Relationship between Science and Technology in the New Zealand Curriculum

Alister Jones
Centre for Science, Mathematics and Technology Education Research, University of Waikato
Private Bag 3105, Hamilton

Introduction

New Zealand underwent major curriculum reforms in the early 1990s. These reforms were determined by the New Zealand Curriculum Framework (Ministry of Education 1993), which provides an overarching framework for the development of curricula in New Zealand and which defines seven broad essential learning areas. The seven essential learning areas that describe in broad terms the knowledge and understanding that all students need to acquire, are health and well-being, the arts, social sciences, technology, science, mathematics, and language and languages. For example, the essential learning area of science includes the subjects of science, biology, chemistry, physics, earth sciences, agriculture, horticulture, and geography, as well as aspects of home economics and environmental studies.

Technology education for all students is a relatively new phenomenon in national and international curricula. Although New Zealand has a long history of technical education in the senior primary and secondary school, a framework for technology education for all students has only recently been developed. Aspects of technology have been included in many existing school programmes, and some programmes have included "technology" in their title. However, these have been presented and undertaken in a coherent way. One area that included technology in the title of one of its strands was science.

These is an emphasis throughout the Science curriculum on using technological applications to teach science, or defined as merely applied science. This means that other forms of knowledge, which are all essential for technology, are not apparent. At the lower levels in the curriculum, technology is viewed as merely applied science, whereas at the higher levels technology is seen as influencing and changing scientific ideas. Relationships between science and technology are more complex and subtle than this (Gardner & Fensham 1994; Jenkins 1994), and Gardner (1994) provides numerous examples to indicate that, historically, technology cannot be understood merely as applied science.

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

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

The three interrelated general aims provide a framework for developing expected learning outcomes, and make a valuable contribution to formulating a balanced curriculum for technology education.

The practice of technology in the world outside the classroom covers a diverse range of activities from agriculture through to the production of synthetic materials and electronics. Technology education must reflect this diverse practice and not limit itself to designing and making with a limited range of materials. The development of technology education must reflect the relevant technological activity. Therefore, it is essential that we consider a range of technological areas in the teaching and learning of technology that are appropriate in the New Zealand context.

Each technological area has its own technological knowledge and ways of undertaking technological activity. It is important, therefore, that students experience a range of technological areas and contexts to develop an understanding of technology and technological practice. Theories of learning also point to the fact that, the more students can work in a number of contexts and areas, then the more likely they are to develop effective knowledge about technology and transfer this knowledge to other contexts and areas (Jones & Carr 1993).

In the New Zealand Technology curriculum the

technological areas include: materials technology; information and communication technology; electronics and control technology; biotechnology; structures and mechanisms; and food technology. Technological areas contexts and achievement aims should be seen to combine into an approach to technology education appropriate for all levels of schooling.

The individual objectives arise from the general aims of technology education. It is impossible to undertake a technological activity without technological knowledge and the utilisation and transformation of other knowledge bases. Students need to develop an understanding of the principles underlying technological developments such as aesthetics, efficiency, ergonomics, feedback, reliability, and optimisation. This knowledge and principles will be dependent on the technological area and context the students are working in. The understanding of systems is essential in developing knowledge in technology. Students will also need to develop an understanding of the nature of technological practice and how this has similarities and differences in different technological practice. It is important that students have an understanding of a range of technologies and how they operate and function. An understanding of strategies for the communication, promotion, and evaluation of technological ideas and outcomes is integral.

Technological activity arises out of the identification of some human need or opportunity. Within the identification of needs and opportunities, students will need to use a variety of techniques to determine consumer preferences. In technological activities, students should develop implementation and production strategies to realise technological solutions. Part of this will involve students in developing possible ideas that will lead to solution, and develop and use strategies to realise these ideas. Within this, students will need to manage time, resources, and people and produce the outcome that meets the identified needs and opportunities. Students should communicate their designs, plans, and strategies and present their technological outcomes in appropriate forms. Part of this process is the devising of strategies for the communication and promotion of ideas and outcomes. Throughout the technological activity, students should continually reflect upon and evaluate the decisions they are making. Research indicates (Jones et al. 1995) that this is essential if students are to realise their technological outcomes.

Students should develop an understanding of the ways in which beliefs, values, and ethics promote or constrain technological development and influence attitudes towards technological development. Students should also develop an awareness and understanding of the impacts of technology on society and the environment.

Progression was expressed in terms of increasing number of variables and the complexity of those variables rather than in terms of increasing complexity of solution or skills development. Progression may be more valuably conceptualised as a broadening and widening of the issues identified as essential to a technological activity (Jones et al. 1995).

Conclusions

Unlike Science and Mathematics curriculum development, there was initially no culture of technology education in New Zealand, therefore part of the meeting and writing process had to develop this. There had to be an agreed understanding of technology and technology education to be able to proceed. This came about through the development of the policy papers, presentations to national teacher groups, community contract, and negotiation at many levels. Different philosophies and interest groups had to be taken into account.

This was only the first stage in the development of a Technology curriculum. The next stage is the way it is interpreted in schools and in the classroom. Technology education does not have a historical home in New Zealand schooling. It will take time to develop a culture of technology education in New Zealand schools. However, the development of this culture could easily be undermined by misinterpretation of technology education by various interest groups, the importation of technology education practices and resources from other countries into New Zealand, and the issue of subject status. The more pragmatic issues such as the impact of national qualifications framework, and a rushed implementation programme on top of teachers who are already coping with curriculum change overload, must all be taken into account in order to break down barriers to the development of technology education in New Zealand schools.

References

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