



Revising the National Technology Curriculum Through Action Research: practical and political action in New Zealand

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Abstract

The national technology curriculum for New Zealand is undergoing redevelopment as part of review and revision of the 1990s national school curriculum framework and contributing subject statements. The technology curriculum was introduced to support New Zealand's competitiveness in a global market and emphasised technological capability through product development within a soft determinist understanding of technology. Since 2000, the technology education community has been involved in two major projects, the National Exemplars Project developing exemplars of student learning in all curriculum areas and the New Zealand Curriculum Project articulating statements of the 'essence' of each curriculum area and redeveloping curricula. In technology, these projects represent contrasting forms of action research. The former employed school-based research for practical action, involving a broad representation of the technology education community and new directions for technology, and the latter pursued policy-led research for political action, involving a subgroup constructed around the 1990s curriculum developers, and is ongoing. Pre-eminence of research for political action signals entrenchment of technology education for economic growth, in line with Government's investment in a Growth and Innovation Framework. This is despite the curriculum review's espousing sustainability-related 'future-focussed themes'. Loss of the opportunity to broaden the scope of technology education signals loss of the technology education community's commitment to school technology and abnegation of New Zealand's responsibilities to a global society, at least for the next decade.

Key words

curriculum development, action research, technological literacy, teacher education

Introduction

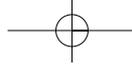
Revising national curriculum, namely the learning, teaching and assessment that goes on

in a nation's classrooms, entails review and modification of national requirements for curriculum. In New Zealand, this revision process began in 2000 less than a decade after the introduction of a national framework for curriculum (Ministry of Education, 1993a) and only a few years since some national statements for 'essential learning areas' were introduced, including that for technology (Ministry of Education, 1995). This paper critically examines the ongoing process of revision of the New Zealand technology curriculum statement, as action research (Elliott, 1991).

Action research sits comfortably with New Zealand's ideal of inclusiveness and egalitarianism. Until the 1990s, national curriculum revision followed a tradition of teacher inclusive rolling revisions of subject prescriptions and syllabi. Within school settings the revision of school and classroom curricula commonly employed the teacher-as-researcher model of curriculum development. Both national and school-based curriculum development exhibited the features of democratic action research. Within the present managerial context, however, action research has been appropriated by government in its bureaucratic form, as a means to implement national curriculum statements at school level.

According to Hammersley (2004), action research entails an inherent tension between action and research, as action and research have different goals, of making change and generating new knowledge. In most action research, the two are brought close together in an oscillating relationship such that research addresses the focus of the action and the research results feed back into the action. In this 'research-subordinated-to-action', Hammersley identifies the tension played out differently depending on the practical or political goals of the action. I will argue that in revising the technology curriculum, initial research for practical action using democratic means has been overtaken by research for





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political action through bureaucratic means, with serious consequences for the technology curriculum and for the commitment of the technology education community.

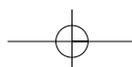
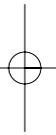
The revision involves three overlapping phases, in action research terms. The National Exemplars Project from 2000 reviewed, reinterpreted and developed support for schools in the implementation of the existing curriculum statements, including that for technology, in national subject-based action research cycles. These contributed to 'reconnaissance', conducted also from 2000, in regard to the implementation of the national curriculum as a whole. The action following the reconnaissance included the redevelopment of the curriculum statements, including technology, through further subject-based action research cycles within the New Zealand Curriculum Project, which began in 2003 and is ongoing.

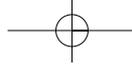
The New Zealand Technology Curriculum Context

The introduction of the national curriculum statement, *Technology in the New Zealand curriculum* (Ministry of Education, 1995), was a significant part of New Zealand's educational response to high overseas debt and an economy in trouble in the early 1980s. A review of national science research towards the end of that decade (New Zealand Government, 1986) had resulted in its reorganisation, the promotion of technology development as applied science, and the introduction of technology as a new school subject at compulsory levels. Technology education was the primary tool in the new National government's reshaping of the curriculum to promote national economic growth (O'Neill and Jolley, 1996/1997; Peters and Marshall, 1996). *The New Zealand curriculum framework* (Ministry of Education, 1993a) placed the control of what and how school learning was undertaken firmly in the hands of central government. Assessment was given emphasis, as might be expected of a conservative approach, with highly structured 'achievement objectives' articulated at eight achievement levels in all learning areas. Schools, with

supposed autonomy, were required to manage and budget for teaching and learning to meet these achievement standards. This managerialist approach, prioritising efficiency through competition, reflects a neoliberal ideology that is widely recognisable in market economies (Olssen, Codd and O'Neill, 2004).

National curriculum statements were developed under contract in each essential learning area, and that for technology was produced in draft form within a year (Ministry of Education, 1993b). Although in 1992 New Zealand-based technology education research was extremely limited, the developers were able to draw on the technology education research undertaken by them in the United Kingdom and elsewhere, and on the experience of technology curriculum development in the UK and also Australia. A policy framework was developed in an initial phase (Jones and Carr, 1993) and, in the subsequent development of the curriculum statement, teachers and teacher educators were invited to form 'writing groups' to assist in the selection and articulation of 'learning and assessment examples' (Jones 2003). Arguably, however, these participants' lack of background in this new subject meant the experience was one of personal development rather than professional contribution. The draft was sent to schools and the wider community for comment and was approved two years later with the introduction of an overall aim of 'technological literacy' to embrace the three 'strands' of 'technological capability', 'technological knowledge and understanding' and 'technology and society' (Ministry of Education, 1995, p. 10). In this curriculum statement, technological literacy both takes meaning from the integration of the strands and provides the aim for learning through the strands, it has never been independently defined. According to the Secretary for Education, the technology curriculum aims 'to develop technological literacy... to enable students to participate fully in the technological society in which they live and work... (and) to make informed choices about technology and to be the innovators of the future' (Ministry of Education, 1995, p. 5).





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Curriculum implementation was undertaken through government contracts let to the curriculum developers to train national 'facilitators' who then undertook training of 'lead teachers' within schools. In schools these lead teachers worked with classroom teachers to develop locally appropriate school-based schemes. Central to these schemes were student learning experiences that integrated the three curriculum strands in holistic technological problem-solving activities. These technology activities were to address 'needs and opportunities' through the development of 'tangible outcomes' according to 'fitness for purpose'. Integration was also required across the seven identified technological areas, including materials, food, electronics and control, and production and process technology and with other learning areas, such as science and social studies. Activities were to be developed in a variety of contexts, from home and school to business (see Figure 1).

Videos of technology and technology education practice and their support materials (Ministry of Education, 1997) have been highly influential in promoting a market context for technological problem-solving. A subsequent series of booklets in each of the technological areas, for example, *Food technology: Classroom practice in Years 1 – 8* (Ministry of Education, 2000), elaborates examples of student product development with recognition of 'client needs', 'consumer demands' and 'marketing preferences' and typical market goals of productivity, profit and efficiency. The materials promote a soft determinist view of technology (MacKenzie and Wajcman, 1999) where the determinist inevitability of technological change, including human response through adaptation to such change, is moderated by recognition of relationships between technologies and members of society. This does not go so far as to recognise the embeddedness of technology within society, as part of and shaped by society. Nor does it recognise technology and society's further embedding in

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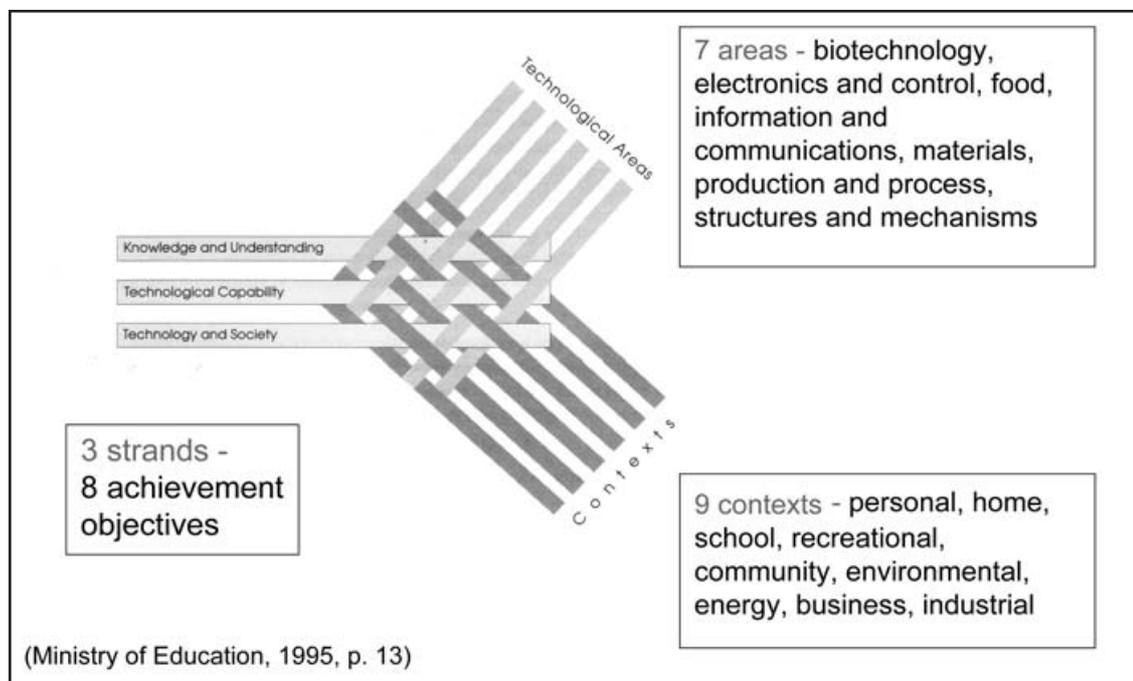


Figure 1. Technology curriculum structure





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the living and physical world, and the interrelatedness of technological, social and natural systems that constitute an ecological understanding of technology (Capra, 1997).

A parallel curriculum statement, *Hangarau* (Ministry of Education, 1999a), was developed in the Maori language from a Maori cultural perspective. *Hangarau* has some significant differences from the English medium statement, including just two curriculum strands, paralleling technological knowledge and technology and society, which are seen together to constitute technological capability, and learning examples that are relevant to Maori. Parallel professional and curriculum development work is undertaken for both curriculum statements. This paper does not attempt to address revision of the Maori medium statement, which is used in bilingual and Maori immersion schools. However, issues are considered in regard to the large proportion (over 85%) of Maori students who attend English medium schools and use the English medium statement, which provides just one suggested learning example drawn from Maori culture, the *hangi* or earth oven.

From the mid 1990s, large sums of money, by New Zealand standards (\$22 million), were invested in teacher professional development in technology. Initially there was considerable enthusiasm among teachers for this new learning area, but the limited nature of the professional development gave teachers an inadequate base from which to develop school-based schemes. The problems of this professional development approach were compounded by the particular demands of the new area, including the integration of curriculum across technological areas and across learning areas, and the difficulty in achieving holistic learning in a context of fragmented assessment (Davies, 1999a). By the time technology curriculum implementation was required, in 1999, there was avoidance of curriculum change and many secondary schools, in particular, used the ambivalence in the curriculum statement in regard to implementation to demonstrate compliance by

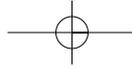
simply identifying, as technology, all those technology-related activities they were already undertaking. At middle school levels, cultures of technical practice that had been developed in the provision of technical education through manual training centres, were influential in maintaining the status quo. Technology was more likely to be implemented holistically at primary levels where an integrated approach to teaching is common practice.

Primary teachers, however, complained of difficulties with implementation as soon as they began to use the curriculum statement, because of a lack of specification of knowledge (Smits, 1998). The statement's learning examples were brief and relied for their interpretation and conversion to classroom schemes on a deeper understanding of technology than teachers had acquired through the available professional development. Mawson (1998) followed eighteen secondary technology teacher trainees through their year of training and into their first year of teaching and found increasing disillusionment as they attempted to implement the statement in the school setting. In an investigation of fifteen secondary technology teachers' self-reports of classroom technological problem-solving, understandings were found to range from development and application of technical skills, through product development (the curriculum approach), to just three teachers considering alternative solutions in relation to stakeholders and their values (Davies, 1999b). Case studies of technology assessment conducted at this time (Moreland and Jones, 2000) found teachers assessing affective responses to learning technology and social, especially cooperative, skills rather than conceptual and procedural technological knowledge. They conclude that teachers' 'concepts of technology were not yet robust enough to retain subject integrity' (p. 302).

Technology Exemplars - research for practical action

In 2000, a newly elected Labour government responded to these and parallel concerns in other learning areas with the *National*





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Exemplars Project (Chamberlain, 2001). Through this project contracts were let to curriculum specialists to work with teachers to identify and develop samples of student work 'to illustrate learning, achievement and quality' in each curriculum area (Ministry of Education, 2002a, p.1). The exemplars were to highlight aspects of student learning chosen to indicate progression in key characteristics of learning, and these characteristics were to be elaborated in 'matrices' of progression across achievement levels 1 to 5 (which covers years 1 to 10).

In the technology exemplars project three groups of professionals from the technology education community were established: a Development Group of largely school technology advisers who developed draft exemplars in collaboration with 35 experienced classroom teachers; a Quality Assurance Group of teachers, technology teacher educators and researchers to review the draft exemplars and

develop draft matrices of technology learning; and an Advisory Group of technology teacher educators and researchers who reviewed both the draft exemplars and matrices. While the contractor and a non-specialist officer of the Ministry of Education participated in all group meetings, direct communication between the groups was strictly limited. As a member of the Advisory Group, I understood this was to encourage open discussion within the groups and open critique of draft exemplars and matrices, and this was certainly my experience. Reporting between groups by the contractors was facilitated by audiotapes and field notes taken through a contracted action research project, which operated across all the exemplar development contracts (Poskitt, Brown, Maw and Taylor, 2003). The research also conducted surveys of trials of the draft exemplars and matrices in a further set of schools, and reported these to the exemplar development contractors (see Figure 2).

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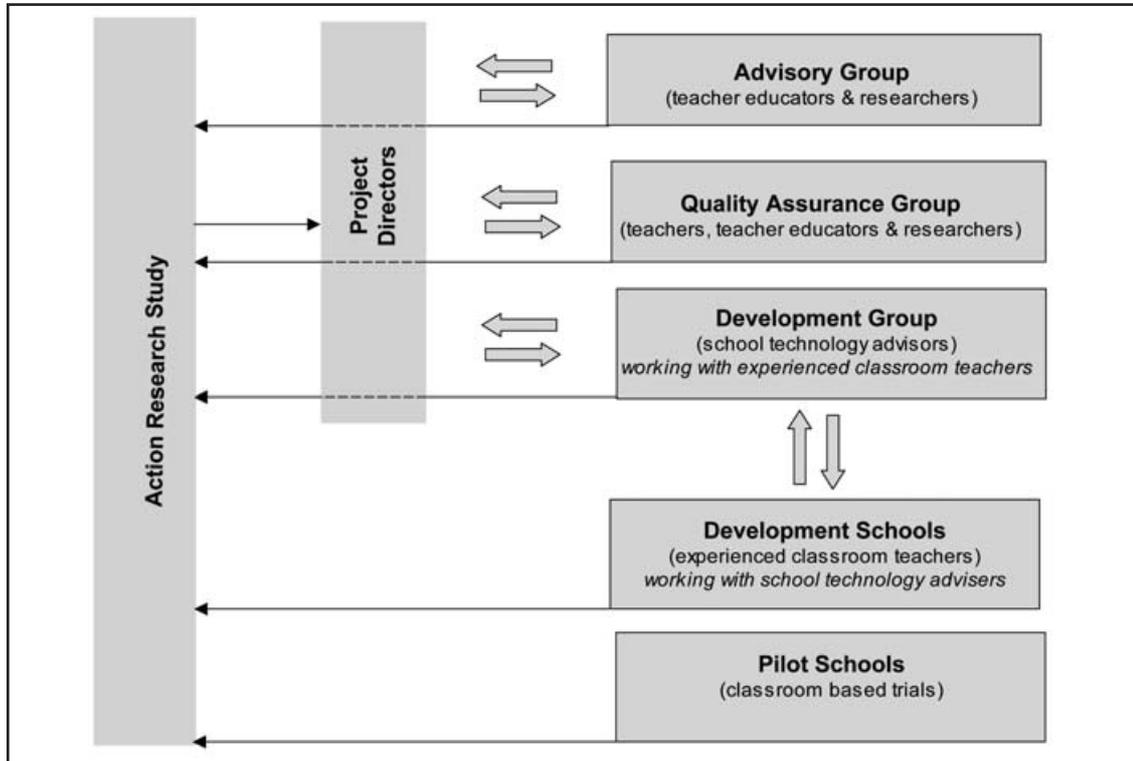
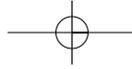


Figure 2. Technology exemplars project: Participants





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The exemplars and matrices were developed through action research that addressed a problem in professional practice, namely, classroom curriculum implementation. The research was conducted in several cycles: initially the development of draft exemplars of learning by the Development Group and the experienced classroom teachers working in their schools; then the review and revision of the exemplars and the development of draft matrices, involving the Quality Assurance Group; and finally the involvement of the Advisory Group and pilot testing of the draft exemplars and matrices in further review and revision (see Figure 3). Despite the political framing, the project enabled collaboration across the breadth of the technology education community over an extended period of time, and the freedom to propose, trial and reflect on characteristics of learning (O'Sullivan, 2003). The location of the research within such *practical* action supported deliberative democracy and the construction of new knowledge.

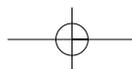
Thirty-five exemplars were developed across levels 1 to 5 and across the range of technological areas (Ministry of Education, 2002b). The exemplars provide authentic samples of student work annotated to show teachers what to look for in assessment, and they articulate the teaching unit from which the work is derived. An illustration from an activity designed to help a local farmer prune the upper branches of trees on his farm is entitled *Climbing Trees* and is shown in Figure 4 (overleaf). While the activity is client-oriented, it is also concerned to develop ecological consciousness.

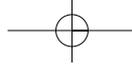
The draft technology matrices (Ministry of Education, 2002c) articulate overall progression in student learning for technological literacy and progression in five component characteristics of learning across the five levels of achievement. The matrices suggest a view of technological literacy that entails understanding of technology as socially shaped, centrally implicated in the shaping of the social and biophysical world and

<p>Climbing Trees (excerpts) Technological areas: Structures and mechanisms, Materials</p>	<p>Level 5</p>	<p>Identifying client needs</p>
<p>The Learning Context The class interviewed a farm forestry owner to identify his needs and the opportunities for them to meet his needs. The teacher introduced the class to national farm forestry and made them aware of the issues and technologies available in the area.</p>		
<p>What the Work Shows Identifying client needs Idea generation linked to materials selection Testing design ideas with the client Ongoing communication with client to end product</p>		<p>Problems Analysis by student learning characteristics</p>

(Ministry of Education, 2002b, pp. 1-4)

Figure 3. Technology exemplar: Climbing trees





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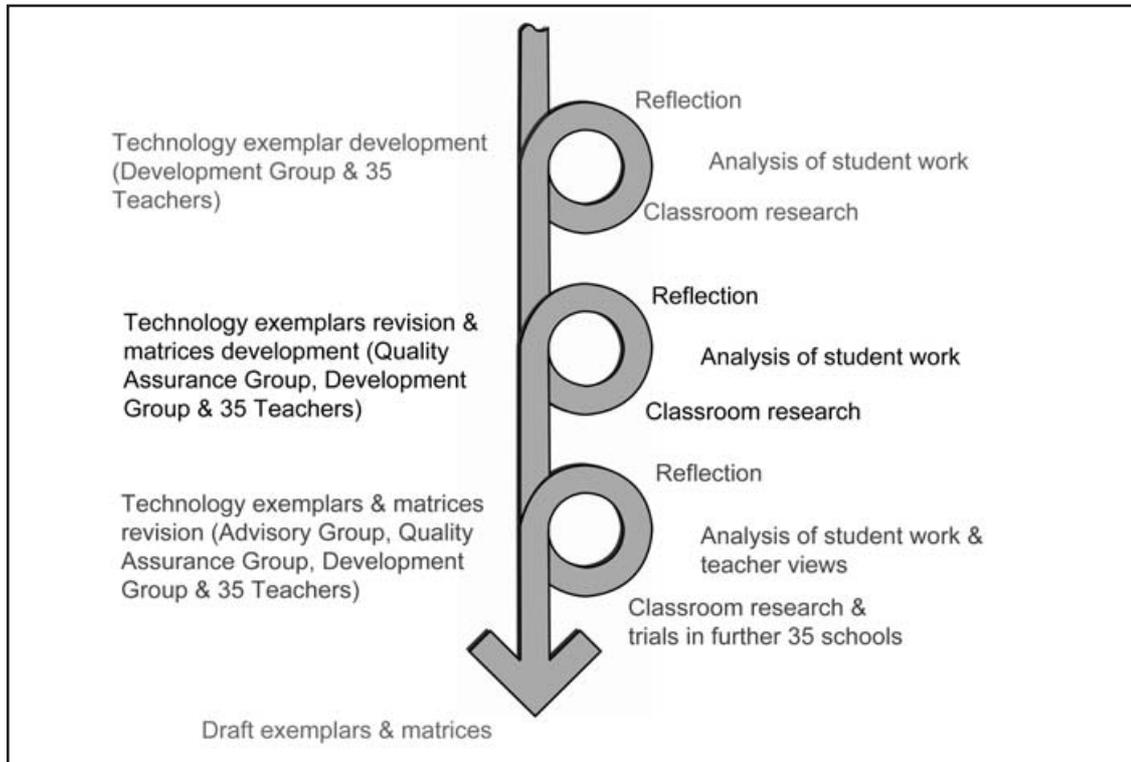


Figure 4. Action research: National technology exemplars project

demanding of the development of value judgement in decision making (see Table 1). The five characteristics of learning are 'being innovative, creative and a risk taker', 'communication and modelling', 'decision making and discernment' as well as the more familiar 'developing and achieving solutions' and 'developing and using technological knowledge'.

These characteristics identify the beliefs, values, knowledge and practice that may be seen to constitute a distinctive Discourse (with a capital 'D') or 'way of being in the world' (Gee, 1996). According to Gee, such a Discourse would be one of the number of 'secondary' Discourses which individuals acquire through acculturation and explicit learning, following acculturation into a 'primary' Discourse in the home. The Discourse supported by the draft technology matrices

includes a socially critical dimension, and would be radically different from the Discourse founded in the soft determinism of the Ministry of Education's curriculum implementation resources. Students acquire literacy as they become fluent in a Discourse, but the degree of fluency they achieve depends in part on the extent to which they adopt the values and beliefs of the Discourse. This in turn depends on possible conflict with the values and beliefs of other Discourses to which they belong. Such conflict provides for contribution to and development of a Discourse and also informs a notion of critical literacy. Where other Discourses are brought to bear on that of school technology, such as those of social studies or media studies that are underpinned by different values and beliefs, students would achieve liberating technological literacy (Davies Burns, 2000).



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Overall statements of student learning (<i>excerpts</i>)				
Level 1 (Y 1-3)	Level 2 (Y 3-5)	Level 3 (Y 5-7)	Level 4 (Y 7-9)	Level 5 (Y9-11)
Students begin to distinguish between the made and natural world ... understand that technologies can be helpful or harmful ...	Students are more familiar with our technological world. ... becoming aware that technology can affect the environment ...	Students know how technology has evolved over time ...beginning to understand that people's changing expectations influence ...	Students ... have some understanding of recent developments in technology ... question the consequences of using and developing ...	Students recognize that technological decision making ... can result in desirable and undesirable consequences ...

Being innovative, creative and a risk taker
Communication and modelling
Decision-making and discernment
Developing and achieving solutions
Developing and using technological knowledge

(Ministry of Education, 2002c, pp. 1-2)

Table 1. Draft technology matrices

Reconnaissance

The matrices were intended to ground work on the revision of the curriculum and, in action research terms, contribute to reconnaissance for a new cycle of research. In parallel with the exemplars project, the Ministry of Education undertook several other initiatives to inform a review of *The New Zealand curriculum framework* and its Maori medium equivalent *Te nga marautanga o Aotearoa* (Ministry of Education, 1993c) and their supporting curriculum statements. These included contracted:

- literature reviews of teaching, learning and assessment practice, both generally and in a range of curriculum areas;
- review of assessment data gathered through the National Education Monitoring Project (NEMP), several IEA studies, on mathematics and science and reading literacy, and OECD science studies;
- external 'commentaries' on the national curriculum framework and statements; and
- surveys of school and teacher experiences of implementation of the New Zealand school curriculum.

Together these initiatives contributed to the *Curriculum stocktake* report (Ministry of Education, 2002d), which concluded that the present overarching curriculum framework should be retained, but that improvement was needed within and between dimensions of the framework, including review and refinement of the learning areas. Revision of the curriculum statements was restricted to 'redevelopment'.

Within this reconnaissance, however, the technology curriculum statement was shown to be distinctive for the problems identified with its implementation. The statement was found by teachers to be the most difficult to use of all the curriculum statements. Teachers identified a lack of resources impeding implementation, and a need for more content knowledge, and more teachers wanted professional development in technology than in any other area (McGee, Jones, Bishop, Cowie, Hill, Harlow, Oliver, Tiakiwai and MacKenzie, 2002). In particular, technology teachers reported uneven implementation of the curriculum with respect to strands and technological areas. For



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the two-thirds of teachers not paying the required equal attention to all three curriculum strands, only a handful gave emphasis to the technology and society strand (4% of respondents). They found teaching was easiest in food technology and in materials technology, which relate to cooking and to woodwork, metalwork and clothing of the old technical curriculum. Further, half of the technology teachers did not find the curriculum statement helpful in meeting the needs of Maori students in their classroom. In regard to professional development, almost half of these technology teachers found 'other teachers in the school' the most useful sources of knowledge. While this reflects typical workplace learning through local communities of practice, in technology teaching, where teachers lack understanding of the curriculum, uninformed practice may be shared and reproduced.

Technology Essence Statement - research for political action

Following the release of the *Curriculum stocktake* report a round of national meetings of educationists and researchers was organised by the Ministry of Education on general issues of pedagogy and assessment and on specific learning areas. In 2003, the Ministry of Education launched the New Zealand Curriculum Project to redevelop the curriculum, establishing a curriculum stocktake 'reference group' and a reference group in each learning area that was charged with developing an 'essence statement' to articulate the fundamental ideas of the area and the important learning outcomes for students. Draft statements were to be posted for discussion on the Curriculum Project Online (Ministry of Education, 2004) and presented to teachers through regional meetings in the 'co-construction' of the redeveloped curriculum. The Technology Reference Group is convened by a Ministry of Education technology specialist and comprises one of the co-directors of the contract for the original development of the technology curriculum, several of their doctoral graduates, and practising teachers and school advisers who have participated in facilitation and research

activities with the group (see Figure 5). As action research, this cycle represents research for *political* action; the reference group provides a single research perspective, well known to the Ministry of Education through previous government contracts, and engages with the community of teachers, teacher educators and researchers through a dedicated Ministry website. Although the Ministry of Education claims co-construction of the redeveloped curriculum, co-construction is possible only within the reference group; the website provides a poor substitute for face-to-face engagement. Indeed the site provides evidence of people talking past each other (Metge and Kinloch, 1978) and of 'lurkers' rather than contributors amongst those registered to the site. Researchers and teacher educators have been reluctant to register. The process disenfranchises the technology education community and leaves any redeveloped curriculum exposed in the process of implementation.

Signally, the latest draft of the essence statement (Ministry of Education, 2005) fails to commit to a statement of the essence of technology, identifying activities and attributes that are common to many disciplines and leaving technological terms, including technological literacy, undefined. The essence statement retains, but renames and reorganises, the three curriculum strands. Most significantly, 'technological practice' replaces 'technological capability' and sequences aspects of this strand according to a linear design path, 'brief development', 'planning for practice and 'outcome development and evaluation', albeit with encouragement to act iteratively. These proposed technological practice achievement objectives, which will include practice knowledge, arise from the Ministry of Education contract Technology Education Assessment Lower Secondary (Compton and Harwood, 2003). The objectives will be recognisable to teachers as the traditional linear process of design, and teachers will find them comfortable to implement; but they lack consideration of values and will reinforce technical problem-solving.



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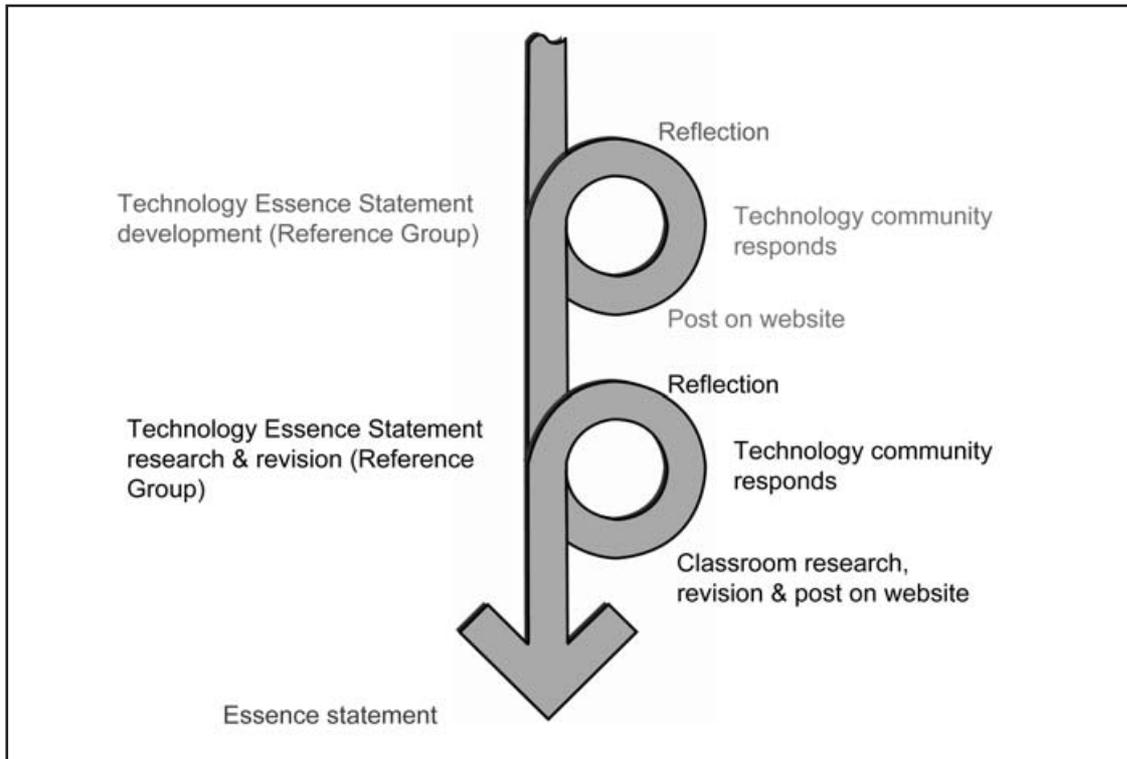


Figure 5. Action research: Technology curriculum project online

This assessment research appears to have driven the proposed change as the redefinition of the remaining two strands is consequential upon that for technological practice. Contracts for research elucidating these strands have been let to members of the reference group. It is not at all clear, however, why any redefinition of strands is necessary. If, as is claimed in the proposal for the technology practice strand, the purpose is to no longer require students to learn technology by carrying out technological product development activities, then that could be accomplished by simply making such a statement; teachers could then make professional decisions about the design of school and classroom schemes and the selection of objectives for assessment. Further, teachers' concerns in regard to a lack of specification of content knowledge are not addressed in the essence statement. Although appropriately removing the technological areas that served to fragment technological learning,

the statement fails to replace these with any integrative topics, such as energy or horticulture, through which important conceptual and procedural technological knowledge could be identified and developed.

These changes respond to issues arising from the implementation of the technology curriculum, but the redevelopment of the curriculum is also required to address more general issues identified in the *Curriculum stocktake* report. In particular the report draws attention to the consideration of values in the New Zealand curriculum and suggests they should have a more explicit role. The relevance to technology is obvious, but values are not highlighted in the draft technology essence statement and they are not mentioned in the proposed practice strand where value judgement should be central. Values-related 'future-focused curriculum themes of ... citizenship, education for a sustainable future



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(and) bicultural and multicultural awareness' (Ministry of Education, 2002b, p.3) are similarly promoted in the report, but are not taken up in the essence statement. Moreover, there is no recognition of the relevance of *Guidelines for environmental education in New Zealand schools* (Ministry of Education, 1999b), though technology is arguably the key curriculum area for developing education for sustainability. Neither is there any mention of Maori and Pasifika students whose needs the report requires to be better met and whose needs technology teachers felt unable to meet through the existing curriculum.

The curriculum redevelopment heralded in the draft technology essence statement appears to be making unnecessary change while leaving fundamental issues unaddressed. Technology at senior school levels does not provide entry to university and student numbers indicate little enthusiasm for the subject. For technology, nothing short of a radical reappraisal of the learning area is needed. The subject must keep pace with wider concerns on the state of the environment, increasing globalisation, new forms of democracy and learning for life and must provide the academic rigour that will qualify a path to tertiary study. Such technology education, however, is a far cry from the vocationally oriented training for national economic growth, which is retained in the proposed redevelopment of the curriculum statement and is promoted at senior secondary levels through the Technology Education Beacon Practice Project (Techlink, 2005). This project aims to increase interaction between technology education and business needs and has funding of \$6 million over four years through Government's Growth and Innovation Framework. This framework is designed to 'lift (New Zealand) back up the economic ladder' (Clark, 2002, p.1) and is the policy focus for the Ministry of Economic Development. Sustainability is addressed in just one of 25 policy papers where it is identified as subservient to economic development. The framework conflicts with the *Curriculum stocktake* report's espousal of sustainability

and citizenship and raises questions about Government's commitment to such future-focused themes.

Conclusion

Redevelopment of the technology curriculum is being conducted against a backdrop of local research and wider review of education theory. Despite this reconnaissance and a flirtation with democratic action research supporting practical action in the initial, holding phase of revision, Government has adopted a bureaucratic approach and conducted research for political action in the present, binding phase. The two major projects of the curriculum revision, the Exemplars Project and the Curriculum Project are in stark contrast, as shown in Table 2.

The exemplar research assisted teachers in building on everyday practice, in making judgements about children's work. Through reflection and discussion with peers, and in collaboration with teacher educators and researchers, teachers identified characteristics of learning to guide assessment and to inform teaching programmes. Elliott (1998) explains the effectiveness of such self-reflection for changing teaching practice. He uses Giddens's (1984) theory of structuration, which recognises the role of individuals in maintaining or changing social systems (essentially patterns of behaviour) through their interpretation of the systems. Teachers' work is recognised as heavily routinised and difficult to change as teachers rationalise and maintain the social systems created by their interpretation of instruments such as curriculum statements and teachers' guides. This Giddens calls 'practical consciousness'. To change the social systems teachers need to develop 'discursive consciousness' in discussion and critical examination of the systems with their peers. The Technology Exemplars Project provided just that opportunity for participants. Teachers involved in exemplar development recognised its significance for conceptual change in surveyed comments, including 'this is the best PD (professional development) I have ever had' (Parfitt, 2005), a view endorsed by a fellow





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Action research for practical action: <i>National Exemplars Project</i>	Action research for political action: <i>Curriculum Project Online</i>
Democratic decision-making, inclusive, practice-research nexus	Bureaucratic decision-making, exclusive, research-practice hierarchy
Diversity of research and practice perspectives, representative groups of teachers, teacher educators and researchers	Single research perspective, group selected by snowball sampling of researcher, teacher educator and teacher participants
Regular meetings of representative groups and with participating schools, structured communication between groups	Regular meetings of selected group, web-based communication with wider technology education community
Action, observation and reflection through participant classroom practice; research integrated with action	Research contracted to group members to fulfill policy objectives; research separated from action
Open discussion constitutive of idea generation, articulation in practice, theorization and critique	Closed discussion within selected group, outcome presentation to wider technology education community, invited comment
Construction of new technology (in exemplars) and new theory (in matrices), technological and scientific outcomes	Application of theory (in essence statement), contracting of new research (to elaborate strands), technical outcome

Table 2. Research for practical vs political action

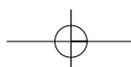
member of the advisory group who commented to me that their involvement was 'great PD for me'.

The political action orientation of the present cycle of curriculum action research, on the other hand, has not so far and is unlikely to, support such reflective consciousness. Further this orientation has serious consequences for the conceptualisation of technology and technology education in the redeveloped curriculum. Deference to economic goals reinforces a soft determinist view of technology and functional literacy, as currently found in middle school technology teachers' focus on technical skills and product development. Commonly teachers saw technological literacy as the use of technological terminology (Edmond-Thompson, 2004). Teachers need professional development that provides the opportunity to develop liberating technological literacy by exploring the conflict between

Discourses in which they participate. The Discourses of teaching challenge the Discourse of soft determinism, as do those of social justice, feminism and non-western cultures in which Discourses teachers are likely to participate.

While changing classroom practice requires teachers to work together to examine and revise programmes through the development of discursive consciousness, Elliott (1998) notes that the individuals shaping and maintaining curriculum extend beyond teachers and the education community. They include parents, employers and the wider community who similarly need to develop discursive consciousness. In such involvement the many parents who retain a technical skills understanding of technology education, with well-finished take-home products as the goal, would have the opportunity to examine their views, and revise their understanding. The

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wider community also has much to contribute to curriculum development. According to a recent survey of public perceptions of science and technology (Hipkins, Stockwell, Bolstad and Baker, 2002) New Zealanders identify as primary, in the relationship between science, technology and the economy, the importance of science and technology for preserving New Zealand's environment. Rather than explaining the curriculum to parents, employers and the wider community, as called for in the Curriculum stocktake report, the community needs to be involved in curriculum development.

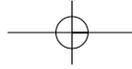
Finally, pursuing technology education for economic growth assumes continuation of the work society, whose core values according to Beck (2000) are dissolved by global capitalism. In the face of deregulation and the 'flexible' workforce, the loss of full employment and ecological crises, which herald the risk society, Beck argues for 'a strengthening of the political society of individuals' (p. 5) both locally and transnationally in seeking new alternatives. School technology clearly has a key role to play through the development of an ecological understanding of technology and liberating technological literacy.

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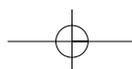
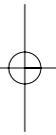
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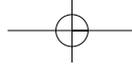
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