the provider of the technology for repairs, parts and servicing, as notions of technology transfer were retained as the most expeditious route toward technological development.

The rise of independent states in the 1960's and 1970's saw the deconstruction of the carefully manufactured grand narratives of colonialism in many nations (Bernstein, 2000). In some instances this was a battle (literally), in others, the changes represented by the developing international postcolonial framework were recognized as inevitable and the transition was peaceful. But either way, the pre-colonial social modes were generally destroyed in the process of colonization. Land ownership, attitudes toward technology, traditional authority structures and both the content and methodology of education were perverted.

Postcolonialism coincided with the rise of postmodernism in western society. Although fraught with battles over definition, a general tenant of postcolonialism is the existence of an antecedent practice that laid claim to a certain exclusivity of insight, which is rejected (Appiah, 2000). In its place is the foundational principle that there is no universal knowledge, but only that which is developed within conditions of specific cultural and social formations.

In the context of technology education, this could be explicated in a number of ways. During colonial times, the modernist approach could be characterized by the representation of technology education as modern woodwork and metalwork, regardless of significant indigenous technologies related to construction (thatch and mudbrick) or hunting or food preservation or appropriate agricultural technologies. This type of approach was clearly related to notions of progress, and the determination of a single path toward what was clearly a western conception of progress which had resulted in the superiority of the north (Ullrich, 1993).

An analysis of the development of technology education in the US also epitomizes the demise of modernism. The curriculum ideas which came to be known as the Jackson's Mill Curriculum theory identified four universal technical systems: communication, construction, manufacturing, and transportation - technical systems that are basic to every society (Hales & Snyder, 1981). The notion of 'universal' was that the systems were *timeless* and had existed since the beginning of technology, and that they were *spacious* and existed in every country. In a post colonial era we would view this type of theory of a universal narrative as very modernist.

This type of proclamation can be contrasted with the more recent development of the US standards where no such proclamation is made. Despite the international agenda of the International Technology Education Association (ITEA), the Standards for Technological Literacy (STL) (ITEA, 2000) are quite explicit in their orientation to the US. The Foreword and the Preface to the STL relate the standards to the context of 'US society' and 'K-12

classrooms in America' (viii), a theme that continues throughout the document. The absence of claims to international applicability are consistent with a postmodern approach which values 'mini narratives' and a respect for situational developments which make no claim to universality (Klages, 1997).

A continuing phenomena which may seem inconsistent in a postmodern international education environment is the existence of international curriculum organizations, which, by their very role, imply that there is a universal curriculum applicable to all regardless of national or regional culture or history. This type of activity would seem to align more with a colonial than postmodern environment in the promotion of totalizing forms of western knowledge. Even worse (author's bias) is that the recipients pay a significant amount of money for the curriculum from a national budget which is invariably stretched.

In this context, the goal of this paper is to explore the use of the US standards in countries other than the US and to determine their applicability and relevance. An initial focus that may assist in achieving this goal is to examine the activities of the ITEA International Centres that exist in Australia, Chile, Cyprus, Finland, Germany, Greece, Japan, New Zealand, Netherlands, Scotland, Spain and Taiwan. These international centres have been established to provide information about ITEA and its benefits through a nominated 'ambassador'. Three of these centres: Germany, Finland and Taiwan have organized the translation of the US standards into their national language.

The Chinese translation was organized by the ITEA International Centre in Taiwan, but because of language variations is not used in Taiwan. The standards are available for sale from the internet, but the extent of usage in China is not known.

In Finland the standards were translated to provide an additional source of information for teachers, teacher trainers and curriculum decision makers about developments in the rest of the world. The notion of 'standards' is not a part of the Finnish curriculum culture, and technology does not have core or essential subject status. The Finnish professional association for technology teachers does not promote the US standards as there is conflict with their prevailing craft-industry focus. The standards are freely available electronically, and many teachers are aware of their availability. There is evidence that they have been used as a source of ideas in the development of the Science and the Handicrafts national curriculum, and that teachers use them in developing school based programs. At least some universities use them as a handbook in their teacher training programs.

In Germany, the translation of the standards is available as a book or it can be downloaded. Not many teachers are aware of the standards, but some technology teacher educators are. The structure of technology education in Germany is very similar to that of the US, but the Association of German Engineers commissioned the elaboration and publication of standards for technology education, and so when there is a need for a reference to standards, it is the German standards that are noted. The US standards have had no recognized impact on classroom teaching in Germany.

In an attempt to collect data to enable an answer to the research question, the ambassadors in all the ITEA International Centres were contacted and asked to respond to a survey. Apart from the above three countries in which Standards translations have taken place, responses were received from Chile, Cyprus, New Zealand, Netherlands, Scotland and Spain. None of

the centres in these countries actively promote the standards, although in Cyprus and New Zealand, access to the standards information is promoted through a web link.

With the exception of Chile, the standards have had very little impact, if any, on the development of curriculum within any of the countries. The new National curriculum of Technology Education for 1-10 in Chile used the same general approach as the US Standards which were used as a model for the curriculum. The standards have been referred to in curriculum review meetings in Cyprus and Scotland. There are some similarities between the standards and the curriculum in Scotland and the Netherlands, but there is strong teacher resistance in Scotland to moving away from the current traditional approach to technology education. In the Netherlands, the standards were developed before the US standards, and so the similarities are the result of the fact that the underlying discussion and philosophical basis is also similar.

Only in Cyprus and Spain have the standards had any influence on classroom teaching; in Spain because some individual teachers use the standards and in Cyprus some instructional support material has been developed based on the standards. In Chile, some technology teacher training programs refer to the standards. The estimates of the numbers of teachers who would be aware of the standards is very low, the highest being 25% in Cyprus.

An additional approach to answering the research question that has been adopted is to compare the curriculum in a number of countries with the standards, not necessarily to determine any causal effect, but to determine similarities. The countries chosen for this comparison are New Zealand, South Africa and Seychelles.

New Zealand

The New Zealand Curriculum Framework (Ministry of Education, 1993) defines seven broad essential learning areas, one of which is technology. The technology area describes learning outcomes against which students' achievements can be assessed and each outcome is described over eight progressive levels.

The general aims of technology education in *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) are to develop:

- technological knowledge and understanding,
- understanding and awareness of the interrelationship between technology and society, and
- technological capability.

These three general aims provide a framework for developing the learning outcomes.

The technological areas through which these aims are achieved are: materials technology; information and communication technology; electronics and control technology; biotechnology; structures and mechanisms; process and production technology; and food technology. Students are to study a range of these technological areas, each with its associated knowledge

The importance given to an understanding of the interactions between technology and society is a common element of the New Zealand curriculum and the US standards. One of the three general aims in New Zealand is devoted to this understanding, and in the US standards 4-7 deal with Technology and society.

The division of the New Zealand technology curriculum into areas of (a) knowledge, understanding and awareness and (b) capability are similar to the US standards division in to cognitive standards (1-10) and process standards (11-20).

The New Zealand definition of the technological areas has some similarities with the process standards described in the US standards. Common described areas include biotechnology, information and communication technologies and production (US: manufacturing) technology.

South Africa

Technology Education was introduced as a compulsory component of the South African school curriculum in 1998. Technology (South Africa Department of Education, 2002). consists of Learning Outcomes and associated Assessment Standards. Learning Outcomes specify the core concepts, content and skills for each grade level and Assessment Standards describe the minimum expected level of performance at each grade level.

Outcome 1 is the core outcome and lists the assessment standard for Technological Skills: *The learner is able to apply technological processes and skills ethically and responsibly using appropriate Information and Communication Technologies (ICT)*. The standards in this outcome are organised under five technological skills: Investigating, Designing, Making, Evaluating and Communicating.

Learning Outcome 2 lists the assessment standard for Technological Knowledge and Understanding: *The learner is able to understand and apply relevant technological knowledge ethically and responsibly*. The standards in this outcome are organised under three content areas: Structures, Processing, and Systems and Control (Mechanical and Electrical/Electronic Systems).

Learning Outcome 3 lists the assessment standard for Technology in Society: *The learner is able to demonstrate an understanding of the inter-relationships between technology, society and the environment*. It is organised under the headings Indigenous Technology and Culture, Impacts of Technology and Bias.

An obvious similarity between South Africa and the US standards is South Africa's Outcome 1: the application of a technological process and the US standards 8-11 about the understanding of design. The use of the term design in the US is qualified in Standard 10 by including troubleshooting, research and development, inventions and innovation and experimentation in problem solving.

The focus on technology in society and the environment is also a common element: learning Outcome 3 in South Africa and Standards 4-7 in the US. A possible departure in this area is the South African focus on indigenous technologies – an internationally unique characteristic of a national technology education curriculum.

While the broad heading areas of Structures, Processing, and Systems and control used in South Africa are different, some of the more detailed content is similar to the US areas of Construction technologies and Energy and Power technologies.

Seychelles

Seychelles is a small country with a population of 86,000 spread over 116 islands in the Indian Ocean. The preexisting Technical Studies national curriculum was revised in 2004-2005 and implemented as Technology and Enterprise in 2006. The brief for the new curriculum was that it matches the manpower needs of the country and provides a structure for future development.

The content of the new curriculum is outlined through thirteen context areas: agriculture, biotechnology, business, construction, electronics, energy and power, engineering, textiles and fashion, fisheries, food, health and welfare, hospitality and transportation. In each of these context areas, students achieve outcomes in five areas: the technology process, information and communication, skills, enterprise and society and environment.

The obvious similarities with this Seychelles curriculum and the US standards are in the context areas of energy and power, agriculture, biotechnology, and transportation. In Seychelles, Engineering is described as a context area whereas in the standards it is described as a type of design. As in South Africa, Seychelles portrays the procedural elements of the curriculum as the technology process while the US standards describe the process as design. The final similarity is the importance of society and environment, standards 4-7 in the US and one of five outcomes in Seychelles

Conclusion

A significant limitation of the applicability of the US standards to other countries is that the majority of technology curriculum developments in countries around the world more comprehensively deal with technology by including food technology and textiles technology and design. As this is quite a separate area in the US it is not included in the US standards.

Terminology of course varies from country to country. The US is unique when compared with the three countries referred to above in their use of benchmarks, as all three countries use outcomes as an integral part of their curriculum, and South Africa sets assessment standards for certain levels.

The US standards seem to have had little impact in the countries where an ITEA International Centre exists, including those countries where the standards have been translated into the national language. Access to the standards document seems ad hoc and individually rather than organizationally based.

There are similarities between the US standards and the technology education curriculum of the countries referred to above, as there no doubt would be with many other countries. Compared with traditional curriculum subjects, technology is a recent development of the last 25 years or so, therefore all the technology curricula have been developed within this period of time. To the extent that there are similarities between countries, the issues that stimulated the development of technology curriculum are also similar, and hence similarities in the curricula are explicable.

Any curricula which is designed or revised is essentially based on what has gone before; it builds on the foundation of social and technological understandings of the country in which it is being developed and so reinforces postmodern notions of local integrity and relevance.

Invariably curricula from other countries are consulted, and it is in this context that the international usefulness of the US Standards exists. Given the significant (in terms of funding and breadth of input) developmental process that was followed in devising the US standards, they are a reflection of the thinking by the variety of input groups about what is important in technology education for the US, and so will be an important resource for those countries or states revising their technology curriculum framework. So it would seem that the ways in which the US standards are both promoted and applied are consistent with a postmodern view of the integrity of local cultures and developments, and the absence of an essential and universal truth.

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