THE PERCEPTIONS OF TERTIARY STUDENTS IN MALAWI TOWARDS TECHNOLOGY AND TECHNOLOGY EDUCATION

Vanwyk Chikasanda[1] *and Judy Moreland*[2]

1. Centre for Science and Technology Education Research, University of Waikato, Hamilton, New Zealand
2. Centre for Science and Technology Education Research, University of Waikato, Hamilton, New Zealand

vkmc1@waikato.ac.nz

ABSTRACT

Student concepts of technology and technology education have a direct influence on their learning of technological concepts and processes. Student attitudes towards technology may also inhibit learning in technology. It is therefore especially important to understand student perceptions of technology and technology education to develop their understandings and skills in the subject. This paper reports on a study that involved first year pre-service students (year 13) in the Department of Technical Education at the Malawi Polytechnic, a constituent college of the University of Malawi. A PATT questionnaire adapted from Burns (1990) was administered to 35 students. The major objective of the study was to understand their perceptions towards technology and technology education in order to inform technology curriculum development and design in Malawi. The study revealed that student concepts in technology, such as technology pillars (matter, energy and information), and their understanding of the relationship between technology and science were high. However, their perceptions related to the nature of technology were limited to viewing it as making things, machines and computers. Student attitudes towards technology were positive. In contrast to other PATT studies gender, age, home background, nature of schooling and achievement levels had no significant effect on student attitudes towards technology and on their perceptions of the nature of technology and technology education. There is therefore an enabling environment for technology education in Malawi but students would benefit from a programme targeting their nature of technology perceptions.

1. INTRODUCTION

An investigation of students' perceptions has been a major feature of educational research to inform curriculum change and developments in science, technology and technology education (Burns, 1992; Jones & Car, 1993; Osborne, Simon, & Collins, 2003). The impact of technology on the current and future lives of society's youth makes it especially important to understand technology and professional practice from the students' perspective (Frantom, Green & Hoffman, 2002). Jones (1996) noted that students' dispositions of concepts of technology and technology education have a direct influence on students' learning of technological concepts and processes. However, Jones citing Mather and Jones (1995) also noted that the interaction between concepts and future learning is complex and depends on a number of factors. Research on social views of learning (Brown, Collins & Duguid, 1989; Hennessy, 1993; Lave, 1991; Perkins, Jay & Tishman, 1993; The Cognition and Technology Group at Vanderbilt, 1990) has shown the importance of situating cognition through cognitive apprenticeship, students' good thinking or dispositions, anchored cognition and use of structured and sequential

authentic activities. The personal relevance curriculum design by Petrina (1992) emphasises integrity, autonomy and personal growth embracing self actualisation, autonomy, authenticism, health and happiness and students are free to develop their own curricula based on their personal problems, developmental levels, goals, interests, curiosities, capabilities and needs. Moreland and Jones (2000) also observed that teachers should include self assessment and peer reviews during teaching practice, which would assist students to be more involved in their own learning progress. The Cognition and Technology Group at Vanderbult (1990) focussed on helping students to develop confidence, skills and knowledge necessary to solve problems, and become independent thinkers and learners. From these studies it can be seen that the theories of learning focussing on students' learning activities and therefore their perceptions, should be reflected in curricula and pedagogy for developing effective instruction. This study is therefore based on the premise that understanding students' perceptions of technology assists in making effective decisions about the development of technology education in Malawi.

All major policy guidelines for Malawi (GoM, 2002a; 2002b; 2004; Ministry of Education, 2001; 2005) put education to the fore as a conduit for developing science and technology and eradicating poverty. However, the current general curriculum does not provide school students with sufficient skills and knowledge to become economically active. Those that drop out face barriers in finding employment and have difficulties understanding current technological developments at the personal, community and national levels. About 60% of school students drop out at the end of Year 8 and only 4% proceed to university after secondary school (World Bank, 2004). Hence, there is a need to review the technology or entire curriculum so that there are opportunities to provide an alternative education that can impart knowledge, capabilities and skills more responsive to the social, economic, and environmental climate of Malawi. An understanding of the students' perception of technology is therefore a first step towards informing the process of reconstructing the curriculum to incorporate technology education.

2. METHODOLOGY

A Pupils' Attitudes toward Technology (PATT) questionnaire (Burns, 1990) was used in a survey in 2007 which targeted first year tertiary students at the Malawi Polytechnic. The instrument has been trialled in over 22 countries (Bame, Dugger, de Vries & McBee, 1993; Boser, Palmer & Daugherty, 1998; Burns, 1992; Raat, de Klerk Wolters & de Vries, 1987; Volk, Yip, & Lo, 2003) but it has not previously been implemented in Malawi. This study was therefore an opportunity to contribute information towards a technology curriculum review. The study employed all the attitude and concept items used by Burns (1990) but modified the attributes and open questions for use in Malawi so that differences in curricula and education systems were taken into account. The instrument comprises four sections. The first section included questions on students' characteristics. The second section had 60 items about attitudes towards technology while the third section had 28 items on concepts of technology. The last section had three open-ended questions on students' views on the meaning of technology and technological literacy and also students' justification for opting for the introduction of technology education in schools. The study targeted all first year students enrolled in the Department of Technical Education at the Malawi Polytechnic. Thirty-five (35) students (25 males and 10 females) completed the questionnaire. Quantitative data were computed and analysed using the Statistical Package for Social Scientists (SPSS) (Pallant, 2005) and this analysis provided descriptive statistics. Open-ended questions were analysed using grounded theory (Strauss & Corbin, 1998).

3. DISCUSSION

This section presents a discussion of the findings from the investigation into the perceptions of tertiary students toward technology and technology education. The objective of the study was to provide baseline data related to Malawi first year tertiary students' perceptions and attitudes towards technology education. Three sub-questions arose. They were:

1. To explore the attitudes of tertiary students towards technology.

2. To explore tertiary students conceptions of technology.

3. To explore tertiary students views on technology, technological literacy and technology education.

The discussion shall therefore address the study objectives and its specific questions with a focus on how the study informs curriculum development and design in Malawi.

3.1 Attitudes of Tertiary Students towards Technology.

Overall students' attitudes towards technology were positive. The attitude scale was categorised into six subscales: interest, gender, consequences, difficulty, curriculum and career. Results showed that students had a better appreciation of three subscales, which were the curriculum, consequences and career subscales. The attitudes of the students towards technology were positive as shown by an aggregated mean score of 3.49. The attitudes were equally high in all the subscales with the highest mean attitude scores for all students registered in the curriculum subscale, followed by the consequences subscale. There were no significant overall differences in the mean attitudes between boys and girls but a mean difference of 0.15 was observed in the interest subscale with boys showing more interest towards technology. For instance, 28 students (80%) (8 females and 20 males) showed interest towards knowing more about computers and 18 students (51%) (14 males and 4 females) showed interest in joining a technology club if there was one. In the gender subscale, the mean score for male students was 3.37 while for female students' mean score was 3.29. Although the difference is not significant but it showed that male students were more concerned with gender equality in technology. The male students were also more interested in taking up a career in technology. However, the mean attitudes for female students in the consequences, difficulty and curriculum subscales were higher than those of males. For example, 29 students (83%) (22 males and 7 females) strongly agreed that technology will be good for the future of Malawi. Females therefore saw the consequences of technology more positively and were also more positive towards the inclusion of technology in the curriculum. More female students compared to male students perceived technology as an easy subject. But as there were only 10 females (29%) compared with 25 males (71%), the mean differences observed above may not represent the actual situation. Hence the need for further study with a balanced sample and proportionally representative of the population of Malawi, which is 49% male and 51% female (GoM, 2005).

The students were interested in technology and supported the inclusion of a technology curriculum in schools. They also showed an awareness of the consequences of technology and they would choose a career in technology. No significant gender differences were observed and gender, age, home background, nature of school attended and scholastic achievement did not show any influence on students' attitudes.

As attitudes are considered to influence learning experiences (Davies & Brember, 2001 cited in Volk et al., 2003), the interest shown by students in this study is important for learning in technology and shaping curriculum developments. As attitudes form and change with social contexts (Prislin & Wood, 2005), the students attitudes towards

technology may be further enhanced during their interaction with technology related content.

The students showed concern over consequences of technology. However in the open-ended questions the students were unable to illustrate the consequences except for some benefits of technology. Consequences in the PATT questionnaire covered aspects of technology in relation to people's lifestyles, the world with or without technology, national economic prosperity, unemployment, pollution and as a future school subject. The students did not recognise most of these consequences in their definitions of technology, which highlighted their lack of understanding of the social influences of technology. However, the students' positive attitude towards the consequences of technology provides an opportunity to further build the students' awareness on technology, the environment and development concerns. In Boser et al. (1998), an integrated instructional approach to technology helped students attain a more balanced view of technology and its consequences. As most of the factors that constituted consequences are socially construed, an integrated approach using situated social practice (Lave, 1991) may help change the students' attitudes. Solomonidou and Tassios (2007) argued that an environmental program in the Greek curriculum influenced students' representations of technology as having an impact on the environment. Appropriate curriculum approaches could therefore play a role in transforming the attitudes and the students' views on technology and technology education.

3.2 Students' Conceptions of Technology

There were 28 items in the concept of technology scale of the PATT questionnaire and these were categorised into four subscales (Burns, 1990; Raat, et al., 1987). These included technology as a human activity and influences on society, interrelatedness between technology and science, the relationship between designing and technical skills and the three pillars of technology: matter, energy and information. The findings on tertiary students' conceptions of technology and technological literacy revealed that students had a broad understanding of the concepts of technology.

The mean score of concepts of technology for all the students was 0.709. This implies that the students correctly answered 71% of the 28 concept of technology items. Out of 28 statements, the lowest scoring student got 10 correct items while the highest got 27 correct items. The female students had a mean score of 0.669 while the male students' mean score was 0.725. Overall, male students showed a slightly better understanding of the concepts of technology. For instance in the society and sciences subscales male students got more correct responses than females. The majority of students showed an understanding that technology influences people's daily lives as 32 students (91%) agreed with the statements that technology has a large influence on people and that government influences technological developments. Although 32 students (91%) did not see any relationship between chemistry and technology, 34 students (97%) (all 25 males and nine of the ten females) recognised physics as having a relationship with technology.

All the students however showed more knowledge of the concepts under the technology pillars subscale followed by the technology and science subscale. Although 14 students (40%) expressed lack of knowledge on whether technology is more a part of computers than computer programs, 24 students (69%) recognised technology as more than just computers or computer programs. Twenty-six (74%) students also recognised the importance of technology in solving energy problems. Proportionately more girls than boys showed a greater understanding of the pillars of technology. For example all the girls viewed the processing of materials as an important part of technology while one boy did not see any link between the two concepts.

In other PATT studies (Bame, et al., 1993; Burns, 1992; de Vries & Tamir, 1997, Raat, de Vries & Alting, 1985) students' understandings of technology concepts were attributed to ability, home background and exposure to technology education. As the students in

this study had no technology learning experience (except for 2 students who had learnt technical subjects and one who did design and technology at school), the findings may be attributed to other factors. However, the study did not establish any link between the concepts and the students' age, home background, nature of school attended and scholastic achievement. The sample included 23 students from private secondary schools where technical subjects were not usually offered. Only one student learnt Design and Technology from a high school as part of the International General Certificate of Secondary Education (IGCSE) examinations from the United Kingdom (UK). Twenty-two students (63%) also grew up in towns where accessibility and use of a technological infrastructure may be regarded as more common than in rural situations. However, the infrastructure in most towns in Malawi is so poor that basic services and facilities hardly exist. It is therefore difficult for these students to appreciate technological concepts and related activities as they do not come face to face with everyday technology (Lewis, 2000). Current circumstances such as demands for the technical education program rather than urban modernity or rural indigenousness (Lewis, 2000) may therefore have influenced their disposition towards technology.

The study also revealed that gender differences did not significantly affect students' concepts of technology. However females showed a broader understanding of the technology pillars (matter, energy and information) while males had a greater awareness of technical skills and the relationship between society, science and technology. On their views of the meaning of technology, females were more concerned with issues of energy use and efficiency (for example, use of hotplates instead of firewood), quality, clothing and food production and health. It was also noted that more males than females chose engineering and agriculture (agriculture engineering and irrigation) which also matches the males greater confidence in the technical skills subscale. Therefore, gendered perceptions may have influenced the students' views on their concepts of technology, technological literacy and technology education.

3.3 Students Views on Technology, Technological Literacy and Technology Education

The students conceived technology as an application of scientific knowledge for making things, and using hardware such as machines and computers and related products to solve problems. As in other studies (Bame et al., 1993; Solomonidou, & Tassios, 2007), the students associated technology with modern artefacts or products such as computers, mobile phones, ex-rays (machines), auto-teller machines (ATM) and bicycles. For instance;

> "Technology to me means the use of machines in order to improve or make work or life easier in so many ways, for example using mobile phones instead of writing letters, using hot plates instead of a three-stand oven which uses firewood. So the development of all these new machines (technology) makes life better." (Grace)

However their views did not fully incorporate society values and beliefs. The students' views of technology were restricted to artefacts, making things and machines. No indigenous artefacts were mentioned as technology even among the 12 students (34%) that grew up in villages. Villages, towns and cities alike have energy, transportation and communication problems and hence perhaps the students' higher scores in the pillars subscale. Common occupations in the villages include for example subsistence farming, hunting, playing games and traditional dances. These all involve development and design of products befitting such activities which the students may have been involved in one way or the other. The students were unable to recognise historical origins, cultural influences or values of technology. Though technology may be described as a seamless web of interactive components in a complex socio-technical system comprising cultural, organisational and technical aspects (Layton, 1993) the students, in contrast, viewed technology as sporadic and isolated components of the web. Technology was also viewed as the process of making, inventing and solving problems that affect daily livelihood.

These processes were viewed as employing scientific and technical skills. The students' meanings of technology were therefore restricted to artefacts, knowledge, skill and techniques. Their views did not go beyond scientific and technical considerations to incorporate user values, and production and maintenance constraints (Layton, 1993; Solomonidou & Tassios, 2007). Environmental, economic impacts and better lifestyles were also mentioned as consequences of technology.

Students' views of technology influenced their perceptions towards technological literacy and also technology education. Technological literacy was viewed by the students as having knowledge of and ability to produce, operate or select technologies appropriate for the community. Technologically literate people were those who are informed about advanced technologies and understand the merits and demerits of such technologies to communities and the environment. For example, Gilbert said: "It is when someone is well informed or knows well what kind of technology is being introduced or done and understands how it is done, how important it is to the community and its impact on the community." Although indigenous technologies were not appreciated, students recognised community and environmental concerns as technological issues. One could surmise that students' ideas were improving from one section of the PATT questionnaire to the next.

The students' views of technological literacy as being fully informed of and about technology therefore confirms arguments by Fleming (1989) and Petrina (2000). According to Fleming (1989) a technologically literate person is expected to understand social issues surrounding technology and with such knowledge, be able to understand implications of technological developments. Petrina (2000), citing *Technology for all Americans*, argued that technological literacy is the ability to use, manage and understand technology. The students' perception of technological literacy was therefore unexpected considering their earlier responses to the PATT questionnaire where societal impacts were not included.

The results are reflective of the narrow concepts of technology depicted in the research tool which the students may have applied in the process of defining technology and technological literacy when answering the open-ended questions. For instance the statements on the concepts of technology included such issues as technology and machines, computers, better life styles and national economic prosperity among others. In their responses to the open questions the students replicated these words almost word for word.

Their limited views of technology also influenced their perceptions related to the justification for technology education in schools. The students viewed technology education as a gateway to jobs and self-employment. Besides opening up opportunities for entrepreneurship, the students considered the subject as an appropriate means for imparting basic technical skills necessary for the production of goods for export and in turn boost the country's economy. For example;

> "If a person knows technology, that means he can have the skills to be making things on his own. Therefore, teaching technology in Malawian schools can help pupils who have failed to go for further education to be self reliant by establishing small scale businesses and using the technologies they got from school." (Harold)

In Ireland technology education was introduced based on a rationale that it was important for economic success (Carty & Phelan, 2006). Technology Education was also perceived as less resource intensive than woodwork/construction and metalwork/engineering. In New Zealand there were six grounds for developing technology education, namely: economic, pedagogic, motivational, cultural, environmental, and personal (Jones, 2003). Malawi students' reasons for the introduction of technology education were similar to findings from other research studies (Carty &

Phelan, 2006; Jones, 2003) in that technology would shape the youths' after school occupations and enhance Malawi's economic development. The students also viewed technology education as a means to attain technological literacy as they would be empowered with technical skills for their involvement in technological developments.

4. CONCLUSION

The study has shown that the students had a broad understanding of the concepts of technology. However, their knowledge of the nature of technology and technological literacy was somewhat limited and mostly restricted to artefacts, knowledge, making and techniques. The study has also shown that tertiary students had positive attitudes towards technology and technology education. Though only 35 students undertook the questionnaire students knowledge of and attitudes towards technology provides some justification for the introduction of technology education in the school curriculum. This may help popularise technology and empower people to appreciate and participate in technological developments. However, as evidenced from the students' limited appreciation of society values and beliefs in technology, attention to social relevance aspects may need to be included in the technical education program at the Polytechnic in order to enhance a broader understanding of the nature of technology. Further research with a larger sample of students needs to be undertaken in order to improve teaching and learning in technical education and to also better understand how current thinking on teaching and learning in technology could be embraced in the program. As the world is changing technologically, technology education will help prepare the Malawi youth for living and working in a technology based economy and society. As technology is a social phenomenon (Jones, 2003; Pavlova, 2005) and an integral part of the social structure, Malawi's technical education curriculum should include aspects related to technology for social change.

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