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How is Technology Education Implemented in South African Schools? Views from Technology Education Learners

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ABSTRACT The present study sought to establish learners' views on the learning and teaching of Technology Education (TE) in junior secondary schools in one educational district in the Eastern Cape Province of South Africa. The study employed both quantitative and qualitative approaches and adopted a case study design. A purposive sample of 40 learners learning technology in the 7th, 8th and 9th Grades participated in the study. The data was collected through a semi-structured questionnaire. Quantitative data were analyzed manually and qualitative data were analysed through content analysis. The study found that learners were motivated to learn Technology Education and considered it as an important practical subject in the curriculum. There were numerous challenges that affected the learning and teaching of TE in schools and these included lack of time and space as well as inadequacy of resources. The researchers concluded that an important subject such as TE may not be taught meaningfully and effectively under the current conditions and recommended that responsible authorities and curriculum planners should attend to the fundamental issues to ensure meaningful learning and teaching of TE in schools.

INTRODUCTION

The use of technology in education is becoming an increasingly important part of higher and professional education (Wernet et al. 2000; Almekhlafi 2006). Technology gives learners not only the opportunity to control their own learning process, but also provides them with ready access to a vast amount of information over which the educator has no control (Lam and Lawrence 2002). After a recent literature review of technology related professional development, Lawless and Pellegrino (2007) also called for a study to compare models of technology-related professional development and the study of scaling such interventions from a local to a national level (including the scaling up of provision to train large numbers of educators).

The International Society for Technology Education (2004) has proposed standards regarding educating all children in the use of technology to create products in the classroom, facilitate communication, solve problems and make decisions. Nowadays, education is emphasizing student activity and is, thus, making use of constructivist strategies where students construct their own knowledge bases and educators give less direct instruction by facilitating the learning process (Parette et al. 2000). Technology as a school learning area revolves around the technological process itself and provided a systematic approach to problem solving (Hatting and Du Plessis 2004). Technology and Technology Education (TE) motivates learners to develop their own skills and to construct their own solutions in order to solve everyday problems. Technology as a new learning area incorporates many of the principles which have been accepted internationally: design back from learning outcomes, learner-centered and hands on facilitation and continuous assessment (Hattingh and Du Plessis 2004).

It is advisable that young learners be taught the "language of technology" as a subject from an early age. This will help them to really understand the concepts related to TE. In addition, Fromkin and Rodnam (1993) stated that it is best to learn any language before puberty. Technology has its own language and hence introduction of technology education early enough is surely appropriate.

Kahn and Volmink (1997: 11) shared their vision for TE by stating that:

"… technology education will be part of the education of every boy, girl, educator and adult learner by the year 2005 with a view of them becoming creative, adaptable, critical, autonomous, entrepreneurial and employable citizens who can contribute meaningfully and

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responsibly to their own communities, South African society, and therefore, all stakeholders involved in education should work towards accommodating learners who experience barriers to learning, so that they will ultimately fulfill their roles in society optimally."

The literature on technology abounds with misrepresentations and stereotypical perceptions of technology and TE (Daugherty and Wicklein 2002). McCormick (1997) viewed that, TE has little or no established history as a learning area. It is this limited knowledge that has given birth to misunderstandings, misinterpretations and misrepresentations of what technology and TE really are. Misunderstandings can lead to misconceptions and misinterpretations and these may inhibit the proper implementation and the growth of TE and the advantages to be derived from such growth.

Curriculum Implementation

The Department of Education (DoE), curriculum planners, subject advisors and educators as curriculum implementers, members of the community should have a common understanding and vision of what curriculum should achieve. Labbo and Reinking (1999) noted that for a new technology to be effective in a literacy classroom, it must be accessible, able to enhance and transform traditional literacy instruction, and assist to empower learners for the future. The researchers have concluded that the effective teacher training is an important pillar for successful integration, implementation and sustainability of ICT in education (Culp et al. 2003; Haydon and Barton 2007; Somekh 2008).

The DoE and the curriculum planners, together with educators as curriculum implementers, are the drivers of the curriculum. Thus, the DoE, the curriculum planners and educators as implementers of the curriculum, should have a common understanding and vision of what curriculum should achieve. African National Congress (1995: 8) submitted that, any curriculum initiative will come to a grief if it is not supported by at least those people who stand to benefit from it and those that have to drive it. Pullias (1992) emphasized that Technology Education must be thought of as something new. Curriculum 2005 advocated that learning be a combination of knowledge, skills and values and attitudes. Van Rensburg et al. (1996) and Elmer (1998) stated that this holds true for TE as well.

Hall and Hord (2011) recently published guidance for this and the metaphor of the Implementation Bridge and four research-based constructs of the Concerns Based Adoption Model (CBAM) can be used to evaluate the extent of implementation and as diagnostic tools for facilitating implementation. The constructs of CBAM can also be applied in studies of relationships between the extent of implementation and student outcomes. The implementation bridge addresses the important components like outcomes. The explicit assumption with most of the innovations is that if they are used properly, there will be higher outcomes (like increase in student learning). When the perspective of an implementation bridge is employed, outcomes can be expected to vary with how far across the bridge each implementer has progressed.

The values and attitudes are often thought of as providing space for politicizing the learner in line with ideals entrenched in the Constitution of the Republic of South Africa, that is, "they also define the moral aspirations of South African democracies as defined in our Constitution and Bill of Rights" (James et al. 2000: 1-2). Lubisi et al. (1999) also alluded to value assumptions as necessary conditions for unfolding transformation. Van Rensburg et al. (1996) stated that skills and knowledge, and values and attitudes are "intertwined, inseparable and integrated, and not easily identifiable".

Technology Education Curriculum Implementation

In South Africa, the IPT (1998) acknowledged that the winds of change are blowing through the education system and these ought to bring in new challenges and problems. The change, however good, always brings with it skepticism, distrust and possible negative attitudes. To avoid any unwanted ramifications in the implementation of the Technology Education curriculum, first-hand investigations need to be conducted in the schools and the classrooms.

Maravanyika (1986) supported the above view by stating that to be conversant with the context within which curriculum operates does not mean only values, principles and skills a particular society cherishes are recognized. Maravanyika (1986) continued to state that most importantly, the understanding of the learners, their background at home and community, men-

tal and physical development, health, nutrition, interests and aptitudes also need to be given due consideration. The same author continued to state that poor and insufficient facilities and a lack of a culture of learning and teaching also add to the problems that prevent technology implementation from being successful. The same report emphasized that failure to win educator's support leads to many problems of curriculum implementation because educators are directly involved in classroom practice. It, further, alluded to technological literacy as an important factor in developing educator's confidence, enthusiasm and attitudes towards the implementation of Technology Education. From the research findings it is envisaged that there is still a lot to be desired from the government. Ramothea (1996: 13) too recorded a concurring view and put it thus: "… curriculum developers have to be conversant with the context within which curriculum operates to make it meaningful". Perhaps the largest constraint to the development of Technology as a learning area in schools is the fact that there is no general technology subject at tertiary level in South African institutions (De Vries 2007).

Pratt (1980) argued that technology implementation needs basic stages for preparation like educator training, assessment and improvement of institutional environment, provision of teaching and learning materials and the departmental support for educators in the classroom. Continuous contact must be made with implementers to offer advice, assistance and to promote mutual contact between departmental officials, educators as well as learners and parents. Cowan (2005) stated that schools should be adequately equipped with relevant resources. In addition, material (resources) should be provided as specified in the curriculum. Proper planning of workshops and the provision of follow-up support are necessary.

Challenges in TE Curriculum Implementation

The challenges in learning and teaching TE do not end with the design of policies. Garson (2000) concurred with this observation by stating that TE is a new learning area and educators are still grappling with understanding what exactly it entails. Different types of schools and different contexts require different approaches to curriculum choices and curriculum management. Pudi (2002) observed that former Minister of Education, Kader Asmal cautioned that there could be problems which may be hidden. According to Pudi (2002), curriculum planning and design is theory but implementation means converting the theory into practice. Making the two coincide sometimes leads to new problems that the curriculum designer as theorist did not anticipate. On paper, TE curriculum may seem implementable, but implementation of the curriculum is not done in boardrooms or offices but in classrooms. In the classrooms, the available facilities and technological resources, teacher qualifications and experiences and, educators' and learners' individual differences are heterogeneous.

Based on the survey data from 612 pupils in five English primary schools on children's engagement with Information and Communication Technology (ICT) inside and outside the school context, Selwyn et al. (2009: 919) observed that "… analysis of the data shows pupils' engagement with ICT to be often perfunctory and unspectacular, especially, within the school setting, where the influence of year group and school attended are prominent". They conclude that whilst the majority of children considers that, although, the use of ICT leads to gains in learning, there is a strong view that educational uses of ICT is constrained by the nature of the schools within which educational use is largely framed and often situated.

A number of barriers hinder technology integration. Almekhlafi and Almeqdadi (2010) observed that a number of barriers hinder technology integration such as time, access, support, resources and training. Similar or other factors have also been documented by researchers such as Flores (2002), Earle (2002) and Brinkerhof (2006). Brinkerhof (2006) pointed out that barriers are grouped into four main categories: Resources; institutional and administrative support; training; and experience and attitudinal or personality factors. Innovation and adaptation are costly in terms of the time needed to develop and establish new practices. There is government's drive towards the provision of opportunities and expertise for using ICT in all schools, yet significant weaknesses are supported by policy and practice.

The present subject curricula, assessment frameworks, and policies concerning the ICT use and implementation of technology education

seem to simultaneously encourage and constrain educators in using technology in the classroom. Key barriers that inhibit successful technology integration efforts were also researched. Among the list of critical factors are: availability and access to computers (Barron et al. 2003; Norris et al. 2003), availability of curriculum materials (Becker and Ravitz 2001), teacher's beliefs (Lumper and Chambers 2001; Ertmer 2005; Venkatesh and Abrami 2006), teachers' technological and content knowledge (Pierson 2001), and technical, administration and peer support (Ringstaff and Kelly 2002; Van Melle et al. 2003; Sandholtz and Reilly 2004). Pudi (2002) viewed that, access to education and to TE in particular is often inhibited by the realities such as poverty, budgetary constraints and lack of resourceful thinking from the policy makers, the schools or even the educators and the learners themselves.

Flores (2002) explored that the teachers face many barriers in their quest to incorporate technology: in addition to time scheduling for technology use and administrative support, equity is another important issue and the introduction of technology is particularly hard when there are few resources. Earle (2002) observed some barriers to the integration of technology in the classroom including both restraining forces that are extrinsic to the teachers such as access, time, support, resources, and training and forces that are intrinsic such as attitudes, beliefs, practices, and resistance. Deaney and Hennessy (2007) reported on contextual factors which serve as barriers such as lack of confidence, experience, motivation and training; inadequate access to reliable resources and classroom practices which clash with the culture of student exploitation.

Curriculum knowledge is primarily created outside the classroom by the experts who design and develop the curriculum innovation. Change is conceived of as a linear process, with educators implementing the innovation as developed in the classroom. The curriculum is evaluated to determine whether the planned outcomes have been achieved. Implementation is successful when the educators carry out the curricular changes as directed. If they do carry out the plan as intended, then the curricular change itself can be fairly evaluated. If they do not implement the innovation correctly or fully, then the change cannot be fairly evaluated because it was never really implemented. Fidelity was dominant perspective underlying the curriculum implementation research reviewed by Fullan and Pomfret (1977). The five factors found to inhibit implementation were:

(a) Educators' lack of clarity about innovation;
(b) Educators' lack of skills and knowledge needed to conform to the new role model;
(c) Unavailability of required instructional materials;
(d) Incompatibility of organizational arrangements with the innovation; and,
(e) Staff's lack of motivation.

Goal of the Study

The study sought to establish learners' views on the implementation of Technology Education in selected schools in one educational district in the Eastern Cape Province of South Africa.

RESEARCH METHODOLOGY

The study adopted both quantitative and qualitative methodologies. An explanatory sequential design was followed. In this design, quantitative data were collected first and qualitative data followed. A purposive sample as nominated by educators in the schools was utilized to select participants to the study. Forty learners were drawn from 20 junior secondary schools. A semi structured questionnaire was employed to collect data. A pilot study was conducted to validate the research instrument. Quantitative data were analyzed manually and content analysis was used to analyze qualitative data. The researchers also attended to ethical issues such as research permission and informed consent from participants.

RESULTS

Data from Learners:
Demographic Data of Learners

Biographical Variables of Learner Respondents

The data indicated that the majority (65%) of the members of the learner sample were in the 13-14 year age group and that the remainder (35%) were in the 15-17 year age group. Considering that the age for entry into school is 6 years,

at Grade 7, 8 and 9, the age should be 13, 14 and 15 years respectively, assuming that all enrolled at 6 years. However, 35 percent were in the 15-17 years indicating that all did not enrol at 6 years in Grade 1. In general, the responses indicated that the majority of learners do satisfy the admission requirements.

Nonetheless, the data that there was none at 18 years and above indicating that the parents enrol the children 6-8 years of age at Grade 1 for compulsory schooling. This is a healthy departure from the past of the apartheid era, when many children from rural areas did not enrol at schools even at 10 years, probably due to non-encouragement from the government and its agencies, non-availability of schools in rural areas and non-enthusiasm of parents. With the present data, one can conclude that TE is not a male domain. However, technology is a way of life for everyone, not just for men, and it was found in all spheres of life. It can be concluded that females were more than males in the sample.

Data in Table 1 revealed that the majority of the respondents were from Grade 8. It appeared that educators nominated learners mostly from Grades 7 and 8. The researchers did not get an opportunity to find out why they preferred to nominate more learners from these grades. The

Table 1: Biographical variables of learner respondents

Biographical variable	*Description*	*Number*	*Percentage*
Age	13 -14	26	65
	15 – 17	14	35
	18 and above	0	0
Gender	Male	16	40
	Female	24	60
Grade	Grade 7	13	32
	Grade 8	19	48
	Grade 9	8	20
Favourite Learning Areas	Languages	12	30
	Maths	20	50
	Commerce	5	13
	Technology	3	7
Years of Learning Technology	1 year	3	7
	2 years	3	7
	3 years and above	34	86
Self-assessment in Learning Technology	Poor	0	0
	Fair/Average	6	15
	Good	14	35
	Very Good	20	50
	Excellent	0	0

responses indicated that many learners enjoyed Maths and Languages more than Technology and Commercial subjects. It is surely a concern that only 3 out of 40 learners chose TE as the most liked learning area. It is possible that this may be because TE is a new Learning area and some learners are still battling to understand it. The data point to serious implications for the implementation of TE. The responses indicated that many students had been involved in TE for more than three years. While 50 percent of the sample assessed their performance as 'very good', 35 percent did so as 'good'. This means that 85 percent of the learners assessed their own performance as at least 'good' and this data is an encouraging one. Only a small percentage (15%) viewed their own performance as 'fair/average'.

Self-assessment is a valuable tool for effective learning because it provided learners with an opportunity to take responsibility for their own learning and gives them greater ownership of the learning which they undertake. Educators ought to teach learners to assess their own work critically as a life skill.

Learners' Responses on TE Curriculum, Implementation and Challenges

Data were gathered from the survey on learners' responses on the TE curriculum, implementation and challenges

This section provides learners' responses on the TE curriculum implementation and challenges. Each section had items where respondents were expected to respond by indicating the extent to which they agreed or disagreed with the statement.

From Table 2, the strongly disagree (SD) and disagree responses (D) were collapsed into disagree (D). Similarly, agree (A) and strongly agree (SA) responses were collapsed into agree (A) to generate Table 3 to summarise the data. Percentage figures were rounded off and the total percentage may differ slightly.

Analysis and Interpretation

TE as a Practical Subject

The majority of the respondents (90%) agreed with the statement that in technology, practical work enhanced learning. However, 10 percent of the respondents disagreed with the

Table 2: Learners' views

Items	*Responses*					
	SD	*D*	*NO*	*A*	*SA*	*Total*
1. In Technology Education practical work enhances learning more than written work.	0	0	4	25	11	40
2. The government has provided adequate textbooks for Technology Education.	5	13	3	11	8	40
3. Learners are motivated and positive towards Technology Education.	1	0	8	17	14	40
4. There is a lack of teacher-training for Technology Education.	8	13	4	13	2	40
5. Learners attitude towards the implementation of Technology Education are negative.	10	14	9	4	3	40
6. Cultural differences play part in the implementation of Technology Education.	15	8	12	5	0	40
7. Learning Technology is demanding.	2	2	7	24	5	40
8. Learners do not know what the Technology Education learning area really entails.	11	19	3	6	1	40
9. In Technology Education learning area, most lessons are child-centred.	1	1	2	21	15	40
10.There are enough subject-advisors to assist and support educators in the implementation of Technology Education.	2	13	9	9	7	40

Table 3: Summary of learners' views

Items	*Disagree (D)*	*No opinion (NO)*	*Agree (A)*	*Total*
1	0	4	36	40
2	18	3	19	40
3	1	8	31	40
4	21	4	15	40
5	24	9	7	40
6	23	12	5	40
7	4	7	29	40
8	30	3	7	40
9	2	2	36	40
10	15	9	16	40

view. The majority of respondents concurred that TE was a practical rather than theoretical subject. This could be interpreted as an indication of activity-based learning in the classrooms.

Provision of Adequate Textbooks for TE

Learners gave divided opinions with an almost equal split on the availability of textbooks. While 45 percent of the respondents disagreed and 48 percent agreed with the statement, about 8 per cent of the respondents were uncertain. Textbooks are important resources in schools and the present data indicated a serious challenge.

Learners' Motivation towards TE

Most of the respondents, (78%) agreed that they were motivated to learn TE. However, (20%) were uncertain. About 35 percent of the respondents disagreed. While learners are motivated and positive towards TE, the possibility of learning with understanding is enhanced.

Quality of TE Teachers

The majority of respondents (53%) disagreed with the statement, 38 per cent agreed and 10 per cent were uncertain. The learners were experiencing good teaching and learning experiences and this is a positive observation.

Learners' Attitude towards the Implementation of TE

Most of the learners (60%) disagreed with the statement and 18 percent agreed. However, 23 percent were uncertain. Today's students live in a digital age where computers are used in virtually every sphere of life. Students using ICT will be able to receive feedback while solving problems; this motivates the students and instils a curiosity that enabled them to learn more. In summary, the majority of learners (60%) had a positive attitude towards the implementation of TE. This indicates that the introduction of TE as a learning area was timely.

Cultural Differences and the Implementation of TE

Most of the respondents (58%) disagreed with the statement, which implied that most of

the respondents believed that cultural differences did not play a role in the implementation of TE. About 13 percent of the respondents agreed and 30 percent were uncertain. It is possible that all the members of the sample were from very similar cultural backgrounds and had never been exposed to multi-cultural contexts. Without such exposure, they could not see the possibilities of the impact of cultural differences on the implementation of TE.

The Demands of TE as a Subject

Most of the respondents (73%) agreed with the statement. However, 10 percent of the respondents disagreed and about 18 percent were uncertain. This core learning area aimed to promote all aspects of TE, including planning, design and manufacturing and surely, TE makes a lot of demand on the learners. Learners' realisation that TE is demanding will serve as a motivational factor for devoting attention to TE.

Learners' Knowledge of what TE Entailed

Seventy-five percent of the respondents disagreed with the statement, about 18 percent agreed and 7.5 percent were uncertain. This could indicate that they were conversant with policy stipulations for the implementation of Technology Education. The possibility is that educators (facilitators) help learners to understand what the technology learning area really entailed. This could have been possible by the educators providing an overview of TE to the learners at the very outset and reminding learners about the expected outcomes.

Learning Approaches in TE

Most of the respondents (90%) agreed that learning approaches centred on the learners, 5 per cent disagreed and 5 percent were uncertain. The majority of the respondents were of the opinion that Technology contributed to the learner's mastery of skills and students constructed their own solutions in order to solve everyday problems. The focus on learner-centeredness in the classroom is a positive factor, which is worthy of noting.

Support in the Teaching and Learning of TE

From the data, the learners seem to have divided opinions on this question as demonstrated by the almost equal split of the responses. 40 per cent of the respondents agreed with statement, about 38 percent disagreed and about 23 percent were uncertain. It is probably difficult also for learners to know whether there were enough subject advisors to assist and support educators in the implementation of TE except by gauging their involvement through the visits of subject advisors to schools.

Data Gathered Through Open-ended Questions

Question 1 sought to gather data about main problems which hamper technology teaching and question 2 sought to gather information about the steps required to improve the implementation process. Question 3 sought to gather data about kind of support given and provision of Learning and Teacher Support Material (LTSM) by the Department of Education.

DISCUSSION

The study established that lack of resources negatively affected the learning of TE in schools. Similarly, learners expressed concern on the inadequacy or lack of resources, equipment, materials, space, classrooms or technical rooms. Williams (2009: 241) concurs that "… many rural schools have very few resources and it will take many years before all schools enjoy a basic level of technology resources and equipment… " Findings of the present study were therefore consistent with issues raised by Wiliams (2009) of lack of space and resources.

The study further established that learners considered it important to learn TE in school. Wernet et al. (2000) and Almekhlafi (2006) had also observed that the use of technology in education was becoming an increasingly important part of higher and professional education. Further, Lam and Lawrence (2002) observed that technology not only gave learners the opportunity to control their own learning process, but also provided them with ready access to a vast amount of information over which the educator had no control. Given this context, the finding that learners agreed that technology brought about global change and that technology is essential due the world technologically advancing fast is pertinent.

It emerged from the study that TE provided learners with technical skills. This finding cor-

roborates the DoE (2002) vision in offering TE in schools as DoE (2002: 4) states that technology is "the use of knowledge, skills and resources to meet people's needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration". The learners exhibited a positive attitude to TE and its benefits.

Hall (2010) observed that the absence of a clearly defined national policy has been an ongoing problem in many schools. However, although the national policy in South Africa promotes district level support, the implementation of that support is poorly done as indicated by the consensus that DoE support is insufficient. Well back in the late 70s, McLaughlin and Berman (1979) drew attention to the need for district level support by stating that the greater the "real" district level support, the greater will be the degree of implementation, especially, administrative support.

The study found that the teaching and learning of TE, as stated by learners, was negatively affected by the lack of time as the learning area required more time for practical work. This finding is consistent with views by Earle (2002) that there were some barriers to the integration of technology in the classroom which included inadequate time provision as one of the restraining forces. The sample also concurred on the inadequacy time for TE.

CONCLUSION

It could be concluded from the findings that learners deemed TE a very important subject in the school curriculum in line with rapid technological changes in the world. The learning of TE was, however, affected negatively by challenges on time, space and resources.

RECOMMENDATIONS

To ensure effective teaching and learning of TE, there are fundamental issues that should be attended to by the Department of Education. Properly trained TE teachers should be teaching the subject and such teachers should be fully supported. Teaching of TE should not be done in ordinary classrooms hence, specifically, built workshops and laboratories should be made available. Material resources necessary for the teaching of TE should also be made available in schools.

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