Implementing Technology Education in a High School: A Case Study

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This paper discusses the results of a study of the factors, which enhanced or hindered the implementation of technology education into one Queensland secondary school. A case study research methodology was used. The results of the study revealed that the experience of the site was very similar to that of schools in other countries and Australian states who have already proceeded in this direction. It showed that the implementation of technology education is enhanced by access to and participation in quality inservice training; appropriate facilities and equipment; support from the school's administration; adequate budget for continual improvements to the facilities and equipment purchases; active marketing and promotion of the subject to students, other teaching staff, school administration and the wider school community; and involvement of the teachers in the development of curriculum. It also identify some additional factors that were not a major focus of previous research in this area, in particular the impact that the personal qualities of the teachers have on the effectiveness (or perceived effectiveness) of the implementation. Strong leadership was identified as a key factor in the continuing success and improvement in technology education in the school studied.

Introduction

The study reported in this paper was undertaken in 2001 and examined the implementation of technology education into one independent secondary school in Queensland. The specific focus of the investigation was the factors that enhanced or hindered this process in a school that is considered to have had a reasonable measure of success in implementing technology education programs.

Internationally, technology education is emerging as an essential part of the general education of all students, as it is aimed at the development of problem-solving and critical thinking skills, specifically in the ability to develop and use new technologies. Those skills and abilities are recognised as essential in today's workforce and society. It is not only about understanding today's technologies but equipping students to be able to utilise emerging technologies in the future.

The contribution of technology education was formally recognised in Australia in April 1989 when the Australian Education Council agreed to a statement, known as the Hobart Declaration, which recognised eight national key learning areas (KLAs) which all students must undertake during their compulsory schooling years (Years 1–10).
Technology Education is one of these eight KLAs. To implement this agreement, the Queensland School Curriculum Council released the draft Years 1–10 Syllabus-in-Development for Technology during term 4 1999, for a trial period in selected Queensland schools. In addition, the Queensland Board of Senior Secondary School Studies developed and released the first senior Technology Studies Syllabus in 1992 and a revised version in 1999. One of the main departments implementing the subject is the manual arts department in secondary schools.

The implementation of the technology syllabus in Queensland schools represents the largest change to occur in the technology area in this state. This raises two issues. The first is concerned with ways to facilitate a successful change. The second is concerned with the nature of the syllabus implemented, with the desire of progressive practitioners that it be implemented as a dynamic area of study.

**Literature review**

Technology education is concept and process-based, as opposed to the fact-based manual/industrial arts subject areas. It requires technology students to work through problems as opposed to the 'copy-me' manual arts. This distinction is important because of the rapidity of change in today's society. Specific skills quickly become unusable and irrelevant as new, more advanced machinery is produced. The implementation of a technology education curriculum has significant implications for teachers, students and the school administration. These changes include the philosophy underpinning the area, the teaching strategies and assessment mechanisms used.

As a minimum an 'ideal' technology education program would be one that:

- highlights social/cultural impacts of technology (Foster 1994b)
- develops problem-solving skills and abilities to integrate systems of technology (Daugherty & Boser 1993; Wright 1991; Foster 1994b)
- uses group-based activities and the develops communication skills (Conte & Weber 1999; Edmison, Henak, Scanlin, Schwaller & Smallwood 1991; Wright 1991)
- forms part of general education of all students and grade levels (Breckon 1998; Gibson 1991)
- uses an interdisciplinary approach (cross-curricula potential) (Conte et al 1999).

The implementation of technology education into secondary schools is a complex process which is impacted on (positively and negatively) by a variety of factors. The results revealed that their experience was very similar to that of schools in other countries and Australian states who have already proceeded in this direction. That is, implementation is enhanced by:

- access to and participation in quality inservice training (Rogers & Mahler 1994; Weissglass 1991; Warner 1995a; Compton et al 1998)
- appropriate facilities and equipment (Sharpe 1996; Linnell 1992; Bussey, Dormody & Van Leeuwen 2000)
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- support from the school's administration (Hill, Weiklein & Daugherty 1996; Sharpe 1996; Oats 1991; Clark 1989)
- adequate budget for continual improvements to the facilities and equipment purchases (Hill et al 1996; Oats 1991)
- active marketing and promotion of the subject to students, other teaching staff, school administration and the wider school community (Sharpe 1996; Benzie 1997; Johnson 1997; Wright & Custer 1998)
- involvement of the teachers in the development of curriculum (Rogers et al 1994, Sharpe 1996; Bussey et al 2000). The more participatory the process the more likely it will be accepted by the teaching staff and implemented.

Sharpe recognised that many of these factors are inter-related (Sharpe 1996). That is, they impact on each other. For example, a supportive school administration makes access to required resources easier.

During the past ten years the philosophy, curricula, and methodologies used to guide technology education have changed more dramatically then they have in the preceding one hundred years (Daugherty et al 1993; Waetjen 1994). It is evident that as the field of technology education continues to evolve and its unique mission to provide relevant and meaningful learning experiences which enhance higher-order thinking skills, is gradually becoming clearer (Johnson, in Hill et al 1996).

Methodology

An evaluative case study methodology was selected for this study as it enabled the identification of factors which help or hinder the implementation of technology education, and make judgements as to their importance at the site studied.

The case can be defined in various ways, depending on the focus and approach adopted by the researcher (Stake 1994). Merriam asserts that the "focus of research in a case study is on one unit of analysis. There may be numerous events, participants, or phases of a process subsumed under the unit" (Merriam 1988, p.46). In the study discussed, the case (unit of analysis) is a co-educational independent secondary college, and within it the teachers, facilities and administrators will be investigated.

Figure 1 depicts the research design. It shows the logical flow from the preliminary activities that initiated the study and the development of the preliminary conceptual model through data collection and analysis, refinement of the conceptual model, articulation of a set of working hypotheses, and collection and analysis of data.

Data was collected from three primary sources:
- documentary evidence consisting of primary source material related to the implementation of technology education at the Queensland secondary school studied
- semi-structured interviews with participants who were involved in the implementation of technology education within the College
- observations of the technology education activities at the College.
Figure 1
Research design
Figure 2
Factors affecting implementation of technology education
The study's three data collection techniques offered complementary perspectives on the implementation of technology education at the College. Each technique collected different types of information, each of which had a special utility for the research. A primary concern for the data collection was to develop a data repository upon which the researcher could answer the study's research question.

Pattern-matching logic was used to analyse the data. This involved identifying common patterns across the data sources. The empirical data from the case was then compared with the predicted ones identified in the preliminary conceptual model (Yin 1994). The identification of patterns enables causal inferences to be drawn. Merriam (2000) also refers to this as the constant comparative method.

Results
The results of the study revealed that the experience of the site was very similar to that of schools in other countries and Australian states who have already proceeded in this direction. The study showed that the implementation of technology education is enhanced by:

- access to and participation in quality inservice training
- appropriate facilities and equipment
- support from the school's administration
- adequate budget for continual improvements to the facilities and equipment purchases
- active marketing and promotion of the subject to students, other teaching staff, school administration and the wider school community
- involvement of the teachers in the development of curriculum.

However, some additional factors, not previously a major focus of research in this area, were revealed. The primary factor identified was the impact that the personal qualities of the teachers had on the effectiveness (or perceived effectiveness) of the implementation. The teacher's passion was a key to getting technology education established within the College, however, it was identified that passion was not enough to drive continual improvement.

Strong leadership was identified as a key factor in the continuing success and improvement in technology education in the College. Due to the significant budgetary demand of the area and its need to 'compete' with traditional curriculum areas, it was identified that a good leader is required. A good leader was defined as a person who is able to understand and work within the political and budgetary framework of a school to ensure that the future needs of the area are addressed. In addition, the leader was seen as one who is able to develop and work towards achieving a common shared vision for the area and one who is able to mentor and ensure the continual improvement of the teaching staff. This was identified as lacking in consistency throughout the implementation of technology education at the College.

The other additional factors identified included:

- the frequency that the work programs are reviewed. Frequent review was identified as important in ensuring the program remains focused on the technology process (rather
than the product); relevant and of interest to the students; and the program continues
to deliver the desired learning outcomes for technology education.

- inclusion of technology education in the school's strategic plan, thus ensuring
technology education remains a growth priority for the school. Inclusion of
technology education in a school's strategic plan ensures that the required
improvements/enhancement to facilities and other equipment purchases are
included in the school's long-term budgeting and planning framework.

- a prolonged focus on the marketing and promotion of the area to ensure the students,
parents and wider school community understand and value the contribution of
technology education to all students' education. An extended focus ensures that
developments in the area are promoted. This assists in acquiring and sustaining broad
support for technology education at the school.

- participation of the teaching staff in networking opportunities to facilitate the sharing
of ideas and projects/problems which are able to achieve the desired learning
outcomes. This includes sharing design briefs, assessment tools and effective teaching
strategies. Effective implementation and the achievement of the desired learning
outcomes are essential to continued success of this subject area. Technology education
and technology educators can only benefit from sharing of knowledge, information
and ideas.

- school administrators sharing the vision for the technology education program with
the teaching staff. This ensures commitment to the continual improvement of the
technology education area.

A conceptual model (see Figure 2) was developed which showed the relationship
between the factors identified with sufficient emphasis placed on the personal factors
related to the teachers and the administration.

Conclusion
The results of this study, which relate one school's experience, contributes to knowledge
in a number of key areas for curriculum implementation, especially in relation to
technology education. It contributes further information on the implementation of
technology education in Australia, specifically Queensland. As revealed in the literature
review, there was an information base over a number of years available on the transition
from traditional industrial arts to technology education in north America (and to a lesser
degree other countries), but limited information is available on the Australian context.

The conceptual model, developed as a result of this study, identifies the key factors
which influence the implementation of technology education into a Queensland
secondary school. The model conceptualises the relationship between these factors and
also identifies that technology education operates in a framework of continual
improvement. This model could be used by technology educationists, curriculum
developers and school administrators to assist in the planning and evaluation of the
implementation of technology education, and continual improvement of this area in
other sites in Queensland and beyond.
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The study identified that for technology education, and potentially other curriculum areas, to be implemented successfully into secondary schools, staff need to be actively involved in the development of the curriculum and the implementation process. It also identified that a support network or system including the provision of reference materials, professional development opportunities (including inservice) and access to 'experts' in the field, is essential. These are captured in the theoretical model developed. It has also shown that the implementation of a new curriculum requires planning and time, and this needs to be considered and allowed for.

References
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