Abstract
During 2003, a Years 1-10 Technology Syllabus and associated curriculum materials developed by the Queensland Studies Authority (QSA) were provided to schools. Subsequent expectation is that Education Queensland schools should have Technology curriculum programs for full implementation by the start of the 2007 school year. A component of the Education Queensland strategy is a partnership approach involving research being undertaken by Universities of the implementation processes being developed by Innovator Schools during 2004. Innovator Schools are perceived as being sites for 'harvesting corporate knowledge' to inform Education Queensland’s collective understanding of implementation issues relating to this new Technology Key Learning Area in Queensland schools. This paper reports the findings gained through this initiative through case studies of teachers from three Gold Coast schools working in a research partnership with Griffith University. Reported successes, difficulties and suggestions to inform Technology implementation are provided.

The problem - technology education: from intention to implementation
Fleer and Jane (2004) note that primary technology education has been in existence since 1994 (Webberley, 2003; Williams; 2002) and refer to the importance in Australia of the release of

“the National Statement on Technology Education and the accompanying Profile signalled to all states and territories the important place of technology education in the school curriculum for primary children (Ewington, 2002; Finger, Adams-Jones & Vickers, 2002; Fox-Turnbull, 2002; Jane, 2002; Keirl, 2002).” (p. 43)

Technology curriculum in all states and territories of Australia must comply with the National Statement on Technology for Australian Schools (Curriculum Corporation, 1994). This document outlines technology in society, the importance of technology, technology in the curriculum and technology for all students, and identifies the strands of technology, which are designing, making and appraising; information; materials; and systems (Curriculum Corporation, 1994).
In Queensland, the Queensland Studies Authority (QSA) established under the Education (Queensland Studies Authority) Act 2002 has “portfolio-wide responsibilities for the development, review and approval of pre-school guidelines and syllabuses for years 1-12, as well as the development of professional resources for teachers to support the implementation of relevant guidelines and syllabuses” (QSA, 2002a). Those responsibilities include the design, development and publishing of a Years 1 to 10 Technology KLA syllabus, sourcebook guidelines and initial in-service materials for use in Queensland schools from 2002 (QSA, 2002b). That project, which began in January 1998, under the auspices of the former Queensland School Curriculum Council, moved through trial and pilot phases. Descriptions of the project can be found elsewhere (QSA, 2000b) and the Technology Years 1 to 10 Syllabus has been developed and approved (QSA, 2000c).

As Finger, Adams-Jones and Vickers (2002) indicate, until recently, teachers in Queensland primary schools have not had any formal syllabus for teaching technology. Thus, teachers are faced with the emergence of a new curriculum area in the form of technology as a Key Learning Area (KLA). A component of the Education Queensland strategy to assist with system-wide implementation is a partnership approach involving research being undertaken by Universities of the implementation processes being developed by Innovator Schools during 2004. Innovator Schools are perceived as being sites for ‘harvesting corporate knowledge’ to inform Education Queensland’s collective understanding of implementation issues related to this new Technology Key Learning Area in Queensland schools. This paper reports the findings gained through this initiative through case studies of teachers from three Gold Coast schools working in a research partnership with Griffith University. Reported successes, difficulties and suggestions to inform technology implementation are provided. As the project is still in progress, the findings reported should be viewed as providing the story so far, as further activities are still underway.

The intention
The suite of technology curriculum documents developed by QSA and distributed to Education Queensland schools is provided in Figure 1 below.

Figure 1: Suite of QSA technology curriculum materials. (QSA, 2003d, p.1)
The Initial in-service materials provide activities for teachers to assist their understanding of all aspects of the new syllabus (QSA, 2003d), and the sourcebook guidelines assist teachers in implementing the new syllabus (QSA, 2003e). “The sourcebook modules provide planning, learning, teaching and assessment ideas to assist students to demonstrate the core learning outcomes” (QSA, 2003e). It is the responsibility of Queensland teachers to familiarise themselves with these documents, and to plan and implement technology units accordingly.

The Queensland technology syllabus has four strands - technology practice, information, materials, and systems. Technology units must be embedded within these strands and have considerations of appropriateness, contexts and management (QSA, 2003c). The connection between these considerations and the strands of the syllabus underline “working technologically” (QSA, 2003c). Thus, technology is seen as allowing us to satisfy human needs and wants and to take advantage of opportunities. It also suggests that impacts and consequences will result from all products of technology (QSA, 2003c). By “working technologically” students will be able to actively engage in design challenges to design and construct products (QSA, 2003c) to form the basis of technology units. Students can design products to satisfy human needs and wants; incorporate the strands of the technology syllabus; and allow students to consider appropriateness, context and management as they relate to their particular design and product (QSA, 2003c). Successful technology units should incorporate these aspects of the technology syllabus and this provides a framework for judging whether or not the implementation of a technology unit has been successful in being consistent with the intention of the technology syllabus.

**The implementation issues**

Of interest now is the translation from the intention of the curriculum materials to implementation in schools. There is a systemic expectation by Education Queensland that full implementation will be occurring in Queensland government schools by 2007. Therefore, there is a range of professional development activities being developed to assist teachers in understanding a new key learning area, unpacking the curriculum materials, and planning and implementing technology effectively.

**The research problem**

The implementation of a new KLA is a process that needs to be carefully monitored. It is vital that teachers understand the technology KLA and are able to implement this as it is intended in the syllabus. This research aims to:

a. identify teachers’ initial knowledge, understanding and attitudes about the technology KLA;

b. identify teacher and student knowledge, understanding and attitudes of technology throughout the teaching of the technology units;

c. identify challenges that arise during the implementation process and compare them with issues identified in research; and

This paper reports early findings in relation to these aims.
Project description and background
Two projects – Quality Teacher Project (QTP) and *Researching School Change in Technology Education* (Education Queensland, 2004) became integrally linked. These projects provide an important framework for understanding the negotiations between the schools involved and Griffith University which developed and determined the authorisation of planned courses of action (Finger, Jamieson-Proctor, and Middleton, 2004).

a. **Quality Teacher Project (QTP) initiative – teaching technology in the classroom**
QTP funding was sought and gained by three Gold Coast Schools – Upper Coomera State College, Coomera State School, and Oxenford State School – to promote technology teaching within those schools. The funding was gained through the QTP which had identified technology as one of the four key priorities areas for 2004. QTP funding was required to be expended by 31 March 2004, with some activities to continue after that date to maximise the ongoing follow-up. Several activities, such as the organisation of a Technology Mini-conference, presentations at staff meetings, and discussions with teachers, were organised and implemented. These formed part of the relationship building between Griffith University and those three schools described in the following project.

b. **Researching school change in technology education – the intention**
In a briefing document from Education Queensland, the project was summarised as being concerned with examining the ways teachers change in response to the content and pedagogic demands of the new technology Syllabus. The study was planned to involve technology teachers from selected Innovator Schools in the metropolitan Brisbane area and from some country areas. It was envisaged that the duration would be for approximately 12 months to enable a longitudinal study of teaching practices, using focused interviews with participating teachers, surveys and observations. Griffith University was approached to provide research to accompany this. Specifically, in terms of the Gold Coast North and Gold Coast South Districts, no school developed a submission seeking to be an Innovator School. Discussion with Education Queensland resulted in an alternative course of action to build a relationship with the three schools involved in the QTP initiative. Thus, for the purpose of researching school change in technology education, this became a hybrid project with the three Gold Coast schools linking the QTP initiative and the *Researching School Change in Technology Education* project, although the schools are not officially Innovator Schools.

Research Methodology
As the research is still in progress, some data collection has been completed and some has yet to be undertaken. The methodology involved selecting a number of focus teachers from the three schools to develop case studies of these teachers. The focus teachers have been involved in planning units of work around design challenges in their classroom. Classroom observations of the selected focus teachers were made during planned school visits. Interviews were used to gauge teacher and student understandings throughout the implementation process. This will help to further identify student understandings at particular stages throughout the unit. In addition, initial surveys and follow-up surveys are to be administered to all staff to gauge teachers’ level of understanding of the new syllabus and the their confidence to implement technology in their classroom. Only the initial survey had been conducted at the case study schools at the time of writing this paper.

The implementation issues - ‘harvesting corporate knowledge’ – the story so far
Themes from the Case studies
Due to a range of contextual considerations and school and researcher constraints, the three case study schools negotiated differing forms of introduction, engagement and ongoing activity. While all three schools – Coomera State School, Upper Coomera State College, and Oxenford State School – are located in the Gold Coast North district in Queensland, differences exist in school organisation and size of school. Due to space limitations in this paper, the common themes related to implementation issues are reported here in terms of the difficulties, the successes and suggestions.

The difficulties
This research project, in providing the story so far, has revealed common implementation issues consistent with previous research. As discussed in the following summary, these issues include resources, in particular time management, limited teacher understandings of technology and technology education, and assessment methods.

a. Resources – especially time
The initial survey revealed that some teachers reported that they did not have a copy of the curriculum documents, and few teachers reported that they had accessed the documents available on the QSA website. A key issue for teachers in implementing technology is a lack of resources, specifically time and time management. These issues are concerned with the amount of time required to plan and implement a new KLA in the classroom, and how teachers will organise their time efficiently (Stein, McRobbie and Ginns, 2001). For some, the concern lies in the ability to position technology within the pre-established classroom timetable so it does not deduct valuable time from the other KLAs (Stein, McRobbie and Ginns, 2001). This issue can also be seen as a challenge to try to integrate a new KLA into an already overcrowded timetable (Jones, Harlow and Cowie, 2004). Teachers have overcome this issue by integrating technology into other learning areas rather than teaching technology as a separate subject (Stein, McRobbie and Ginns, 2001; Jones, Harlow and Cowie, 2004).

Time management is essential in order for the implementation to be successful. Not only is it required for planning and implementing technology units, but it also allows for teachers to familiarise themselves with the KLA, and to feel comfortable teaching it in their classroom (Treagust and Rennie, 1993). Time is also required to allow for documentation to be made, which is an integral part of the implementation process (Treagust and Rennie, 1993). From conversations with the teachers and difficulties in being able to arrange times for professional development, there was a sense of both a siege mentality and a siege reality with teacher perceptions of ‘already too many meetings’, and ‘too many changes too quickly’, giving rise to accumulating sets of demands and roles which are unsustainable. Indicative comments included:

- “Time is I feel a major factor. This is a cause for concern as the curriculum is at the moment very much full.”
- “PD after Uni is not so good because of time constraints.”
• “The curriculum is so overloaded that it is difficult to cover everything even when trying to integrate. Technology takes time and a lot of discussion which can become exhausting.”

b. Lack of teacher understandings about technology and technology education
Another issue evident in the research related to technology implementation is that of a lack of teacher understandings about technology and technology education. This was a finding reported in the independent evaluation of trial and pilot schools (see, for example, EdData, 2000, pp. 26-28). In addition, primary teachers, in particular, have been found to have a limited view of technology. Teachers not only need to have an understanding about technology, they also need to understand how technology fits within the primary classroom. For this to occur, teachers need to have a thorough knowledge and understanding of the syllabus and curriculum documents (Stein, McRobbie and Ginns, 2001). For example, the initial survey required teachers to indicate the extent to which they were familiar with and understood key understandings such as ‘working technologically’, ‘technology practice’, ‘information’, ‘materials’, ‘systems’, ‘appropriateness’, ‘contexts’, and ‘management’. The majority of teachers indicated that they were either ‘not at all’ familiar or were familiar to ‘some extent’.

A caution is presented from the New Zealand experience, whereby, three years after technology became compulsory in all New Zealand schools, studies have found that 22% of New Zealand teachers have little understanding of the curriculum. These teachers articulated the need for further professional development, during and after the implementation process (Jones, Harlow and Cowie, 2004). They suggest that professional development should focus on specific technological areas to ensure teacher understandings in all areas of the curriculum (Jones, Harlow and Cowie, 2004). Stein, McRobbie and Ginns (2001) also suggest that professional development would be beneficial for teachers. Samples of teacher comments from the survey reflecting this included:
• “Haven’t had any exposure to Technology KLA at all. Would definitely need inservicing.”
• “I feel I need more professional development in this area – plus I need to read more of the documents.”

C. Assessment of student work
Assessment of student work is essential in evaluating the overall success of the technology unit, and in gauging whether the implementation process was successful (Stein, McRobbie and Ginns, 2001). Jones, Harlow and Cowie (2004) have reported that teachers are concerned with finding suitable methods of assessment for the new key learning area, and feel that professional guidance would be of assistance. Similar issues emerged in this study with teachers interested in gaining ideas of the assessment evidence which they might ask their students to produce. As well as some concerns about assessing the outcomes students were demonstrating, teachers found it difficult to identify technology-specific forms of evidence. In some instances, there was evidence that teachers had built the assessment into the design challenge whereby students needed to develop their design solutions to meet defined criteria; e.g. design a boat that floats, design and construct Medieval castles that can withstand the castle destroyer. In addition, some teachers had commenced collecting student
samples developed during the design process, such as designs and sketches. However, increased understanding to making professional judgements about the student evidence in terms of the outcomes presented challenges for many teachers.

**The Successes**
The story so far revealed that teachers were positive about the level of student engagement in technology, the ability to develop design challenges which connect students to authentic tasks, and the ease with which they were able to identify cross curricular links with technology.

**a. Student engagement**
Teachers reported high to very high levels of student engagement in technology activities. Observations of students also confirmed this with students developing ownership of their design process and products, children were being encouraged to reflect on any modifications they made, and the evaluation component of technology practice was an integral part of planning and implementation.

**b. Developing design challenges which connect students to authentic tasks**
Teacher planning was commendable at all school sites in collaboratively planned units of work which built upon design challenges. Examples included designing boats that float (Year 1), bug catchers (Year 2), diorama designs (Year 3), designing toys (Year 4), designing a food product (Year 5), costume constructions (Stage A – Years 1-3), medieval castles (Stage B- Years 4-6), and Toys by Us (Stage C – Years 7-9).

**c. Identifying cross curricular links**
Teachers were becoming familiar with the many teaching tasks which they previously implemented but which they hadn’t considered as ‘Technology’. As some teachers improved their understanding of ‘working technologically’, they were able to more confidently articulate technology practice in their planning and implementation. The identification of design challenges also facilitated the identification of cross curricular links. As one teacher stated, “Technology is easy to integrate into any unit of work. There is always something that can be designed or redesigned!”

**The Suggestions**
Two key strategic suggestions, made as a result of the overall early findings reported in this paper, are to provide teachers with time and space to engage with the curriculum materials, and to pursue the development of professional learning communities to achieve alignment within and across schools.

**a. Provide time and space for teachers to engage with the curriculum materials to develop the essential shared understandings**
Teachers’ professional learning about technology is an important prerequisite for being able to effectively plan and implement technology teaching which has an appropriate technology demand. As indicated earlier, this is a new KLA for most teachers, and hence this brings with it the requirement for the acquisition of new curriculum knowledge. There is the risk that teachers will hastily plan and implement units of work doing what they feel is ‘their best’ given the many demands on their time, without having had the time and space needed
to engage sufficiently in the conversations about key technology understandings. For example, the case study school’s initial surveys revealed teacher uncertainty about ‘working technologically’. Important associated understandings of terms such as appropriateness, contexts, and management were found to be alien terms to the teachers in the case study schools. There were also varying levels of understandings among the teachers of the outcomes and strands. Few teachers had indicated that they had read the syllabus, the Sourcebook Guidelines, or any of the Sourcebook Modules. We believe that it is a critical system, district and school-based responsibility that time for teachers to engage with the curriculum documents is not only encouraged, but is ensured.

**b. Pursue the development of professional learning communities to achieve alignment within and across schools.**

The Innovator School strategy could be used as a starting point to work towards a model for achieving dissemination of teaching technology ideas among schools. This dissemination is clearly needed. The case study schools reported here have revealed insights into school change in technology education, but as they were not official Innovator Schools, there was no expectation in the research undertaken for these schools to be ‘hubs’ for disseminating their experiences with and supporting other schools. Elsewhere, in relation to the IDEAS Project, Andrews et al. (2004, pp. 10-14) outline the ideas process consisting of five phases – initiating, discovering, envisioning, actioning, and sustaining. While their work has tended to focus on widespread school revitalisation, we suggest that the success reported in the IDEAS Project (see, for example, Crowther, 2002) articulates an approach which we believe might enable effective school change in technology education to occur. The following is adapted from Andrews et al. (2004) summary of those phases:

- **Phase 1: Initiating** – ensuring that teachers are viewed as being central to the processes required for successful technology implementation.
- **Phase 2: Discovering** – in relation to technology education, this phase could audit current technology understandings, activities, achievements and challenges.
- **Phase 3: Envisioning** – aspiring to achieve more than the accountable milestones for technology implementation, within the school and beyond the school.
- **Phase 4: Actioning** – applying the envisioning decisions, with teachers and administrators working in parallel. In relation to technology education, this actioning will have a *curriculum* focus, rather than a structural (e.g. school organisation) or student focus (e.g. behaviour management).
- **Phase 5: Sustaining** – in relation to school change in technology education, processes need to consider how the curriculum focus for introducing, implementing and improving technology teaching and learning decisions can be sustained.

**Conclusion**

This paper has provided a summary of the intentions and insights into the implementation of the new technology KLA curriculum documents for schools in Queensland. The translation from intention to implementation brings with it associated challenges. As part of Education Queensland’s *Researching School Change in Technology Education* initiative, this paper presented the story so far in three Gold Coast schools to provide some insights to inform the ‘harvest of corporate knowledge’ about implementation difficulties, successes, and
suggestions. To continue the *story so far* metaphor, there are many chapters yet to be written.

**References**


