PERCEPTIONS OF TECHNOLOGY: A MALAYSIAN PRIMARY EDUCATION PERSPECTIVE

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In the name of Allah
The Most Gracious, The Most Merciful

Dedication
thanks for the inspirations
and continuous support
to my beloved family

saleh
afif
rif'at
ziha
zhifa
nadia

ABSTRACT

This study investigates the perceptions of technology held by Malaysian in primary education. In particular, the study looks into students' understandings of and attitudes towards technology. The study was carried out with 521 primary students, 272 girls and 249 boys, and 28 of their teachers in the Malaysian state of Sarawak. A case study design, using a measure of student perceptions of technology consisting of a writing/drawing activity, a picture quiz, and a technology questionnaire, teacher interviews and curriculum content analysis was employed in this study.

The findings from this study show that students' understandings of technology are low. Like the findings obtained elsewhere, students associate technology with products, especially high-tech products and electrical appliances. A comparison by gender, however, shows that there is significant difference in the understanding of technology between boys and girls. Meanwhile, in the comparison related to ethnicity, native students' understandings of technology are slightly lower than those of non-native students. In the comparison by location, the findings show that rural students tend to associate technology with building and low-tech products, while urban students tend to associate technology with computers.

Malaysian students' attitudes towards technology, however, are positive. This finding parallels findings obtained in Australia, England, New Zealand and elsewhere. Comparison by gender, ethnicity and location shows that there is no apparent difference between boys and girls and between urban and rural students interest in technology. However, native students are more interested in technology as compared to non-native students, while urban students are more positive about the social aspects of technology. This view about technology among students corresponds to the views held by teachers and as stated in the technology curriculum documents.

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CHAPTER ONE

INTRODUCTION

In Malaysia, the vision of becoming an industrialised country by the year 2020, as outlined in the Malaysian's Government VISION 2020 statements (Mahathir, 1991) has brought about greater encouragement of technology. Technology development is seen as one of the factors for the achievement of industrialised status. Thus science and technology have been identified as one of the nine challenges to achieve such a vision.

Malaysia's education programme in science and especially technology, has been given greater emphasis in the changes or innovations to the school curriculum as a move towards realisation of the above vision. The recent inclusion of science education (Malaysian Ministry of Education, 1993a) at the primary school level and the compulsory subjects of living skills and integrated living skills for all students in primary and lower secondary education, respectively, further manifest the importance of science and technology.

Technology education is linked to science education as there is no separate curriculum for technology education. Elements of technology are included in the senior science subjects (Rohana, 1994) and in the recently introduced primary science curriculum. In the senior science subjects, elements such as food technology, micro-technology and biotechnology are included. However, these subjects are offered as options. A section on technology is included in the primary science curriculum. In this curriculum, the focus of technology incorporates the history of technology, structure and design, and the appreciation of what technology has done to humans. The secondary science however was introduced in schools since the 1980's.

The living skills subject has been reorganised using an integrated approach called *integrated living skills* (Malaysian Ministry of Education, 1991) with the aim of producing an individual who is self-reliant, literate in technology and economics, possesses self-confidence and who has initiative and is creative, innovative and productive. At primary school level, this curriculum is introduced to develop the manipulative, entrepreneurial and self-management capabilities of the students as well as to instil among them, positive attitudes towards technology and entrepreneurship. In this aspect, students are required to acquire the basic skills and knowledge about technology and entrepreneurship.

Technology is understood today as human problem solving to meet needs or wants in society through the development of products, systems and environment. It is more than simple artefacts, such as cars or computers. The subject technology is "directly concerned with the individual's capacity to design and make, to solve problems with the use of materials and to understand the significance of technology" (Eggleston, 1992).

The main focus on capabilities or skills, as seen in these curricula, is geared towards industrialisation. The development of these curricula, similarly to all curricula and matters related to the planning and implementation of education in the Malaysian educational system, are guided by the National Education Philosophy (Malaysian Ministry of Education, 1993b) which states that:

> Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards, and who are responsible and capable of achieving high level of personal well-being as well as being able to contribute to the harmony and betterment of the family, the society and nation at large.
>
> (p.vii)

The formulation of this philosophy is stated as "in the context of preparing more dynamic, productive, caring and humanistic citizens for the forthcoming challenges in the process of national development towards attaining the industrialised status" (Malaysian Ministry of Education, 1993b, p.vi).

The extent to which the students are being prepared to carry the responsibility of achieving the country's vision, through the implementation of technology in schools, is not known. Furthermore, the nature of technology education, since its implementation, initially in

1990, has never been properly studied to determine its effectiveness in preparing students to face the reality of a technological world. Technology is taught through two curricula, science and living skills, and by different science and living skills teachers. How these teachers interpret the curricula and their understandings of the nature of technology are important for the understandings of technology that the students develop.

This study responded to the author's concerns about perceptions of, and the attitudes towards technology held by Malaysians, especially by the education community. This research employed a case study design to investigate students' perceptions of technology in the Malaysian state of Sarawak. Primary school students in the regions of Kuching and Samarahan, both the urban and rural areas, were involved. Students' perceptions of technology were investigated by using an instrument consisting of three activities: writing or drawing about technology, identifying pictures that are related to technology, and a technology questionnaire (see Rennie & Jarvis, 1994). The technology curriculum documents, living skills and science, and teachers' perceptions and experiences of teaching these curricula, were also investigated.

With the knowledge of how students and teachers perceived technology, and how it is taught in schools, this research will be able to give an insight whether there is a likelihood that students can be entrepreneurs, or whether the vision of an industrialised nation can be achieved in terms of the appropriate perceptions.

The overview of chapters in this thesis is as follows: chapter two reviews literature concerning the meaning of *technology*, its relationship to science, technology in school curricula, and students' perceptions of *technology*. The outlines of the research methodology, sampling, instrumentation and administration procedures adopted are outlined in chapter three. Chapters four, five and six present the findings of the study of the technology-related documents analysis, students' perceptions of technology, and teachers' perceptions of technology and experiences of school technology respectively. These findings are integrated and discussed in chapter seven.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews selected literature concerning the nature of technology, including the relationship of science with technology, the representation of technology in school curricula and the technology education achievable through these curricula, and students' and teachers' perceptions of technology.

2.1 The Meaning of Technology

There are various definitions for *technology*, given according to the different emphasis. MacKenzie and Wajcman (1985) give three meaning of technology; physical objects, human activities, and knowledge and know-how and are concerned about integrating all of these within a socially contextualised process. On the other hand, Kline (1985), defines technology according to its usage. He attributes four usage of technology: hardware or artefacts; sociotechnical system of manufacture; knowledge, technique and methodology; and sociotechnical system of use. In both definitions, technology is referred to as a *product* developed by humans, as can be seen in the above definitions as physical objects or hardware or artefacts.

The development of technological product involves people that are needed to manufacture, and to accomplish the task of production or a system. This is referred to as human activities in the first definition above. The last aspect in which technology is referred to above is the technical aspects that are needed to accomplish the tasks of developing the product or system. The technical aspects include, among others, knowledge, skills, information and procedures that can be summarised as *process*.

Pacey (1983) extends the meaning of technology by referring to technology and its practice, taking into account the political, economic and social cultural aspects that might influence technology and the product of technology. He defines technology as "the application of scientific and other knowledge to practical tasks by ordered systems that involve people and organisations, living things and machine" (p.6). In this definition, he states that technology involves not only the technical aspect as commonly understood, but also a general meaning that includes all aspects of technology practice.

Another belief about technology is that it is regarded as an applied science. However, according to Gardner (1992), this view fails to recognise the contribution of non-scientific knowledge to technological development, adding that where science is applied to technology the process is usually complex. On the other hand, Gardner (1994, p.12) suggests that "technology and science represent interacting communities of people who learn from each other but who hold differing sets of values".

2.2 Technology in School Curricula

The definition of technology in school curricula also varies from country to country. The British curriculum of technology, Design and Technology (1990), is stated as "concerned with the individual's capacity to design and make, to solve problems with the use of materials and to understand the significance of technology" (Eggleston, 1992, p.13). The definition of technology in the Australian curriculum is stated as involving "the purposeful application of knowledge, experience and resources to create products and processes that meet human needs" (Rennie & Jarvis, 1994, p.3). *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) defines technology as "a creative, purposeful activity aimed at meeting needs and opportunity through the development of products, systems or environments where knowledge, skills, and resources combine to help solve practical problems. Technological practice takes place within, and is influenced by, social context" (p.6).

Both the curriculum for England and Wales and the Australian curriculum focus on design and make, based on capability and problem solving, a narrow view as highlighted by, among others, Mackay (1992), Burns (1993) and Layton (1993). Thus the implementation of the curricula ended up with developing products or processes. However, the Australian view of technology in their curricula also encompass the application of knowledge. Concurrently, the New Zealand definition encompasses a wider scope of technology to include the social context which influences technology. Thus as can be seen different countries have different emphasis on the learning of technology in school.

2.3 Technology Education

The late 1980s and 1990s mark the era of technology education implementation in various countries. In most countries technology education emerges by a "process of subject transformation" (Layton, 1993b, p.13) which progresses from manual training to technical and vocational subjects, and presently to technology education (see for examples; Medway, 1992; Eggleston, 1992; Jonathan, 1990; Lewis, 1995). The areas of focus are diverse, as highlighted by De Vries (1994, p.33-36) who outlines eight approaches from which the technology curriculum might originate:

- the craft-oriented approach
- the industrial production-oriented approach
- the high-tech approach
- the applied science approach
- the general technological concepts approach
- the design approach
- the key competencies approach
- the Science/Technology/Society (STS) approach

According to De Vries, a few examples of the countries which adopted some of the above approaches are: Belgium with a combination of the craft-oriented and a limited form of design approach; Germany which adopts the craft and industrial production-oriented approaches and is moving towards the general technological concepts and key competence approaches; and the Netherlands focuses on the craft-oriented tradition for its vocational education, while still undecided for the general education.

The following sections discusses technology education in some school curricula, the goals of technology education, teaching learning strategies, and the management or organisation of technology education in school.

2.3.1 Technclogy education through some school curricula

In Britain, the technology curriculum originated from the technical subject for less able students (Donnelly, 1993). The transformation of this curriculum later resulted in the inclusion of the design process with the aim of raising the status of the subjects, and involving "the reconciliation of functional demands with the various constraints on the situation, such as material limitations, cost and time restrictions, ergonomic and aesthetic requirements" (Layton, 1993b, p. 18). Thus the subject of Craft, Design and Technology (CDT) which covered a range of problem solving disciplines, focusing on skill-based subjects such as woodwork and metalwork, appeared in the school curriculum in the early 1980s.

The implementations of the National Curriculum paved the way for the introduction of technology as one of the foundation subjects in primary and secondary schools in 1990 (Layton, 1993b). The subject integrated the elements from CDT with business studies and home economics to become Design and Technology (Eggleston, 1992). The Design and Technology curriculum of 1990 focuses on four attainment targets: identifying needs and opportunities, generating a design, planning and making, and evaluating.

Morgan (1994) reports that technology education in Australia was developed from the tradition of manual training, manual arts, industrial arts and design. According to Morgan, the move towards technology was "accelerated by the development of computer education courses, and the incorporation of computer-aided design and manufacture and robotics into design and technology classes" (p. 119). By 1990, it is reported that every state in Australia had some form of technology education (Rennie & Jarvis, 1995). The curriculum consisted of four interdependent strands of technology learning (Curriculum Corporation, 1994): design, making and appraising; information; materials; and systems, in which all learning involves the design, making and appraising strands.

While both the English and the Australian technology curricula seem to emphasise an individual's capability, the New Zealand technology curriculum presents a more balanced and holistic approach, as can be seen in its aim (Ministry of Education, 1995, p.8) of technology education:

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

The New Zealand technology curriculum however, has yet to be implemented and then may change, as the British curriculum is still changing.

2.3.2 Goals for technology education

The creation of the technology education, has been of concern to various pressure groups who try to influence it, especially its goals. There are two main conflicting groups trying to formulate these goals, the economically motivated group and the educational (liberal educator) group. The most powerful of these forces is the economically motivated source, identified by Layton (1993a) as economic instrumentalists, which has influenced most technology curricula of western capitalism. The liberal educators emphasise the importance of shaping technology instead of allowing technology to shape human behaviour, as supported by Layton who states that "technology should go beyond knowledge and skills to include understanding of work in the context of its social, economic, political, moral and aesthetic dimension" (p.12).

Technology education is seen by the economic instrumentalists as the key to economic development and in some instances reviving part of the economic decline. The recession of the early 1970s, for example, has lead to the scapegoating of education, in which schools are seen as major contributors to unemployment (Jonathan, 1990). Economic instrumentalists claimed that schools have ignored the teaching of the skills needed by the labour market. Medway (1989) states that this group argues the need for schools to produce a highly skilled work force for the marketplace. However, according to Mackay (1992), with the advancement of technology, high-tech occupations will require less skill and the majority of jobs created by the end of this century may not require multilevel skills (Feinberg & Horowitz 1990).

Economic justifications are used to emphasise skill acquisition through training. However, Aristotle distinguishes the difference between training and education, in which training involves performance and the development of skills needed to complete a given task "whereas education involves developing the ability to address the social and moral implication of the otherwise technical activity" (Feinberg & Horowitz, 1990, p.191). Besides, narrow skills training can never meet the needs of a fast-changing industrial society.

The focus on technology education for economic purposes has resulted in a curriculum for the "real world" of work, "a purposeful activity aimed at meeting needs or satisfying desires through the production of artefacts or systems, and drawing on knowledge, skills and personal qualities" (Medway, 1989, p.4). Furthermore, Medway states that technology education is seen as involving two elements, technological *capability* and technological *awareness*. With the economic imperative focusing on skills for the work force, the main content of technology education seems to be on technological capability. In Britain, for example, the Design and Technology curriculum is identified as *doing* rather than *knowing,* the outcome being *capability* rather than *understanding* (Medway, 1989).

Various definitions have been given for *capability* which is said to revolve around knowledge, the process of making and evaluation (Verbowski, 1992). However, Hyland (1993) states that "the needs of a constantly evolving industrial society can never be met by narrow skills training which neglects aspect of general education" (p.96). Furthermore, the shaping of technology education with respect to capability, especially problem solving capabilities, will create a disadvantage for girls because of the masculine construction of the subject. Burns (1993) states that the subject is often developed in areas of traditional Western male interest and expertise which would exclude access to it by girls. The monopoly of technological development by males will place females as users and consumers (Layton, 1993a), or as passive receivers (Farmer, 1992) which will further enslave (Burns, 1997) this group.

What will be the appropriate goal for technology education? An interesting aspect about developing technology has been stressed by Mulberg (1992): "students should learn not only how to develop technology but also how to combine the technical with the social, the physical with the cultural and emotional with the economic. They should experience the effect that technology has on people's lives, and they must learn the responsibility that goes with such power"(p.32).

Thus the curriculum for technology education should be empowering (Burns, 1992) which calls for the incorporation of not only technological problem solving activities, but also recognising the role of technology in society and giving opportunities for students to choose the form of society they want. Burns (1993) states that empowerment as the goal would extend technology education beyond skills to full technological literacy.

2.3.3 Technological literacy

Mackay (1992) argues that technological literacy should encompass "a real technological understanding, which is required for a technological society" (p.141), and not only on technological expertise. Segal (1988) also outlines a different form of literacy, emphasising the critical, historical perspective as opposed to functional literacy. Functional literacy, according to Burns (1997), employs a cognitive deficit model and does not provide much of a prospect except to define the artefacts and their functions.

Presently, literacy has a wider interpretation which is said to be "multiple and inclusive of a variety of communicative competencies that allow the exchange of information" (Burns, 1997), while technological literacy is one of the various forms of literacy. Furthermore, interpretation of technological literacy needs to be diverse (Layton, 1993a) especially between the developed and the developing countries. According to Layton, in developing countries, technological literacy "involves the capability to choose, acquire, adapt and apply technologies as much as to generate new ones" (p.23).

Recently it has been suggested that technological literacy be developed according to a contextual model. Burns (1997) in citing Wynne (1991) refers 'knowledge in context' that combines local knowledge and technological knowledge, and incorporates knowledge of how technologies arise and develop.

Treagust (1990) states that technological literacy has been stated as one of the components of technology education, alongside technological awareness, technological capability and information technology. While this is supported by Hodson and Farmer (1992) they do not include the information technology component. However, with the change in the understanding of technological literacy in recent years, technological literacy would now be seen to include technological understanding, technological capability, and technology and society as can be seen in the Technology in the New Zealand Curriculum (1995).

On a wider perspective, the dimension of technological literacy could be summarised as knowledge about technology and knowledge within technology (Burns, 1997). The knowledge about technology addresses areas of the social and philosophical context of technology, whereas knowledge within technology addresses current knowledge and current practice. However, there is a need for the balancing of both in the teaching of technology education.

The study of the knowledge about technology is best in the historical context as suggested by Burns (1992) who claims that a curriculum should "extend students' views to accommodate an appreciation of the nature of technological processes, especially their social context" (p.78). Further, Burns makes the observation that the inclusion of the historical perspective would be attractive to girls and women as this would allow them to reposition their involvement in the light of the already distorted, male dominated historical views. Furthermore, the historical context could incorporate local technology especially those of the indigenous technologies, or in the context of New Zealand, Maori technology.

Another important context to be included in this goal is the social context that highlights the relationship between technology and society. Burns (1992) found that most students are unable to communicate the awareness of technological development in society. The inclusion of this social aspect would enhance student awareness of the role played by people in identifying societal problems and in shaping the solution wisely.

Values are another central issue as highlighted by Layton (1993b). In his critique of competence he states that "the ability to judge the worth of a technological development in the light of personal values and to step outside the *mental set*, to evaluate what it is doing to us" (p.61) is of significance. Conway (1994) also identifies the role of personal and communal values and belief in shaping technology as well as the shaping of technological development on society.

2.3.4 Teaching and Learning Technology

In most curricula, technology education gives emphasis to problem-solving as the process of technological learning. In teaching problem solving, there are concerns as to whether specific strategies should be taught (which is the usual practice) for solving various types of problems or general strategies that will apply to many problem types. Simon (1980) indicates that general methods "can be taught in such a way that they can be used in new domains where they are relevant" (p.86). The *specific* methods, though, constitute the core of general problem solving, but, according to Newell (1980) are weak methods, because they sacrifice *generality* for *power* (p.186). However, in real situations, problem solving is usually specific in context and goal directed (Hennessy *et al.*, 1993) and techniques of problem solving vary according to circumstances and the condition of problems rather than following the general problem solving model, such as the linear model.

Technological processes in schools often adopted the "design, make, test, evaluate" approach (Hennessy *et al.*, 1993). However according to Rogers and Clare (1994) it is not the end-product that is to be evaluated but rather the process. Hennessy *et al.*, (1993) states that "attempts to represent authentic problem solving activity and dilemma resolution as a systematic sequence of recognising a problem, representing it, implementing a resolution and evaluating the results, ignore the multitude of ways of tackling a problem and the fact that some activities take place simultaneously or structure each other differently on different occasions" (p.83). Kimbell (1991) in challenging the practicality of the linear problem solving model, points out that evaluation, for example, does not "only happen at the end of the process or that ideas are only necessary at a practical level" (p.142). This implies that evaluation has been undertaken constantly throughout the process, thus challenging general linear problem solving strategies. In fact, in assessing a technological task, the focus is on the active or reflective analysis of capability within the activity as a whole and within the procedural component of it.

A further emphasis on the same aspect has been made by the APU (1992) who look at technology from a different angle, claiming it to be "a way that placed the interactive process at the heart of [our] work and the products as subservient to that process ...concentrated on the thinking and decision-making that result in these products" (p.61). Thus, to assess these technological processes a framework was developed by them that consists of three ingredients, conceptual understanding (inside the head), explanatory or communicative facility (outside the head) and procedural capability. They "see the essence of design and technology as being the interaction of mind and hand - inside and outside the head" (APU, 1992, p.61). What happens inside the head is the imaging and modelling involving activities such as speculation, exploring, clarifying, validating and critical appraisal, and outside the head, when confronting reality, activities such as discussion, drawings, sketches, diagrams, notes, modelling, prototyping or provisional solutions may arise.

Through this model, APU (1992) hoped that it "would be possible to see (and assess) the central procedures of the activities as well as the extent to which they were resource by the conceptual understanding on one hand, and expressive facility on the other"(p.66). A further implication of this model aims at students' ability "to be aware of what they need to know" and thus can probe into student capability in "accessing relevant knowledge and skills" (p.66). This is in line with Schon's (1983) suggestion of reflection-in-action, which is the ability to adjust subsequent actions based on new information.

For meaningful learning of problem solving in technological tasks, Newmann (1992) suggests that students need to be taught not only knowledge or skills, but also dispositions of thoughtfulness because they are "central in generating both the will to think and in developing those artistic, ineffable qualities of judgement that lead knowledge and skills in productive directions" (p.108). Burns *et al.*, (1991), emphasises the need for students to be taught understanding, suggesting that students can "be taught to recognise when there is a problem and then taught what questions to ask to solve the problem" (p.286). Another important suggestion proposed by Burns *et al.* is the provision of a condition allowing students to pursue coherence, such as the opportunity for students to discuss among themselves problems and ideas which arise.

Another general learning or teaching strategy which could be incorporated into technology education includes learning by doing as termed by Gibbs (1988) drawing on Kolb's model of experiential learning. This resembles much of Federicksen's (1983) learning as discovery method in which he states that there is evidence "that learning by discovery rather than rules results in better problem representation" (p.62). Lawson (1991) stresses the importance of teachers as a source of knowledge and as models for students.

2.3.5 Managing technology education.

Technology education can encompass various curricula, overlap with other subjects, both from the science and social science disciplines (see for example Murray, 1990; DES, 1990; Ministry of Education (N.Z), 1995) and therefore there needs to be consideration of the management or organisation of delivering the curriculum. Eggleston (1992 p.71) puts forward a useful pattern for the organisation of the Design and Technology curriculum in England and Wales, who identifies three models as can be seen in Figure 2.1. They are: the faculty model where the component subject Figure 2.1 Organisational patterns for the adoption of Design and Technology (from Breckon, 1990 cited in Eggleston, 1992, p.71) departments work together (Figure 2.1a); the satellite or cross-curricular model where all subjects contribute to the curriculum, and out of combined efforts, technological capability appears (Figure 2.1b); and the new discipline model where all existing subjects cease and a new one is born (Figure 2.1c).

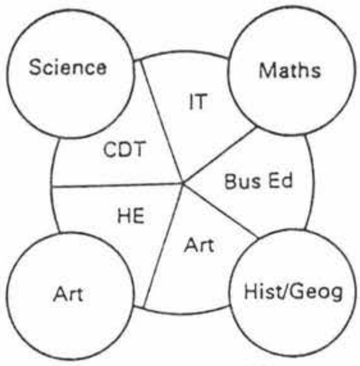
In New Zealand, the technology curriculum suggests that schools should develop "an implementation process which builds on the strengths of its current practice and provides a balanced education in technology [and] that technology is taught in substantial sections rather than dissipated across the curriculum" (Ministry of Education, 1995, p.29). The curriculum suggested four options, namely providing a time-table for the subject of technology, with teachers teaching the subject from a range of disciplines; developing an integrated approach across the curriculum, which also involves teachers from various disciplines, a combination of both options; or suspending the timetable for a fixed period to focus on technological activities across the year group, or the whole school (p.29).

Another area of management that needs to be considered, as highlighted by Eggleston (1992), is the room facility for delivering this curriculum. Technology in England and Wales is usually taught in "specially designed and equipped laboratories, suites, workshops and studios" (p.75) even for young children. For this purpose, specific considerations such as safety in handling dangerous machines and hazardous material, storage systems, and guidelines need to be managed by the schools.

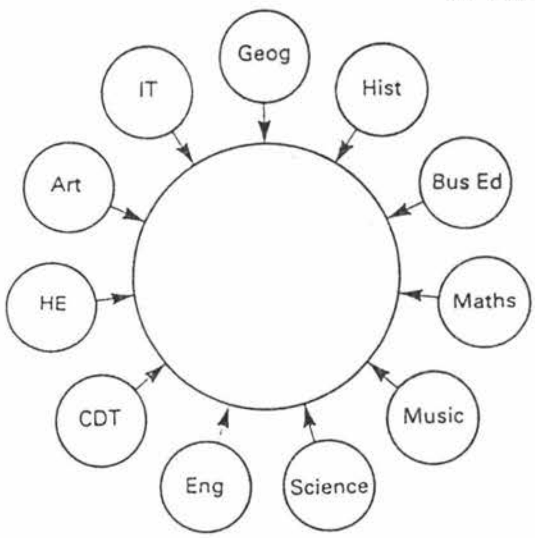
2.4 Students' Perceptions of Technology

Students' perceptions of technology comprise both their understanding of, and attitudes towards technology. The study of students' perceptions has been reported since 1987 in Europe (Raat, de Klerk Wolters & de Vries, 1987). These studies used the questionnaire developed from the Pupils' Attitudes Towards Technology (PATT) project in the Netherlands which were undertaken mostly with secondary students.

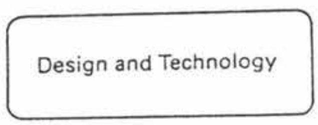
Figure 2.1 Organisational patterns for the adoption of Design and Technology (from Breckon, 1990 cited in Eggleston, 1992, p.71)



(a) Faculty model



(b) Design and Technology cross-curricular model



(c) New subject model

In New Zealand, a study by Burns (1990) using the PATT instrument on first year secondary students (13 year olds) shows that student attitudes towards and concepts of technology were similar with those of students elsewhere, the students being interested in and holding positive attitudes towards technology. Problems, however, were identified with the validity of the accumulated scales extracted by RAAT *et al* (1987). Using individual item scores, it was found that girls had more positive attitudes than boys on equality of gender capability, and did not consider technology as difficult as boys do. On the other hand, boys showed more interest in technology than girls and had positive attitudes about technology for career consequences and curriculum.

On the concept of technology, like elsewhere, New Zealand boys scored significantly higher than girls. In the open-ended questions stating the meaning of technology, Burns (1992) reports New Zealand students see technology as a "recent phenomenon" and as "artefacts" such items as computers, microwave ovens, cars and machines. Burns reports that about one-third saw technology as a technical or scientific problem solving process.

The New Zealand study also made a comparison of perception in terms of the ethnicity of Maori and European students. Burns (1992) reports that "Maori students have higher interest in technology than European students and are more likely to see it as a career possibility, but they are also more likely to gender-stereotype technology and see it as more difficult than European students "(p.76). Maori students however, were found to have a poorer understanding of the nature of technology than their European counterpart.

In another study of attitudes to science and technology in Botswana and Lesotho, Kent and Towse (1995) report that both countries showed relatively high degrees of technological awareness, with students understanding technology as "making things work", "solving everyday problems", "making lives easier" and "harnessing the world's resources". Students were stated as acknowledging that products of technology such as tractors, tarmac roads and piped water make their lives easier while showing an awareness of harmful environmental impacts on society. However, the researchers reported that Lesotho girls view technology more positively in terms of resources and wealth creation, while Lesotho boys view technology more positively in terms of consumption or consumerism.

A study of student perception of technology specifically in primary schools was undertaken by Rennie and Jarvis (1994, 1995), comparing English children with Australian children from year three to year six, using three different methods to investigate primary children's perceptions of technology including the Technology Questionnaire for upper primary which was developed from the PATT questionnaire, the Picture Quiz designed for young children and children with reading disabilities, and the Writing or Drawing activity for primary children of all levels.

The results of the Rennie and Jarvis 1995 study, using approximately 800 students each from Britain and Australia, indicate that children had a variety of ideas and perceptions about technology, views which Rennie and Jarvis suggested become more complex and coherent as children grow older. As in New Zealand, most of the students in both countries are reported to relate technology to computer and electrical appliances. An interesting finding in the Writing/Drawing activity is that Australian children tended to give greater support for electrical products, while the English children gave strong themes on design and model-making. Rennie and Jarvis suggest this is related to the nature of technology education in the two countries. In Britain there is strong emphasis on design while in Australia the focus is on design and make.

Student responses to the picture quiz suggest that they had a narrow perception of technology based on the number of pictures chosen that was less than half of the 25 pictures identified as technology-related. The pictures chosen by more than 70% in each group illustrated a computer, microwave oven, telephone, aeroplane, clock, factory or mine.

In the technology questionnaire activity, students in both countries expressed interest in technology. However, in the Australian sample, it is reported that girls were less interested than boys, with little difference in interest between gender in the English sample. Students' perceptions about the social aspects of technology were also stated as positive.

2.5 Teachers' Perceptions of Technology

In line with the study of students' perceptions, teachers' perceptions of technology have also been investigated by a few researchers. De Vries (1991) reports in his study of teacher trainees taking the Dutch Technology Teacher Programme that they have a fairly broad understanding of technology. However, according to De Vries, student teachers understanding of technology had some biases. Technology was perceived as "more towards new than old technology; more towards mechanical and electrical objects than with bio-related objects; only weakly related with science; more focused on matter than on energy and information; and more focused on individual human needs than on societal effects" (p.177).

A study of technology teachers in England by Riggs (1993), shows that these teachers related technology to applied science, and that technology was concerned with solving human problems, believing that current environmental problems could be solved by the use of new technologies. In another English study, Jarvis and Rennie (1996) report the perception of technology held by primary teachers ranged from technology as the application of science to use of machines to aid the process of designing and making artefacts. In another study, Nigerian teachers are reported to view technology as being the application of science in addition to mathematics in order to solve human problems (Hayden, Suleman & Gomper, 1992).

In a study of teachers' perceptions of technology education in England, Paechter (1991) found that different perceptions of technology among teachers, influenced what was taught and learnt in technology. In New Zealand too, Jones and Carr (1992) report that teachers have a narrow view of technology education, views influenced by their teaching subcultures. This was especially true for secondary school teachers and some primary teachers. Thus, it was found that science teachers would emphasise the "applications of science; social studies teachers focused on societal aspects of technology; ...and technical teachers focused on technical skills, designing and making" (Jones, 1995, p.187). In the primary school, it was found that teachers focused on problem solving or using "technological hardware" like computers to solve problems. It was discovered that teachers' perceptions were influenced by their past experiences both in and out of school.

2.6 Summary and Research Problem

This review began by identifying the meaning of technology. It is noted that technology is commonly referred to as technological products. This definition, however, is recognised as a restricted meaning for technology. A wider perspective of the meaning of technology is suggested to encompass not only the products and the technical aspects necessary to create these products, but also taking into consideration the political, economic, and sociocultural aspects that underpin these products and their development.

The review then looked at technology education by noting the forces that have directed its development including its goals, which in turn influenced the emphases of curricula. The most prominent of these forces was the economic instrumentalists group which has influenced most western technology education. It was found that technology curricula which emphasise economic justifications tend to focus on a narrow area of technology education, namely technological skill or capability. A wider scope is suggested to extend capability to full technological literacy, which encompasses capability, awareness and social context of technology, and the development of empowerment. For meaningful learning in technology, it is suggested that the focus of teaching is not only knowledge and skills, but also understanding.

The nature of technology education in school curricula is reflected in the teaching and learning of technology. The literature notes that teachers' and students' perceptions of technology focus on products, the result of the emphasis of these curricula on design and make tasks involving problem solving. Even though teachers' and students' understanding of technology in international studies are found to be either poor or narrow, students, however, are noted to be interested in technology.

This study will examine the perceptions of technology held by Malaysian students to determine the likelihood that the Vision 2020 will be achieved. In particular, the study seeks to look into students' understanding of and attitude towards technology. In an attempt to understand students' perceptions of technology, the Malaysian technology curricula for living skills and science, and teachers' experiences of teaching such curricula and their perceptions of technology will be investigated.

CHAPTER THREE

METHODOLOGY

This chapter outlines the research method adopted, sampling procedure, instrumentation, administration of research, and limitations regarding this research. Data analysis employed throughout the study is described in the relevant findings of chapter four, five and six.

3.1 Research Questions

The study sought to address the following questions:

1. What is the nature of the intended primary school technology curriculum of Malaysia?
   - What is the structure of the technology-related curriculum documents?
   - What is the teaching strategy suggested in the curriculum documents?
   - What is the meaning of technology in the curriculum documents?

2. What do Malaysian primary students understand by *technology*?
   - What do girls and boys understand by *technology*?
   - What do the students from different ethnic groups understand by *technology*?
   - What do rural and urban students understand by *technology*?

3. What are Malaysian primary students attitudes towards *technology*?
   - What are girls and boys' attitudes towards *technology*?
   - What are the attitudes of students from different ethnic groups towards *technology*?
   - What are the differences in attitudes between students in rural schools and students in urban schools towards *technology*?

4. What are teachers' perceptions of technology and experiences of school technology?
   - What are teachers' perceptions of *technology*?

- What are teachers' experiences of teaching technology?
- What problems do teachers perceive in teaching technology?

3.2 Outline of Method

This research investigates the research questions through a case study. Case studies can provide an insight in an investigation and "are carried out in a context of existing knowledge and circumstances" (Bromley, 1986, p.20). Recently, in the Malaysian education system, technology has been given much emphasis. A study of primary students' and teachers' perceptions of technology will provide understanding of the implementation of the technology curricula, which in turn can provide a foundation for improvement or innovation in either the technology curriculum documents or teaching strategies adopted by teachers. A non-experimental research case study "tends to involve an ongoing situation that presents itself for investigation" (McBurney, 1994, p.179).

This methodology is chosen as it encompasses a wider scope for inquiry, seen in Yin's (1994) technical definition which defines *case study* as "an empirical inquiry that investigates a contemporary phenomenon within a real-life context, [and] relies on multiple sources of evidence" (p.13). Thus, the strength of a case study investigation, according to Yin's definition, lies in the multiple approaches to gathering of evidence which comprise a mixture of quantitative and qualitative evidence.

Stenhouse (1988) states that there are various approaches to collecting case study data citing, among others, participant observation or non-participant observation and interview as the most common approaches, collection of documentary evidence, and the administration of questionnaires. In this study, data collection includes the use of a student questionnaire, interviews with teachers, and an analysis of the relevant technology curriculum documents. Questionnaire is used because more students can be included in the study to explore their perception of technology, while interview on teachers would give an overview of their practices in teaching and their views of technology.

This case study of primary technology education in Malaysia, describes perceptions of technology held by students in a sample of schools, with regard to the students' gender, ethnicity and location and teachers' perceptions of technology and their experiences in implementing the curricula in those schools. These perceptions are considered in the context of an analysis of the required curricula.

3.3 Sampling

The population for this study comprised Year Four students, and teachers teaching the living skills and science curricula in the Kuching - Samarahan regions of Sarawak. This level was chosen because it is at this level that the students were introduced to science and technology at primary school level. The study will be conducted in the regions of Kuching - Samarahan in the state of Sarawak because this is the home region of the researcher. Table 3.1 shows the statistic of students in Sarawak and the Kuching - Samarahan region.

Table 3.1
Population of Students in Sarawak and
Kuching - Samarahan Region

	Gender		
	Boys	Girls	Total
Year 1 – 6 (All)	131 311	123 396	254 707
Urban (All)	40 706	39 705	80 411
Rural (All)	90 605	83 691	174 296
Year 4 (All)	21 726	20 516	42 242
Year 4 (Kuc – Sam)	8 094	7 689	15 783
Year 4 Urban (Kuc- Sam)	2 905	2 789	5 694
Year 4 Rural (Kuc - Sam)	5 189	4 900	10 089

(Source: Sarawak Department of Education, 1995)

Beside familiarity with the stated regions, Kuching - Samarahan offer a wide choice of schools and participants. Urban schools are situated in the Kuching region, while rural schools can be found in both Kuching – Samarahan region. Table 3.2 shows the number of schools in Sarawak and the Kuching Samarahan region.

Table 3.2
Statistic of Schools in Sarawak and the Kuching - Samarahan Region

	Urban	Rural	Total
Sarawak (All)	108	1 140	1 248
Kuching – Samarahan Region	47	344	391

(Source: Sarawak Department of Education, 1995)

Ethnicity of native and non-native students can easily be identified from these regions. The native group, which includes Malays, Iban, Bidayuh, Melanau and other indigenous groups, represents about 70% of the population, and have their origins in the country, whereas the non-native group consists mainly of immigrants of Chinese and Indian origin.

However very few Indian is found in Sarawak. Thus a sample representing this ethnic group could not be taken.

3.3.1 Sampling procedure.

The proposed sample size for this study was between 500 to 600 with at least 40 students from each gender according to ethnicity and location. The number 40 were chosen because this was the expected class size in the school and that this study intended to select one whole class from each sample school. Furthermore, this number would give sufficient students in each group to make statistical comparisons. Thus when total up the sample size would be between 500 to 600 students. Table 3.3 shows the intended sampling plan.

Table 3.3
Proposed Sampling Plan for Students and Schools

	Boys		Girls		Students	Schools
Ethnic	Urban	Rural	Urban	Rural	Total	Total
Malay	40	40	40	40	160	4
Chinese	40	40	40	40	160	4
Iban		40		40	80	2
Bidayuh		40		40	80	2
Melanau		40		40	80	2
Total	80	200	80	200	560	14

Five ethnic groups, Malay, Chinese, Iban, Bidayuh and Melanau, were studied. Malay and Chinese samples were gathered from both urban and rural locations, while the other three ethnic groups were gathered from rural areas only, since most of these ethnic groups are to be found in rural areas. However, it was found that the numbers of these students in two ethnic groups, namely; Bidayuh and Melanau, were small (only 4 respondents were obtained) in rural schools. Since these two ethnic group are also native groups, the researcher found that it was more feasible to combine these groups together with the Malay and Iban group as *native* and the Chinese together with the Indians as the *non-native* group. Table 3.4 shows the revised sampling plan for students and schools.

Table 3.4
Revised Sampling Plan for Students and Schools

	Boys		Girls		Students	Schools
Ethnic	Urban	Rural	Urban	Rural	Total	Total
Native	40	160	40	160	400	10
Non-native	40	40	40	40	160	4
Total	80	200	80	200	560	14

Since this research attempts to describe the differences in student understanding of technology with regard to gender, ethnicity and location, the sample of school was obtained by applying stratified and purposive sampling. The stratified sampling method was used to- ensure certain portions of the population (Chadwick *et. al.*, 1984) were drawn from homogenous subgroups of that population (Babbie, 1992). Schools were stratified according to urban and rural location in the Kuching - Samarahan Districts.

The particular schools were chosen to represent native and non native groups by the purposive sampling method to "obtain a sample that appears to be representative of the population" (Nachmias & Nachmias, 1992, p. 175), or where "many members of the subset are easily identified" (Babbie, 1992, p. 230). Most schools were coeducational, in the urban area some were single sex. The schools were then selected according to ethnic majority, where information on ethnicity come from the Sarawak Department of Education's (1995) statistic. Two single sex schools, one girls' and one boys', were chosen to obtain the required number of Chinese students. However during the administration of the questionnaire, it was found that these two single sex schools have more native than non-native. One intact class was chosen from each school (see Table 3.5) for ease of administration.

Survey forms asking for principals' consent, number of Year Four classes and enrolment and time for teacher interviews were sent or handed to the selected schools. All the schools in the rural area, except one, had only one Year Four class. In the urban areas, all schools except one had more than one class. When this occurred, the Year Four classes were selected purposively. For this purpose, a discussion with the principal was carried out to choose the most appropriate class, taking into consideration the number of students according to gender and ethnicity.

3.3.2 School sample obtained

In the urban areas, four co-educational schools were selected to represent the native group of students, while two were selected for the non-native group. Another two single-sex urban schools, each representing all girls and all boys, were also selected. Seven schools, all co-educational, were selected from the rural areas which constitutes 0.6% of the whole rural student population. Whereas in the urban area, eight schools were selected which is

7.4% of the whole urban student population. Table 3.5 presents the characteristic of the sample schools

Table 3.5
Characteristics of Sample Schools Obtained

Characteristics	School	
	Urban	Rural
Co-educational school:		
Native	4	5
Non-native	2	2
Single sex school:		
All girls (Native majority)	1	-
All boys (Native majority)	1	-
Total	8	7

3.3.3 Student sample obtained

The subjects were 521 (10-year-old) primary school students currently studying in Year Four and comprising 272 girls and 249 boys. This sample constitutes 0.2% of the whole student population. Three hundred and thirty students were from urban areas while 191 were from rural areas. Rural schools tended to have smaller enrolments in a class than those schools in urban areas, a factor attributing to the smaller number in the rural sample. Another factor taken into consideration for sampling was to have proportionate number of boys and girls. Ethnicity was represented by 372 native students and 145 non-native students, while four students were from *others* category, such as Eurasian. The small number of non-native and rural sample was not boosted because of time factor and budget constraints. In addition, if more rural schools were to be added, the researcher have to go beyond the two stated districts. Table 3.6 shows the statistics of the sample of students obtained.

3.3.4 Teacher sample obtained

The living skills and science teachers were chosen for the interview because they were implementing the curricula that were considered technology-related. The teacher sample, comprising 28 teachers, was selected from the schools involved in the study. Schools were asked to suggest two representatives, one each from the living skills and science subject disciplines, for an interview. All the schools except two suggested the requested number.

Teachers were either teaching one of the two subjects or held the position of head of department. Two schools suggested a representative who taught both subjects.

Table 3.6
Student Sample Statistic

Characteristics	Required (N)	Obtained (N)
All Students	560	521
Girls	280	272
Boys	280	249
Native	400	372
Non-native	160	145
Others		4
Urban	160	330
Rural	400	191

3.4 Instrumentation

The instrument to measure students' perceptions of technology is developed from the Rennie and Jarvis (1994, 1995) technology instrument for English and Australian primary school children which consists of three sections focusing on technology: the writing/drawing section, picture quiz, and the technology questionnaire. For the Malaysian instrument, these sections were modified slightly and a fourth section was added to include background information about students. The technology instrument originated from the Pupil Attitude Towards Technology (PATT) (Raat, J.H. et. al., 1987) project developed in the Netherlands for students aged 13-15 years. Rennie and Jarvis (1994) subsequently modified it to suit students aged 7-10 years. This instrument had been tested and used on Australian and British students.

The first section, a drawing/writing section of the instrument, was designed to probe into students' perceptions of technology. It asked the students what they meant by *technology*. The second section, which also probed students' perception of technology, was a picture quiz which consisted of 28 pictures, in which students needed to tick the one involved with technology. The third section was a technology questionnaire which consisted of 10 statements concerning conceptions of technology (diversity of technology and design process) and 10 statements concerning attitudes towards technology (interest in and social aspects of technology). Each statement used a closed sentence expressing a point of view, a belief, a preference, a judgement, or a position for or against a phrase. It permits respondents to state whether they agreed, disagreed, were undecided or did not know.

3.4.1 Students' instrument construction

A copy of the English version of the Rennie and Jarvis (1994) instrument to measure students' perceptions of technology is translated into Malay, the national language of Malaysia. The instrument was translated carefully in order to preserve the context according to the original questionnaire. The method of communicative translation (Newmark, 1981) was adopted. According to Newmark, the translation produced has "the same effect on the target language readers as was produced by the original on the source language readers" (p.22).

All items except six in the picture quiz were retained from the original because they represented things which were appropriate to Malaysian culture. The six items changed in the Malaysian instrument are presented in Table 3.7. The criteria involve in finding replacements for each item stipulated that the replacement must be from the same category as the original item. Thus, *trousers* substituted *jeans* because it was in the textile (product) category; *bean curd* replaced *cheese* in the processed food products; *otter*, unlike *platypus,* is a wild animal more common in Malaysia; *rabbits* replaced *poodle* as pets in Malaysia. Both *food stalls* and *fish and chip shops* involved industrial processes. *Gum trees* and *mangrove trees* are still in their natural state, and had not been involved in any biological technology.

Table 3.7
Items Changed in Picture Quiz Activity

English version	Malaysian version
Jeans	Trousers
Cheese	Bean curd
Platypus	Otter
Fish and chip shop	Food stall
Poodle	Rabbit
Gum tree	Mangrove tree

It should be noted that 25 of the 28 items were most appropriate examples of technology. Three items not related to technology were included to see whether students could differentiate between technological and non-technological items. The three least appropriate items were otter, mountain and mangrove tree. Nonetheless, it is not difficult to comprehend why any student might select these least appropriate items. The subjectivity of interpretation signifies an unavoidable limitation to the design of their instrument.

The instrument began with the writing/drawing activity in Part 1, followed by picture quiz activity in Part 2, technology questionnaire in Part 3, and respondent particulars in Part 4. The organisation of the instrument was arranged in such manner so that the writing/drawing activity would not be influenced by the other parts. The final instrument is attached in Appendix One.

Pilot testing of instrument

Pilot testing was initially carried out in two stages at three schools. In the first stage, two schools, one rural and one urban, tested the first translated instruments. Another urban school tested the modified instrument.

In the first stage, the first school which is situated in the rural area consisted of Malay Year Four students. After the testing, eleven students consisting of 5 boys and 6 girls were interviewed. The second school, situated in the urban area, is a multiethnic school where eight students, four boys and four girls, were interviewed. They represented all the ethnic groups enrolled in the class.

The interview in the first school focused on the picture quiz and technology questionnaire, respondents were asked questions on why they did or did not choose certain pictures or statements and what they understand by certain words or statements. These pictures included computer, advertisement, bean curd, microwave oven, factory, mines and plan. These pictures were chosen because they represented items that were likely to be less familiar to the students in everyday life. For example, some students, especially from rural areas, might not have heard nor seen a computer or microwave oven or an advertisement. However, from the pilot testing it was found that students do know or heard about these products.

With respect to the questionnaire section, the interview was focused on statements; A2 (model), A3 (experts), A4 (metal), A6 (solve problem), A7 (design and plan new things), B2 (...better place to live in), and B8 (Invention do more good than harm). These words or statement were chosen because they were considered either technical words, such as *model*, *metal,* and *design and plan*, or subjective words or statements that were opened to various interpretations.

As all the respondents in the first school spoke Malay, it was found that the eleven students did not face any problems in understanding the language of the instruments. The focus then, was moved to students' understanding of technology and where they learned or acquired information about technology.

An interview with the eight respondents from the second school gave a better insight into the student understanding and use of Malay for certain words or statements. It was found that non-Malay students did not understand certain words. These students, however, were able to understand the words when the items were asked in English.

A modification was done after piloting and interviewing respondents in the two schools. They were:

a) An English version was included together with the Malay version of the instruments.
b) Additional variables were added in section 4, which explored the following respondent particulars:
    - gender
    - ethnic group
    - (Question 3) - item on where the students get information about technology. A closed answer to be chosen by respondents was included with an open option 'others (please specify)'.
    - (Question 4), an open ended type, which asked what are the electronic media available in the respondents home. This question was changed to a close type after the second pilot testing.

In the second stage of the pilot testing, the internal consistency reliability of the technology questionnaire with the pilot sample was computed with Cronbach's coefficient. The results indicating the reliability levels of the questionnaire based on the final pilot testing are: diversity (0.04), design process (0.28), interest (0.51), and social aspects (0.63). Except for the social and interest aspects subscales, the two other subscales showed low reliability levels in the Malaysian technology questionnaire instrument.

The instrument when tested in Australia and England showed a level of 0.67 on Cronbach alpha reliability as reported by Rennie and Jarvis (1995). However, it should be noted that the scales that were used for the study reported by Rennie and Jarvis in 1995 are different from those published in 1994, which were used in the Malaysian instrument developed in the present study. The study in 1995 by Rennie and Jarvis used the five point-Likert scale while the 1994 instrument used the four – point scale.

The low level of reliability found with the Malaysian sample may have resulted from this difference in scales. Furthermore, the items are all rather different in sophistication. A positive response on one does not necessarily mean a positive response overall. A five-point instead of three-point scale could be expected to give a higher reliability. It also suggests that this questionnaire needs to be tested elsewhere especially in other countries with a non-English speaking background. These low level of reliability in the instrument tested in Malaysia had resulted the calculation of the overall mean scores for diversity, design, interest and social aspect been ignored in this study, and only the mean score for each item was used.

3.4.2 Teacher interview

A respondent type of interview was adopted for the teacher interviews where the interviewer can retain "control throughout the whole process" (Powney and Watt, 1987, p.17) to arrive at the issues needed from the respondents. However, the interview was semi-structured in nature to allow "more latitude to probe beyond the answers" (May, 1993, p.93). Open-ended questions were used to allow respondents to answer more in their own terms.

The interview questions were divided into three areas: technological resources; teaching strategies and problems faced by teachers in teaching the science and living skills curriculum; and teachers' perceptions of technology. The questions were deliberately arranged to begin with a non-threatening one, aiming at encouraging the respondents to talk freely about the thing they knew in general. The following questions invited them to talk about specific things which needed personal views, such as their experiences in teaching the technology subject and their views or perception about technology. The interview schedule (see Appendix Two) was trailed in two of the pilot schools, one in rural and one in urban. No changes were made subsequently.

3.4.3 Technology-related documents

The curricula and government prepared support materials of living skills and science were studied to analyse the technological aspects, seeking answers to questions on the structure of each curriculum, the teaching strategies suggested, and the views of technology. The documents analysed included two of these curricula (Malaysian Ministry of Education 1991, 1993a, and 1994) course materials for living skills and science teachers in-service training, teacher's guide (Malaysian Ministry of Education 1992), packages of modules for teachers (Malaysian Ministry of Education 1995), textbooks, and other related resources approved by the government.

3.5 Procedures

The administration of students' instruments and teachers' interviews was performed in person by the researcher over a period of three months. In some schools, a teacher was present during the administration of the instruments to help in controlling the class and distributing the material. At other times the researcher was left alone with the students throughout the whole study. Each school was visited for a day for the administration of the student instrument and the teacher interview.

3.5.1 Administration of student instruments

The student instruments, which consisted of four parts, were given separately to the students, each part printed so that it could be given separately. When one of the parts was done, it was immediately collected from the students to prevent them from referring to or altering answers. The writing/drawing activity was used first to avoid students taking ideas from other sections to this section. The instruction for each section was read to the class. The meaning of the word *technology* was frequently asked by the students, but they were told to give their own ideas because their ideas were important.

During pilot testing, the writing/drawing activity took most students about half an hour, but there were some students who completed this activity in about fifteen minutes. Therefore, a time allowance of half an hour was allocated for this activity throughout the study. The picture quiz section took the least time, about five to eight minutes during pilot testing. Therefore, about eight minutes was allocated for this section. The questionnaire section took about eight to fifteen minutes during pilot testing. Therefore, fifteen minutes as finally allocated for this section. Thus the total time allocated was about an hour with the remainder of the time allocated for reading instructions.

In some schools, because slow learners or students with reading problems were present, the questionnaire was read to them by the researcher. In a school with a Chinese majority who cannot readily understand Malay or English, the study took more than an hour because of the language problem. Here, the researcher had to simplify the language and even use the local dialect to explain or translate the pictures or words or statements. A translation into the Chinese language was done verbally by a Chinese student, who is also fluent in Malay, after she understood the researcher's explanation. The questionnaire section was read wholly to this group. Elsewhere the questionnaire section was read only when necessary. The English version was not read at all to the students as it was meant for those who can read and understand in English.

3.5.2 Administration of teachers' interviews

Interviewing was undertaken with the living skills and science teachers in every sample school. Where there were two representatives (one living skills, one science) from the same school, the interview was conducted with the two teachers together. Most schools, except one, requested the interview to be done after the administration of the student instrument. Before the interview, respondents were told about the intention of the interview. All the interviews were audio recorded after permission was granted from the respondents. Audio recording enabled the research to concentrate fully on and listen to the answers given by respondents.

All of the interviews took place either in the school library, or resource room or staff common room. The interviews took about 20 to 30 minutes. The transcription of the interviews was done after the researcher came back to New Zealand. As such, respondents were not offered the opportunity to check the transcripts because of lack of time.

Throughout the study, teachers co-operated very well showing their interest in the discussions and openness in giving their views. Some of them hoped that the study would convey the problems faced in teaching and implementing these curricula to the authorities concerned.

3.5.3 Ethical procedure

Permission was sought from the Malaysian Ministry of Education and the State Education Department of Sarawak prior to the study. A formal standard application issued by the Malaysian Ministry of Education was completed and sent, together with a copy of the proposal, to the Ministry. After the approval was given by the Ministry, a letter from the researcher, together with the approval letter from the Ministry was sent to the State Education Department of Sarawak seeking permission to carry out the research in the state. An approval letter was issued by the state department. With these approval letters, (see Appendix) the researcher could go to any of the government institutions or schools or departments. However, out of courtesy, copies of these letters together with the invitation letter for participation were either handed or sent to the participating schools.

None of the selected schools rejected the invitation to participate. The principals and the teachers involved gave full co-operation during the day of the study. Most of the principals or their representatives brought the researcher to the class and introduced her to the teacher and students before the study was carried out. In order to preserve confidentiality, anonymity and freedom of response, all respondents including teachers and schools were assigned a participant code number and respondents' names were not used.

3.6 Limitations

Besides the analysis of the curriculum content, all data in this study were from self-reports and interviews, and thus might be subjected to social desirability biases (Babbie, 1992). In this aspect, according to Babbie, respondents might give information or answer "through a filter of what will make them look good" (p.151). However, efforts to ensure anonymity of students and schools and impartial administration of the study by the researcher in person rather than by the schools, were carried out in order to limit bias effect. The nature of the Ministry procedure with approval given to carry out any research, meant that it was difficult for schools or individuals to refuse. But the observation of participants' goodwill by the researcher throughout the study counters the likelihood of unwillingness by the respondents.

For this study, the generalisability of the findings was restricted by sample locations with only two districts in a region of one state being studied. Extending the location of the study to wider areas across the country may have given different results. The number of sample obtained was based on gender proportion rather than ethnicity and location. Thus there was uneven number of sample according to ethnicity and location, which might also affect the result of this study. In addition the nature of the student instruments, especially the picture quiz section, does not asked the students to state the reason they choose the pictures. Thus it was only known that they identified a particular picture, but was not known why they select that picture.

CHAPTER FOUR

TECHNOLOGY CURRICULA IN MALAYSIA

This chapter outlines the study of the contents of technology-related documents, in particular the living skills and science curricula in Malaysian primary education. The structure of the curricula, the teaching strategies and views of *technology* supported in these curricula are investigated. Other related documents analysed include materials from in-service teachers' courses for both living skills and science, and the teachers' guide for both curricula, teaching modules for teachers, and textbooks published by the Ministry of Education.

4.1 Structure of Technology-related Curricula

There is no single curriculum for technology education in Malaysia, but elements of technology can be seen in the living skills and science curricula, subjects taught from level II (years 4-6) onwards in the primary school. Malaysian primary education is divided into two phases, or levels. Level I accommodates students of age 7-9, from Year One to Year Three. At this level, the main learning focus is on reading, writing and arithmetic. Level II, especially at Year Four, is the starting point for the introduction of other curricula, such as living skills and science. These subjects are taught through the lower secondary school (Year 7-9) for the Living Skills, and through to the upper secondary (Year 10 and 11) for science. Both of these subjects are compulsory for all students at the stated level.

The historical development of these curricula and their present structure are outlined. An overview of the curricula contents are summarised in Appendix Three.

4.1.1 Primary living skills curriculum

Prior to the introduction of the living skills curriculum, the curriculum for manipulative skills was introduced in the early 1990s (Malaysian Ministry of Education, 1990) and was planned to enable students to handle simple basic tools and materials as well as learning the various techniques for producing a product. The curriculum claims that such experiences will help students *recognise* technology and acquire practical skills.

This manipulative skills curriculum was the first step in educating the Malaysian community about technology. By teaching practical skills, the curriculum claimed that it can help solve problems in everyday life which rely mostly on technology and technological achievements. The goals of the manipulative skills curriculum (Malaysian Ministry of Education, 1990, p.2) are to enable students to gain basic practical skills and knowledge about technology so that the students will tend to be involved in design and invention and undertake self-employment.

Manipulative skills are imparted through practical activities which focus on three areas, construction, assembly and disassembly, and simple maintenance. Every learning activity has to integrate additional aspects like safety in handling tools, techniques of using tools, reading a design or plan, and following procedures or processes of making a product, for example a wooden ruler or a dust pane from discarded tin can. During learning activities, students use various materials such as ready-made construction sets (Lego), metals and non-metals, electronic components, hand tools and other related tools suitable for this primary level.

Though the teaching of this curriculum was focused on the acquisition of skills, the development of knowledge, positive attitudes and values were emphasised too. These values included working systematically, being clean and tidy, and self-disciplined. This process of nurturing students towards designing and self-management aims at training them to be more creative, capable and responsible.

In 1991, the manipulative skills curriculum was integrated into the living skills curriculum as one of its components. The living skills curriculum encompassed a wider scope of focus to include manipulative skills, commercial skills, and self and work management skills developed through practical skills and knowledge. Besides, it instilled positive values based on technology and entrepreneurial activities. The goals of the living skills curriculum are "to enable students to acquire basic practical skills and knowledge based on technology, entrepreneurial skills and aspects of self-management so that they will be able to be self-employed and be involved in business and designing and inventing" (Malaysian Ministry of Education, 1991, p.2). The contents of this living skills curriculum are organised into three components, manipulative skills, entrepreneurship, and self-management.

Manipulative skills

This component focuses on maintenance, repairing and making of products. It aims at enabling students to do maintenance work, and repair tools and simple machines. Students are encouraged to design and make products using metal and non-metal materials, including discarded materials. Besides, students are given encouragement to venture into landscaping.

Another development process was involved recently when the design and invent component was added into its curriculum (Malaysian Ministry of Education, 1994). This component was integrated into the *making product* section of the manipulative component of the living skills. Design and invent component is not entirely new in the school curriculum. Prior to this it had appeared as a minor part of the manipulative skills curriculum of 1990.

This component is said to widen student knowledge of the importance of design and invention in solving problems of everyday life, as well as encouraging more far-reaching inventions that can improve the quality of life more generally. The goal of the design and invent component in primary education is "to produce students who are creative, innovative and inventive, and enabling them to produce appropriate inventions based on current technological developments for the betterment and prosperity of the country" (Malaysian Ministry of Education, 1994, p.1).

Further, the objectives of this component are to enable students to think creatively, innovatively and inventively; design and invent product(s); and practice good working values and attitudes such as a diligent, responsible and competitive spirit, and realise the greatness of God (Malaysian Ministry of Education, 1994, p. 2).

The foci on creative, innovative and inventive activities in this area of technology are based on three basic concepts, *mind*, *skills* and *values*. The mind is said to play an important role in generating and developing ideas that are the first step towards designing and inventing. Thus, thinking is needed during this process. Skills, on the other hand, emphasise invention and innovation. The curriculum states that invention involves making an object or new product from the student's point of view, whereas innovation involves modifying an object or product to upgrade its performance. In the process of thinking and inventing, emphasis is given on instilling good values and attitudes.

Three learning areas are highlighted in design and invent, creativity, innovation projects, and design and invention projects. They are emphasised according to levels (year 4, 5, and 6).

Entrepreneurship

Commercial skills, the main topic for this component are included to help develop students' interest in business through appropriate selling and buying activities. These skills include planning, managing, and recording of sales. Students are encouraged to identify the risks of the business world. Through these activities, students are exposed to the elements of entrepreneurship.

Self- management

This component aims at enabling students to adapt themselves well with family members and friends, to manage personal finances, time and work effectively, and to use given facilities with full responsibility.

4.1.2 Primary science curriculum

The science curriculum for primary education was only implemented in 1996. Prior to this, science was taught as a component in the Man and Environment curriculum, and integrated in the Malay and English language subjects "in the form of comprehension passages" (APEID, 1993). Primary science education aims at

> producing knowledgeable and skilful persons to shape a society with an orientation towards science and technology, to be empathetic, dynamic and progressive so that they are more responsible towards the environment and can appreciate the greatness of nature. (Malaysian Ministry of Education, 1993a, p.2)

This aim can be achieved by encouraging learning through experiences described later in this chapter. The science curriculum focuses on three aspects of learning to be integrated across the curriculum, scientific skills, thinking skills, and values and attitudes.

Scientific skills comprise scientific process skills and manipulative skills. The scientific process skills are taught to enable students to be critical in viewing an issue and to arrive at solutions systematically, and to develop simple as well as complex skills. Manipulative skills, on the other hand, involve psychomotor processes in investigating science.

Thinking skills involve mental processes: the integration of knowledge, skills and attitudes, to understand and to shape the environment. Thinking skills involve both critical and creative aspects. In critical thinking, students can evaluate an idea systematically before accepting it, while in creative thinking, students can use their imagination and find various strategies for problem solving as well as produce original ideas.

Learning by experience in science education is said to inculcate positive values and attitudes, including positive attitudes towards science. Among the scientific attitudes and positive values are interest in nature, honesty and precision in recording and validation of data, being systematic and confident, co-operative, responsible, friendly, appreciating science and technological achievement, empathetic, and awareness that science is one of the ways to understand nature.

The science curriculum identifies five areas to be taught at the primary level: investigate the living world; investigate the physical world; investigate the material world; investigate earth and the universe; and investigate the world of technology. This curriculum structure is similar to the science curriculum of New Zealand (Ministry of Education, 1993). However, the New Zealand science curriculum integrates the technology strand across the curriculum while the Malaysian curriculum makes technology an independent area. Since the New Zealand curriculum was developed earlier than the Malaysian curriculum, it is probable that the development of the Malaysian curriculum was influenced by the New Zealand curriculum of science.

The technology in the science curriculum is stated as an area of study that will enable students to widen their knowledge and scientific skills. The component of technology for primary education through the science curriculum investigates the following aspects: the history and development of technology; structure, construction and designing; analysis of simple machines; and the contributions of technology toward humanity.

4.2 Teaching and Learning Strategies in Technology Curricula

An important aspect of education in Malaysia, as stated in the National Education Philosophy (NEP) of Malaysia (Malaysian Ministry of Education, 1993b), is the emphasis on nurturing and developing individual potential holistically and in an integrated manner. As such, the process of learning in Malaysian schools emphasises not only the acquisition of skills, but also focuses on inculcating positive attitudes and values. The emphasis on thinking skills in the learning process of all the curricula complements the two earlier foci of skills and values. Before 1990, thinking skills were not taught within the Malaysian curriculum.

The living skills and science curricula, implemented after the declaration of the NEP, includes most if not all these three aspects. This section outlines the teaching and learning strategies in these two curricula.

4.2.1 Teaching and learning strategy for the living skills curricula

Learning by experience is the main focus of teaching and learning in the living skills curriculum. With this strategy, students are given the opportunity to perform an activity on their own or in a group to gain practical skills. However, the curricula suggest that knowledge and skills should be taught together. Teachers play an important role in not only delivering knowledge but also as a facilitator to students while doing their activities.

Various methods and techniques of teaching can be used including demonstration, story telling, research, simulation, brainstorming, role play, games, interview, inquiry and visiting (Malaysian Ministry of Education, 1992, 1993a, 1994). The method chosen depends on various factors such as the lesson's objectives, resources, class size, and student ability, and at the discretion of the teacher. Because the nature of the focus for this curriculum is on the acquisition of skills, the curriculum suggests teaching strategies be mainly student-centred and activity-based. However, there was no mention of problem solving technique (which is more appropriate to technology) to be used in the teaching.

Teaching by station

Teaching by station (TBS) is a form of class organisation for practical activities in the teaching of living skills (Malaysian Ministry of Education, 1993). By using this technique, teachers can demonstrate, facilitate, evaluate and, most importantly, manage the class. TBS is considered as a strategy to overcome lack of tools and materials. Figure 4.1 in Appendix Four shows the strategy of teaching by station.

There are a few factors to be considered when using TBS. As a station can accommodate one or more activities, different activities can be planned for the various stations, or the same activity for various stations. The number of stations created depend on the number of students, the quantity of the materials and tools, working space, and a teacher's ability to manage or control the class.

Cue card

Practical activities can be done individually or in a group. To facilitate teaching and learning activities, a cue card is devised to enable students to refer to it without waiting for the teacher to explain (Malaysian Ministry of Education, 1994). This card is useful especially for project or group work or learning by station. Besides, using a cue card encourages students to be more independent.

The information available in the card includes the name of the activity or project, tools and materials, plan or design of the project, procedures, and safety rules. Cue cards can be created as a folded card, printed sheet, or rolled board or other media.

Materials for teaching and learning living skills

In performing an activity or project for the design and invent component, teachers are encouraged not only to use commercially bought materials, but to use materials available locally, such as bamboo, rattan, plants, sea shells and discarded materials like boxes, bottles, plastic, paper, pieces of wood, components from old machines, and tyres. Using such material will not only save money, but can encourage students to be more innovative by taking advantage of the materials available around them.

4.2.2 Teaching strategy for the science curriculum

The teaching strategy suggested for teaching science at primary level is similarly learning by experience focusing on the inquiry method which incorporates the techniques of finding information, asking questioning, and investigating (Malaysian Ministry of Education, 1993a). The main characteristic of the inquiry method is the nature of the investigation that is done by the students. However, at the primary level, students are led and helped by their teachers to understand, especially a concept or principle. Teachers can facilitate this activity by asking questions, or being questioned by the students, or using problem-solving methods. Nevertheless, this is not the only method to be used in teaching science.

The science curriculum suggests various other methods or techniques useful in imparting knowledge, scientific skills, and values. Experimentation is an important technique used for investigation. Thus, students need to be familiar with the scientific process and manipulative skills described earlier in using this technique.

Other teaching strategies include discussion, simulation and project work. In discussion, students are encouraged to ask questions and convey their ideas based on facts and try to accept other people's ideas. The method of simulation involves carrying out an activity as similar to the original situation as possible. Examples of simulation activities are role play, games and activities using models. In games, students played to learn a certain principle or to understand a certain process for decision-making. The project is carried out either individually or in a group, and might be extended beyond formal lessons.

4.3 The Meaning of Technology in the Curricula

The meaning of *technology* is not stated in either the living skills or science curriculum. In the living skills curriculum, the word *technology* appears in various places. Abdul Rahman, in the foreword of the Living Skills Curriculum for Primary Schools (Malaysian Ministry of Education, 1991), emphasises the importance of living skills for students because the curriculum offers opportunity for them to acquire useful skills, as well as to expose them to technology. The introduction section of this curriculum also touches on the word *technology* in other places:

> This subject is introduced to develop students' manipulative capability, entrepreneurship and self-management through the acquisition of practical

> skills and knowledge as well as instilling positive attitudes based on *technology* and entrepreneurship... The effort [in introducing this subject] by education will enable society to be sensitive towards the development of technology....The skills [introduced in this curriculum] are the first efforts to help students to face a more meaningful life in the world of technology and business....[This curriculum] offers the opportunity for students to try, operate, and observe various technological products...(pp.1-2)

The design and invent component (Malaysian Ministry of Education, 1994), however, presents a better relationship with technology as it is currently understood. It states that "design and invent involves carrying out a certain project or making a new product or innovation of the product from the technological aspects to better suit the present and future market. This can be an original product or a product that involves innovation" (p.1).

In the primary science curriculum (Malaysian Ministry of Education, 1993a), technology is associated with science as can be seen in the phrase "science and technology". As this is one of the curricula that specifies technology as an area of study, it contains no mention of the meaning for *technology*. However, the meaning of *technology* can be found in a module of the primary science training package for teachers. This resource book refers to *technology* as "the process of application of scientific knowledge to fulfil human needs" (Malaysian Ministry of Education, 1995, p.39). Technology is stated as "involving technique in doing something, such as technique of cloning animals or plants" (p.39).

While design and invent are also associated with technology in this resource book, its meaning is a little different from that in the living skills curriculum. Design and invent in the science curriculum, as stated in this resource book for teachers, are "the processes of creating a product which has never been created successfully before. It is a systematic process and involves creativity and problem solving skills" (p.41). The process of design and invent involves eight steps: identifying a problem, generating ideas, designing a prototype, building a prototype, testing the prototype, refining, production, and marketing.

4.4 Summary

The living skills curriculum is considered as one of the technology-related curricula in the Malaysian education system. It is aimed at educating students with practical skills and knowledge based on technology, entrepreneurship and self-management. Unlike the living skills curriculum, the technology area of the science curriculum provides chances to investigate the history and development of technology in various fields. Meanwhile, the science curriculum also emphasises creativity through design and invent activities using scientific principles. In this aspect, there seems to be an overlap with the living skills curriculum. The relationship between technology and society is also given emphasis in science.

Various teaching strategies are employed in these two curricula. Both the living skills and science curricula emphasise the *learning by experience* approach, allowing students to do hands-on activities either by group work or individually. However, there are specific methods and techniques for each of the curriculum. The teaching methods within the living skills curriculum include demonstrations, story telling, research, simulation, brainstorming, role play, games, interview, inquiry, and visiting. A specific technique, *teaching by station,* is employed in this curriculum, especially in overcoming the shortage of tools and equipment. Here, students are grouped and placed in various stations to perform a certain activity or activities. Cue cards are devised to help students to learn independently, whether group work or individually. However, the direct instructions given in the cue cards does not provide much creativity for the students even though they can do the activity on their own. In the science curriculum, the main teaching method suggested is the inquiry method which incorporates the technique of finding information, questioning, and investigation. Other methods are experimentation, discussion, simulation, and carrying out a project.

The definition of *technology* is not given in the living skills curriculum. However, in the science curriculum, the meaning of technology is given in a teacher training package module and other resources available commercially. Both of these resources describe technology as the process of application of scientific knowledge to fulfil human needs. This supports the view that technology is strongly associated with science. Both the science and living skills curriculum documents states that design and invent involve the creating products. Design and invent in the living skills however, emphasise the making for product for marketing, whereas in science, it involves creativity and problem solving skills.

CHAPTER FIVE

STUDENTS' PERCEPTIONS OF TECHNOLOGY

This chapter presents the statistical results of student responses to the writing/drawing activity, picture quiz, and technology questionnaire. These instruments were developed by Rennie and Jarvis (1994), and as far as possible are maintained in this study except for some modifications as described in chapter 3 to items in the picture quiz to suit Malaysian students. A total of 521 students, 272 girls and 249 boys, from 15 schools in the Malaysian state of Sarawak are involved in this study. A comparison by gender, ethnicity (native and non-native) and location (urban and rural) were undertaken with all three activities. The statistical program of SPSS version 6.1 (Norusis, 1994) was used to analyse the data.

5.1 The Writing/Drawing Activity

Students' understanding of technology is first identified by the writing/drawing activity administered before the picture quiz or technology questionnaire so that students do not take the ideas or are influenced by these other activities. The writing/drawing activity was distributed on a sheet of paper stating, "Technology can mean different things to different people. When you read the word *technology,* what comes into your mind? What does technology involve? Please tell us what technology means to you by writing about it, or by drawing a picture. You might like to do both." Most students could understand this activity, though some of them took quite a while to start. Students wrote either in Malay or English.

5.1.1 Nature of responses to the writing/drawing activity

The writing/drawing activity involves three formats of responses for students to convey what they understand by technology, drawing only, writing only, and both writing and drawing. Where students draw and label their work, it is not considered an example of a writing and drawing format, but rather the drawing format only. The percentage of students using each format of response is used to compare the nature of responses among students. Table 5.1 shows the nature of students responses by gender, ethnicity and location.

Table 5.1
Format of Responses to the Writing/Drawing Activity
for All Students, and by Gender, Ethnicity and Location

	All Students	Drawing only		Writing only		Writing and drawing	
		N	%	N	%	N	%
All	521	391	75.0	63	12.1	67	12.9
Girls	272	197	72.4	38	14.0	37	13.6
Boys	249	194	77.9	25	10.0	30	12.0
+ Native	372	278	74.7	40	10.8	54	14.5
Non-Native	145	110	75.9	22	15.2	13	9.0
Urban	330	237	71.8	41	12.4	52	15.8
Rural	191	154	80.6	22	11.5	15	7.9

+ Four other students who fall neither in the native nor non-native groups were eliminated in the analysis for comparison between ethnicity.

As can be seen from Table 5.1, the most common format of response employed by students to convey ideas was the drawing only option adopted by 75%. Only 12.1% responded by using the writing only option, while 12.9% used the writing and drawing option.

Between gender, 77.9% of boys compared to 72.4% of girls adopted the drawing only format. However, 14% of girls compared to 10% of boys, and 13.6% of girls compared to 12% of boys responded to the writing only, and writing and drawing options, respectively. This showed that a higher percentages of boys adopted the drawing only format, whereas a higher percentage of girls adopted the writing only and the writing and drawing formats. This result suggests that girls may be more able to convey their ideas in writing than boys.

Among ethnicity, responses to the drawing only format were adopted by almost the same percentage of both native and non-native students, with the non-native students having a slightly higher percentage: 74.7% for native students and 75.9% for non-native students. However, 15.2% of non-native students compared to 10.8% of students responded using the writing only option, while 14.5% of the natives compared to 9% of the non-natives responded using the writing and drawing format. This result suggests that non-native students may be more competent in conveying ideas in writing.

Comparison by location showed that 80.6% of rural students compared to 71.8% of urban students used the drawing only format, whereas 12.4% and 15.8% of the urban students compared to 11.5% and 7.90% of rural students adopted the writing only, and writing and drawing formats, respectively. These results show higher percentages of rural students used the drawing only option, while slightly higher percentages of urban students used the writing only, and writing and drawing options. Thus, as expected, this finding suggests that urban student ability to convey their idea by writing is better than rural students. The result of these findings signifies that there are differences among the various groups in relating their ideas about technology.

5.1.2 Ideas about technology mentioned by students

Student responses to the writing/drawing activity are summarised in eleven main categories, including a category for incorrect ideas, such as natural phenomena, being examples of technology. These categories, except for 'processed products' which is a new category introduced by the researcher, have been devised by Rennie & Jarvis (1994), and was maintained in this study to allow for comparison among countries. Details of the main and subcategories are attached in Appendix Five. The same categories are used for all subsequent results of the writing/drawing activity. However, some of the main categories are further subcategorised. A category or subcategory is coded only once even though students might give many examples in the same category or subcategory. There is also a category to deal with student attitudes towards technology.

Each of the categories or subcategories is given a code of 1 for a response and 0 for no response or an incorrect idea. This section reports ideas commonly mentioned by Malaysian students in the writing/drawing activity (see Table 5.2).

The idea most often mentioned by students was *processed products* at 47%. The objects within *processed products,* in student responses, were all those products not identified in the other product categories, including objects like furniture, such as tables and chairs, and graphic media, such as books and pens or pencils. It seemed most of the processed products mentioned were those used daily by students. Vehicles were mentioned by more than 43% of the students, including the various vehicles used on land and in the air such as aeroplanes and space ships.

Table 5.2
Ideas about Technology Commonly Mentioned by All Students

Main Category Subcategory	N (521)	%
Human element	209	40.1
Non-technological	52	10.0
Art	27	5.2
Concept of change		
Early technology	1	0.2
Modern / futuristic	51	9.8
Biological technology	70	13.4
Products		
Processed products	245	47.0
General machinery	105	20.2
Electrical appliances	155	29.8
Computers	100	19.2
Vehicles and transport	227	43.7
Telecommunications	47	9.0
Weapons	7	1.3
Industrial processes	49	9.4
Building, Environments	90	17.3
Design process		
Ideas and inventions	21	4.0
Research and dev't, marketing	2	0.4
Making models	4	0.8
Knowledge		
General knowledge or learning	5	1.0
Science-related knowledge	7	1.3
Affective reactions		
Attitudes	5	1.0
Positive consequences	9	1.7
Diversity	5	1.0

However, almost as many, more than 40% of students, suggested that there was a human element to technology. Examples of a person provided in student responses included a person repairing a car, a person driving, individuals cleaning high rise buildings by using a lift and technologists or scientists working in a laboratory.

Other ideas mentioned by about 20% of students were electrical appliances (29.8%), general machinery (20.2%), and computers (19.2%). It seems that, though the individual percentages were not high, most students related technology to products of some kind. Students did relate technology to building (17.3%) when high rise buildings were drawn. Biological technology was mentioned by 13.5% of the students. However, most of the biological aspects mentioned were about local fruits familiar to the students.

Ideas least mentioned (by less than 10%) were art, concepts of change, industrial processes, design process, and knowledge of and affective reactions to technology. Except for the art category, most of these categories were mentioned in the writing only or writing and drawing option. Some of these responses gave good definitions of *technology*. The following examples were written by students in English.

> Technology means things that people invent or even make during the modern times. Now, they are many thing(s) people invent. Example; (a car was drawn).
>
> Technology are also things like lorries, aeroplanes and much more. Now in the modern times, different countries invent different things. Now if we go to a fun fair, we go to many places. The most popular place to go is the haunted house. It will bring you around. Now you shall see lots of monsters moving around. The small train in there brings you slowly around. The monsters are controlled by a thing. That is part of technology. Now even computers, refrigerators, television and the radio are part of technology. Scientist are now on hard work trying to invent something new, like a robot. Example: (a robot was drawn).
>
> (respondent 82g)

In the above example, at least seven subcategories of ideas were mentioned: concept of change (modern times), electrical appliances (e.g. refrigerators); computers (e.g. robot); vehicles (e.g. lorries); general machinery (e.g. the machines used in the haunted house); design process (e.g. invent); and human element (scientists...invent something).

In the following example, this student gave ideas on the concept of change, product, design processes, knowledge, and affective reactions to technology, positive consequences (life much easier), and diversity (technology can mean many things).

> Technology is the things that involve in the 19th century and above. For example, the aeroplane, Apollo 13, the car, telephone, etc. We use these things in our life. They were invented so we can live life much easier. Like the refrigerator, we don't have to salt food in order to keep them fresh longer, right? We owe all these inventions to Thomas Edison, Alexander G. Bell, etc. So, you see, technology can mean many things, like language, inventions, and many more. But most of all technology is the things that improve by the years, decades and centuries. (Objects drawn were computer, radio, television, telephone, space shuttle, and an equation $E=MC^2$)
>
> (Respondent 71b)

The following student showed a positive attitude towards technology but a narrow understanding of technology:

> Technology means to me a very advanced world. What I mean is that technology will make us advanced. When the word technology comes into my mind, I think of a computer.
>
> (Respondent 48g)

5.1.3 Ideas about technology given by subgroup of students

This section reports on the comparison by gender, ethnicity and location for the writing/drawing activity. Ideas about technology follow the categories as outlined in section 5.1.2. The program of SPSS (Norusis, 1994) using the statistics of cross tabulation and chi-square were used to find differences and test of significance between the subgroups.

Comparisons by gender

Ideas about technology most commonly mentioned by boys and girls were both from the product category. Processed product by 57.0% of girls and vehicles by 56.5% of boys (see Table 5.3).

Significantly higher percentages of girls than boys identified the *human element* in technology and identified technology as *processed products*, while significantly higher percentages of boys than girls identified technology as *electrical appliances, computers,* *vehicles* and *telecommunications*. This focus among boys on recent high technology and lower recognition of human element suggests that boys have narrower and more traditional conceptions of technology than girls.

Table 5.3
Ideas about Technology Compare by Gender

Main Category	Girls (n=272)		Boys (n=249)	
	N	%	N	%
Human element	126	46.3	83	33.3*
Non-technological	33	12.1	19	7.6
Art	17	6.3	10	4.0
Concept of change				
Early technology	0	0.0	1	0.4
Modern / futuristic	25	9.2	26	10.4
Biological technology	43	15.8	27	10.8
Products				
Processed products	155	57.0	90	36.1***
General machinery	55	20.2	50	20.1
Electrical appliances	70	25.7	85	34.1*
Computers	33	12.2	67	26.9***
Vehicles and transport	87	32.0	140	56.5***
Telecommunications	11	4.0	36	10.5***
Weapons	2	0.7	5	2.0
Industrial processes	29	10.7	20	8.0
Building, Environments	50	18.4	40	16.0
Design process				
Ideas and inventions	12	3.6	9	4.0
Research dev't marketing	2	0.7	0	0.0
Making models	3	1.1	1	0.4
Knowledge				
General knowledge/learning	4	1.5	1	0.4
Science-related knowledge	4	1.5	3	1.2
Affective reactions				
Attitudes	4	1.5	1	0.4
Positive consequences	6	2.2	3	1.2
Diversity	2	1.1	2	0.8

Levels of significance *$p<0.05$ **$p<0.01$ ***$p<0.001$

Comparisons by ethnicity

Ideas about technology most commonly mentioned by native students concerned products, transportation was identified by 44.2% of native students while processed products were identified by 63.4% of non-native students. This is shown in Table 5.4.

Table 5.4
Ideas about Technology Compare by Ethnicity

Main Category	Native (N=372)		N. Native (N=145)	
	N	%	N	%
Human element	121	32.5	86	59.3***
Non-technological	31	8.3	21	14.5*
Art	14	3.8	12	8.2*
Concept of change				
Early technology	0	0.0	1	0.7
Modern / futuristic	44	11.8	6	4.1**
Biological technology	44	11.8	25	17.2
Products				
Processed products	151	40.6	92	63.4***
General machinery	67	18.0	38	26.2*
Electrical appliances	120	32.3	35	24.1
Computers	78	21.0	22	15.2
Vehicles and transport	164	44.2	62	42.8
Telecommunications	40	10.8	7	4.8*
Weapons	6	1.6	1	0.7
Industrial processes	12	3.2	36	24.8***
Building, Environments	60	16.1	30	20.7
Design process				
Ideas and inventions	15	4.0	6	4.1
Research & dev't marketing	0	0.0	2	1.4*
Making models	3	0.8	1	0.7
Knowledge				
General knowledge or learning	4	1.1	1	0.7
Science-related knowledge	5	1.3	2	1.4
Affective reactions				
Attitudes	3	0.8	2	1.4
Positive consequences	6	1.6	3	2.1
Diversity	3	0.8	2	1.4

Levels of significance *$p<0.05$ **$p<0.01$ ***$p<0.001$

Significantly more non-native students than native students identified the human element in technology, processed products, general machinery, industrial processes, and research development and marketing, whereas significantly more native students identified telecommunications and gave modern and futuristic examples. This suggests that a narrower and more stereotypical view of technology is held by native students than non-native students. However, significantly more non-native students incorrectly identified non-technological ideas as technological, 14.5 % of non-native students compared with 8.3% of native students.

Comparisons by location

Table 5.5 presents the ideas about technology commonly mentioned by urban and rural school students.

Table 5.5
Ideas about Technology Compare to Location

Main Category	Urban (N=330)		Rural (N=191)	
	N	%	N	%
Human element	126	38.2	83	43.5
Non-technological	37	11.2	15	7.9
Art	17	5.2	10	5.2
Concept of change				
Early technology	1	0.3	0	0.0
Modern / futuristic	33	10.0	18	9.4
Biological technology	53	16.1	17	8.9*
Products				
Processed products	135	40.9	110	57.6***
General machinery	61	18.5	44	23.0
Electrical appliances	102	30.9	53	27.8
Computers	73	22.1	27	14.2*
Vehicles and transport	129	39.1	98	51.6**
Telecommunications	36	10.9	11	5.8
Weapons	3	0.9	4	2.1
Industrial processes	34	10.3	15	7.9
Building, Environments	45	13.6	45	23.6**
Design process				
Ideas and inventions	18	5.4	3	1.6*
Research & dev't marketing	1	0.3	1	0.5
Making models	2	0.6	2	1.0
Knowledge				
General knowledge or learning	5	1.5	0	0.0
Science-related knowledge	4	1.2	3	1.6
Affective reactions				
Attitudes	3	0.9	2	1.0
Positive consequences	8	2.4	1	0.5
Diversity	3	0.9	2	1.0

Levels of significance *p<0.05 **p<0.01 ***p<0.001

Significant perception differences were found between urban and rural in following four categories. In the *biological technology* category, urban students scored slightly better than rural students. In the *products* category and its three subcategories, *processed products*, *computers*, and *transportation*, significant differences were isolated between urban and rural student percentage scores. Except for *computers,* where urban students scored higher, rural students scored better in all of the other two subcategories. Rural students also scored higher than urban students in the *building and environment* category, while urban students scored higher in the *ideas and invention* subcategory.

5.2 Picture Quiz Activity

This section reports student understanding of technology based on the pictures chosen by them in the picture quiz activity. A total of 28 pictures, printed on a double-sided sheet of paper, were given to each student, with the students asked to choose the pictures they thought had something to do with technology. A score of 1 is given for a picture ticked and 0 for non-tick picture. Percentages of students choosing the pictures, and the percentage score between gender, ethnicity and location is computed through cross-tabulation by using SPSS.

The 28 pictures used in this activity were examples which represented eight main categories: *non-technological* category (otter, mangrove tree, and mountain); *art* (sheet of music and a statue); *concept of change* (hand axe and windmill); *biological technology* (rose and rabbit); *products* (beancurd, trousers, book, cup, clock, microwave oven, computer, aeroplane, telephone and gun); *industrial processes* (mine, factory, food-stall and cough medicine); *building and environment* (bridge, bedroom, play ground); and *design process* (house plan and advertisement). Except for non-technological items, all items chosen for the picture quiz activity were made to meet human needs. Among these items students would most likely be expected to choose products related to electrical appliances and high-tech products such as computers and aeroplanes.

5.2.1 Percentages of students choosing each picture

Table 5.6 shows the percentage of students choosing each picture. The pictures most often chosen by Malaysian students were *computer* (96%), *telephone* (90%), *microwave oven* (88%), *clock* (87%), *aeroplane* (83%), *windmill (*80%), *mine (*75%) and *factory* (69%). These were the pictures chosen by about or more than 70% of the students. Five of the pictures chosen were related to a high-tech product. Based on the low percentage of student responses within the *product* category, pictures like beancurd, cup, trousers and book were frequently not thought of as technological products.

Table 5.6
Percentages of Students Choosing each Picture

Picture	N	%
Otter	104	20.0
Mangrove tree	163	31.3
mountain	169	32.4
sheet of music	211	40.5
statue	265	50.9
hand axe	202	38.8
windmill	415	79.7
rose	121	23.2
rabbit	105	20.0
beancurd	118	22.6
trousers	161	30.9
book	233	44.7
cup	146	28.0
clock	452	86.8
microwave	459	88.1
computer	498	95.6
aeroplane	430	82.5
telephone	469	90.0
gun	292	56.0
mine	393	75.4
factory	358	68.7
food-stall	234	44.9
cough medicine	208	39.9
bridge	224	43.0
bedroom	325	62.4
playground	312	59.9
house plan	338	64.9
advertisement	251	48.2

Another category associated with technology was *industrial processes*, where students choose *mine* and *factory*. Surprisingly, windmill, an item not commonly found in Malaysia, was also associated with technology by a high percentage of Malaysian students. The pictures of the rabbit and the rose, which were related to *biological technology*, were pictures chosen least often by students, together with otter, mangrove, mountain and the old stone axe. However, even though least selected, the non-technological pictures of otter, mangrove and mountain were chosen by 20% to 32% of the students, reflecting that about

28% to 30% of students were unable to accurately distinguish whether these pictures were technologically related or not.

5.2.2 Comparisons of students' percentage scores by gender, ethnicity and location.

This section presents findings of Malaysian students' responses to the picture quiz by gender, ethnicity and location. Descriptive statistics were calculated using Pearson Chi-Square Test of Independence for comparison among gender, ethnicity and location.

Comparisons on gender scores

Girls' and boys' choice of pictures with percentage higher than 60.0% appeared to be similar for *windmill*, *clock*, *microwave oven*, *computers*, *aeroplane*, *telephone*, *mine*, *factor*, and *house plan*. Girls' percentage scores were slightly higher than boys for *windmill*, *factory* and *house plan*, and the same for *computers*, while boys' percentage scores were higher for *clock*, *microwave oven*, *aeroplane*, *telephone* and *mine*. However, more girls chose the wrong picture of non-technological pictures as technology. For both genders, the highest percentage score was the same for *computer* (95.6%). Table 5.7 presents the percentage scores of responses to the picture quiz.

Ten out of twelve pictures showed girls scoring significantly better than boys: *mangrove tree*, *mountain*, *sheet of music*, *hand axe*, *rose*, *beancurd*, *trousers*, *book*, *cough medicine* and *playground*. As expected the gender-related items of *rose* and *beancurd* were picked by the girls, but it may be because they are knowledgeable about flowers and food and is not known whether they know these items are technologically developed. Interestingly, *hand axe* and *trousers* which are supposed to be male-related objects were also selected by girls. However, girls' higher mean scores of *mangrove tree* and *mountain*, non-technological items, suggests that they don't know was is technologically developed or what is not. Two other responses where boys scored significantly higher (*aeroplane* and *mine*) were related to high-tech and industrial processes, compared to the eight responses by girls which indicated that girls did not relate to technology as high-tech in nature.

Table 5.7
Percentages for Picture Chosen According to Gender

Picture	Girls (N=272)		Boys (N=249)	
	N	%	N	%
Otter	62	22.8	42	16.9
Mangrove tree	103	37.9	60	24.1***
mountain	106	39.0	63	25.3**
sheet of music	125	46.0	86	34.5**
statue	144	52.9	121	48.6
hand axe	128	47.1	74	29.7***
windmill	219	80.5	196	78.7
rose	76	27.9	45	18.1**
rabbit	60	22.1	45	18.1
beancurd	80	29.4	38	15.3***
trousers	98	36.0	63	25.3*
book	157	57.7	76	30.5***
cup	86	31.6	60	24.1
clock	234	86.0	218	87.6
microwave	236	86.8	223	89.6
computer	260	95.6	238	95.6
aeroplane	214	78.7	216	86.7*
telephone	240	88.2	229	92.0
gun	144	52.9	148	59.4
mine	190	69.9	203	81.5**
factory	195	71.7	163	65.5
food-stall	131	41.4	103	48.2
cough medicine	130	47.8	78	31.3***
bridge	126	39.4	98	43.0
bedroom	176	64.7	149	59.8
playground	181	66.5	131	52.6**
house plan	180	66.2	158	63.5
advertisement	128	47.1	123	49.4

Levels of significance *$p<0.05$ **$p<0.01$ ***$p<0.001$

Comparisons by ethnicity

The pattern of items chosen by more than 60% of both the native and non-native were similar. Native students scored slightly higher *for windmill, clock, microwave oven, computer, aeroplane, telephone, mine* and *factory,* whereas non-native scored slightly higher for *bedroom* and *house plan*. Table 5.8 indicates the percentage score of the native and non-native groups of students.

Table 5.8
Percentages of Picture Chosen According to Ethnic Origin

Picture	Native (N=372)		Non-N (N=145)	
	N	%	N	%
otter	69	18.6	34	23.4
mangrove tree	110	29.6	51	35.2
mountain	115	30.9	52	35.9
sheet of music	137	36.8	73	50.3**
statue	200	53.8	63	43.4*
hand axe	127	34.1	73	50.3***
windmill	301	80.9	111	76.6
Rose	78	21.0	42	29.0
Rabbit	67	18.0	37	25.5
Beancurd	74	19.9	43	29.7*
Trousers	99	26.6	60	41.4**
book	147	39.5	83	57.2***
cup	91	24.5	53	35.6**
clock	333	89.5	116	80.8**
microwave	340	91.4	116	80.8***
computer	361	97.0	133	91.7*
aeroplane	321	86.3	106	73.1***
telephone	343	92.2	123	84.8*
gun	218	58.6	72	49.7
mine	287	77.2	104	71.7
factory	258	69.4	97	66.9
food-stall	161	43.3	72	49.7
cough med.	141	37.9	64	44.1
bridge	154	41.4	68	46.9
bedroom	229	61.6	93	64.1
playground	228	61.0	83	57.2
house plan	231	62.1	104	71.7*
advertisement	187	50.3	62	42.8

Levels of significance *$p<0.05$ **$p<0.01$ ***$p<0.001$

Significant differences between native and non-native students were found in thirteen items. The non-native students scored significantly higher in *sheet of music*, *hand axe, beancurd*, *trousers*, *book*, *cup*, and *house plan*, whereas native students scored significantly higher in *statue*, *clock*, *microwave oven, computer*, *aeroplane* and *telephone*. An interesting finding in these differences is that native students showed higher responses to high-tech items, as can be seen in four of the product scores, and that non-native students showed high responses in the other four products that were not high-tech. however, this finding does not shows that the students know these items were technologically-related.

Comparisons by location

The pattern of choice for items with more than 60.0% for both urban and rural students were similar as can be seen in Table 5.9.

Table 5.9
Percentages of Picture Chosen According to Location

Picture	Urban (N=330)		Rural (N=191)	
	N	%	N	%
otter	66	20.0	38	19.9
mangrove tree	93	28.1	70	36.7*
mountain	116	35.2	53	27.8
sheet of music	131	39.7	80	41.9
statue	160	48.5	105	55.0
hand axe	132	40.0	70	36.6
windmill	263	79.7	152	79.6
rose	75	22.7	46	24.1
rabbit	66	20.0	39	20.4
beancurd	70	21.2	48	25.1
trousers	99	30.0	62	32.5
book	142	43.0	91	47.6
cup	95	28.8	51	26.7
clock	285	86.4	167	87.4
microwave	296	89.7	163	85.4
computer	316	95.8	182	95.3
aeroplane	271	82.1	159	83.3
telephone	301	91.2	168	88.0
gun	177	53.6	115	60.2
mine	257	77.9	136	71.2
factory	216	65.4	142	74.4*
food-stall	134	40.6	100	52.4*
cough med.	133	40.3	75	39.3
bridge	133	40.3	91	47.6
bedroom	200	60.6	`25	65.6
playground	188	57.0	124	64.9
house plan	202	61.2	136	71.2*
advertisement	150	45.4	101	52.9

Levels of significance *p<0.05 **p<0.01 ***p<0.001

However, urban students scored slightly higher for *microwave*, *computer*, *telephone* and *mine*, while rural students scored slightly better for *clock*, *aeroplane*, *factory*, *bedroom*, *playground* and *house plan*. Only four out of twenty-eight items have percentages scores which differ significantly between urban and rural students: *mangrove tree*, *food-stall*, *factory*, and *house plan*, where all of the mean scores were higher for rural students than urban students. Two of the items, *food-stall* and *factory*, were industry-related, However *food-stall* can be found everywhere in the state whereas *factory* can be found in city, while *house plan* was design-related. *Mangrove tree* was not a technology-related item but is commonly found in rural area.

5.3 Technology Questionnaire

The technology questionnaire section was the third section of the perception of technology instrument and consisted of 20 statements categorised into four subcategories. The odd numbered statements in part A are related to technology as diversity, while the even numbered statements are related to technology as a design process. In part B, the odd numbered statements attempt to look into student interests in technology while the even numbered statements attempt to study student attitudes towards the social aspects of technology.

All statements within the diversity subcategory are negatively worded, thus the correct answer was *disagree*. All statements in the technology as design process subsection are positively worded with the correct answers falling on the *agree* scale. Meanwhile all statements in part B are attitudinal and therefore there is no correct answer. However, the response of agreement indicates interest in technology and thus shows a positive attitude of the student.

For all positively worded items, response to each statement is given a score of 0 for *don't know*; 1 for *disagree*; 2 for *undecided*; and 3 for *agree* including statement No.6, on the social aspects of technology. For the negatively worded statements, a score of 0 for *don't know*; 1 for *agree*; 2 for *undecided*; and 3 for *disagree* were assigned to each statement.

Percentages of students responding in each category to each item were computed by using SPSS. When a mean score was calculated, however, the score of '1 to 3' (agree to disagree) was only used, while the score of '0' (don't know) was omitted as in the comparison among gender, ethnicity and location. It is assumed that the intervals between scores, 'agree' to 'don't know' and 'don't' know' to 'disagree', are equal. This section reports the result of technology questionnaire for the Malaysian sample. A comparison among gender, ethnicity and location was undertaken using the independent samples t-test of significance.

5.3.1 Response to the Technology Questionnaire

The technology questionnaire in this study used a four-point scale of response. This questionnaire, devised by Rennie and Jarvis (1994), uses a different scale from the one reported later by Rennie and Jarvis (1995), which uses a Likert five-point scale. Table 5.10 shows the percentages of all students' responding to the technology questionnaire on each item, for all scales.

In the *diversity* subsection, students' perceptions scores were high for only two statements, namely, *technology is mostly about computers and things like computers,* and *technology needs electricity*. For these statements, approximately 60% of the students disagree. On the other hand, perception scores were low for the other three statements: *technological things can only be used by experts, most people don't use technology in their everyday lives,* and *there was no technology before my grandparents were alive.* However, in the last statement, the percentage for each response is almost the same.

Again, in the *technology as design process* subcategory, student mean scores were slightly better for only two statements, reflecting higher perceptions for these statement: *in technology there are chances to design and plan new things,* and *technology means inventing ways of doing things.* About 70% agreed with the first statement and about 50% agreed with the second statement. However, student percentage scores were slightly lower in three other statements, namely, *making models and testing them is part of technology, working with wood and metal is an important part of technology,* and *technology is making plans to solve problems.*

Table 5.10
Percentage of Students Responding in Each Category

	Agree	Can't Decide	Disagree	Don't Know
Section 3A				
Diversity of technology				
1 Technology is mostly about computers and things like computers	7.8	22.2	60.9	9.1
3 Technological things can only be used by experts.	43.5	19.7	22.2	14.5
5 Technology needs electricity.	13.0	22.6	53.9	10.5
7 Most people don't use technology in their everyday lives	36.7	29.7	15.3	18.3
9 There was no technology before my grandparents were alive.	22.9	25.2	29.8	22.9
Technology as a design process				
2 Making models and testing them is part of technology.	33.3	34.5	13.2	17.0
4 Working with wood and metal is an important part of technology.	32.8	24.4	19.4	23.4
6 Technology is making plans to solve problems.	32.6	26.9	21.0	19.4
8 In technology there are chances to design and plan new things	69.1	12.6	8.9	9.3
10 Technology means inventing ways of doing things.	53.2	23.1	10.5	13.2
Section 3B				
Interest in technology				
1 I am interested in technology.	75.0	13.4	5.2	6.4
3 I would like to learn about technology.	70.0	12.6	10.1	7.4
5 I would like a job in technology later on.	51.1	29.9	7.5	11.6
7 I like to read books and magazines about technology.	68.5	13.2	8.7	9.7
9 I would like to join a hobby club about technology.	52.3	24.6	9.8	13.3
Social aspects of technology				
2 Technology makes the world a better place to live in.	51.2	24.5	9.7	14.7
4 Technology has brought more good things than bad things	46.2	23.5	13.5	16.9
6 It is worth spending money on technology.	17.0	30.6	33.9	18.5
8 Inventions in technology do more good than harm.	40.4	27.3	14.2	18.1
10 Technology is needed by everybody.	50.3	23.3	13.5	12.9

The interest in technology subcategory findings show that all students' percentage scores were high, reflecting that students have positive attitudes towards technology. About 50-70% of the students agree with these statements. In the *social aspects of technology* subcategory, students' percentage scores were slightly higher for the first statement, *technology makes the world a better place to live in*, and the last statement, *technology is needed by everybody,* with 50% of the students agreeing with these statements. However, students' percentage scores were slightly lower in *technology has brought more good things than bad things,* and *inventions in technology do more good than harm.* The percentage was low for the statement, *it is worth spending money on technology,* reflecting that students were pessimistic about the worthiness of spending money on technology. The findings above suggests that students seemed a little unsure about the nature of technology (diversity and design), were interested in it, but were not too impressed about its social effects.

5.3.2 Comparison of means scores by gender

The pattern of students' perceptions was similar for all subscales. In the *diversity* subcategory, significant gender differences were found in the statements *technological things can only be used by experts,* and *technology needs electricity.* In both of these statements, boys' mean score were higher than girls' mean score showing that boys gave better answer than girls.

In the *design process* subcategory, mean score for the statement *technology means inventing ways of doing things* showed a significant difference between genders with boys scoring higher than girls. However, both genders had positive attitudes towards technology with no apparent significant difference between girls and boys interest. No significant gender difference was found in the *social aspect* subcategory. However, boys mean scores were higher than girls for most statements signifying that boys were more sure about the nature of technology (diversity and design process), were more interested and more optimistic of the social effects than girls. Table 5.11 shows the mean score and t-test results for technology questionnaire according to gender.

5.3.3 Comparisons of ethnic scores

The pattern of students' perceptions was also similar in comparison by ethnicity. Native students mean scores were slightly higher than non-native students in the *diversity*, *design process* and *interest* subcategories. However, in the *social aspects* subcategory, non-native students mean scores were slightly higher than native in four out of five statements. The *t*-test shows that there were significant differences between the native and non-native students on eight statements.

In the *diversity* category, significant ethnic differences were found in the third statement, *technology needs electricity*, with native students having higher conceptions. There were significant different in two statements in the *design process,* namely; *in technology there are chances to design and plan new things* and *technology means inventing ways of doing things*. In both statements, native students score significantly higher than non-native students. The native students show significantly more interested in technology than non-native in three statements. These statements were *I am interested in technology, I would like a job in technology later on,* and *I like to read books and magazines about technology.* Meanwhile in the social aspects, significantly higher score were found among non-native students in the statements *technology has brought more good things than bad things* and *it is worth spending money on technology.*

These findings suggest that native students seemed slightly sure about the nature of technology and were interested in it, but were a little pessimistic about the social affects, whereas non-native students seemed optimistic about its social affects. Table 5.12 shows the means scores for the Technology Questionnaire according to ethnicity.

5.3.4 Comparison by location

The pattern of perceptions for urban and rural students was similar for all subcategories. The *t*-test indicates that there were significant differences between urban and rural students on two statements in the *diversity* subcategory, and two statements on *social aspects of technology*. These statements were *technology is mostly about computers and things like computers* and *most people don't use technology in their everyday lives.* In all these

Table 5.11
Means Score for Concepts of and Attitudes Toward Technology for All Students and According to Gender

	All	Girls	Boys
Diversity of technology			
1 Technology is mostly about computers and things like computers	2.35	2.56	2.62
3 Technological things can only be used by experts.	1.50	1.67	1.84*
5 Technology needs electricity.	2.20	2.39	2.53*
7 Most people don't use technology in their everyday lives	1.42	1.74	1.74
9 There was no technology before my grandparents were alive	1.62	2.10	2.10
Technology as a design process			
2 Making models and testing them is part of technology.	1.84	2.22	2.22
4 Working with wood and metal is an important part of technology	1.66	2.15	2.20
6 Technology is making plans to solve problems.	1.73	2.13	2.16
8 In technology there are chances to design and plan new things.	2.42	2.66	2.67
10 Technology means inventing ways of doing things.	2.16	2.42	2.56*
Interest in technology			
1 I am interested in technology.	2.57	2.70	2.79
3 I would like to learn about technology.	2.45	2.63	2.67
5 I would like a job in technology later on.	2.20	2.48	2.50
7 I like to read books and magazines about technology.	2.40	2.65	2.67
9 I would like to join a hobby club about technology.	2.16	2.49	2.49
Social aspects of technology			
2 Technology makes the world a better place to live in.	2.12	2.43	2.54
4 Technology has brought more good things than bad things	2.00	2.40	2.39
6 It is worth spending money on technology.	1.46	1.75	1.83
8 Inventions in technology do more good than harm.	1.90	2.29	2.35
10 Technology is needed by everybody.	2.11	2.41	2.43

Levels of significance $*p<0.05$ $**p<0.01$ $***p<0.001$

Table 5.12
Means Score for Concepts of and Attitudes toward Technology for Native and Non-native Students

	Native	Non-native
Diversity of technology		
1 Technology is mostly about computers and things like computers	2.61	2.53
3 Technological things can only be used by experts.	1.73	1.80
5 Technology needs electricity.	2.52	2.29**
7 Most people don't use technology in their everyday lives.	1.72	1.79
9 There was no technology before my grandparents were alive.	2.11	2.10
Technology as a design process		
2 Making models and testing them is part of technology.	2.20	2.27
4 Working with wood and metal is an important part of technology.	2.16	2.20
6 Technology is making plans to solve problems.	2.16	2.10
8 In technology there are chances to design and plan new things	2.72	2.50**
10 Technology means inventing ways of doing things.	2.54	2.37*
Interest in technology		
1 I am interested in technology.	2.81	2.56***
3 I would like to learn about technology.	2.66	2.61
5 I would like a job in technology later on.	2.53	2.38*
7 I like to read books and magazines about technology.	2.73	2.46***
9 I would like to join a hobby club about technology.	2.50	2.44
Social aspects of technology		
2 Technology makes the world a better place to live in.	2.46	2.54
4 Technology has brought more good things than bad things.	2.35	2.51*
6 It is worth spending money on technology.	1.74	1.91*
8 Inventions in technology do more good than harm.	2.34	2.26
10 Technology is needed by everybody.	2.42	2.41

Levels of significance *$p<0.05$ **$p<0.01$ ***$p<0.001$

statements, urban students mean scores were higher than rural students, reflecting broader understanding of and positive attitude towards technology. There was no significant difference between urban and rural students in the *design process* and *interest in technology* subcategories. Table 5.13 presents the mean scores and *t*-test results for urban and rural students.

Table 5.13
Means Score for Concepts of and Attitude toward Technology for Urban and Rural Students

	Urban	Rural
Diversity of technology		
1 Technology is mostly about computers and things like computers	2.63	2.50*
3 Technological things can only be used by experts.	1.74	1.78
5 Technology needs electricity.	2.51	2.37
7 Most people don't use technology in their everyday lives	1.80	1.64*
9 There was no technology before my grandparents were alive.	2.06	2.17
Technology as a design process		
2 Making models and testing them is part of technology.	2.23	2.20
4 Working with wood and metal is an important part of technology.	2.16	2.20
6 Technology is making plans to solve problems.	2.20	2.04
8 In technology there are chances to design and plan new things.	2.69	2.61
10 Technology means inventing ways of doing things.	2.53	2.42
Interest in technology		
1 I am interested in technology.	2.76	2.72
3 I would like to learn about technology.	2.66	2.63
5 I would like a job in technology later on.	2.50	2.48
7 I like to read books and magazines about technology.	2.67	2.65
9 I would like to join a hobby club about technology.	2.48	2.51
Social aspects of technology		
2 Technology makes the world a better place to live in.	2.55	2.37**
4 Technology has brought more good things than bad things.	2.43	2.33
6 It is worth spending money on technology.	1.81	1.75
8 Inventions in technology do more good than harm.	2.32	2.32
10 Technology is needed by everybody.	2.49	2.30*

Levels of significance $*p<0.05$ $**p<0.01$ $***p<0.001$

5.4 Summary

This chapter examined Year Four Malaysian students' perceptions of technology with three different sections of the Rennie and Jarvis (1994) instrument; the writing/drawing activity, picture quiz, and the technology questionnaire, and a section on student's personal data in which only the items on gender and ethnic origin were used. With these three sections, student ability to convey ideas about technology, especially understanding about and attitudes towards technology, can be gained. Each of the sections in the instrument provides information that is mutually supportive, except for a few results.

The writing/drawing activity, with three different options of format to convey ideas, made it possible for students with different abilities to give responses about what they understood by *technology*. Most of the students conveyed their ideas using the drawing format. Through this format, most of the ideas about technology were related to objects or artefacts, even though some of the objects drawn were not technologically related. The writing format, though employed by fewer students, enabled students to give broader ideas about technology that were non-artefact in nature, such as knowledge, affective reactions and concepts of technological change. However, the overall findings suggest students' understanding of technology in the writing/drawing activity were limited and stereotypical. Ideas mentioned most by students were processed products and vehicles, as well as human elements.

As expected, and as in the writing/drawing activity, the items identified by students as technology in the picture quiz activity were computers and other *high-tech* products. The ability to identify only 11 out of 25 pictures considered as technology-related (by more than 60% of the students), showed that students' understanding of technology is still limited.

In the technology questionnaire, students show a mix of concepts of technology. They were found to relate technology to design and inventing ways of doing things. However, surprisingly, they did not agree that technology is mostly about computer, despite the fact that most students identified computer as a representation of technology in the picture quiz activity. On the other hand, students' interest in technology was found to be very positive.

Girls and boys' perceptions of technology were found to be almost similar except for four items that there were significant differences. The results showed that boys tend to associate technology to electrical and high-tech products while girls associate technology to human element and processed products. However, both girls and boys showed interest in technology.

Among ethnicity, differences in perceptions of technology were found between native and non-native students across the writing/drawing and picture quiz activity. Non-native students were found to give more categories of technology in the writing/drawing activity, signifying a wider perception of technology among this group. However, in the picture quiz, the native group tended to associate technology with high-tech products compared to the non-native group. Both ethnic groups were found to be interested in technology. However, native students' interest in technology were significantly higher.

On the comparison between location, it was found that rural students associated technology to building while urban students associated technology to design. There were some significant differences in the diversity and social aspects of the technology questionnaire. However, both urban and rural students showed interest in technology and seemed slightly sure about technology as a design process.

CHAPTER SIX
TEACHERS' EXPERIENCES OF SCHOOL TECHNOLOGY

This chapter reports teachers' perceptions of technology, teaching strategies employed and problems faced in teaching technology-related curricula. Data were gathered through interviews with teachers teaching the science and living skills curricula, involving twenty-eight teachers from fifteen schools. Each school except two, sent two teachers to the interview one representing the science and the other the living skills curriculum, while the remaining two schools sent a teacher representing both curricula. Each teacher was assigned a code: for living skills (Ls1 to Ls13), science (Sc1 to Sc13), and representative of both living skills and science (LsSc1 to LsSc2). Details of the code are attached in Appendix Four.

Data from the interviews with teachers were analysed in two ways. Teachers' perceptions of technology which are especially important, were transcribed very carefully. In the other two sections, teaching strategies and problems of teaching technology were not transcribed but analysed according to themes or categories, directly from the audio tape.

6.1 **Perceptions of Technology**

This section reports teachers' views about their own and students' perceptions of technology.

6.1.1 Teachers' perceptions of technology

The interviews with science and living skills teachers addressed their perceptions of technology. Most teachers gave short answer and said they would need more preparation if they were to give longer answers. The views given by teachers are mainly concerned with the concept of technology, especially what they mean by technology. However, the majority of teachers gave more than one category of concepts. Their responses can be grouped into three main themes: *products, ideas and invention* and *knowledge.*

Products

Eight teachers, mostly science teachers, relate technology to *products*, and in particular, 'tools or materials or things' made by people. However, most of the products were associated with *positive consequences*, such as '...tools or things, no matter how simple [that] make life easier' (Sc10), '...things that make our work easier' (LsSc02, Sc13), '...help to speed up our work, save our time' (Sc06), 'electronic equipment that can help people in [many fields such as] education, entertainment, sport' (Sc9), '...tools that can speed up communication system' (Sc8), and '...things that help to solve everyday problems' (Ls04, Sc11).

Ideas and inventions

Fifteen teachers related technology to ideas and inventions. However, they associated technology with *modern and up-to date* ideas or inventions, as can be seen in the following opinions: '...advance inventions' (LsSc01, Ls01, Sc04,); 'modern things that can be applied to daily life' (Sc02, Sc12); 'technology is something which is advanced, up-to date; (Ls06, Sc06, Sc07); 'something which is modern and up-to date like computers' (Ls9, Sc12); 'anything which is invented, no matter how small or simple, ...up-to date' (Ls03) ; 'technology is a modern thing, something everyone should know' (Ls10); and '...technology is something which brings modernisation' (Ls12). One teacher (Sc05) relates technology as important to the future. Another teacher said technology is 'new ideas or methods' (Sc10). A teacher stated that technology is 'anything that are invented technically ...' (Sc13).

Knowledge

Another category, though one which not many teachers gave, is that in which technology is related to knowledge especially *science-related knowledge*. This can be seen in these opinions. Three teachers said technology is related to science; '...scientific things, complicated, can stimulate people to think [scientific way of thinking] to invent'. (Ls18), '...from science, even simple things...'(Sc10), and '...technology is a concept related to the development of modern science...'(Sc14). However, one teacher stated that technology is a mixture of science and non scientific subjects as can be seen in this opinion '...from science [but] not necessarily scientific [and can] be combination with other [non-scientific] subjects' (Sc12).

Four teachers, mostly living skills teachers, gave the opinion of technology as *not science-related knowledge* as can be seen in the following opinions. One teacher suggested technology as 'knowledge that needs to be learned for daily used' (Ls05), while another said technology 'helps to speed up knowledge about the future' (Ls9).Two teachers stated that technology has a broad meaning and a broad concepts (Ls11 and Ls13).

The findings suggest that except for ideas and inventions, there were differences in the perceptions of technology between science and living skills teachers. Science teachers associate technology to products and knowledge of scientific in nature, while living skills teacher associated technology to knowledge of non-scientific in nature. However both science and living skills teachers relate technology to ideas and inventions especially modern and sophisticated ideas and inventions.

6.1.2 Teachers' views of students' understanding of and attitudes towards technology

Both science and living skills teachers said their students are interested in technology-related subjects. Two living skills teachers said their students were always looking forward to learning about this subject. This could be seen by the way students reacted when the bell rang for the living skills subject to start. The section they were most interested in was the assembly and disassembly (of the construction set) section of the manipulative component. Also, teachers reported that during science lessons students showed their interest and eagerness to learn. However, in some schools, only good students (as identified by their teacher) were eager to know more about science and technology. Some of these students, especially from urban areas, had advanced knowledge of science and technology. Teachers explained this might be so because these students had computers at home, and were influenced by the electronic media, especially television and information technology. According to a teacher some of these students even have an encyclopaedia to refer to at home. Thus, their knowledge of scientific and technological things were better.

According to their teachers, rural school students had good understanding of technology.

Like their counterparts in urban areas, these students were exposed to electronic media at home. Teachers from only one school reported a low level of students' understanding in science and technology, saying this might be due to the students' low socio-economic background as most of the students were from low income families living in a suburban area.

Gender differences in interest in technology

In both living skills and science curricula, there was a mixed report on the differences between gender perceptions of technology. In some schools there were perceived differences, while in other schools there were no perceived differences. This section reports the views of twenty- five teachers, twelve teachers each representing science and living skills and one teacher representing both, from thirteen schools. Two single gender schools were not included because the teachers could not make comparison between their students who were single sex.

Living skills teachers from four schools said there were no differences in student interest in technology as both genders were equally interested. The other eight living skills teachers said their students showed differences in their interest in technology, while one teacher could not judge the difference. The perceived differences shown by students according to gender were interest in certain components or sections of the living skills curriculum. Most teachers said boys liked woodwork and construction, some boys were even becoming involved in inventing simple machines out of discarded material. Some teachers said boys were more creative than girls. Girls, according to them, liked commercial skills and landscaping. However, even within landscaping, there was a difference in interest between boys and girls. Girls liked pruning and maintaining, but not the fertilising and in some cases planting.

However, the opposite occurred in science. Eight science teachers said there were no differences in students' interest in technology, while four others said there was a difference. Another teacher could not judge. The teachers said the differences shown by students were related to their interest to learn or know the science curriculum. According to these teachers, girls asked more questions than boys and wanting to know more. However, there were some girls who were afraid to do experiments, especially handling apparatus. Four other teachers said students' interest in technology was the same between boys and girls.

6.2 Teaching Strategies for Technology-related Curricula

This section describes the teaching of the technology-related curricula, living skills and new primary science, from the teacher's point of view.

6.2.1 Living skills curriculum

As described in section 4.1.1 the living skills curriculum, (Malaysian Ministry of Education, 1991), consists of three main components: manipulative, entrepreneurship, and self-management skills. An additional section, *design and invent*, was added in 1994 and was incorporated into the *making product* section of the manipulative component.

Only one school has started teaching the design and invent section of the manipulative component. Except for teachers in one school, all other living skills teacher said they have not attended any course or received any training to help teach this section. The school teaching this design and invent section has been selected as a pilot school in the state, two teachers from the school were being sent to attend the national level training course, and to act as facilitators for implementation of the course in the state of Sarawak.

Allocation of time

The living skills curriculum is allocated 60 minutes in the time-table. All schools arranged the two slots consecutively. Teachers in three schools said the time allocated is not enough, especially for practical work. Students have to take their work home and bring it back to continue the next week. However, according to the teachers, this seemed to create problems, such as students not bringing back their work the next lesson. Another problem is time constraint. Teachers have to move on to another topic, otherwise they would not be able to finish the curriculum content. Thus, the content is not taught thoroughly.

Equipment for teaching and learning

According to all the teachers, equipment for teaching and learning of living skills include basic and simple hand tools, such as a hammer, handsaw, pliers; gardening tools; simple electric circuits and electronic components; and construction sets such as Lego and Lasy. This equipment is supplied through Education Department funding allocation to each school. The amount paid is based on the number of students per school. All schools have enough equipment for the group work activity. Materials such as wood and paint, are provided by schools through the same fund. However, some materials used are discarded, unwanted materials, or materials available locally brought by students from home.

Teaching strategy for the living skills

As a practical subject, teachers said the living skills curriculum is taught through practical and hands-on activities. Students are divided into groups for most of the activities, especially when engaged in project work requiring the use of tools. Group work was encouraged to overcome the shortage of tools. Where tools were limited, teachers used the technique of *learning by station* as explained in chapter four. This was in line with curriculum suggestions.

Teachers said they would usually demonstrate or teach the components before the students did the actual practical activities. According to them, Year Four students are trained to observe before going into planning in year five; by year six, they would carry out project work.

Much of the students' work could be seen around the schools, especially landscaping or beautifying projects. While planting flowers is the main theme for landscaping, some schools beautify their compounds with colourful paintings with used or discarded materials, such as old water tanks and car tyres, for decorative purposes.

6.2.2 Science curriculum

As described in chapter four, a section on technology is included in the primary science curriculum (Malaysian Ministry of Education, 1993b) the content mainly concerning the history of technology. However, as this is the last section in the curriculum it had not been taught by many teachers at the time of the interviews. Therefore, this section reports on the overall science curriculum teaching by teachers.

Allocation of time

The science subject is allocated 150 minutes in the time-table. Thirteen schools allocated three slots - two slots of sixty minutes each and a single slot of thirty minutes in the time-table, while two schools allocated two slots of sixty minutes and ninety minutes each. All teachers said the time allocated was sufficient.

Equipment and tools

Science apparatus is provided for each school by the Education Department through the allocation of funds according to the number of students enrolled. Large schools receive a larger allocation than smaller schools. Teachers in two small rural schools stated that the science apparatus provided is not sufficient for their purposes. However, most equipment is meant to be shared by students in the class.

Teaching strategy for science curriculum

Science teachers said they use both group and individual strategies to teach science. Group work overcomes the shortage of equipment or for activities that need collaboration and co-operation, especially to come to a conclusion. Teachers reported various methods to teach the subject. Most teachers said science is an experimental subject, and as such students are to be involved in doing experiments. However, most teachers use the demonstration method especially in teaching difficult and dangerous topics such as using Bunsen burners or boiling water. This, according to them is for the safety of the students especially at Year Four where most of the activities are demonstrated by the teachers in front of the class.

Another method used is the inquiry and discovery method, where students are involved in fieldwork. Teachers encourage students to observe things around the school and report in groups. For this purpose, students are involved in discussion so that they could come to a conclusion, or use inference

Computers in schools

All schools except one have at least one computer. Nine schools have one or two computers, while the other five schools have between five to fifteen computers. Most of the schools get one computer supplied by the Department of Education. The main purpose of the department in supplying the computers is for use in administration and in preparation of examination papers by the school staff. However, the schools with more than five computers acquire them for the school computer club. These computers are either donated by the parent-teacher association or bought with funds collected from computer club members.

Computer Clubs

Five schools, four urban and one rural, had a computer club for students. While the club is opened to level II (year 4 - 6) students only, not all students join the club. Students wishing to join have to pay a monthly fee. Most teachers said only students who could afford to pay join the club. Access to the computer is an hour per week for each student. Although students are taught by the computer teacher from the school, in some urban schools, the computer club hire a local computer consultant.

6.3 Problems Faced in Teaching the Technology-related Curricula

The problems teachers said they faced in teaching the technology-related curricula are reported in this section.

6.3.1 Problems faced in teaching the living skills curriculum

Teachers from all schools, except one, complained that the main problem in implementing this curriculum is the room facility. In these schools, they do not have a proper room or workshop for practical activities. If there is a designated room, the room is not suitable for practical activities. The room is usually shared with other subjects like science, and in some schools, with the library or resource room. In such cases, teachers have to use a classroom most of the time. However, they felt that the classroom is not suitable for practical activities, such as woodwork where tools are used. Most teachers are worried about the safety of their students when working in a classroom.

To overcome this problem, many teachers would take their students outside the classroom, if there is space available around the school, for practical activities such as woodwork. In some big schools with a hall, teachers make use of the hall for practical activities. Nevertheless, they said it is difficult because some tools such as a clamp, needs a special table. However, a few schools with a big area or compound build a temporary shed for the students to do practical activities. Components like *electricity* and *electronics* are done inside the classroom.

Another problem faced by teachers is the class size. A few schools have classes of 35 to 45 students. With such large numbers, teachers said it is hard to control the class during practical activities. In some schools, the number of students in a group within a class is between 10 and 15. Teachers are also worried about students' safety, especially in handling tools in such a big group.

Regarding tools and equipment teachers said some of the tools ordered by the school arrive too late. This is especially true for rural schools. In some instances, the tools and other equipment supplied are not appropriate to the students' age. An example given by teachers is the electronic equipment that is too small for primary students.

Teachers in three schools complained that the two slots per week allocated in the time-table for teaching this subject are insufficient to finish some project work. In most cases, students would take their work home and continue it there. However, this poses yet another problem, because the students tend to forget to bring their work back the next week. Some even lost it.

6.3.2 Problems faced in teaching the science curriculum

Teachers said they faced many problems in implementing this curriculum. Furthermore, this is the first time science is offered at primary level as a subject on its own. The main problem in most schools is the room facility. Only one school has a laboratory for teaching science, while another school shares it with a secondary school. Other schools use the classroom or resource room, shared with other subjects like living skills, and the library.

However, in these schools, the teaching is mainly done in the classroom. The equipment and apparatus are stored in the resource room. The problem with this arrangement, according to the teachers, is that they have to take the apparatus to the classroom every time they need it. In some rural schools, teachers commented that there was no water facility, especially inside the classroom. Two schools stated they do not have proper electricity connections to the local supply. Most teachers preferred a separate room from their classroom for teaching science.

Another major problem faced by teachers in many urban schools is class enrolment. With many students in a class, the classroom is crowded, leading to the problem of class control. With such large numbers of students teachers expressed concern about the safety of students when carrying out experiments.

A number of teachers also voiced concern about the content of the curriculum. They repeated that they are a little confused and unsure about how much detail of the content should be taught. Even the text book is not helpful because there is little suggestion or information in it. A teacher gave an example of teaching about mammals. She is not sure whether to introduce words like *carnivorous* or *omnivorous* to her students. Some teachers said they have no experience of teaching this subject since this is a new subject. They commented they needed to attend more courses or training sessions.

Another problem is the apparatus which teachers felt is not supplied according to the specifications given by the Education Department. Some of the apparatus are not suitable for primary students. In some rural schools, the apparatus arrived late.

6.4 Summary

The science and living skills teachers' perceptions of technology was limited to a few conceptions. Though most of them gave more than one category of concept, their conceptions can be grouped into three main themes: products, ideas and inventions, and knowledge. Both the science and living skills teachers suggest that technology is related to ideas and inventions. However, they shared different perceptions of technology as related to knowledge. Science teachers associated technology to science and scientific knowledge, whereas living skills teachers associated technology to a broader concept of knowledge including non-scientific in nature. Most science teachers also relate technology to products that give positive consequences to those who use it.

Teachers judged students' perceptions of technology mainly on understanding and attitudes, especially interest. Most teachers from urban or rural schools, stated that their students have a good understanding of technology, and they were interested in learning technology-related subjects. However, there was gender differences in interest about technology, differences which depended on different components of the curriculum. Most boys like *woodwork* and *construction*, while girls prefer *landscaping* and *commercial* skills. In science, girls were more eager to know than boys, although some of them were afraid to handle apparatus.

The science and living skills curricula is taught by different teachers in schools. The time allocation for both curricula is different; science being allocated 150 minutes per week while living skills is allocated only 60 minutes per week. Teaching strategies employed in both curricula show some similarities. Both science and living skills would involved students in practical (hands-on or doing experiment) activities. Group work was used in both curricula, though science teachers would also employ individual learning strategy. In both curricula, teachers would demonstrate or teach a component before students do their practical activity. The only difference in the teaching strategy is that living skills would employ learning by station for group work. Most of the activities in living skills involved doing project work, while science would involved field work to encourage learning through inquiry and discovery.

Implementation of the science and living skills curricula is not without problems. Most teachers complain of lack of specialist room for practical activities, whether workshop or laboratory. Students have to share room with other subjects, with the library or resource room. Most of the activities have to be carried out inside the classroom, whereas the classroom itself is usually crowded with students. This poses yet another problem, namely, safety. Other problems include inappropriate tools, especially for young age students, and insufficient time to complete some practical work in living skills. In some schools, especially rural schools, there is no water or proper electricity facilities inside the room. As a new subject, science teachers are also unaware about teaching the content of the curriculum. Some of them have no experience with science and have not attended courses or training to teach this curriculum

CHAPTER SEVEN
DISCUSSION

Perceptions of technology held by Malaysian primary students are discussed in this chapter in relation to the technology education curriculum and teachers' perceptions and experiences of school technology.

7.1 Nature of Malaysian Primary Technology Education

This section draws together the findings in the technology curriculum documents, views of and attitude towards technology held by the teachers and students, and teaching strategies employed by teachers as a Malaysian case study on the perceptions of technology.

7.1.1 View of technology

The view about technology as stated in the technology curricula, corresponds to the view about technology held by teachers and students. In most cases, teachers viewed technology as products, ideas and inventions and the application of scientific knowledge. Students' view of technology however, corresponds to the above view on the aspect of products only, especially products of recent phenomenon such as computers and vehicles, processed products and electrical appliances. Though students identified computers as technology, they did not agree that technology is mainly about computers. Students however, did associate technology to human elements and intervention, an element that is not viewed by most teachers or stated in the curriculum documents.

While the overall Malaysia students' understanding of technology was low, a finding similar with students elsewhere (see for example Kent & Towse, 1995), it appeared that the Malaysian girls and boys have different perceptions of technology. In the writing/drawing activity and picture quiz, there is significant difference in the products identified by girls and boys. Girls associated technology to processed products of low-tech, while boys associate technology to electrical appliances and products of high-tech. The human element identified by more girls than boys in the drawing/picture activity is rather a special case. This suggests that girls believed there is human intervention in technology. The focus among boys on recent high-tech products and lower recognition of human dimension suggests that boys have narrower and more traditional conceptions of technology than girls, but in the technology questionnaire boys could answers better than girls. Although in the picture quiz girls can identified more correct examples of products, but more girls identified the incorrect examples of technology items, suggesting that they might just tick more and could not discriminate between the correct and incorrect items.

The Malaysian native and non-native students too held different perceptions of technology in the three activities. In the writing/drawing activity, non-native students' could significantly identify six categories of technology including the human element, while the native could identify only two categories of technology. However, in the picture quiz, both groups could choose seven correct pictures each, but native students chose more high-tech items compare to non-native. These findings suggest that a narrower and more stereotypical view of technology is held by native students than non-native. This difference among ethnic groups is similar to that reported by Burns (1990) between Maori and European students in New Zealand, in that, Maori students, have lower conceptions of technology compared to European students. Nevertheless, native students could answer better in the technology questionnaire (diversity and design process).

A comparison among urban and rural students was done on Malaysian samples. In the writing/Drawing activity, the urban students had a higher percentage score for computers, which is expected of these students because five out of eight urban schools were found to organise computer clubs for their students. In this activity, both groups significantly identified three categories of technology each. In the picture quiz however, rural students could identify significantly four items, but one of the items (mangrove tree) is an incorrect example of technology. While this group might not be able to discriminate between correct and incorrect answer, but the fact that mangrove tree grows mainly in rural area might influence this group to choose this item. In the technology questionnaire activity (diversity), urban students scored better than rural students.

The emphasise in the curriculum documents and by teachers and students, of technology as product is mainly economically motivated which suggests that the technology-related curricula in the country are being influenced by the economic instrumentalist (Layton, 1993a) group. This, however, is in line with the Government's vision of achieving the industrialised nation status by the year 2020. The literature suggests that technology education which employs economic justifications would emphasise more on capability (see for example Mackay, 1992). The Malaysian technology education was found to place importance on the acquisition of skills, especially technical skills to create products. Such emphasis would focus mainly on the development of technology technically, as warned by Mulberg (1992), whereas student should focus on full technological literacy as highlighted by Mackay (1992) and Burns 1993). It should incorporate the social, cultural, historical and economic aspects of technology too.

7.1.2 Attitude towards technology

In the technology-related curriculum documents, technology is stated to be good and can be meaningful to the students in facing the future. The technology curricula states that technology could enhance development and progression of the nation. Students too have positive attitudes towards technology as seen in the technology questionnaire findings. This supports Burns (1990) and Rennie & Jarvis (1995) finding that students' attitudes towards technology have been found to be positive. More than half of the students are interested in technology and would like to learn about it or take a job on it later on. They believe that technology could make the world a better place to live in and that technology is needed by everybody. However, a third of the students do not agree that it is worth spending money on technology.

There was no significant difference between girls and boys in interest in technology. Although this is the case, the boys showed a tendency toward more positive responses. This includes taking a job on it later, learning or reading about it, and joining a hobby club about technology. More boys believe that technology could make the world a better place to live in. They also believe that invention do more good than harm and that it is worth spending money on technology. Girls, however, believe that technology has brought more good things than bad things.

Among ethnicity, the native students are more interested in technology. Non-native students however, were more positive about the social aspects of technology than native students. These findings suggest that native students were interested in technology, but were a little pessimistic about its social effects. Meanwhile, there is no significant difference in interest between rural and urban students, but urban students were more positive about the social aspects of technology, suggesting that urban students were more optimistic about the social effects of technology.

Meanwhile, teachers' attitude towards technology were found to be positive too. However, they related technological products mostly as having positive consequences. They believed that technological products could make life or work easier. It could speed up communication system and help to solve everyday problems. These findings suggested that teachers attitude towards technology corresponds students attitude towards technology.

7.1.3 Teaching strategies

The living skills curriculum is more economically motivated than the science curriculum.. This can be seen in the contents which it is geared towards the world of work and the world of technology. As can be seen, the focus is thus on training students to be skilful through a curriculum which identifies capability as the important content to be taught. This, according to Medway, (1989) emphasises doing rather than knowledge or understanding, whereas contemporary views called for full technological literacy.

As prescribed, the learning of technology involves student-centred practical activity based on three basic concepts of mind, skills and values (Malaysian Ministry of Education, 1993a). The curriculum also suggests learning by experience, a suggestion in line with Gibbs (1988) and Federicksen (1983), on learning by doing and learning by discovery. However, the extent to that the activities are carried out based on the student-centred strategy is a concern because the curriculum does not give enough guidelines, facilities or time on the implementation of this strategy. Even then, there is a contradiction within the curriculum on this matter. On the one hand, it emphasises student-centred activities, and on the other hand it suggests cue cards with the prescribed design brief showing that the activities are closed and directed to achieve the end product. With the prescribed design brief, students are directed towards technical skills rather than full technological capability that would involve problem solving or even contextualised problem solving, thus defeating the purpose of emphasising creativity among students.

In line with Schon's (1983) suggestion of reflection-in-action, technological learning processes should enhance student's ability to adjust subsequent actions based on new information rather than the closed design brief as suggested in the cue cards. Interview data from teachers who state that they would use the demonstration method before student embark on certain technological activities further contradicts the suggestion of the curriculum to focus on learning by experience. For meaningful learning, Newmann (1992) suggests the teaching of thoughtfulness, while Burns *et al* (1991) suggests a need to teach understanding among students.

7.2 Comparison of Malaysian, British and Australian Students' Perceptions of Technology

The results obtained from this study were broadly similar to those found in the earlier studies on British and Australian students that used the same instruments to measure perceptions of technology (Rennie & Jarvis, 1995). It was found that the common perception of technology was products. A difference, however, was found in the type of products referred to by students in the writing and drawing activity. In this section, Malaysian students associated technology with low-tech processed products and vehicles, while the Australian students associated technology with computer and electrical appliances and the English children gave strong theme on making models.

A feature that is similar to all students in the three countries is the inclusion of human elements in their drawing. While percentage of Malaysian and Australian students is the same (40%), slightly lower percentage (34.0%) was given by English students. Table 7.1 shows the ideas about technology commonly mentioned by students in the writing/drawing activity among the three countries. These findings suggest that students across the three countries believe that there is human intervention on technology.

In the Picture Quiz activity too, a similar pattern of students' perceptions were found among the three countries, as can be seen in Table 7.2. The pictures chosen as representative of technology by these students across the three nations are computers and electrical products. With reference to the pictures that were chosen by more than 60% of the students, it was found that Malaysian students chose more pictures of technologies than the Australian and the English children. Eleven out of twenty five pictures were chosen by

Table 7.1
Ideas about Technology Commonly Mentioned by Students
in the Writing/Drawing Activity by Countries (%)

Idea / objects	Malaysia (n=521)	Australia (n=721)	England (n=698)
Human elements	40.1	40.2	34.1
Product related ideas			
Processed products	47.0	-	-
Computers	19.2	31.9	26.5
Electrical appliances	29.8	31.9	28.8
General machinery	20.2	17.1	19.5
Vehicles	43.7	20.4	19.5
Telephones	9.0	5.1	6.7
Design-related ideas			
Inventing, inventions	4.0	9.2	7.4
Designing, experimenting	0.4	4.0	14.8
Making models	0.8	7.9	47.4
Temporal aspects			
Modern	9.8	10.1	4.4
Futuristic	*	5.1	1.6
Affective aspects			
Positive aspects	1.8	9.7	4.6
Diversity/pervasiveness	1.0	10.5	4.2
Importance	1.0	3.2	1.2
Other aspects			
Scientific things	1.4	19.6	13.3
Knowledge/learning	1.0	12.3	6.9
Building/environments	17.3	-	-
Biological technology	13.5	-	-
Industrial process	9.4	-	-

* In the Malaysian study, modern and futuristic is categorised as a subcategory.

the Malaysians as compared to eight and nine respectively by the Australian and the English children. A surprising finding in the Malaysian study is the frequency with which the windmill was chosen, namely by 80% of the Malaysian students, even though windmills are not commonly found in Malaysia. This happened probably because the students have been exposed to such technology by electronic media such as television or in books. These findings across the three nations indicate that students have almost similar perceptions of technology.

Table 7.2
Percentage of Students Choosing each Picture
According to Country

Picture	Malaysia	Australia	England
computer	96	97	95
telephone	90	85	75
microwave	88	85	77
clock	87	77	70
aeroplane	83	79	74
windmill	80	59	73
mine	75	70	73
factory	69	73	71
house plan	65	47	59
bedroom	62	30	27
playground	60	35	42
gun	56	43	33
statue	51	28	38
advertisement	48	30	23
foodstall	45	38	25
book	45	33	38
bridge	43	35	45
sheet of music	41	28	26
cough med.	40	40	30
old stone axe	39	25	34
mountain / volcano	32	24	32
mangrove / gum / oak tree	31	8	14
trousers / jeans	31	13	7
cup	28	15	7
rose	23	4	8
beancurd / cheese	23	8	5
rabbit / poodle	20	5	4
otter / platypus / fox	20	5	4

7.3 Implications

The limited views of technology in the Malaysian technology curriculum documents, and of teachers and students makes the author wonder whether the technology curricula is able to help in the realisation of Vision 2020 in which Malaysia targeted to be an industrialised country by then. The narrow view of technology in the curricula will be unable to extend the teachers and students understanding of technology. By emphasising more on creating product as in the design and invent component, it is doubtful that students, especially girls, could be prepared to face the real technological world. However, these curricula were introduced and implemented only recently and will only be able to be assessed after certain years of implementation, especially the science curriculum..

The existence of a living skills curriculum with a strong emphasis on skills and capability was so economically oriented that the values to be instilled were found to be directed towards economic values, as can be seen in the objectives of the design and invent component; "[to] practice good working values and attitudes such as diligent, responsible, [and have] competing spirit" (Malaysian Ministry of Education, 1994, p.2). This findings contradicts what Layton (1993b) argues about values, that one have to step outside the *mental set* to be able to assess the impact of technology.

The existence of two different curricula providing technology education is unusual. Furthermore, these curricula are taught by different teachers. The overlapping nature of these curricula might pose problems to students' understanding of technology as different perceptions of technology among teachers from different disciplines, as pointed out by Paechter (1991) and Jones and Carr (1992), might influence what was taught and learned in technology.

Teachers doubt about the extent to which the contents of the science curriculum is to be taught need to be taken into consideration. As a new subject and especially with the technology component which has never been taught in schools before, teachers need to be given more in-service training or development to enable them to teach the subject with confidence.

The technology component in science needs to accommodate not only aspects of the historical development, but should emphasise on full technological literacy as stated in the literature (Burns 1992, 1997; Layton 1993a; Segal 1998; Mackay 1992) Full technological literacy, according to Burns (1997), comprises a balance of knowledge about technology and knowledge within technology.

7.4 Conclusion

By using three sources of collecting data as advocated by Stenhouse (1988), this case study gave a clear insight into technology education in Malaysia.

Technology education is taught in two different curricula, namely: living skills and science. The living skills curriculum focuses on giving practical skill and knowledge based on technology. The economically motivated curriculum, however, emphasises mostly manipulative skills, commercial skills and practices as well as self-management. The science curriculum on the other hand, provides an area of study which investigates the history and development of technology, the role of technologist, and simple construction. Both curricula focused on student-centred learning, through inquiry or investigation methods. Technology in the science curriculum is associated to the process of using scientific knowledge in problem-solving. It involves the technique of designing and creating a product.

These two curricula taught by different teachers in schools are imparted to level 2 (year 4 - 6) primary students. This study found that Malaysian primary students have a rather limited perceptions of technology, but positive attitudes towards technology. The interest in technology among students is high. Students believed that with technology the world could be a better place to live in.

Teachers perceptions of technology, though broader than students', are limited to a few conceptions, namely: products, ideas and inventions, and knowledge. They also relate technological products to positive consequences, especially its usefulness. The teaching strategy employed by the science and living skills teachers is learning by experience with practical and hands-on activities, mostly in groups. However, most teachers would demonstrate or teach a component before the actual practical activity is done by the students. In teaching these curricula, teachers faced a few problems such as poor facility, improper room for practical activities, and insufficient tools and equipment. Teachers are concerned too about the extent of the content to be taught, especially science and need training on the new component of design and invent.

The Malaysian philosophy of education (Malaysian Ministry of Education, 1993b) states the importance of developing students' potential in a holistic and integrated manner. The technology education thus, has to be able to develop students' perception of technology holistically. It should emphasise not only skills and knowledge, but also the impact of technology on society. A single technology curriculum which extends its content to full technological literacy would help to achieve the aims of the philosophy and towards realisation of the vision for the year 2020 in Malaysia.

7.5 Recommendations

There is a need to review the technology curriculum and resources that support the implementation of the curriculum, in particular:

- the goal need to incorporate full technological literacy and an empowering curriculum;
- a single technology education need to be considered which, at present, comprised of the living skills and science curricula which pose confusion in understanding of technology among students;
- the resources such as books, equipment, materials and computers that support the implementation of technology education need to be reviewed;
- further training in the nature of technology and technology education for teachers who are the most important resource in curriculum implementation, either through in-service or pre-service training;
- printed and non-printed resources, such as textbooks for students or teaching modules and references for teachers need to be revisited and reviewed in the light of contemporary views on technological literacy;
- review the time allocation for implementation of living skills curriculum;
- workshops suitable to do practical activities with benches and equipment need to be considered;
- laboratory needed with water and electricity supply to enhance experiment and safety of students;

- maximum class size for practical work be reduced to between 20 and 25 students;
- introduce teacher aides especially in practical work.

7.6 Suggestions for Future Research

This is a first attempt to study students' perceptions of technology in the Malaysian context. A suggestion for further research in the future includes:

- extends this study to the whole country;
- a study on students achievement in science examination between gender, ethnicity and location;
- the correlation between students' socio-economic background and their understanding of and interest towards technology;
- correlation between teachers and students' views of technology

References

APEID (1993) In-service Teacher Education in Science Technology and Mathematics, Bangkok: UNESCO

Assessment of Performance Unit (1992) Learning through Design and Technology, in McCormick, R., Murphy, P. and Harrison, M. (eds) *Teaching and Learning Technology*. Workingham: Addison-Wesley.

Babbie, E.R. (1992) *The Practice of Social Research*. Belmont, Ca.: Wadsworth.

Breckon, A. (1992) Organisational Patterns for the Adoption of Design and Technology, cited by Eggleston, J. *Teaching Design and Technology*. Buckingham: Open University Press.

Bromley, D. B. (1986). *The Case Study Methods in Psychology and Related Disciplines*. Chichester: Wiley.

Burns, J. (1990). *Students' Attitudes Towards and Concepts of Technology*. Report to the Ministry of Education, Welllington, New Zealand.

Burns, J. (1992). Students Perceptions of Technology and Implications for an Empowering Curriculum, *Research in Science Education, 22,* 72-80.

Burns, J. (1993). *Empowerement through Technology Education: The Need for an Historical Focus*. Paper presented to NZARE, Hamilton, December.

Burns, J. (1997). Girls and Women and Scientific and Technological Literacy. In Jenkins, E. W. (Ed.) *Innovations in Science and Technology Education, vol. 6,*

Burns, J., Clift, J. and Duncan, J. (1991). Understanding of Understanding: Implications for Learning and Teaching, *British Journal of Educational Psychology*, 61, 276-289.

Chadwick, B. A, Bahr, H. & Albrecht, S. L (1984). *Social Science Research Methods*. Englewood Cliffs, N. J.: Practice-Hall.

Conway, R. (1994). Values in Technology Education. *International Journal of Technology and Design Education*, 4, 109-116.

DES (1990). *Technology in the National Curriculum*. London: H.M.S.O.

De Vries, M.J. (1991). What Do Students in Dutch Technology Teacher Programmes Think of Their Subjects? *Research in Science & Technological Education, vol. 9(2),* pp 173-179.

De Vries, M. J. (1994). Technology Education in Western Europe. In D. Layton (ed) *Innovations in Science and Technology Education, vol 5,* Paris: UNESCO.

Donnelly, J. F. (1993). Technology in School Curriculum: A Critical Bibliography. In E. W. Jenkins (ed) *School Science and Technology: Some Issues and Perspectives.* Centre for Studies in Science and Mathematics Education: University of Leeds.

Eggleston, J. (1992). *Teaching Design and Technology.* Buckingham: Open University Press.

Farmer, B. (1992). Technology yes - but where are the girls? *New Zealand Science Teacher,* winter, 15-20.

Farmer, B. & Hodson, D. (1991). What do you mean by technology? *New Zealand Science Teacher,* winter, 6-10.

Feinberg, W. And Horowitz, B. (1990). Vocational Education and Equality of Opportunity, *Journal of Curriculum Studies, 22*, 188-192.

Frederikson, N. (1983). *Implications of Theory for Instruction in Problem Solving.* Princeton: Educational Testing Service.

Gardner, P. (1992). The Application of Science to Technology. *Research in Science Education,* 22, 140-148.

Gardner, P. (1994). The Relationship Between Science and Technology: Some Historical and Philosophical Reflections, Part II. *International Journal of Technology and Design Education,* 5(1).

Gibbs, G. (1988). *Learning by Doing: A Guide to Teaching and Learning Method.* London: Federal Education Unit.

Harvey, S. and Higgins, I (1992). *Thinking Translations a course in Translation Method.* London: Routledge.

Hayden, M.A., Suleman, I.Y. & Gomper, S (1992). Technology Education in Nigeria: The Views of Practitioners, *International Journal of Technology and Design Education, vol. 2(3),* pp 61-64.

Hennessy, S., McCormick, R. and Murphy, P. (1993). The Myth of General Problem-solving Ability: Design and Technology as an Example, *The Curriculum Journal,* 4(1), 73-89.

Hyland, T. (1993). Vocational Reconstruction and Dewey's Instrumentalism, *Oxford Review of Education, 19(1),* 89-100.

Jarvis, T. & Rennie, L.J. (1996). Perceptions about Technology Held by Primary Teachers in England, *Research in Science & Technological Education, vol 14(1),* pp.43-54

Jenkins, E. W. (1994). Science and Technology in the New Zealand Curriculum. *The Relationship Between Science and Technology in the New Zealand Curriculum.* Auckland: Education Forum.

Jonathan, R. (1990). The Curriculum and the New Vocationalism, *Journal of Curriculum Studies, 22,* 184-188.

Jones, A & Carr, M. (1992). Teachers' Perceptions of Technology Education: Implications for Curriculum Innovation. *Research in Science Education, 22*, pp. 230-239.

Jones, A (1995). Technology Education in the New Zealand Curriculum: From Policy to Curriculum. *SAME papers.*

Kimbell, R. (1991). Tackling Technological tasks, in Woolnough, B. E. (ed). *Practical Science,* Milton Keynes: Open University Press.

Kent, D. & Towse, P (1995). *Focusing on the Future: Young Peoples' Attitudes to Science and Technology in Botswana and Lesotho: Technology and Its Impact on Culture and Socio-economic Life.* A paper presented at the DSA Conforence, England.

Kline, S. J. (1985). What is technology? *Bulletin of Science, Technology and Society,* 5(3).

Lawson, M. (1991). Managing Problem-solving, in Biggs, J. B. (ed). *Teaching for Learning: A view from Cognitive Psychology.* Hawthorn, Vic: ACER.

Layton, D. (1993a). A School Subject in the Making? The Search for Fundamentals. In Layton, D. (Ed.) *Innovations in Science and Technology Education,* vol. 5, Paris: UNESCO.

Layton, D. (1993b). *Technology's Challenge to Science Education.* Buckingham: Open University Press.

Lewis, T. (1995). From Manual Training to Technology Education. *Journal of Curriculum Studies,* vol. 27, No. 6, 621-645

Mackay, H. (1992). From Computer Literacy to Technological Literacy. In Beynons, J And Mackay, H. (Eds.) *Technology Literacy and the Curriculum.* London: Falmers.

Mackenzie, D. & Wajcman, J. (1994). *The Social Shaping of Technology.* Milton Keynes: Open University Press.

Mahathir, M. (1991). *Malaysia: the Way Forwards.* Paper presented at the Malaysian Business Forum, 28 February 1991, Kuala Lumpur.

Malaysian Ministry of Education (1990). *Manipulative Skill Curriculum for Primary School.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1991). *Primary Living Skills Curriculum.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1992). *Teacher's Guide for Living Skills.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1993a). *Primary Science Curriculum.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1993b). *Education in Malaysia.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1994). *Design and Invent in Primary Education.* Kuala Lumpur: Curriculum Development Centre.

Malaysian Ministry of Education (1995). *Science Concepts in Primary School: Module 6,* Kuala Lumpur: Curriculum Development Centre.

May, T. (1993). *Social Research: Issues, Methods and Process.* Buckingham: Open University Press.

McBurney, D. H. (1994). *Research Methods.* California: Brooks/ Cole Publisher.

McCormick, R., Murphy, P. & Harrison, M. (1993). *Teaching and Learning Technology.* Buckingham: Open University Press.

Medway, P. (1989). Issues in the Theory and Practice of Technology Education. *Studies in Science Education, 16,* 1-24.

Medway, P. (1992). Constructions of Technology: Reflections on a New Subject, in Beynon, J. and Mackay, H. (eds). *Technological Literacy and the Curriculum.* London: Falmer.

Ministry of Education (1995). *Technology in the New Zealand Curriculum.* Wellington: Ministry of Education.

Morgan, K. (1994). Technology in Australia and South-East Asia. In D. Layton (ed) *Innovations in Science and Technology Education, vol 5,* Paris: UNESCO.

Mulberg, C. (1992). Beyond the Looking Glass: Technological Myths in Education. In Budgett-Meakin, C. (Ed.) *Make the Future Works.* London: Longman.

Murray, R. (1990). Getting Started, in Murray R (ed). *Managing Design and Technology in the National Curriculum: A Coordinated Approach.* London: Heinemann.

Nachmias, C. F. and Nachmias, D. (1992). *Research Method in the Social Sciences.* London: Edward Arnold.

Newmark, P. (1981). *Approaches to Translation.* Oxford, New York: Pergamon Press.

Newmann, F. M. (1992). The Prospects of Classroom Thoughfulness in High School Social Studies, in Collins, C and Mangier J. W (eds) *Teaching Thinking: An Agenda for the Twenty-First Century.* Hillsdale, N. J.: Commence Erlbaum.

Newell, A. (1980). One Final Word, in Tuma, D. T. and Kief, F (eds). *Problem Solving and Education: Issues in Teaching and Research.* Hillsdale: Erlbaum.

Norusis, M. J. (1994). *SPSS: Professional Statistics Version 6.1.* Chicago: SPSS.

Paechter, C. (1991). *Subcultural Retreat: Negotiating the Design and Technology Curriculum.* Paper presented at the British Education Research Association Annual Conference.

Pacey, A. (1983). technology: Practice and Culture. *The Culture of Technology.* Oxford: Blackwell.

Powney and Watt, (1987). *Interviewing in Educational Research.* London: Routledge and Kegan Paul.

Raat, de Klerk Wolters and de Vries (1987). *Report PATT Conference 1987,* vol. 1 Proceedings, Eindhoven University of Technology, Eindhoven, The Netherlands.

Rennie, L. & Jarvis, T. (1993). *Three Approaches to Measuring Children's Perception about Technology.* Paper presented at the Annual Meeting of the National Association for research in Science Teaching, April 1993, Atlanta, GA.

Rennie, L. & Jarvis, T. (1994). *Helping Children Understand Technology.* Perth: National Key Centre for School Science and Mathematics.

Rennie, L. & Jarvis, T. (1995). English and Australian Children's Perceptions about Technology. *Research in Science and Technological Education, 13(1),* pp. 37-52.

Riggs, A (1993). *Teachers' Personal and Public beliefs about Science and Technology, in Smith, J.S. (ed), IDATER 93.* International Conference on Design and Technology Educational Research and Curriculum Development, Loughborough University of Technology, pp.165-170.

Rogers, M. and Clare, D. (1994). The Process Diary: Developing Capability within National Curriculum Design and Technology - Some Initial Findings, *International Design and Technology Education Research,* 94, 22-28.

Rohana, M. S. (1994). *Synopsis of Country Reports: Malaysia.* Report to the Regional Workshop for Scientific and Technological Literacy for All in Asia and Pacific, 7-18 November 1994, Tokyo.

Schon, D. A. (1983). From Technical Rationality to Reflection in Action, in Schon, D. A. *The Reflective Practitioner*, New York: Basic Books.

Simon, H. A. (1980). Problem-solving and Education, in Tuma, D. T. and Rief, F (eds). *Problem-solving and Education: Issues in Teaching and Research.* Hillsdale: Erlbaum.

Segal, H. P. (1988). The Several Ironies of Technological Literacy, *Michigan Quarterly Review, 27(3),* 448-453.

Stenhouse (1988). Case Study Methods, in J. P Keeves. *Educational Research, Methodology, and Measurement: An International Handbook*. Oxford: Pergamon Press.

Treagust, D. F. (1990). Integration of Technology in the School Curriculum, *Research in Science Education, 20,* 272-281.

Verbowski, E. (1992). Towards an Appropriate Model for Technology Education. *Science and Mathematics Education Papers.* Hamilton: University of Waikato.

Yin, R. K. (1994). *Case Study Research: Design and Methods.* Thousand Oaks: Sage Publication.

Appendix One

1. Students Instrument
2. Calculation of Technology Understanding and Attitudes Scores

Student Instrument

BORANG SOAL SELIDIK TEKNOLOGI
(TECHNOLOGY QUESTIONNAIRE)

Tujuan soal selidik ini adalah untuk mengenal pasti persepsi pelajar-pelajar sekolah rendah terhadap teknologi, iaitu pemahaman serta pandangan terhadap teknologi.
(The aim of this questionnaire is to identify the primary students' perceptions of technology, that is the conception of and attitude towards technology.)

1 Anda dipelawa untuk menyertai dan mengisi borang soal selidik ini.
(You are invited to participate in this questionnaire.)

2 Sila jawab mengikut pemahaman dan pandangan anda dengan jujur.
(Please answer according to your understanding honestly.)

3 Jawapan yang anda berikan tidak akan dinilai salah atau betul.
(There is no right or wrong answer.)

4 Terima kasih kerana sudi menyertai kajian ini.
(Thank you for participating in this questionnaire.)

Bahagian 1: Apakah makna teknologi bagi saya (anda)

Section 1: What technology means to me

ID 1

SCH 2

LOC 3

Teknologi boleh membawa makna yang berbeza bagi orang yang berlainan. Apabila anda terbaca perkataan 'teknologi", apakah yang anda bayangkan? Bagi anda, teknologi melibatkan apa?
Sila beritahu saya apakah makna teknologi bagi anda dengan menuliskannya atau melukiskan gambarnya. Anda boleh juga melakukan kedua-duanya sekali.

(Technology can mean different things to different people. When you read the word 'technology' what comes into your mind? What does technology involve? Please tell me what technology means to you by writing about it, or by drawing a picture. You might like to do both.)

4

5

6

7 8

9

10 11 12

13 14 15 16

17

18

19 20 21

22 23

24 25 26 27

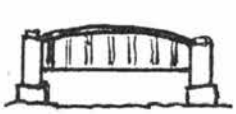
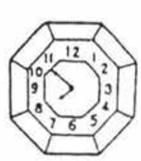
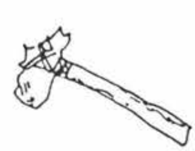
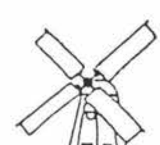
Bahagian 2: Kuiz bergambar

(Section 2: Pictures quiz)

ID

Di bawah ini terdapat beberapa gambar lukisan untuk tatapan anda.
Sila tandakan √ berhampiran gambar-gambar yang anda fikir ada kaitan dengan teknologi.

*(Here are some pictures for you.
Put a tick √ by the pictures which you think have something to do with technology)*

				
cawan *(cup)*	telefon *(telephone)*	kapal terbang *(aeroplane)*	buku *(book)*	28 29 30 31
				
jambatan *(bridge)*	komputer *(computer)*	senapang *(gun)*	seluar panjang *(trousers)*	32 33 34 35
				
iklan *(advertisement)*	jam *(clock)*	muzik *(music)*	kapak purba *(old stone axe)*	36 37 38 39
				
taman permainan *(playground)*	tauhu *(beancurd)*	memerang *(otter)*	kincir angin *(windmill)*	40 41 42 43


ubat batuk
(cough medicine)

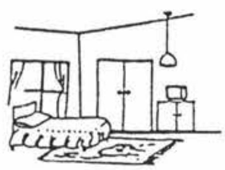

ketuhar gelombang mikro
(microwave oven)


bunga ros
(rose)

gerai makanan
(foodstall)

44 45 46 47


arnab
(rabbit)


bilik tidur
(bedroom)


kilang
(factory)


patung
(statue)

48 49 50 51


gunung
(mountain)


lombong
(mine)


pelan
(plan)


pokok api-api
(mangrove tree)

52 53 54 55

Bahagian 3: Soal selidik teknologi

(Section 3: Technology questionnaire)

Bahagian ini terdapat beberapa ayat tentang teknologi. Untuk setiap ayat, bulatkan nombor yang anda fikirkan betul berdasarkan skala di atasnya. Beberapa skala telah digunakan.

(Here are some sentences about technology. For each sentence, circle the number which is the right answer for you according to a set of scales above it. A few scales had been used.)

Contoh bagaimana menggunakan skala tersebut adalah seperti berikut:
(Here is how you are to use the scales:)

Setuju	Tidak pasti	Tidak setuju	Tidak tahu
Agree	*Can't decide*	*Dis-agree*	*Don't know*

Sekiranya anda <u>setuju</u> dengan ayat tersebut, anda perlu membulatkan *(If you feel you <u>agree</u> with the sentence, then circle)*	(1)	2	3	4
Sekiranya anda <u>tidak pasti</u> dengan ayat tersebut, anda perlu membulatkan *(If you feel you <u>can't decide or not sure</u> with the sentence, then circle)*	1	(2)	3	4
Sekiranya anda <u>tidak setuju</u> dengan ayat tersebut, anda perlu membulatkkan *(If you feel you <u>don't agree</u> with the sentence, then circle)*	1	2	(3)	4
Sekiranya <u>tidak tahu</u> langsung jawapan bagi sesuatu pernyataan, anda perlu membulatkan *(If you feel you <u>don't know</u> at all, then circle)*	1	2	3	(4)

Jadikan setiap ayat dalam bahagian ini satu item yang berasingan. Jangan melihat kembali pada pernyataan yang sebelumnya atau sesudahnya. Bacalah dengan teliti dan usah gopoh. Anda dikehendaki menandakan nombor mengikut pandangan atau fikiran atau perasaan anda yang 'mula-mula' sekali.
(Make each sentence a separate and independent judgement. Do not look back and forth over the sentences. Work at a steady pace. It is your 'first impressions' or immediate feelings that we want.)

Bahagian 3A: Apakah itu teknologi?

(Section 3A: What is technology?)

ID

		Setuju *Agree*	Tidak pasti *Can't decide*	Tidak setuju *Dis-agree*	Tidak tahu *Don't know*	
1	Biasanya teknologi adalah tentang komputer dan benda-benda seperti komputer. *(Technology is mostly about computers and things like computers.)*	1	2	3	4	36
2	Membuat model (rangka) dan mencubakan model tersebut adalah sebahagian daripada teknologi. *(Making models and testing them is part of technology.)*	1	2	3	4	37
3	Hasil teknologi hanya dapat digunakan oleh pakar teknologi sahaja. *(Technological things can only be used by experts.)*	1	2	3	4	38
4	Membuat sesuatu dengan kayu dan logam (contohnya besi dan tembaga) adalah bahagian yang penting daripada teknologi. *(Working with wood and metal is an important part of technology.)*	1	2	3	4	39
5	Teknologi memerlukan elektrik. *(Technology needs electricity.)*	1	2	3	4	60
6	Teknologi melibatkan cadangan untuk menyelesaikan masalah. *(Technology is making plans to solve problems.)*	1	2	3	4	61
7	Kebanyakan orang tidak menggunakan teknologi dalam kehidupan seharian. *(Most people don't use technology in their everyday lives.)*	1	2	3	4	62
8	Dalam teknologi, terdapat peluang untuk mereka-cipta dan membentuk barang-barang baru. *(In technology there are chances to design and plan new things.)*	1	2	3	4	63
9	Teknologi tidak wujud pada zaman nenek moyang saya. *(There was no technology before my grandparents were alive.)*	1	2	3	4	64
10	Teknologi bermaksud mencipta cara- cara untuk membuat sesuatu barangan. *(Technology means inventing ways of doing things.)*	1	2	3	4	65

Bahagian 3B: Apakah pandangan (sikap) anda terhadap teknologi?

(Section 3B: What do you think about technology?)

	Setuju *Agree*	Tidak pasti *Can't decide*	Tidak setuju *Dis-agree*	Tidak tahu *Don't know*	
1 Saya berminat dalam teknologi. *(I am interested in technology.)*	1	2	3	4	66
2 Teknologi menjadikan dunia ini tempat yang selesa (lebih baik) untuk didiami. *(Technology makes the world a better place to live in.)*	1	2	3	4	67
3 Saya ingin mengetahui lebih mendalam tentang teknologi. *(I would like to learn more about technology.)*	1	2	3	4	68
4 Teknologi membawa lebih banyak kebaikan daripada keburukan. *(Technology has brought more good things than bad things.)*	1	2	3	4	69
5 Saya ingin mendapat pekerjaan dalam bidang teknologi pada suatu hari nanti. *(I would like a job in technology later on.)*	1	2	3	4	70
6 Berbelanja untuk membeli barangan teknologi menguntungkan. *(It is worth spending money on technology.)*	1	2	3	4	71
7 Saya suka membaca buku dan majalah tentang teknologi. *(I like to read books and magazines about technology.)*	1	2	3	4	72
8 Hasil ciptaan teknologi membawa lebih banyak kebaikan daripada kemudaratan (kerosakan). *(Inventions in technology do more good than harm.)*	1	2	3	4	73
9 Saya ingin menyertai kelab hobi berkaitan dengan teknologi. *(I would like to join a hobby club about technology.)*	1	2	3	4	74
10 Teknologi diperlukan oleh setiap orang. *(Technology is needed by everybody.)*	1	2	3	4	75

Bahagian 4: Butir-butir peribadi

(Section 4: Personal data)

ID

Sila tandakan / bagi yang berkenaan.
(Please tick / by the data which is or are relevant to you.)

1 Saya adalah seorang pelajar *(I am a)*
- perempuan *(girl)* ☐
- lelaki *(boy)* ☐

76

2 Saya berbangsa *(I consider myself as)*

(Anda boleh pangkah lebih daripada satu bangsa) *(You can tick more than one category)*
- Melayu *(Malay)* ☐
- Cina *(Chinese)* ☐
- Iban ☐
- Bidayuh ☐
- Melanau ☐
- lain-lain *(others)* ☐

(sila nyatakan) *(please specify)* ___________

77 78

3 Anda mungkin mendapat tahu tentang teknologi dari beberapa sumber. Sila pangkah sumber-sumber di mana anda memperolehi maklumat tentang teknologi. (Anda boleh pangkah lebih daripada satu) *(You might get to know about technology from many sources. Please tick the sources you got the information about technology.) (You may tick more than one)*
- mata pelajaran Sains *(Science subject)* ☐
- mata pelajaran Kemahiran Hidup *(Living Skills subject)* ☐
- mata pelajaran lain *(other subjects)* ☐
- suratkhabar *(newspaper)* ☐
- majalah *(magazines)* ☐
- buku-buku *(books)* ☐
- television ☐
- komputer *(computer)* ☐
- radio ☐
- lain-lain *(others)* ☐

(sila nyatakan) *(please specify)* ___________

79 80

81 82 83 84

85 86 87 88

4 Di rumah saya terdapat alat-alat berikut (Sila pangkah yang berkenaan) *(I have the following things at home)*
- television ☐
- radio ☐
- perakam video ☐
- perakam kaset ☐
- komputer ☐

89

90 91 92 93

GRPABL 94

Calculation of Technology Understanding and Attitude Scores

Understanding of technology:

Negatively worded items: 1, 3, 5, 7, 9

Subcategories:

Diversity : items 1, 3, 5, 7, 9

Design Process: items 2, 4, 6, 8, 10

Correct answer;

1.	disagree	6.	agree
2.	agree	7.	disagree
3.	disagree	8.	agree
4.	agree	9.	disagree
5.	disagree	10.	agree

Attitude:

All were positively worded items

Subcategories

Interest: items 1, 3, 5, 7, 9

Social aspect: items 2, 4, 6, 8, 10

Correct answer:

There is no correct answer for attitude
An 'agree' shows positive attitude

Appendix Two

Teacher Interview Schedule

A. Technological equipment

- What is the technological equipment available in this school?
- How is this equipment used?
- How often is this equipment being used by the students?

B. Science and Living Skills curricula

- How much time is allocated for each of these subjects?
- What are the teaching strategies used to teach these subjects?
- What are the problems faced in teaching these subjects?
- What are the equipment used for teaching - learning of these subjects?
- What is the teaching - learning facilities (such as special room or laboratory) available for teaching these subjects?

C. Perceptions of technology

- What do you think is the students' perceptions towards technology?
- Is there any difference in perceptions between boys and girls? If there is, what are the differences?
- What is your own perception of technology?

Appendix Three

An Overview of Technology curricula in Malaysia

The Living Skills Curriculum

The contents of this curriculum is organised into three components; (a) manipulative skills, (b) entrepreneurship, and (c) self-management. These components are categorised into three main topics under (i) maintenance, repairing and making products, (ii) commercial practice, and (iii) self and work management.

(i) Maintenance, repairing and making product

Activities in this components focus on:

- assemble and disassembly;
- maintenance of tools and simple machine;
- maintenance of furniture and building;
- (small) repair work on tools and simple machine;
- (small) repair work on furniture and building;
- making project from metal and non-metal materials;
- doing electrical and electronic projects;
- designing and inventing (making) a project; and
- plants decoration.

(ii) Commercial skills

The activities in this component are:

- identify goods for selling;
- planning for selling;
- prepare the selling;
- promoting sales;
- recording sales, and
- identify the risk in selling.

(iii) Self and work management

The component of self and work management comprise:

- adapting with others;
- time management;
- personal financial management;

- planning and managing work; and
- evaluating work done.

Design and invent

Three aspects of learning areas are highlighted in the curriculum of design and invention. They are creativity, innovation projects, and design and invention projects. The areas to be emphasised are divided according to levels (year 4, 5, and 6 level).

In the *creativity* section, the focus are as follows:

- identify and solve problems (year 4)
- generating ideas from various perceptions (year 5)

Under *innovation* of products, the focus are:

- studying the systems and characteristics of an object such as toys and daily used tools (year 4)
- identifying the needs to modify (year 4)
- modifying objects from various aspects such as materials, components, and additional functions of the projects (year 4)

Design and invention projects are taught at year 5 and 6 levels. The focus is on the process through to evaluation of the project as can be seen as follows:

- identify project for solving the problems arise (at year 5 level, the problems are from teachers, students, or the surrounding, whereas at year 6 level, the problems are identify by the students through experience and research, either individually or in groups)
- designing the project
- name the project and identify the materials (including sources) to be used
- identify the tools to be used
- identify and plan the time frame for the project
- identify work procedures
- making the product
- testing the product
- modifying the product when and if necessary
- evaluate the product (project)

Primary Science curriculum

The Science curriculum identifies five areas to be taught at the primary level. They are; (i) investigate the nature, (ii) investigate the physical world, (iii) investigate matter (materials), (iv) investigate earth and the universe, and (v) investigate the world of technology.

The component of technology for primary education investigates the following aspects.

At year 4 level, it investigates:

- technology as the way human overcomes the limit of their ability,
- The history and development of technology within transportation, communication, agriculture and constructions, and
- the role plays by technologists (inventors) in the areas of transportation, communication, agriculture and constructions.

At level 5, the aspects to be investigated and learned are:

- structure of certain constructions which depends very much on its form, and
- synthesising of idea of form to build a strong structure.

The aspects to be investigated at year 6 level are:

- analysis of the function of a simple machine,
- synthesising idea on the function of a simple machine to design a tool, and
- appreciation of technology achievement towards human.

Appendix Four

Figure 4.1 Models of Teaching by Station (TBS)

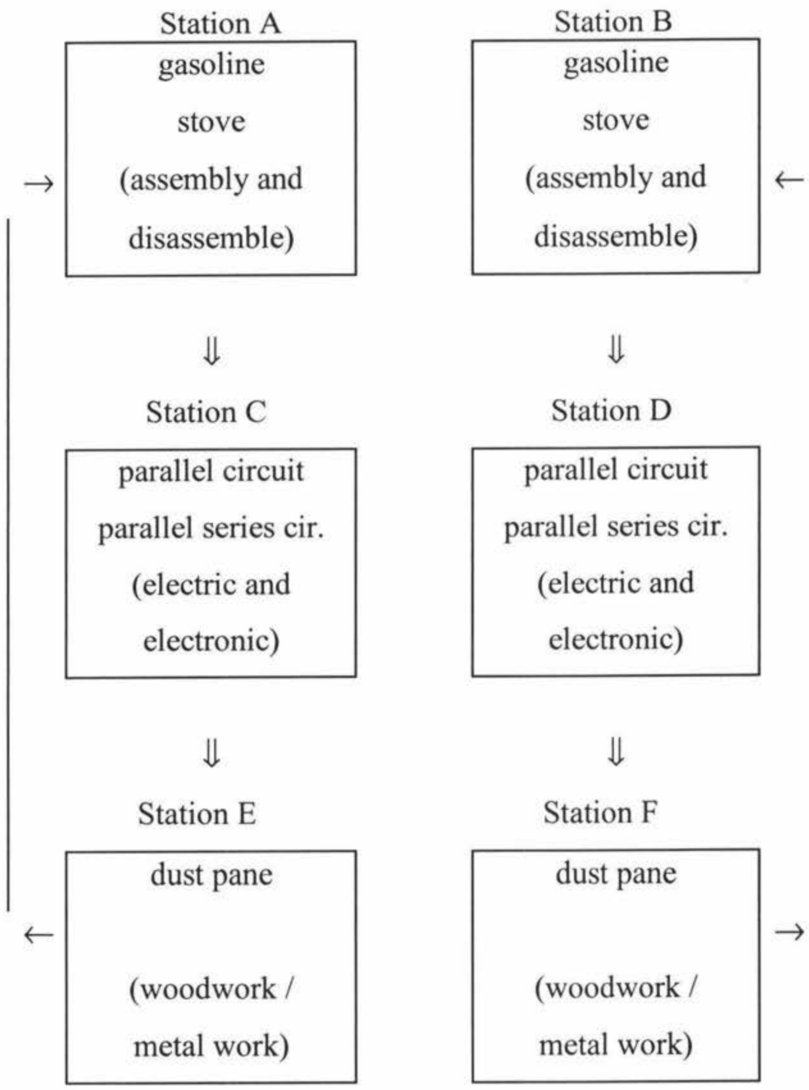
Example 1: Model for two activities in four stations

Station A		Station B
wooden ruler (woodwork)		wooden ruler (woodwork)
⇓		⇓
Station C		**Station D**
torch light marine torch light (assembly and disassembly)		torch light marine torch light (assembly and disassembly

Example 2: Model for different activities in four stations

Station A		Station B
construction set with Lego (construction)	⇒	pencil sharpener bicycle pump (assembly and disassembly)
⇑		⇓
Station C		**Station D**
series circuit (electric and electronic)	⇐	wooden ruler (woodwork)

Example 3: Model for three activities in six stations



(adapted from In-Service Course Materials for Living Skills, 1993)

Appendix Five

Main and Subcategories of Technology in the Writing/Drawing Activity

	Main Category	Examples of Category
0	Human Element	included humans in response
1	Non-technological	plants/ animals, space (excluding space travel), natural phenomena
2	Art	art products, music, theater arts
3	Concept of Change	early technology, up-to date technology/ modernizing, futuristic
4	Biological Technology	human intervention in life, including horticulture and animal husbandary
5	Products	Processed products such as food, textiles, graphic media. furniture, utensils
		general machinery
		electrical appliances
		computers
		vehicles and transport
		telephones and communication
		weapons
6	Industrial Processes	primary, secondary and tertiary industry (including health issues), general work-related ideas
7	Bulidings, Environments	building, houses, parks, roads
8	Design Process	ideas and inventions, research and development, marketing, making models
9	Knowledge	general knowledge or learning, science-related knowledge
10	Affective Reactions to Technology	attitudes such as interesting, complex, positive consequences, negative consequences, diversity, technology is many things

Appendix Six

Teacher's and Student's Code

Teachers' code in the interview were as follows:

LsSc1 and LsSc2	-	respondent representing both living skills and science
Ls1 - Ls13	-	living skills teachers
Sc1 - Sc13	-	science teachers

Student's Code

b	-	boy
g	-	girl

Example: 82g means the 82nd student coded and that student happen to be a girl

Appendix Seven

Correspondence

1. Application to conduct research (Malay language)
2. Application to conduct research (translation)
3. Letter from Supervisor
4. Med Thesis Approval
5. Letter to Sarawak Department of Education
6. Letter of approval to conduct research from EPRD (Maalay language)
7. Letter of approval to conduct research from EPRD (translation)
8. Letter if approval to conduct research from Sarawak Department of Education (Malay language)
9. Letter of approval to conduct research from Sarawak Department of Education (translation)

1. Application to conduct research

BPPP
(Untuk diisi dalam dua salinan)

Pengarah,
[redacted]

Permohonan Untuk Menjalankan Penyelidikan Di Sekolah-Sekolah, Maktab-Maktab Perguruan, Jabatan-Jabatan Pendidikan dan Bahagian-Bahagian di Bawah Kementerian Pendidikan

Bahagian A : BUTIR-BUTIR MENGENAI PENYELIDIK DAN PENYELIDIKAN

1. Nama Penyelidik (~~Tuan~~/~~Encik~~/Puan/~~Cik~~) ....
   NUR JULIANA ABDULLAH
2. Warganegara : MALAYSIA ......No. KP/Pasport [redacted]
3. Alamat Tetap : BATU LINTANG TEACHER COLLEGE, COLLEGE ROAD, 93200 KUCHING .... No. Tel : [redacted]
4. Pekerjaan Sekarang : PPP SISWAZAH (PENSYARAH) ....
5. Maklumat mengenai institusi tempat anda belajar/bekerja:
   i. Nama Institusi : MASSEY UNIVERSITY ....
   ii. Alamat : PALMERSTON NORTH ....
   ....
   No. Tel : +64-6-3569099 ....
   iii. Fakualti/Jabatan Pengajian/Tahun Pengajian : .....
   FACULTY OF EDUCATION (1995-1997)
   iv. Tempat bekerja* : – ....
   v. Alamat* : – ....
   ....–.....No. Tel: ....
   vi. Lain-lain keterangan – ....

6. Peringkat penyelidikan (Diploma/B.A/M.A/M.Ed/M.Sc/Ph.d/dll)

MASTER OF EDUCATION

7. Tajuk Penyelidikan : Malaysian Primary Students Perceptions of Technology

8. Sampel Penyelidikan : Senaraikan nama sekolah dan tingkatan/darjah/institusi pendidikan/Bahagian, di bawah Kementerian Pendidikan dan bilangan murid atau pegawai dan lain-lain kakitangan yang dicadangkan sebagai sampel dalam kajian ini.
(Sila lampirkan dua salinan senarai tersebut dengan permohonan ini)

9. Tarikh kajian perintis: Dari January hingga February 1996

10. Tarikh penyelidikan : Dari March hingga May 1996

11. Tarikh laporan/tesis dijangka siap : February 1997

Dengan ini saya Nur Juliana Abdullah mengakui bahawa saya akan mematuhi segala syarat yang ditetapkan oleh Kementerian Pendidikan. Saya memberi jsaminan bahawa satu naskhah disertasi/tesis/laporan yang berkenaan akan dihantar kepada Kementerian Pendidikan melalui Ketua Jabatan/Fakulti saya sebaik sahaja ianya siap.

Tarikh : 28.12.1995

Tandatangan Penyelidik

*Untuk diisi oleh Penyelidik-Penyelidik yang sedang bekerja/bekerja sendiri.

Peringatan:

1. Tiap-tiap permohonan hendaklah menggunakan dua salinan Borang Penyelidikan BPPP I ini.

2. Dua salinan cadangan penyelidikan yang lengkap hendaklah juga disertakan.

3. Dua salinan instrumen kajian dan dua salinan senarai sampel hendaklah juga dilampirkan sekiranya cadangan penyelidikan tidak mengandungi perkara-perkara tersebut. (Nota : sampel kajian tidak boleh melibatkan kelas-kelas peperiksaan).

4. Sila sertakan permohonan dan juga **TIGA** sampul surat (21.5cm X 10.5cm) bersetem 30 sen tiap-tiap satu.

5. Satu naskhah disertasi/tesis/laporan kajian ini hendaklah dihantar kepada Pengarah Perancangan dan Penyelidikan Pendidikan, sebaik sahaja ianya siap melalui Ketua Jabatan/Fakulti.

6. Kementerian Pendidikan berhak menolak sebarang permohonan untuk menjalankan penyelidikan di sekolah-sekolah, institusi pendidikan, Bahagian-Bahagian di bawah Kementerian Pendidikan dan membatalkan kebenaran yang telah diberi tanpa memberi apa-apa sebab.

BAHAGIAN B : UNTUK KEGUNAAN KETUA JABATAN/FAKULTI PENYELIDIK

Penyelidik ini *disokong/tidak disokong kerana ....

....

.....(attached letter of approval to conduct ~~thesis~~ research .....

from the Higher Degree Committee from Massey University and Supervisor)

Penyelidik telah membuat pengakuan bahawa satu salinan disertasi/tesis/Laporan akan dihantar kepada Kementerian Pendidikan apabila ianya siap melalui Ketua Jabatan/Fakulti.

Tarikh: ....

(Tandatangan Ketua Jabatan/ Fakulti

Nama :

Cop rasmi:

2. Application to conduct research

Research Form EPRD 1
(To be completed in duplicate)

Director,
Educational Planning and Research Division
Ministry of Education Malaysia
Level 2, Block J,
Pusat Bandar Damansara
50604 Kuala Lumpur
Malaysia

Application for Conducting Research in Schools, Teacher Traning Colleges, Education Departments and Divisions in the Ministry of Education

Section A: PARTICULARS OF THE RESEARCHER AND THE RESEARCH

1. Name of Researcher: ....
2. Nationality: .... Passport No: ....
3. Permanent address: ....

   .... Telephone No: ....
4. Present occupation: ....
5. Information on institution where you are presently studying.working:

   i. Name of institution:

....

   ii. Address:

....

   .... Telephone No:

....

   iii. Faculty/Department and year of study :

....

   iv. Place of

work:*..

   v. Address:*

....

   ....Telephone No:*

....

vi. Other details:

....

....

6. Degree to be taken M.A/M.Ed/M.Sc/Ph.D/etc.

....

7. Topic of research/study: ....

....

8. Sample of study: (List of institutions/schools and the level and number of classes, pupils or students involved in this study. The list must be in duplicate and attached to the application).

9. Date of pilot study: from .... to ....

10. Date of actual research: from ....to ....

11. Expected date of completion of Thesis/Dissertation/Report:

....

I, ... hereby declare that I will abide by the conditions set by the Ministry of Education of Malaysia. I promise that a copy of my Dissertation/Thesis/Report will be submitted to the Ministry of Education through my Head of Department/Faculty upon completion.

Date: ....

Signature of Applicant

* To be filled only by those researchers who are presently working?self-employed.

<u>Section B</u>: <u>TO BE FILLED BY THE HEAD OF DEPARTMENT/DEAN OF FACULTY OF THE RESEARCHER</u>

The researcher is *recommended/ not recommended because: ....

....

....

The researcher has agreed to submit a copy of the Dissertation/Thesis/Report to the Ministry of Education upon completion.

date: ....

....

Signature of

Head of Department/

Faculty

Name:

....

Official Seal:

*Please delete

whichever not applicable

Section C: FOR OFFICIAL USE BY THE MINISTRY OF EDUCATION

Note:

The Ministry of Education has the right to reject any application for research in schools/instituions without giving any explanation.

/nm

3. Letter from Supervisor

MASSEY
UNIVERSITY

Private Bag 11222
Palmerston North
New Zealand
Telephone 0-6-350 4533
Facsimile 0-6-350 5635

FACULTY OF
EDUCATION

DEPARTMENT OF
EDUCATIONAL
PSYCHOLOGY

19 12 95

To whom it may concern

Nur Juliana Bt. Abdullah

The Higher Degrees Committee of the Faculty of Education, Massey University has approved the research proposal for a Master of Education thesis submitted by Ms Abdullah. A copy of the letter is enclosed.

The research will investigate Malaysian primary school students' perceptions of technology and has the potential to provide valuable baseline information in the development of technology education in schools in Malaysia. The research also has important international implications as technolgy education undergoes rapid development world-wide. It will provide a case-study of students' ideas about technology as they emerge within Malaysian culture.

Ms Abdullah is an excellent student and is expected to produce a first-rate thesis. On behalf of the Faculty of Education, I request your support to enable Ms Abdullah to conduct the fieldwork for this research.

Yours sincerely

Janet Burns

Dr Janet R. Burns
MEd Thesis Supervisor

4. *Med thesis approval*

MASSEY
UNIVERSITY

Private Bag 11222
Palmerston North
New Zealand
Telephone 0-6-350 4534
Facsimile 0-6-350 5635

FACULTY OF
EDUCATION

DEPARTMENT OF
POLICY STUDIES
IN EDUCATION

19 December 1995

Nur Juliana Bt Abdullah
[redacted]

[redacted]

MEd Thesis Approval

Your thesis proposal has been approved by the Higher Degrees Committee. Dr Janet Burns has agreed to be the main supervisor. Confirmation of supervision arrangements will be notified in February when the Supervision Sub-Committee has met.

You may now proceed with enrolment in the MEd Thesis for 1996.

Yours sincerely

John A. Codd
Associate Professor of Education

cc Dr Janet Burns

5. Letter to Sarawak Department of Education

Nur Juliana Bt. Abdullah
c/o Batu Lintang Teachers College
College Road
Kuching
Sarawak

State Director of Education, Sarawak
Sarawak Department of Education
T. D. T. Hj. Bujang Building
Simpang Tiga Road
Kuching

Through:

Dr. Janet Burns
Supervisor
Faculty of Education
Massey University
Palmerston North
New Zealand

1 December 1995

Sir,

Application to Conduct Research in Primary School

I wish to refer to my application above.

I am currently studying at Massey University, New Zealand, under the sponsorship of the Federal Government Scholarship, Malaysian Ministry of Education. For the requirement of my Med degree, I wish to pursue a study for my thesis, under the supervision of Dr. Janet Burns, on Malaysian Primary Students' Perceptions of Technology.

I wish to seek your approval to carry out a study on Year Four students in the Kuching, Samarahan and Mukah area. I would also like to interview a few teachers teaching the Living Skills and/or Science in the selected schools.

The sample for this study includes students from the ethnic groups of Malay, Chinese, Iban, Bidayuh and Melanau. A sample of at least 80 students (40 boys and 40 girls) is needed. The research will be carried out in two stages, a pilot testing, from January to February 1996, and a main study from March to May 1996.

This study is divided into three sections, each about 15 to 30 minutes. To ensure anonymity, all respondents will not enclose their names. A report will be given to the State Education Department and distributed to the sample schools.

Your kind consideration is much appreciated.

Thank you

Yours sincerely

(NUR JULIANA BT ABDULLAH)

6. Letter of approval to conduct research from EPRD

BAHAGIAN PERANCANGAN DAN
PENYELIDIKAN PENDIDIKAN,
KEMENTERIAN PENDIDIKAN,
PARAS 2, 3 DAN 5, BLOK J,
PUSAT BANDAR DAMANSARA,
50604 KUALA LUMPUR

Telefon: 2556900
Kawat: "PENDIDIKAN"
Faks: 03-2554960

Ruj. Tuan:
Ruj. Kami: [redacted]
Tarikh: [redacted]

Pn. Nur Juliana bt. Abdullah,
d/a Normilah Nordin,
Maktab Perguruan Batu Lintang,
Jalan Kolej,
93200 Kuching,
Sarawak.

Puan,

Kebenaran Bagi Menjalankan Kajian Ke Sekolah-Sekolah, Jabatan-Jabatan Dan Institusi-Institusi Di Bawah Kementerian Pendidikan Malaysia

Adalah saya diarah untuk memaklumkan bahawa permohonan puan untuk menjalankan kajian mengenai

"Malaysian Primary Students' Perceptions Of Technology"

diluluskan.

2. Kelulusan ini adalah berdasarkan kepada hanya apa yang terkandung di dalam cadangan penyelidikan yang puan kemukakan ke Bahagian ini. Kebenaran bagi menggunakan sampel kajian perlu diperolehi daripada Ketua Bahagian/Pengarah Pendidikan Negeri yang berkenaan.

3. Puan juga dikehendaki menghantar senaskhah hasil kajian puan ke Bahagian ini sebaik sahaja selesai kelak.

Sekian.

"BERKHIDMAT UNTUK NEGARA".

"CINTAILAH BAHASA KITA".

Saya yang menurut perintah,

(DR. ABD. KARIM B. MD. NOR)
b.p. Pengarah Perancangan dan Penyelidikan Pendidikan,
b.p. Pendaftar Besar Sekolah-Sekolah dan Guru-Guru,
Kementerian Pendidikan.

7. Letter of approval to conduct research from EPRD

Educational Planning and Research Division
Malaysian Ministry of Education
Level 2, 3, and 5, Block J
Pusat Bandar Damansara
50604 Kuala Lumpur
Malaysia

Nur Juliana bt Abdullah
c/o Normilah Nordin
Batu Lintang Teachers College
College Road
93200 Kuching
Sarawak

27 January 1996

Madam,

Approval to Carry Out Research in Schools, Departments and Institutions in the Malaysian <u>Ministry of Education</u>

I have been directed to inform you that your request to do a research on the "Malaysian Primary Students' Perceptions of Technology" has been approved.

2. The approval is given based on the contents of your research proposal which you have sent to the division.

3. You are also required to send a copy of your work to the division as soon as you have completed your research.

"Service for the Nation"

"Love your Language"

I am at your service,

(DR. ABD. KARIM B. MD. NOR)
for Director of Educational Planning and Research Division
for Registry of Schools and Teachers, Ministry of Education
c.c. Director of Education, Sarawak Education Department

8. Letter of approval to conduct research from Sarawak Department of Education

BANGUNAN TUN DATUK PATINGGI
TUANKU HAJI BUJANG,
JALAN SIMPANG TIGA,
93604 KUCHING,
SARAWAK.

Telefon: 082 - 243201
FAX: 082 - 246750
Kawat: PENDIDIKAN

Ruj. Tuan:

Ruj. Kami: [redacted]

Tarikh: **14 Februari 1996**

Puan Nur Juliana bt. Abdullah,
d/a Maktab Perguruan Batu Lintang,
Jalan Kolej,
Kuching.

Puan,

Kebenaran Menjalankan Kajian ke Sekolah-Sekolah, Jabatan-Jabatan dan Institusi-institusi Di Bawah Kementerian Pendidikan Malaysia

Sukacita saya merujuk surat puan bertarikh 1 Disember 1995 dan surat Kementerian Pendidikan bil. KP(BPPP)13/15 Jld.45(56) bertarikh 27.1.1996.

2. Sehubungan itu, Jabatan ini tiada halangan untuk memberi kebenaran kepada puan untuk menjalankan kajian sepertimana yang dinyatakan dalam surat puan yang berkaitan.

Sekian. Harap maklum.

'BERKHIDMAT UNTUK NEGARA'

Saya yang menurut perintah,

(SAHDI HAJI KEN)
Sektor Pengurusan Sekolah.
b/p Pengarah Pendidikan
Sarawak.

SK/ss

9. Letter of approval to conduct research from Sarawak Department of Education

Tun Datuk Patinggi Tuanku Haji Bujang Building
Simpang Tiga Road
93604 Kuching
Sarawak

Nur Juliana bt. Abdullah
c/o Batu Lintang Teachers College
College Road
Kuching

14 February 1996

Madam,

Approval to Carry Out Research in Schools, Departments and Institutions in the Malaysian Ministry of Education

We refer to your letters dated 1st December 1995 and the letter from the Ministry of Education re: KP(BPPP)13/15 Jld.45(56) dated 27.1.1996.

2. In this aspect, this department has consented your application to carry out the research as stipulated in your letter.

"Service for the Nation"

I am at your service,

(SAHDI HAJI KEN)
School Management Sector
for the Director of Education
Sarawak.