Int J Edu Sci, 19(1): 64-70 (2017)
DOI: 10.31901/24566322.2017/19.01.09

Undergraduate Students' Perceptions in Learning Technology towards their Degree Qualification at a South African University

Samuel Khoza[1] and Vasidevan Naiker[2]

27 St Andrews Road, University of the Witwatersrand, Parktown, Johannesburg 2050, South Africa
[1]<Samuel.khoza@wits.ac.za>, [2]<Vasidevan.naiker@wits.ac.za>

KEYWORDS Perceptions. Technology. Undergraduate Students. Technical Subjects. Technology Education

ABSTRACT Technology is a subject that is offered over a period of two years in levels I and II to undergraduate students in a Johannesburg University where this study was carried out. It lays a firm foundation for the undergraduate students towards their specializations in Technical subjects in level III. However the undergraduate students have misconceptions on Technology subject and end up not continuing with Technical subjects in level III because of such misconceptions. This paper then investigated undergraduate students' perceptions towards Technology subject of their degree course. The study made use of mixed method approaches in the form of focus group interviews and questionnaires to collect data. Forty eight undergraduate students from levels I to III were part of the study. Findings of the study revealed that students do not understand the purpose of doing Technology and they find it irrelevant towards their field of study.

INTRODUCTION

Technology education was introduced into the South African curriculum in recognition of the need to produce engineers, technicians and artisans needed in modern society and the need to develop a technologically literate population for the modern world (Curriculum and Assessment Policy Statements (CAPS); Department of Basic Education (DBE) 2011). Even though technology education subject was viewed as a foundation subject to develop such niche area, according to Makgato (2011), Technology education in South Africa has not gained a good recognition and status as have other subjects such as Mathematics and Science. For instance, at a Johannesburg University, Technology subject is one of the technical subjects that the Bachelor of Education (BEd) degree students take in the first two years of their four year undergraduate course. Its purpose is to lay a firm foundation for the undergraduate students to continue with any technical subject of their choice when they do their level III.

Technology subject contains concepts such as Graphical Communication, Structures, Electrical Systems, Materials and Processes as well as Hydraulics and Pneumatics. All these concepts have practical components with the Graphical Communication assisting the undergraduate students to develop design skills that will ease their making of practical components. The subjects that they have to choose in Level III include Mechanical, Civil, Electrical as well as or Information Technologies with Engineering Graphics and Design (EGD). Technology education on the other hand, which is a programme that offers technical subjects, was introduced into the South African curriculum in recognition of the need to produce engineers, technicians and artisans needed in modern society and the need to develop a technologically literate population for the modern world (DBE 2011).

Historically, Technology education field, formerly known as Technical education, has been conceived as being associated with the acquisition of motor skills or computer related activities (Makgato 2000). Yet this view doesn't fully incorporate all the knowledge and skills needed in Technology education. Currently, technology education fields involve higher cognitive processes such as creating, designing, modelling, predicting, and experimenting in conjunction with practical problem-solving tasks (Makgato 2011). Based on the demand of knowledge that technology education fields require,

Address for correspondence:
Dr. Samuel Khoza
Telephone: +2784 300 4543, +2711 717 3252

most of the students who are doing the BEd degree at a Johannesburg university, seem to be reluctant to study technology subject. They are being selective in its (Technology) concepts when they are in class. Some of the students enjoy the practical component; others enjoy the theory component while others dislike the entire subject even though Technology subject comes as being part of their course package.

Students normally enrol in large numbers of 65 during their first year where they are introduced to the Technology subject but the number gets halved when they are expected to carry on with Technical subjects like EGD as well as Mechanical Technology in their third year of study. However, there are a lot of misconceptions among students about Technology education, because of a lack of professional development and teacher awareness of what technology education implies (Chisholm 2000). Most of the students who take Technology subject do not show any interest when they are taken through various processes of learning Technology (Chow et al. 2012). They seem disinterested and at the end perform poorly when given a task.

Objectives of the Study

The main objective of this paper was to investigate the undergraduate students' perceptions in learning Technology subject towards their degree qualification in a Johannesburg university in South Africa.

Literature Review

The word Technology has varying meanings depending on where it is used. Internationally and in some countries across the African continent, 'technology' is a 'device' that is used to teach, to surf the net or a means of a tool that students use in the classroom to learn, but in the South African context; specifically where this study was carried out; Technology is a subject that the undergraduate students at a Johannesburg university learn as part of their teaching programme. It is the knowledge of using tools and machines to do the tasks efficiently (Kalanda 2005). Ankiewicz et al. (2000) on the other hand defines Technology education as what happens in the technology classroom. He further on says that Technology is the study of how to manage, understand and use technology in all its forms and dimensions.

On the other hand, Technology is a study of the technical means undertaken in all cultures (a universal), which involves the systematic application of organized knowledge (synthesis) and tangibles (tools and material) for the extension of human activities that are restricted as a result of the evolutionary process (Kim 2000). Colbeck et al. (2000) stated that "students are more likely to experience their own accomplishments when engaging in active, hands-on learning experiences rather than when passively listening to lectures". Research by Lindner et al. (2004) indicated students' positive experiences (emotional arousal) in science increased their enthusiasm for science and their belief in their ability to pursue science careers. Being that it may, the undergraduate students at a Johannesburg university show little or no interest in the subject Technology in their first two years of their degree course.

They seem not to believe in their capabilities that they can successfully pass Technology subject because after all, it comes as a package for their degree course. Regarding self-efficacy, Bandura (1995) explains that it "refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations". More simply, self-efficacy is what an individual believes he or she can accomplish using his or her skills under certain circumstances (Snyder and Lopez 2007). The basic principle behind Self-Efficacy Theory is that individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not (Van der Bijl and Shortridge-Baggett 2002).

METHODOLOGY

The study employed the mixed method approaches in gathering and analysing the data. According to Ngulube and Ngulube (2015), the main purpose of using mixed methods research (MMR) is that of the promise it holds to providing a better and balanced investigation of research problems in context. Teddlie and Tashakkori (2012) on the other hand regard MMR as a third methodological movement that advocates methodological eclecticism that involves the utilization of quantitative and qualitative approaches within a single study. The main rea-

son of using the MMR approach was to overcome the tensions in the epistemological, ontological, methodological, axiological and doxological differences of quantitative and qualitative research (Tashakkori and Creswell 2007).

Bogdan and Biklen (2003) assert that qualitative research is descriptive. The data collected take the form of words or pictures rather than numbers. Qualitative research was used in this study to obtain information through structured focus group interviews from the undergraduate students enrolled for Technology subject in the first and second year of their degree course and those who were in their EGD III course. On the other hand the Technology Teaching Efficacy Belief Instrument (TecTEBI) was used as a quantitative tool to collect quantitative data from the same undergraduate students. This instrument served as a questionnaire that was adapted from an instrument titled "*Science Teaching Efficacy Belief Instrument, STEBI"* (Riggs and Knochs 1990). The instruments had boxes where ***SA*** denoted 'strongly agree'; ***A*** meant 'agree', **UNCTN** meant 'uncertain'; **D** referring to 'disagree' and **SD** meaning 'strongly disagree'. Items from the STEBI instrument were selected raw as they are with just an alteration of the word 'Science' to 'Technology'. The STEBI instrument had a total of 23 items as shown in Table 2.

The population in this study was forty eight undergraduate degree students doing Technology I and II as well as EGD III who had done Technology subject before. Bless and Higson-Smith (2000) defines population as the complete set of events, people or things to which the research findings are to be applied. The study made use of judgmental sampling, which is the deliberate choice of an informant due to the qualities the informant possesses. It is a non-random technique that does not need underlying theories or a set number of informants. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard 2002; Lewis and Shep-pard 2006). There were twenty undergraduate students doing Technology I subject, fifteen undergraduate students in Technology II subject as well as thirteen EGD III students who had done Technology I and II subject before.

The presentation and analysis of RQ 1 data took the form of narrative and detailed description with respondents' quotations used to capture their real views. SPSS software was used to analyse the quantitative data which encompassed both RQ'S 1 and 2. Niemann et al (2000) cited Smaling (1994) as saying that reliability is regarded as elimination of causal error that can influence the results. The methods for establishing the reliability of an instrument (questionnaire included) include: the test-retest method, alternative form method, split half method, or calculation of the Cronbach's alpha coefficient (De Vos 2002). The reliability of the TecTEBI instrument was calculated as 0.72 which certified the items to be reliable (Santos 1999) as shown in Table 1:

Table 1: Reliability statistics

Cronbach's Alpha	*Cronbach's Alpha based on standardized items*	*N of items*
0.72	.309	23

Therefore the study engaged the undergraduate students in what their perceptions were when they first enrolled in the BEd degree. Since these undergraduate students come from various provinces, their views in Technology subject could differ. In order to understand how the undergraduate students perceive Technology subject the following was asked:

"What are the undergraduate students' perceptions concerning Technology subjects in their degree course?"

To explore how the undergraduate students' perceptions are in Technology subject, the following sub questions were formulated**:** (RQ's):

RQ 1- *What are the undergraduate students' challenges in the Technology subject?*

RQ 2- What influence does Technology subject offered at a Johannesburg university have towards the undergraduate students' degree course?

RESULTS

Interview responses showed a variety of undergraduate students' perceptions about Technology subject. The majority of them studied Technology subject not as a choice but because it was part of the packaged subject in their degree course. Below are the undergraduate students' responses to the above RQ 1 *(What are the undergraduate students' perceptions on the Technology subject?)*

RQ 1: The BEd undergraduate students' perceptions on Technology subject

The above question aimed at getting responses from the undergraduate students' perceptions and thinking about Technology subject. The question produced one theme: *(1) Technology subject deals with computing and not designing and making processes.*

Theme 1: Technology subject deals with computing and not designing and making processes

A Technology I student commented: *"When I enrolled for this BEd degree I saw Technology I on the subjects' lists and saw that as an advantage to learn more of computer stuff to cope in the changing technology of today"*. On the other hand her classmate said: *"I was mistaken to see Technology as more of a Technical subject and not as a computer base subject, now I start to dislike it"*. However one EGD III student said the following: *"I have done Technology at secondary level but we merely used cardboard in making projects but now we have to search the web and design from there and it is much more challenging."*

The above responses complement what Makgato (2000**)** says that historically, technology education, formerly known as technical education, has been conceived as being associated with the acquisition of motor skills or computer related activities. This seems to be the students' perception even today. On the other hand, Chisholm (2000) states that there are a lot of misconceptions among students on Technology education because of a lack of professional development and teacher awareness of what Technology education imply. Students' responses do cement that notion because of the reasons that they give when asked on challenges that they have in Technology subject.

RQ 2: The influence that technology subject has towards the undergraduate students' degree course.

Research Question 2 (RQ 2) produced two themes: *(1) Technology subject as an important subject in the teaching career but not related to the sub-major that they are doing* as well as *(2) Technology subject as not a Further Education and Training (FET) subject.* Students' responses showed there was a mixture of feelings to the above question.

Theme 1: The subject technology as an important subject in the teaching career but not supported by the sub-major

Technology Further Education and Training (FET) Phase Teacher

A Technology I student said the following: *"Technology is an important subject but I realised that I will make a wrong choice when I pair it with First Additional Language (IsiZulu) as an FET phase student because the two subjects do not assist each other, they are just irrelevant and I cannot cope in other subjects offered in level III."*

Technology Senior Primary Phase Teacher

On the other hand, a Technology II student said: *"I am in a senior primary phase and I specialize in Visual Arts and Technology but when I am told to produce a drawing when making a project, I really get lost. I do not see the importance of drawing because Drawing is an FET phase subject, which I do not need."*

An EGD III student added: *"When I was still in Technology I and II we used to draw easy stuff but now EGD III is different and difficult and I do not see any contribution of Technology I and II in my EGD as Visual Arts is my submajor."* The above comments show that students lacked subject advice when they enrolled in their degree course. The fact that Technology subject came as a compulsory subject is not a bad idea at all but it should be 'accompanied' by a relevant subject that is in the same path towards specialization after qualifying, as stated in the CAPS document (2011). The senior primary phase student find themselves selecting an FET subject unaware that they will not even qualify to teach it at FET phase when they go into the teaching field. On the other hand the FET phase students who find themselves teaching other technologies like Mechanical, Civil and Electrical Technology see a huge gap between Technology I and II as well as their specialised FET Technologies.

Theme 2: Technology subject as not a Further Education and Training (FET) subject

A Technology I student said: *"I do not think that I made a right choice when choosing my subjects because I just realised that Technology subject is not what I wanted because it won't help me in the future. Therefore the university should make us specialize with Mechanical, Electrical and Civil Technology from year one because they are what we need as FET phase students."* An EGD III student said: *"My aim was to be a Mechanical Technology teacher in future and I knew that I will have to do EGD but my current Mechanical Technology III is different as compared to what I did in Technology I and II. My Mechanical Technology is a bit advanced."*

The above comments expose the extent to which students find themselves in terms of the importance and irrelevance of Technology subject to their entire four year course. Students' responses show that there should have been a brief description of what Technology subject entails before their registration period. Their comments show that the EGD III students doing Mechanical Technology are the only ones that see Technology subject relevant to them. Students see that, they also have a challenge in EGD as a subject which serves as a vehicle to the design process in the workshop. Students show that they have less self-belief in the Technology subject since they entered the BEd degree with their own expectations rather than what the course requires (Van der Bijl and Shortridge-Baggett 2002). They only concentrate on subjects that they 'love' like languages and dislike the subject Technology because of what it entails.

RQ's 1 and 2: TecTEBI students' questionnaire responses

Table 2 presents the quantitative responses of the Technology I, II and EGD III undergraduate students. The responses were a collective of RQ 1 and RQ 2 *(What are the undergraduate students' challenges in the Technology subject?),* and *(How relevant is Technology subject towards the undergraduate students' path to professionalism?).* The representations of the numbers which denote students' responses in the TecTEBI table are that the first number represents the first number is the frequency (F) and the second number represents the percentage (%).

Table 2 shows the quantitative responses of the undergraduate students in Technology I, II as well as EGD III. The table shows three of the 23 items that were on the TecTEBI instrument. A total of 48 students completed a TecTEBI questionnaire. 11 students (23%), of the sample agree to be confident in teaching Technology subject upon their degree completion whereas 21 percent of the students were uncertain if they will be confident in teaching the subject. Twenty-seven the students which add to 56 percent of the sample said they are not confident in teaching Technology subject. On the other hand 18 students (37%) agreed to have all the necessary skills to teach Technology subject with only 38 percent of the sample being uncertain if they do have the necessary skills to teach it. Eleven students (23% of the sample) said they do not have the necessary skills to teach Technology.

Seven students (14% of the population) said they can teach Technology like they do with other subjects or their second major whereas 29 students (61% of the sample) said they are unable to teach Technology subject much as confident as their other major subject. The students' responses show a misconception about the subject Technology.

DISCUSSION

In response to RQ's 1 and 2, the undergraduate students were requested to elaborate on

Table 2: TecTEBI Instrument

Statement	*Responses (N/(PERCENT)) where N= 48(F / %)*				
	SA	*A*	*UNCTN*	*D*	*SD*
1. I will be confident to be observed when teaching the subject Technology	6/ 13	5/ 10	10/ 21	16/ 33	11/ 23
2. I do have skills to teach the subject Technology	4/ 8	14/ 29	18/ 38	7/ 15	4/ 8
3. I cannot teach Technology like other subjects	4/ 8	3/ 6	12/ 25	10/ 21	19/ 40

their perceptions and the influence of Technology subject towards their degree. The findings on the focus group' interviews exposed students' lack of knowledge on Technology subject and that they did not have career guidance when choosing subjects during the registration process at the university. Students came into the Technology subject with an assumption that Technology subject will be more of computer hands-on subject rather than working with tools, designing and making prototypes. This then concurs with what Ankiewicz et al. (2000) said that Technology subject involves the systematic application of organized knowledge (synthesis) and tangibles (tools and material); which seem to be the lack of knowledge that the students had when they registered for it.

The fact that the undergraduate students entered the BEd programme with their own expectations on the Technology subject, affected their self belief about success in the Technology subject as it was alluded to by Van der Bijl and Shortridge-Baggett (2002). Therefore this seems to be the opposite from what the students had expected more simply because self-efficacy is what an individual believes he or she can accomplish using his or her skills under certain circumstances (Snyder and Lopez 2007). The fact that 13 percent of the undergraduate students do not feel confident in teaching Technology subject adds to what Bandura (1995) says that it "lack of belief in one's capabilities to organize and execute the courses of action required to manage prospective situations is detrimental to the success in learning a particular programme or unit".

CONCLUSION

The findings of the study reveal that the preservice teachers confuse the subject Technology with 'technological applications' in general. Students in the senior phase see Technology as a relevant subject but when they have to go and design a project before the making process they feel like they are in a wrong space. The FET phase students find EGD an interesting subject but they still feel that the subject Technology did not contribute greatly to their Mechanical Technology. Students' subject choices are also not informed because students do not know the pathways that the subject Technology creates for them and they also do not know which subjects are FET phase and which ones are not.

RECOMMENDATIONS

The recommendations for the study in its context is that the undergraduate students' need to be assisted in the subject choice when they enter the degree course in the Technology field because it is apparent that most of them come into the university with wrong ideas in as far as Technology subject is concerned. It would also be beneficial that during the career days in secondary schools, the information on Technology subject be fully explained to the students before entering the University sector.

ACKNOWLEDGEMENTS

This paper is dedicated to all the Technology Education students who are constantly faced with challenges of learning in adverse situations but endure because of the love that they have for development of their communities. We also would like to thank all the Johannesburg students who took part in this project.

REFERENCES

Ankiewicz P, De Swart E, De Vries MJ 2006. Some implications of the philosophy of technology for science, technology and society (STS) studies. *International Journal of Technology and Design Education,* 16(2): 117-141.

Bandura A 1995. Exercise of personal and collective efficacy in changing societies. In: A Bandura (Ed.): *Self-efficacy in Changing Societies.* New York: Cambridge University Press, pp. 1-45.

Bernard HR 2002. *Research Methods in Anthropology: Qualitative and Quantitative Methods.* 3rd Edition. Walnut Creek, California: Alta Mira Press.

Bless C, Higson-Smith C 2000. *Fundamentals of Social Research Methods: An African Perspective.* 3rd Edition. Kenwyn: Juta.

Bogdan RC, Biklen SK 2003. *Qualitative Research for Education: An Introduction to Theory and Methods.* Cape Town: Pearson.

Colbeck CL, Cabrera AF, Terenzini PT 2000. Learning professional confidence: Linking teaching practices, students' self-perceptions, and gender. *The Review of Higher Education,* 24(2): 173 -191.

Chisholm LA 2000. *South African Curriculum for the Twenty-first Century. Report of the Review Committee on Curriculum 2005.* Pretoria: Department of Education.

Chow A, Eccles JS, Salmelo-Aro K 2012. Task value profiles across subjects and aspirations to physical and IT-related sciences in the United States and Finland. *Developmental Psychology,* 48: 1612–1628.

Department of Basic Education 2011. *Curriculum Assessment and Policy Statement for Technology*. Pretoria: Government Printers.

De Vos AS 2002. *Research at Grassroot.* 2nd Edition. Pretoria: Van Schaik Publishers.

Lindner JR, Wingenbach GW, Harlin J, Li Y, Lee IH, Jackson R et al. 2004. Students' beliefs about science and sources of influence affecting science career choice. *NACTA Jour,* 48(2): 2-7.

Kalanda K 2005. Factors influencing college students' attitudes towards technology in Lesotho. *Journal of Technology Education,* 20: 1.

Kim JS 2000. *Students' Attitudes and Perceptions Toward Technology*. Retrospective Theses and Dissertations. USA: Iowa State University.

Lewis JL, Sheppard SRJ 2006. Culture and communication: can landscape visualization improve forest management consultation with indigenous communities? *Landscape and Urban Planning,* 77: 291–313.

Makgato M 2000. The Education and Training of Technology Teachers' for Learners in Grade 10 to 12 (NQF 2-4) in FET Institutions: A Challenge for Higher Education. *A Paper Presented at the 3rd Conference of International Collaboration in Community and Further Education and Training: A Strategy for the New Millennium in Cape Town*. International Association of Community and Further Education, Cape Town, 25-28 June 2000.

Makgato M 2011. Technological process skills for technological literacy: a case of few technology teachers at schools in Tshwane North District D3, South Africa. *World Transactions on Engineering and Technology Education,* 9(2): 119-124.

Niemann SM, Brazelle RR, Van Staden J, Heyns M, De Wet C 2000. Objectivity, reliability, validity and reliability in qualitative research. *South African Journal of Education,* 20(4): 283-286.

Ngulube P, Ngulube B 2015. Mixed methods research in the South African Journal of Economic and Management Sciences: An investigation of trends in the literature. *SAJEMS,* 18(1): 1-13.

Riggs I, Knochs L 1990. Towards the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education,* 74: 625-637.

Santos, JRA 1999. Cronbach's alpha: A tool for assessing the reliability of scales. *Journal of Extension,* 37(2): 1-5.

Snyder CR, Lopez SJ 2007. *Positive Psychology: The Scientific and Practical Explorations of Human Strengths.* Thousand Oaks, CA: Sage.

Tashakkori A, Creswell JW 2007. Editorial: The new era of mixed methods. *Journal of Mixed Methods Research,* 1(1): 3-7.

Teddlie C, Tashakkori A 2012. Common 'core' characteristics of mixed methods research: A review of critical issues and call for greater convergence. *American Behavioral Scientist,* 56(6): 774-788.

Van der Bijl JJ, Shortridge-Baggett LM 2002. The theory and measurement of the self-efficacy construct. In: EA Lentz, LM Shortridge-Baggett (Eds.): *Self-efficacy in Nursing: Research and Measurement Perspectives.* New York: Springer, pp. 9-28.

Paper received for publication on July 2015
Paper accepted for publication on December 2016