CHAPTER 11

PERSPECTIVES ON IMPLEMENTING A NEW TECHNOLOGY SYLLABUS IN QUEENSLAND SCHOOLS.

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Abstract

This study explored factors that favoured and inhibited the implementation of the new Key Learning Area Technology syllabus (QSA, 2003a) in Queensland. It sought to identify and clarify the implementation needs of the system, districts, schools and teachers. The aim was to help the system to target specific areas when developing a professional development program for schools. The implementing system differs from the statutory authority responsible for the curriculum development and provision of print and e-based initial in-service materials (QSA, 2003b). The audience for this paper is the education system's curriculum implementation branch. Our questions asked: 1. What are the perceived needs and technology education expectations of schools implementing the syllabus? 2. What vision do schools have for technology? How can schools be assisted in developing this vision? 3. What strategies do schools have in place to enhance "working technologically" under the new syllabus? 4. What factors and actions enhance or inhibit the syllabus's implementation? The factors that impact on implementation include systemic and district implementation models, teachers' views of technology, the relationship of technology to other key learning areas, assessment in an outcomes-based syllabus and to a lesser extent teaching time, networks and resources and physical space. The most apparent factor is teachers' limited understanding of syllabus outcomes and difficulty in 'making sense of outcomes'. Observations show that teachers' planning stalls when they need to identify appropriate conceptual learning that links to an outcome, and then plan learning activities that address the specific outcomes.

INTRODUCTION

A new Technology syllabus for Years 1-10 (Queensland Studies Authority [QSA], 2003a) was released for schools in 2003. These materials comprise the new syllabus, sourcebook modules, and a CDROM of case studies and presentations designed to educate and guide teachers. The syllabus has an embedded futures perspective and encourages the development of higher order thinking, and concept differentiation skills in teachers and students.

Technology is a new Key Learning Area (KLA) for primary schools, and requires teachers to reconceptualise the subject's content and pedagogy. Technology is more than an amalgam of traditional junior secondary school Manual Arts, Business Studies, Information Technology, Agricultural Science, and Home Economics. Further, the syllabus is outcomes-based such that planning, teaching and assessment focuses on concept learning and, where possible, high-level thinking. The syllabus is based on an approach to technology practice that differs from that of other states in that it does not use the Design, Make and Appraise (DMA) model. The system has chosen to expand this set to four phases: Investigate and Ideate in which learners explore and plan possible solutions (formerly Design), Produce (Make) and Evaluate (Appraise). Some Australian states have chosen to collocate science and technology in the one curriculum document. Together, the Queensland changes are a substantial challenge for teachers.

Shulman (1986) identified several areas of knowledge necessary for teaching, including knowledge of the curriculum, knowledge of students, subject matter knowledge, general pedagogical knowledge, and knowledge of ways to teach specific aspects of content (pedagogical content knowledge, or PCK). PCK is unique to expert teachers and is more than good pedagogy. PCK is necessary to teach key subjects like technology and is developed from content, pedagogy, knowledge of students, curriculum and assessment, and is influenced by the teacher's beliefs about learning and teaching, as well as contextual frames such as school organization and assessment (Magnusson, Krajcik & Borko, 1999). Jones, Moreland and Chambers (2001, p.1) comment on the need for teachers to construct such a knowledge base if we expect "teachers to add technology teaching to the learning areas that they are required to teach ... enhanced teacher knowledge related to concepts about the nature of technology and concepts in different areas of technology will promote quality feedback, which is essential in supporting and enhancing learning". Development of new knowledge for a KLA requires teachers to simultaneously advance their knowledge in several areas and levels, and may also ask them to re-examine their views of teaching and learning, Teachers need considerable support in making contextual and conceptual changes. It is

suggested that the changes sought are readily available in environments where there is a collaborative culture and opportunities exists for reflection in, on and about practice (Fullan & Hargreaves, 1992). The help needed will include in-class support, new content and pedagogical knowledge, supportive networks and knowledge-in-action rather than abstract knowledge. These strategies should enable teachers to embed the new curriculum knowledge in the context of new pedagogies. Table 1 illustrates the pedagogical shift required to assist with the uptake of this new syllabus.

Table 1: The new pedagogies (adapted from UNESCO publication: ICT in Primary and Secondary Education, n.d.)

	Instructional pedagogies	Constructional pedagogies
Classroom activity	Teacher centred	Leaner centred
	Didactic	Interactive
Teacher role	Fact teller	Collaborator
	Always expert	Sometimes expert
Student role	Listener	Collaborator
	Always learner	Sometimes expert
Expert role: science educator and scientist	Information source	Listener
	Didactic	
Instructional emphasis	Facts	Relationships
	Memorisation	Inquiry and invention
Concept of knowledge	Accumulation of facts	Transformation of facts
Demonstration of success	Quantity	Quality of understanding
Assessment	Norm referenced	Criterion referenced
	Multiple choice items	
Technology use	Drill and practice	Communication, collaboration, information access and expression

Simply supplying support materials to teachers is insufficient to ensure that the Technology syllabus (QSA, 2003a) will be effectively implemented. Periods of reflection and collaboration (Fullan & Hargreaves, 1992). are required where new ideas are sought inside and outside one's setting. A recent report (Australian Academy of Technological Sciences & Engineering, 2002) identified deficiencies in Australian teachers' knowledge and pedagogy in Technology, and highlighted the need to enhance teacher knowledge, and support the implementation of new technology programs. The new syllabus presents many challenges including teachers' ability to conceptualise, plan, resource, teach and assess the technology concepts derived from the syllabus. This study begins by evaluating some teachers' responses to these changes.

This study therefore explored and identified factors that favoured or inhibited implementation of the Technology syllabus. The evaluation of teaching considers the needs of three educational audiences: (1) systemic needs, (2) district needs and (3) school and teacher needs.

Consequently, the following questions emerged from the education literature, reports and our previous work with technology teachers (Hunt, Appleton & Harrison, 2004):

1. What are the perceived needs and technology education expectations of schools implementing the syllabus?

2. What vision do schools have for technology? How can schools be assisted in developing this vision?

3. What strategies do schools have in place to enhance "working technologically" under the new syllabus?

4. What factors and actions enhance or inhibit the syllabus's implementation?

METHODOLOGY

Our interest in "what is happening here" (Erickson, 1986) seemed best served by qualitative methods. Therefore the methodology was designed to allow us to 'hear' the voices of its multiple participants (Denzin & Lincoln, 1994; Patton, 2000). Multiple data collection points were employed to provide successive insights into the teacher knowledge, learning, skills and interest. These multiple data sources enhance the study's trustworthiness by allowing us to consider episodes where positive and negative findings are considered (Guba & Lincoln, 1989). This study was conducted over six months, allowing us to become sensitive to the meanings in the data. This allowed us to return to some sources to collect additional data to clarify meanings (Strauss & Corbin, 1998).

The Context

The study explored factors that enhanced and inhibited the implementation of the new Technology syllabus (QSA, 2003a) in Queensland schools. From a systemic perspective, we were interested in ways to support syllabus implementation, whilst from a school perspective, we were interested in schools' perceptions of support required to enhance Technology syllabus implementation. The usefulness and adequacy of the data collected to answer the research questions was considered in each of these contexts to provide indications of ways the system might support schools and teachers to provide richer technological experiences for students.

The Events

The research was conducted in two school districts. District 1 is described as an urban region with a catchment of some 50 public schools. District 2 comprises around 37 public schools in an area described as both regional and rural, with a significant regional centre on the coast and a large proportion of smaller schools (1-3 teachers) in a rural, almost remote belt some three hours away.

The data sources utilised included:

- surveys of teacher perceptions about technology education (Rennie & Jarvis, 2000);
- tests of teacher ideas of classroom practice, Draw a technology teacher (Jane & Appleton, 2001);
- transcripts from audio-interviews conducted during workshops, classroom visits and individual interviews about practice and belief;
- work samples of teacher unit preparation;
- online surveys of beliefs about technology;
- technology curriculum implementation questionnaire (Lewthwaite, 2001)
- transcripts from electronic discussion; and
- personal email communication.

Data from these sources identified a series of issues that appear to impact on the implementation of this new syllabus.

The Issues

The issues identified and discussed are clusters of ideas that need to be better understood by the system if more effective implementation strategies are to be employed and included:

- District implementation models: leadership and perceived priority;
- Views of technology;
- Planning and assessment;
- Outcomes-based syllabus implementation; and
- Networks.

District Implementation Models: Leadership and Perceived Priority:

The research focused on the perceived strengths and weaknesses of the two implementation models: the first district (D1) used external facilitators to implement the syllabus whilst the other (D2) used for the most part a local Education Adviser. D1 sought to reach all schools in the district (n=40). Twenty-three schools eventually participated, with some schools encouraging two or more teachers to participate. Support was through the provision of teacher relief funds to attend workshops during school hours. All teachers were self-identified, wanting to become a Key Teacher-Technology. This is seen as an important aspect. The D1 curriculum leadership group sought expertise from outside the education system to deliver the PD and to support and monitor the syllabus implementation. This district worked with personnel from the local university to develop 4 full day and 2 half-days (intensive stage) of professional development followed by semester-long in-class and online mentoring. The intensive stage involved two phases and was based on modelling pedagogical practices that reflected a shift from traditional pedagogies to constructivist pedagogies (Table 1). Given the constructivist underpinnings of the syllabus, a pedagogical shift towards constructivist practice was considered necessary to enable this new KLA to be better implemented. The alternative was a return to previous practices that in instances were known to be unsuccessful. In Phase 1, Year 1-10 teachers explored 'the nature of technology', the similarities and differences that exist between traditional views of technology and modern curriculum aims. These were building and clarifying actions. In Phase 2, the teachers explored and developed the pedagogies needed to teach the knowledge developed in Phase 1, while Phase 3 studied the in-school experience of the teachers as they begin implementing the new Technology syllabus in 2004: in-class and online mentoring.

Teachers were encouraged to publish their design tasks/briefs online for collegial critique. The cohort using this communication strategy showed considerable growth in understanding and dealing with the issues of implementation. Hay (2004) concluded his report to the system with this comment: "...the Interim Report indicates that the participating teachers will in time be equipped to fill their role/s as Key Teachers–Technology". This district indicated that it would continue to support key teachers through access to a leaders' toolkit training program, providing the skills necessary to share practice with colleagues and other schools. In a survey of participating teachers, comments included: "flexibility allowed in implementation showed a very good understanding, the pace was good and we were not as rushed as a lot of systemic professional development". These teachers have since developed wider networks across the district and have managed three one-day conferences (to July 2004).

In the second district, schools (n=37) were supported by an Education Adviser and university staff. Schools were offered a choice of three one-day, one-off sessions. This delivery model was not negotiated with the PD providers. This model is currently the one preferred, or rather in common use, by the system. It does not provide opportunity for reflection on matters of concern and collaboration across distance and time (Fullan & Hargreaves, 1992). Teachers received one day of Professional Development (PD) only, delivered by university staff. Forty teachers participated at two sites (Site A=32; Site B=8). Site A was an urban coastal town and Site B was a rural community 3 hours from the coast. After these events, the education adviser (EA) assumed responsibility for supporting schools and their staff. It is our belief that the reconceptualisation required for effective implementation cannot be achieved when the PD provider (EA) has a developing and limited understanding of the syllabus, that is, lacking in the specific PCK of the curriculum area. In the system, EAs have a generic role focussed on effective teaching and learning rather than KLA specificity. In a report to Education Queensland regarding progress in district 2, Eborn (2004) reported "... the broad development of a greater understanding and application of the technology KLA and the establishment of significant networks has not progressed as broadly as originally hoped". A teacher in this district told us: "I feel that we're rushed to do it." Comments from teachers in both districts described the perceived pressure felt with systemic delivered PD, where one or more days of consecutive, intensive workshops lead to information overload. Schools from outside the district's urban centre received limited support from the education adviser, a common problem associated with distance. The electronic discussion list requested and made available to these schools by the university facilitators was not used.

We conclude from this that districts taking a strategic and extended-delivery approach to PD enhance teachers' acceptance and delivery of new curricula. When management shows teachers that they value syllabus change by supporting it with external advice, release time and financial support, teachers take greater ownership of the PD. The 'dump and run' model of PD has limited impact as evidenced in Eborn's (2004) final report. In contrast, Hay (2004) concludes his report with these comments: "The exposure has had a positive impact on these teachers' self-perception and greatly enhanced their self-belief. Through the networking (both formal and informal) and the mentoring program, these teachers have grown professionally in knowledge and implementation of the Technology KLA, and developed skills that will enhance their ability to influence others in their schools about the Technology KLA implementation".

Views of Technology: Stories From the Field

Evidence from both districts showed that teachers have well developed views of technology as a KLA. This is not surprising given that most attendees were self-identifiers. Data drawn from teachers' experiences in both districts show a blend of stories about perceptions and practice that are of interest to the system's curriculum implementation staff and are illustrated in the comments following: "They've shown us some Power Point presentations about defining that technology isn't ICT." This teacher identifies a fundamental problem found in many schools and known from anecdotal reports to be widespread. The need to delineate between information and communication technologies (ICTs) and KLA Technology remains problematic. Another teacher told us: "... my specialist area is Home Economics, so I actually feel that the technology practice is very similar to the way I have always taught. I feel familiar with technology practice process in that sense." This teacher links technology to her current practice in home economics but did not deal with the issue of outcomes or conceptual understanding. This was a common position in schools in both districts.

Outcomes-based Syllabuses

Outcomes appear to be poorly understood and we are concerned at the approaches taken towards 'making sense of outcomes'. Identifying what outcomes mean in terms of technology practice and conceptual understandings seem to rely on a variant of the 'do-know' idea used by the curriculum developers. Whilst it is easy to identify technology practice (the procedural aspects of technology) from an outcome, a common belief in schools is that the remaining part of the outcome defines 'the know' or content knowledge. That is, the knowledge and the knowledge about skills and processes. Our observations show that teachers do not clearly identify

appropriate conceptual learning linked to an outcome; rather, they move directly to developing content and activities that 'might' be related to the outcome. The Technology Syllabus Guidelines (QSA, 2003b) provide useful elaborations to assist teachers surmount this barrier but this document is not in wide use. Teachers told us that they were not familiar with this element of the syllabus documentation; reinforcing our view that paper-based and e-documents are alone insufficient to transform teaching or introduce a syllabus that for many is both new and different. In many instances, we found these documents and support materials within the schools' resources centres (libraries) and either unknown to staff or unused. Of concern to the researchers was this conversation, confirmation of the previous comment and not uncommon in discussion with teachers from both districts.

John: Have you had much contact or use with the initial in-service materials?

Candy: The actual syllabus documents?

John: and the CD and the training pack?

Anna: Yes, only through the innovators schools conference last year that I went to.

John: Have you come across the elaborations in the initial in-service materials?

Candy: I think I might have seen them but I'm not I'm not really familiar with a lot of things.

It was interesting to note that the ways in which schools engaged with and used outcomes in planning varied. In one district, teachers became skilled in identifying learning experiences appropriate to outcomes. These teachers had been provided with a scaffold to aid this process: the LITE matrix (Jones & Moreland, 2002), which asks teachers to identify learning of four types; conceptual, procedural, societal and technical. Identifying these types of learning makes clear what will be assessed, together with informing the planning process. Our in-class observations and discussions with teachers in this district showed that teaching was enhanced for those teachers using the matrix, modified or otherwise. They expressed pleasure in having a tool that could resolve the issues of assessment and planning at the same time.

Schools in the other district approached working with outcomes in a different manner. The conversation below reveals a method that gives cause for concern: "Okay we go from the outcomes to core content and then we take our activities from core content. So since I've been at this school I have haven't had the necessity to go back to an outcome and say okay, is this

outcome being covered by what I am doing here because the content is being drawn from those outcomes and we are covering the content." Here, units are planned to address agreed outcomes and these determine 'appropriate' content. The teacher assumes that the content will support the conceptual outcomes. We could find no evidence of any cross-checking and whether or not the end result did in fact contribute to conceptual understanding, process, attitude or skills. This approach is somewhat problematic because it reduces outcomes to mostly content. Conceptual outcomes are implied but not specified in planning documents, leaving the teacher with too many choices and insufficient direction. One teacher explained to us how she understood and used outcomes: "... I believe that probably what I'm doing is certainly meeting the outcomes but I couldn't tell you what outcomes are fitting into my unit. I go through the process, design, investigation, production and evaluation process in most of my units that I teach but I haven't actually gone to the outcomes and aligned them into each one."

Another teacher shared with us this story: "... I honestly don't find the time to sit down and look at my planning and then align the object, the outcomes in there. I haven't honestly made time but and I know that's something I've been meaning to do for a long time." This teacher realises a weakness working with outcomes, but is unable to find time to deal with problems of which she is aware. This is a poignant message to systems about the need for planning time.

This indeterminate approach is of concern; first, because it is unlikely that appropriate outcomes are being met and second, because the problem is not recognised by other teachers or persons who should recognise the weakness of this idea. This points to the issue of misunderstanding of how outcomes should be used and interpreted. It is our belief that better scaffolding (such as that provided by the LITE matrix) would benefit teachers when interpreting, planning, teaching and assessing outcomes.

Observations from the other district confirm this view of supporting teachers to develop 'conceptual targets' at the beginning of the planning process. Rather than specifying content, the matrix returns the focus to technological outcomes (conceptual and technical). The matrix has been shown to help teachers in one district to identify concise technological learning that students will undertake in units of work. It scaffolded the definition of the task clearly and considers how the students will bring together different aspects of technology to complete the task.

This matrix prompts teachers to supply information under the following headings:

- Task definition (called design task in the client system);
- Technological area/s (called strands in the client system);
- Overall student technological practice. (The operationalisation of the conceptual, procedural, societal and technical aspects in student technological practice - integrating all four aspects in undertaking and completing the technology task.);
- Conceptual learning outcomes. (Knowledge and understanding of relevant technological concepts and procedures.);
- Procedural learning outcomes. (Knowing how to do something, what to do and when to do it.);
- Societal learning outcomes. (Aspects related to the inter-relationship between technology and groups of people.);
- Technical learning outcomes. (Skills related to manual/practical techniques.)

http://www.tki.org.nz/r/technology/tech_research/lite_e.php

We have noted that in one of the districts studied, variations of this matrix were in use. We explored this and the teachers said they found it a useful tool, albeit requiring some adaptation to local needs whilst retaining its integrity. This idea of working with outcomes has a natural link to the next issue that presented itself.

Planning and Assessment

Technology often presents as a 'bolt-on' to existing themes and units in primary schools. This can be attributed to its late 'run for a place' in the curriculum stakes and in primary schools, the common belief that it is little more than sophisticated art and craft. Secondary schools have been more successful in reconceptualizing technology, partly because it aligns better with existing subjects. In secondary, it also has a budget line and funding support. We could find no school in either district that had explored the planning tool provided in the syllabus support materials and many indicated that they had no knowledge of it. How to assess outcomes continues to be problematic, a not surprising position given the problems of working with outcomes discussed previously. Teachers continue to view assessment as something that happens at the end. We found little evidence of assessment being planned alongside the content early in the planning cycle. We suggest that a tool such as the LITE matrix (Jones & Moreland, 2002) might ensure that assessment is an integral and important part of the planning cycle. If teachers know from

the outset what they are hoping to achieve (and LITE scaffolds this), then assessment opportunities become evident.

Networks

Teachers in both districts expressed a desire to share ideas and practice across schools and districts. Schools wanted to work across districts to reduce their isolation and share their resources. Schools suggested developing a newsletter or website to support curriculum idea sharing, indicating that the units previously distributed from head office to the innovator schools had been useful. The comments following from teachers support this need for better networks: "... probably some examples of units from other schools. There's been some coming through the Internet. We've been accessing those units from other schools. To see what they're doing is always helpful ... what I would find really helpful is to simply talk with other teachers in my particular technology area rather than I suppose the cattle dip style of professional development - one dose hits all." These teachers are talking of the frustration caused by working in geographically isolated communities where the support structures of coastal and urban schools are not widely available.

DISCUSSION

The research questions asked:

1. What are the perceived needs and technology education expectations of schools implementing a new syllabus??

2. What vision do schools have for technology? How can schools be assisted in developing this vision?

3. What strategies do schools have in place to enhance "working technologically" under the new syllabus?

4. What factors and actions enhance or inhibit the syllabus's implementation?

What then did the research tell us that will enable the system to better implement the syllabus?

Research question 1. The crux of effective teaching is familiarity with what is taught and understanding how it can be taught in response to diverse learner needs. The teachers with whom we have engaged have been willing to explore ways in which rich technology experiences can be delivered in their classrooms. In one district, teachers, received high levels of internal and external support over a sustained period of time. We believe the expression 'community of learners' well describes this group. In the other district,

support was by way of one-off, one-day sessions that typify traditional top-down PD. Teachers in both districts told us that the top-down model was not effective.

In light of this, we would suggest that the system review the current practice of supporting curriculum implementation through the production of print and electronic media and that the system review the roles of education advisers and move towards a model where key teachers in schools and districts are trained in specific syllabus implementation. The key teacher model (D1) has proven successful and sustainable. PD appears more useful when teachers receive sustained support in the implementation. Teachers and schools should continue to be supported in developing an understanding of how to make sense of outcomes, particularly the explicit identification of embedded conceptual understanding.

Research question 2. Some schools appear to have developed sound and appropriate views of technology as a KLA; however, pockets of confusion between information and communication technologies (ICTs) and KLA technology remain. We would suggest that schools be helped navigate their way through the opportunities for planning, teaching and assessment that are embedded in the Initial Technology In-service materials and perhaps this could be enhanced through the scaffolding provided by the LITE matrix. Understanding and sharing these resources will enhance teaching and learning in Technology.

Research question 3: Primary schools are endeavouring to adapt existing materials (units of work) that pre-date the syllabus release. This has not proven successful for a number of reasons: reluctance to rewrite materials and/or lack of time and money to do so. Systems should assume responsibility for following through on curriculum renewal. This is a shared system–school–teacher responsibility. Continuing professional development (CPD) is a necessity if teachers are to develop robust Technology PCK. We would suggest that teachers and schools be encouraged to phase in new or adapted units and build networks and partnerships that facilitate teaching unit renewal, the how-to.

Research question 4: We have noted that it is the interaction between a number of issues that make implementation difficult. These issues include: tensions between implementation models, leaders' perceptions of the priority of competing KLAs; views of Technology held by teachers, schools and districts; how Technology relates to other KLAs; how planning and assessment can best occur; lack of understanding of outcomes-based learning; time for technology; support for technology: networks; resources and physical space. These issues need to be differentiated, competitions diminished and

synergies enhanced. Strategies are needed to ensure that Technology is viewed as an essential element of the curriculum in all schools; that materials be developed and personnel trained to show how Technology can successfully be integrated into units of work; that synergies within Technology and between Technology and other KLAs be identified and enhanced; and that key teachers be identified and trained with expertise in planning and assessment, with a particular emphasis on 'making sense' of outcomes.

CONCLUSION

There appear to be disparate models of Technology implementation that are related to two issues: the models of implementation and the leadership shown at various administrative levels. These issues impact on Technology syllabus implementation in ways that both help and hinder teaching and learning in this new KLA. The district that showed a high level of involvement and support for teachers has made considerable progress towards developing a 'community of learners' with a common interest in Technology learning outcomes for students. The second district has not progressed as far. In the light of this, we believe that existing models of implementation need to be changed so that they are more indicative and supportive of the needs, understandings and learning styles of teachers. The success of the district that chose to develop the key teacher model should also be noted and subjected to further research. It would be interesting to know how well schools sustain and maintain the key teacher role. The second model (second district) relied on delivering generic (traditional) implementation strategies and lacked the specificity required for re-conceptualisation of a syllabus that is new and different. For technology to take its place as a part of a suite of KLAs, commitment that is tangible and enduring will be required from all partners in the process.

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