TECHNOLOGY EDUCATION IN SOUTH AFRICA SINCE 1998: A SHIFT TO DECENTRALISED CONTINUOUS PROFESSIONAL TEACHER DEVELOPMENT

WERNER ENGELBRECHT, PIET ANKIEWICZ AND ESTELLE DE SWARDT

Department of Mathematics, Science, Technology and Computer Education, Faculty of Education, University of Johannesburg, Auckland Park Kingsway Campus, Auckland Park 2006, Johannesburg, South Africa.

Abstract

Traditionally a divide existed between faculties of education at higher education institutions (HEI's) and trade and industry, but the business sector is increasingly buying into community development with corporate social investment, especially regarding technology education. This paper reports on two continuous professional teacher development (CPTD) models that have been developed because of a shift in training. The first model entails trade and industry sponsoring learning support material (LSM) for technology education in under-resourced schools, paying for LSM through their corporate social investment funds. The second model builds on the first by not only supplying LSM, but also sponsoring CPTD of technology educators where they are trained to use the LSM more efficiently. Trade and industry, together with Higher Education Institutions (HEIs) and Education Departments, could change the traditional concept that CPTD is the education departments' responsibility into a new model where trade and industry share some of the responsibility for equipping educators with the necessary CPTD so that they can provide quality education.

This paper argues that because educators are not adequately trained (Khulisa 2001), and as a result of the opportunity for HEIs to become involved in CPTD, the following shifts are important:

- Using previously compiled learner- and educator-support material as a point of departure for the CPTD of technology educators will boost self-confidence and assurance.
- The partnership with trade and industry in the form of sponsorships for learner- and educator-support material and CPTD, and their involvement in compiling the material, plays an important role in the empowerment of technology educators to teach the learning area.

INTRODUCTION

Technology education was implemented for the first time as part of the new national Outcomes-Based Education (OBE) curriculum in 1998. Because of the limited time frame in which the new curriculum had to be implemented, there was very little time to adequately educate or train technology educators (the terms "teacher" and "educator" are often used interchangeably. For the purpose of this paper the term "educator" will be used throughout) in the learning area (Khulisa 2001). Educators are expected to implement technology in schools without being adequately trained with regard to content and/or instructional methodology. Because of the discontinuation of industrial arts subjects, qualified and competent educators in technical subjects such as Home Economics, Woodwork, Metalwork and Industrial Arts, were generally assigned the responsibility of implementing and teaching technology. These educators were confused by the introduction of technology education, because they were accustomed to traditional instructional methodology in the manipulation of materials and the use of technology within the context of their traditional subjects. They were not sure how to approach lesson planning in the new learning area and they were unsure of what to teach learners in class and how to facilitate it. Consequently, they taught content and skills related to their technical subjects by simply using a different approach, thus neglecting the procedural knowledge (technological process) as an essential feature of technology education (Ankiewicz 2003).

Another challenge for educators of technical subjects is that they are used to focusing on only one discipline, while technology education requires an educator to be well versed in various themes of technology. This implies a shift from the traditional individualistic approach, where each educator was responsible for his/her own subject, to a situation where an educator may not be an expert on all the subject matter that has to be facilitated in the curriculum. This shift results in educators having to teach certain themes without the necessary assurance and self-confidence: 'Nobody would be able to grasp all of it (technological knowledge)' (Ropohl 1997). In some schools this problem is being addressed by following a rotation programme where technology is taught by means of a team approach. Each educator is responsible for one theme and the learners rotate among educators. This method in turn gives rise to new problems. Where educators have been accustomed to an individual approach in the past, they are now expected to function as part of a team. This team-work approach is not always done justice (Ankiewicz 2003).

Educators were given the new policy documents for technology and were told that it replaces the old syllabus. This document is very confusing to most educators and very difficult to interpret if

one is faced with a new learning area one knows little about (Ankiewicz & De Swardt 2002). Because educators are ill equipped to implement a new learning area in which they have inadequate background or experience, educators must be trained, and this can be done by means of continuous professional teacher development (CPTD) (also sometimes referred to as INSET) to adapt to their new environment. Therefore, CPTD is a necessary response to a continuously changing education environment. It stands to reason that educators must be equipped with the necessary skills and knowledge to make the paradigm shift from their old subjects to technology education by means of CPTD (Potgieter 2004, Ankiewicz & De Swardt 2002).

In the South African context the national Education Department is responsible for formulating policy, also for CPTD, whilst the nine provincial Education Departments are responsible for the execution of national policy. Initially a cascade model was used for providing CPTD in order to equip educators to implement the new curriculum. In the South African context centralised CPTD implies training in which trainers from each province were trained by a service provider. These provincial officials then cascaded the knowledge and understanding to district officials who in turn cascaded the information to educators in their district. The huge extent of this need for CPTD and a lack of capacity within the provincial Education Departments to act as service providers have forced them to outsource these large scale CPTD projects to other service providers in South Africa. Traditionally the Education Departments (DOE) used their own infrastructures, namely the Colleges of Education, for delivering CPTD programmes to educators. Since the Colleges of Education have been amalgamated with Higher Education Institutions (HEIs) the Education Departments have lost this capacity (Potgieter 2004).

The DOE's recent strategy is to outsource CPTD to HEIs which have not been involved in such large scale CPTD projects in the past (Potgieter 2004). HEIs suddenly became involved in CPTD without having any substantial experience and, in some cases, without the required infrastructure. A number of submissions expressed concern that the Higher Education (HE) sector, colleges and non-government organisations (NGOs) are not adequately involved in the training process. Furthermore, CPTD had to take place within a very unrealistic time frame. These aspects have contributed to the fact that educators are generally not sufficiently trained. Where some involvement exists, it seems the messages sent are not always the same. These varied interpretations raise issues of quality assurance (Chisholm 2000, Chapter 4).

Most companies in trade and industry are, to some extent, concerned with technology. These companies are becoming increasingly willing to channel funds from their CSI funds into

programmes that promote and develop technology. As a result of the nature and essence of technology education, the involvement of HEIs with CPTD provided the opportunity to establish partnerships with trade and industry (Potgieter 2004). This is in itself a remarkable shift within an education faculty where the focus is primarily on social and human sciences. However, the nature of the partnership between HEIs and trade and industry with regard to CPTD still needs to be established/determined. The purpose of this paper is to explain/describe two CPTD models for such a partnership which have been employed by RAUTEC (a university based school technology centre).

The research questions addressed in this paper are:

1. Which CPTD models exist for the training of educators?
2. What are the training needs of technology educators in South Africa?
3. What is the impact of appropriate CPTD models on fulfilling the training needs of technology educators?

CONTINUOUS PROFESSIONAL TEACHER DEVELOPMENT (CPTD)

Introduction

In the literature the terms continuous professional development (CPD) and in-service education and training (INSET) are often used interchangeably. At the University of Johannesburg the term continuous professional teacher development (CPTD) is also used. Craft (1996) states that '...both terms are used to cover a broad range of activities designed to contribute to the learning of teachers who have completed their initial training. ... In practice, therefore, it is possible for the distinction between professional development and INSET to break down'. For the purpose of this article, the term continuous professional teacher development (CPTD) will be used.

CPTD could be defined as ongoing education and training for practising educators, with a view to assist them in keeping up to date with the rapid and numerous changes taking place in the school milieu (Collins 1991; Leclercq 1996). It mainly assists with the re-establishment of contact with theory and methodology in order to maintain the 'extended professional' (Collins 1991). CPTD assists in shaping educators who are not just skilled in the classroom, but who have a grasp of wider thinking about the learning area and about educational issues in general (Steyl 1998). In many CPTD programmes the emphasis therefore falls on upgrading the qualifications of already serving educators, rather than providing newly trained staff (Steyl 1998). CPTD is also necessary in

response to a continuously changing education environment. New curricula, different ways of evaluation and assessment of learners' progress and challenges from the political and social environment dominate the changes within the educational environment (Steyl 1998).

The objective of CPTD is the extension of content knowledge, instructional methodology and skills (Hunsaker & Johnston 1992; Leask 1995; Steyl 1998) and, most importantly, CPTD endeavours to transfer knowledge, skills and attitudes (Steyl 1998). CPTD may serve mainly two purposes, namely the empowerment of unqualified educators in order to assist them to survive in a profession for which they are not yet qualified, and the further development of qualified educators within a specific content area (Steyl 1998). CPTD is aimed at the development of all educational staff at all levels in the educational service, including classroom educators, senior administrators and school principals.

CPTD activities consist of formal and less formal processes. Formal processes are designed to enable development in specific target areas. Curriculum-based courses, as well as CPTD on instructional methodology, and training in response to change, are regarded as rather formal CPTD activities. Formal CPTD activities are believed to provide a concentrated focus on the specifics of change. The negative aspect of formal CPTD processes is that it implies the investment of time and money, as well as the possible disruption for the learners concerned. Less formal CPTD processes are those activities that happen during the normal life of a school. Mentoring, coaching, delegating, team-teaching and rotation of responsibilities are regarded as less formal types of CPTD (Steyl 1998). The following aspects are usually addressed in CPTD programmes:

- Equalisation of educators through upgrading academic and professional qualifications, as well as classroom skills and teaching strategies;
- Efficiency of classrooms and schools as microcosms through proper management training;
- Classroom competence through effective input on subject knowledge, theory, subject methodology and educational philosophy;
- Change brought on through curriculum development, social awareness programmes and CPTD for new roles such as multicultural teaching or religious and sex education;
- Empowerment through action research and educator-led initiatives (Steyl 1998).

Although there might be quite a number of prerequisites for successful CPTD, Steyl (1998) identifies the following four important prerequisites for any intended CPTD to be successful:

- A careful selection of appropriate participants, that is those that have the biggest need of this particular training and who are motivated to use it to full advantage;
- Efficient organisation that is the right environment to enable effective learning to take place, the right time of the day/school year and smooth administration. These aspects are frequently overlooked and may have disastrous effects on the quality of the CPTD provided;
- Effective delivery of the content of a CPTD programme. Good trainers who are knowledgeable, credible and skilful at enabling learning should be used in CPTD activities. A common weakness in CPTD delivery is to invite trainers who are experts in their field but who cannot communicate effectively with their audience. They need to be able to involve and motivate the audience into full participation;
- It is also important to review the success of a CPTD intervention with a view to improve the quality of activities and learning for the next time (Steyl 1998).

MODELS FOR CPTD

Several CPTD models exist (Gettly 2002). It is suggested that both centralised as well as decentralised structures are needed for effective CPTD (Steyl 1998). The models most commonly used are a centralised CPTD model, a school based CPTD model, a school-focused CPTD model and the cascade CPTD model (Edwards 1991; Conzemius; in Burke 1990; Craft 1996; Conner 1991; Groenewald 1995; Gettly 2002).

a) The centralised CPTD model

Craft (1996) refers to centralised CPTD as training where educators from different schools gather at a central venue for courses/workshops of a day or longer. The training personnel at centralised CPTD are normally associated with a higher education institute. Although the original notion was that centralised training should be managed by competent personnel of the HEIs who would ensure that the planning, presentation and training material are of high quality, during the evaluation, the training model was found lacking in many respects (Gettly 2002). ‘Although educators do find such courses stimulating (acquiring new ideas and exchanging experiences with educators from other schools), the (centralised) model has some disadvantages, namely gaps between theory and practice (Craft 1996). Gettly (2002) and Craft (1996) describe the gaps in this model as follow: inappropriate aims on macro level do not comply with the true needs and expectations of the educators; inapplicable activities where no regard for the outcomes has been shown, are planned and educators lack motivation because they are unwilling to attend training as they are not

adequately reimbursed for further qualifications. Finally it is not very popular as educators' private lives are disrupted and single parents struggle to fit it in.

b) The school-based CPTD model

According to Edwards (1991) a school-based CPTD model has as basic point of departure that training occurs within the normal working milieu and is managed mainly, but not completely, by the school's own personnel in order to fulfil the immediate and specific needs of the school (Gettly 2002). The school-based CPTD model was developed in an effort to overcome the problems of the centralised CPTD model (Craft 1996; Gettly 2002). According to Craft (1996) the purpose of school-based CPTD is '…achieving a better match of a CPTD course to the need and culture of a particular group of professionals'. Craft (1996) is of the opinion that all CPTD should be school based. In the words of Edwards (1991): 'The most effective efforts for change to take place close to the action, are concrete, educator-specific, are focused on practical problems, involve educators in project decisions, include classroom assistance, and have regular meetings that focus on practical problems'. From the above description, Gettly (2002) concludes the following:

- Training should be aimed at the needs and expectations of the educators;
- Training should be practical;
- Training should occur continuously;
- Training should give educators the opportunity for professional development and growth;
- Although the education authorities are not involved in the training, which could result in training becoming isolated, the HEIs' quality control of this training model will prevent this isolation;
- The school management team must be informed and supportive.

According to this model aspects like a lack of financial support and continuity may, however, be problematic because of continuous change of personnel (Leckstein 1994).

c) The school-focused CPTD model

The term school-focused CPTD refers to training which occurs at or away from the school and is presented by agencies like higher education institutions, educationalists or the school itself (McBride 1989). The roles and functions of role players in the compilation, planning and implementation, to comply with the needs of an individual school and personnel, receive attention

here. School-focused CPTD therefore complies with the needs of the school as organisation, including the needs and expectations of each educator as individual (Gettly 2002).

According to Conner (1991) school-focused CPTD should be based on needs identified by the educators. In England Day (1999) refers to 'professional development' as '... all natural learning experiences and those conscious and planned activities which are intended to be of direct benefit to the individual, group or school and which contribute, through these to the quality of education in the classroom. It is a process by which, alone and with others, educators review, renew and extend their commitment as change agents to the moral purpose of teaching ...'. From the literature Gettly (2002) deduces the following advantages:

- School-focussed CPTD contributes directly to the improvement of the quality of education of the educator and school;
- Collaboration between colleagues, principal and school management team and support for the training contribute to the professional growth of the educator and promotes transformation;
- The principal/school management team should have the ability to motivate educators to become actively involved in this training;
- Educators are given the opportunity to be trained in the development of learning programmes (curriculum development);
- When 'external agencies' are not involved in the presentation of the training, it is because it is expensive and schools cannot always afford it (Mortimore & Mortimore 1989).

d) The 'cascade' CPTD model

The 'cascade' model is an effort to combine centralised CPTD and school-based CPTD. It is a training programme in which large numbers of educators from different schools are involved and trained during centralised CPTD (Craft 1996). This approach differs from centralised CPTD as the message is 'cascaded' from top to bottom. This implies that dissemination of a central message is built into the training (Craft 1996; Gettly 2002).

The cascade model was initially used as an advocacy strategy by the DOE to provide CPTD to educators to enable them to implement the new national curriculum. This training was a bold attempt to popularise OBE and demystify the new national curriculum at a time when there was much confusion and anxiety. This training was implemented by training 20 officials from each province through a service provider commissioned by the national DOE. These 'master trainers'

then cascaded the information to district officials, who cascaded the information to educators in their districts. Large numbers of educators gathered at central venues for this training and were supposed to 'cascade' the message down to colleagues. Each time the information was cascaded, the message became more diluted and distorted. The cascade model has been widely criticised as an inadequate model for delivering effective training (Khulisa 1999; CEPD 2000; HSRC, 2000; University of Pretoria and NAPTOSA submissions). It failed to prepare either officials or school-based educators for the complexity of the implementation of the new national curriculum. In the first instance the 'cascading' of information resulted in the 'watering down' and/or misinterpretation of crucial information. Secondly, trainers lacked confidence, knowledge and understanding to manage the training process (Khulisa 2001).

District officials who conducted training were criticised for not understanding the terminology themselves and for using teaching methodologies that were not in line with OBE (Bryanston Primary School, COUNT, Free State Education Department, Gauteng District Training Team, Gauteng Education and Training Council, Heine, Waja submissions) and too many of those who facilitated the training have been out of the classroom for too long. The training also created misconceptions that textbooks and content knowledge were no longer necessary in the new paradigm (Chisholm 2000, Chapter 4).

CURRENT TRAINING NEEDS OF THE TECHNOLOGY EDUCATORS

From experience with postgraduate students, Advanced Certificate in Education (ACE) students as well as educators encountered in CPTD workshops, observations were made with regard to the competency of technology educators. Educators have not been given sufficient CPTD through the cascade effort of the DOE to help them cope with OBE in general and specifically with technology education. Technology educators are ill equipped to function within an OBE education system and lack the necessary knowledge (conceptual and procedural) regarding the different themes within technology namely processing, structures and systems and control (Ankiewicz, 2003; Reddy, Ankiewicz, De Swardt & Gross, 2003; Potgieter 2004). These observations are supported by the findings of the Khulisa report on the evaluation of OBE in the Gauteng province, submitted to the Gauteng Institute for Curriculum Development (Khulisa 2001).

Educators of other learning areas have the advantage that their learning areas are based on familiar 'subject matter', in other words the content is roughly the same as it was in the old subject they used to teach, whereas Technology is a whole new learning area, with unique content which is foreign to

most educators. Technology does not have an established academic discipline on which it is based – its academic discipline must still be determined. Rather it is a poly-discipline with content from various other disciplines (Ankiewicz 2003).

Technology education is supposed to cover as many as possible of the themes of technology, namely Structures, Systems and Control, Materials and Processing, as well as Communication (Potgieter 2004; Ankiewicz & De Swardt 2002). Many educators have a lack of experience of the various themes of technology in their frame of reference. Systems and Control is divided into mechanical systems, electric and electronic systems, as well as pneumatic and hydraulic systems. Materials and Processing is divided into the processing of food, textiles and resistant materials. Many educators do not have the necessary competence (knowledge and skills and instructional methodology) to facilitate technology properly. They do not know how electrical and mechanical systems work or how they are controlled. Very few educators know what orthographic projection is, or what the difference between tension and compressive forces in a structure are (Potgieter 2004). It stands to reason that if educators are not familiar with the learning area content that needs to be facilitated to learners, they cannot expect their learners to excel in their class.

A common misconception among management, educators, and even parents is that educators who used to teach technical subjects such as woodwork, technical drawings and home economics are ideally suited to teach technology education. The problem with this notion is that any technical subject focused on only one specific aspect or theme of technology, and then typically focussed on the knowledge and skills required to process a specific kind of material (for example Woodwork, Metalwork, Fitting and Turning, Home Economics, Technica Civil etc.), or making, manipulating and maintaining certain systems (for example Electrical work, Motor mechanics, Electronics, etc.). Technology education's procedural knowledge differs from that of technical subjects. Technical subjects also do not take the subject philosophy of technology education (Ankiewicz 2003) into account. While technology education is based on the technological process, technical subjects, however, are not. Thus technical educators generally do not facilitate technology education in the manner it should be done. Educators from technical subjects often tend to focus on the making of some kind of product, neglecting most of the technological process and the vital procedural knowledge component. This is mainly due to the fact that they are not familiar with the philosophy of technology (Van Niekerk 2003; Ankiewicz 2003). These educators need intensive CPTD for them to make the ‘mind shift’ necessary to become efficient technology educators.

Technology educators do not know what is expected from them with regard to assessment, or how to manage and record assessment in class. They have limited experience with regard to the design and use of assessment instruments. Educators receive guidelines and lists of minimum requirements for portfolios from the Department of Education (Gauteng Department of Education 2003), without sufficient guidance on how to assess, and manage the assessment of the work required for the portfolios. In order to do worthwhile assessment in technology education, the educator needs to assess more than just the final product, otherwise only summative assessment takes place, which does not comply with the prerequisites for OBE. Educators lack a clear framework for assessment (Van Niekerk 2003) to help them assess learners' work according to the formative and summative assessment aspects of the technological process with its stages and thinking sub-processes (Van Niekerk, Ankiewicz & De Swardt 2005).

Content (knowledge, skills and attitudes) is the vehicle needed for achieving the outcomes of technology. In learning programmes the content of technology can not unilaterally include conceptual knowledge of technology as artefacts, but should also contain procedural knowledge on the design and making of such artefacts, and vice versa: '… it is the possession of conceptual knowledge that makes possible the effective use of procedural knowledge of problem solving' (Glaser 1984; in McCormick 1997). 'As the complexity of devices increases so does the importance of the interaction of device knowledge and procedural knowledge' (Gott 1988; in McCormick 1997). Educators must facilitate the technological process because learners need to practise the application of the procedural knowledge of technology education (in other words learners need to identify a problem, investigate possible solutions to the problem, design a suitable solution to the problem, produce the designed solution and then evaluate the solution themselves), focusing on the different themes of technology within different contexts in order to make them fluent in the use and application of the technological process (Ankiewicz 2003; McCormick 1997; Mawson 2003). If educators do not possess this 'vehicle', they cannot effectively teach or facilitate it to learners, and the learners cannot be expected to attain the outcomes. If an educator of a technology class lacks knowledge or skills with regard to the learning area content, it has a direct impact on his/her learners (Ankiewicz 2003; Reddy et al. 2003).

Integration of (conceptual) knowledge from other learning areas is important for technology education. Knowledge, skills and attitudes needed to solve technological problems can be sourced from other learning areas such as Science, Maths, Arts and culture, etc. But this does not happen by itself, and learners need intensive guidance from educators for successful knowledge transfer (Ankiewicz 2003; Johnson 1997).

To present technology education in a meaningful way at school – to convert the learner into a 'young technologist' – it is necessary for the education sector to enter into partnerships with trade and industry. Although learning support material is available, schools do not have sufficient funds to supply learners with the material. Partnership with trade and industry provides a solution for this problem, by providing funds for learning and educator support material (school-based CPTD) and school-focused CPTD from their Corporate Social Investment budgets. RAUTEC has followed the following two models for CPTD based, inter alia, on the prerequisites of CPTD (Steyl 1998; Gettly 2002).

DISCUSSION OF RAUTEC'S CPTD MODELS

Model 1: A school-based CPTD initiative

RAUTEC is involved in social upliftment programmes that commit the University of Johannesburg and trade and industry to a mutually beneficial partnership since they are funded out of the corporate social investment funds of trade and industry. This new development emerges when partners from the private sector use funds earmarked for social upliftment to provide learning support material to schools and CPTD to educators. The Anglo Platinum (a platinum mining company) Schools Project has pioneered this development, and learning-support material (LSM) as well as educator-support material (ESM) were provided to five schools in the Rustenburg region since 2003. Bateman Africa (a mining engineering company) has not hesitated to follow the example set by Anglo Platinum and, based on the same model, dubbed the Technology Education Catalyst Project, sponsors LSM and ESM for two schools in the Boksburg district through their CSI funds (RAU Rapport 2004).

Each learner is supplied with a learner workbook whereas the educator is equipped with a facilitator guide. This model could be seen as pseudo-CPTD for the educator. Although no formal training of the educator takes place, the facilitator guide serves as a complete 'training guide' on how to facilitate a module. It provides instructions and advice with regard to class management, assessment, explanations of conceptual knowledge, time planning, etc. (Ankiewicz, De Swardt & Engelbrecht 2005; De Swardt, Ankiewicz & Engelbrecht 2005). The learner workbooks are used in normal class time and the educator interacts with the facilitator guide on his/her own. Thus this model could be seen as a less formal type of CPTD, and is school based. The purpose of this form

of CPTD is to upgrade educators' classroom skills and instructional methodology and to provide educators with the necessary content knowledge.

Each of the LSM and ESM modules provided to these schools is typically presented over a period of seven weeks. Schools can choose from a variety of seven modules for each of grade 8 and grade 9, as well as four modules for Grade 7, and are usually supplied with enough modules to facilitate technology for a full school year. If the sponsors require it, schools are observed while implementing the LSM and ESM in order to establish how they actually utilise the sponsored material. In such cases, the schools are visited, samples of learners' work are observed and interviews and feedback sessions are held with the educators. Questionnaires are also given to educators to complete. The completed questionnaires, transcripts from the interviews and photographs of the learners' work are then used to compile a progress report for the sponsor. Educators involved in the sponsored intervention have the option of contacting RAUTEC staff for support should they need additional help. Progress reports to the sponsors are made as required. Based on this report by RAUTEC, a school will be allowed to proceed with the next module.

In order to establish the impact of the pseudo-CPTD 'intervention' more research is underway to determine the impact of the LSM and ESM (Ankiewicz et al, 2005; De Swardt et al, 2005). In one case two educators and the head of the department completed a questionnaire and RAUTEC lecturers visited the school twice, and conducted a focus-group interview. The principal and head of department of the school participated in the interviews. The purpose of the questionnaires and interview was to determine the impact of the school-based CPTD. During the interview participants were required to comment on their experience as educators working with the LSM and ESM. The questionnaire focussed on the role of the LSM and ESM during instruction, the aspects included in the LSM and ESM, aspects to be either added or omitted from the LSM and ESM, the content knowledge included in the LSM, the manner in which the LSM has been structured around the technological process, and general comments.

Preliminary research findings (the research project is still in its infant stage) regarding the impact of RAUTEC's school-based CPTD initiative are discussed below. Quotes collected from questionnaires and a focus-group interview is provided as evidence.

a) *The LSM and ESM as part of RAUTEC's school-based CPTD initiative fulfilled the technology educators' needs and expectations*

The LSM and ESM were developed to assist educators, who have never been exposed to technology education, with regard to content knowledge and instructional methodology, as discussed in the previous paragraphs. Regarding the role that the facilitator guide plays during teaching, educators involved commented that the facilitator guide is easy to use and that the sample answers for activities give them an indication of what to expect from the learners and assist them with assessment. They commented that the facilitator guide contains valuable information and guidelines for the educator, and that it gives a clear explanation of how to facilitate the module, and how the activities relate to the departmental policy. Generally technology educators felt that the LSM and ESM are aimed at their needs and expectations:

> *'The workbooks are very good and almost all aspects and knowledge are included'.*
> *'I find the facilitators' guide to be a comprehensive plan of work for several weeks. All that the educator needed to do was to manage the learners' pace while working'*
> *'(the LSM) clearly explains how to conduct assessment, how to allocate marks and that makes my job easier.'*
> *'...I found the learner's workbook to be a source of background information, a worksheet, an instruction sheet, in fact it is the whole curriculum in one book'.*
> *'... clearly defined capability task – you have project brief and material to be used and tools are easily obtainable.'*

Educators commented positively on the impact of the LSM and ESM, giving an indication that the intervention has impact:

> *'All the activities are prepared, I just have to facilitate and give guidelines where necessary. I do not have to think which activity to give during learning and teaching, everything is there...'*
> *'It is good that the guide has background notes for the teacher and model answers and ways of assessing and evaluating achievement. This makes the task easier for the educator and his curriculum is complete.'*

Over time educators should become familiar with the content and methodology to such an extent that they will be able to develop their own material, thus the ESM gives educators the opportunity to develop and grow professionally.

b) *Effective learning resulted from efficient organisation by the technology educators involved in RAUTEC's school-based CPTD initiative*

The sponsorship supplies learners and educators with sufficient LSM for a year, thus the training, in the school, takes place on a continuous basis. The LSM supplied to the learners and educators serves as an example to educators of how a technology learning programme should be developed and facilitated. It is facilitated to learners in the educator's usual classroom during normal school time – the ideal environment for CPTD, as this is where the educator will facilitate future learning programmes as well. One educator commented that he had to adapt the environment because the noise his learners made while making artefacts was disturbing a senior Science class next door. The technology educators ended up moving the technology classes to a different venue:

> '*...the problem is as I said is space and accommodation like if you plan to do the project in class today there is a Science class today next to you ... there is a technology class here and they have to use a hammer to build that (noise of hammering on table) they disturb that other class you see and even ... we have tried now to make sure that we ... accommodate grade eight and nine in a class where it is sound proof ... that is why we tried to put them there where we know that we won't disturb other classes.*'

Besides sponsoring LSM for schools, RAUTEC has involved trade and industry in another way. The essential features of particular technologies (for instance, concrete and mining) become apparent when they are applied in the daily functioning of trade and industry and it is important to introduce learners and students to real-life technology. The workbooks on the processing of cement and concrete which have been developed in co-operation with the Cement and Concrete Institute (C&CI) are excellent examples of partnerships with trade and industry that does not just involve financial sponsorship. Two civil engineers from the C&CI personally gave input on the compilation of the cement and concrete LSM and ESM. The C&CI also supply an instructional video to each school acquiring the material.

Model 2: A school-focused CPTD initiative

As an extension of the first model, Anglo Platinum sponsored the training of 120 technology educators in the Bojanala West region in Northwest in three key RAUTEC modules during 2004. Anglo Platinum has approved workshops for 160 technology educators in 2005. During 2004 educators were provided with a workshop for each theme of technology, i.e. one workshop each on structures, systems and control, and processing.

In this model educators attend workshops at a central location outside of the classroom situation. This could thus be described as formal, school-focused CPTD. The purpose of this CPTD is to upgrade educators' classroom skills and teaching strategies and to provide educators with subject knowledge, theory and instructional methodology. These workshops are organised in conjunction with the regional office of the provincial department of education and presented by RAUTEC lecturers.

Educators are invited to these workshops by the Department of Education – they must be consulted when dates and themes for these workshops are chosen. The provincial DOE is also responsible for providing venues at central locations. The educators who are invited to these workshops are typically from rural schools with limited resources. Every effort is made to keep the materials they process and the tools they use as accessible as possible, so that they could replicate the workshop in their classrooms with the minimum financial implications, using basic tools and, as far as possible, recycled material.

All the tools and materials needed for the workshops are prepared beforehand and transported to the venues where the workshops are facilitated. The workshops focus on typical learner activities that the educators will have to physically facilitate in the classroom.

In order to establish the impact of the workshops, educators completed questionnaires after each workshop. The purpose of these questionnaires was to determine the impact of the school-focussed CPTD. Half of the educators who attended the workshops were chosen randomly to complete the questionnaires and the other half completed the DOE's questionnaires. For five different workshops 286 participants completed the questionnaires in total. The following open-ended questions regarding the perceived quality of the content and the presentation thereof were answered anonymously in order to establish the impact of the intervention:
Did the workshop meet your needs and expectations?

Provide reasons for your attendance of the workshop.
How did you experience the organisational aspects of the workshop?
What is your experience of the competence of the workshop facilitator?
Which other information with regard to the workshop would you like to convey to us?

Preliminary research findings (the research project is still in its infant stage) regarding the impact of RAUTEC's school-focussed CPTD initiative, are discussed below. Quotes collected from the questionnaire responses are provided as evidence.

a) *The LSM and ESM as part of RAUTEC's school-focussed CPTD initiative fulfilled the technology educators' needs and expectations*

The workshop activities are based on ESM to assist educators who have never been exposed to technology education, be it the implementation or instruction thereof. The workshops fulfilled technology educators' great need for this particular training, and this need can be deduced from their written remarks below. The workshops equipped educators with knowledge and skills that contributed to better instruction practices and helped to improve the quality of education that the educator provides.

We found that educators generally have a positive attitude toward the workshops, and many of them travel quite a distance to attend the sessions. Where specific educators from a certain school cannot attend a follow-up session, they send a colleague to attend the sessions so that they will have access to the information. This collaboration between colleagues and the expectation to benefit from the workshops illustrate a will to grow professionally and promote transformation. Educators also expressed the need for their superiors to be involved in their CPTD. Quite often heads of department do attend the workshops, and in one case a principal attended a workshop with a new technology educator. The quotes below indicate that the participants have a need for CPTD:

> *'Wishing to have more of these workshops in future.'*
> *'I hope for the workshop to continue as it gave me a green light especially on this learning area. ...This is a plea to train us on the modules we missed. I missed (the) structures workshop and it is also very important to me to complete the course.'*
> *'The content of the course was very relevant and fruitful to us as educators'.*
> *'I think this type of workshops should continue to empower educators more on technology'.*

'Heads of department and principals should be invited to these courses so that when they moderate us they know what is expected of us'.

'Course content is excellent as well as the handouts'.

'It was an eye opener course for me as most of the technology problems I encountered are now solved'.

b) *Effective learning resulted from efficient organisation by the facilitators involved in RAUTEC's school-focussed CPTD initiative*

The efficient organisation of the workshops takes a lot of planning and preparation on the part of the facilitators (RAUTEC lecturers). Tools and materials have to be sourced and prepared in advance. ESM and additional handouts need to be prepared and duplicated. Materials, tools and ESM need to be transported to the sites where the workshops take place. Great effort is made to ensure that the workshops start and end on time. The workshops are not scheduled over weekends or holidays, but rather during work hours in an attempt to keep educators positive, and are facilitated in venues that are centrally located so as to be accessible to as many educators in the district as possible. Both venues used to facilitate the workshops are situated in rural areas. No direct comments were made with regard to the appropriateness of the environment in which the workshops were facilitated or the efficiency of the organisation thereof, but the fact that educators were satisfied with the workshop facilitation indicates that the environment was conducive to the effective delivery of the CPTD content. The following comments are evidence of the appreciation of the educators:

'The lessons were well presented with very good examples'

'Excellently presented. I understood everything.'

'Good presentation, especially ... practical sessions, it promoted class participation.'

c) *Competent facilitators contributed to effective delivery of RAUTEC's school-focussed CPTD initiative*

Workshops are not delegated to secondary service providers, but are prepared and facilitated by knowledgeable and competent HEI staff that is also co-authors of the LSM and ESM, experienced in educator training and facilitating practical activity-based workshops. Educators made the following written comments on the presentation of the workshop:

'Presentation was good. The presenter knew his work'.

'(presentation was) wonderfully done by a knowledgeable person, makes lesson very interesting...'

'... please don't change the facilitator because he is good in facilitating all the modules.'

The workshop activities are based on the LSM, and the ESM is incorporated where applicable. This provides them with some resources to facilitate the RAUTEC modules with confidence, focusing on aspects such as classroom/workshop management with regard to tools and materials, safety precautions, assessment of learners' work and the administration thereof. Educators are also given some practical pointers on preparing activities in their classroom, managing group work etc. They are also made aware of the aspects that need to be taken into account when designing their own learning programmes (curriculum development).

According to the evidence provided, the workshops were very successful. The impact of the intervention on the actual classroom practice of the educators involved will, however, have to be investigated further. Suffice to say that the educators' positive experience of the school-focussed CPTD is a good start on the road to good technology education teaching and classroom practice.

The training is provided by knowledgeable, experienced lecturers who do research in the field of technology education. The LSM and ESM are written in collaboration with postgraduate students who are technology educators themselves. The learning programmes that the LSM and ESM are based on were first facilitated in a classroom by those experienced educators.

The school-focused CPTD is well organised and prepared. Punctual arrival for and time management during the workshops are strictly adhered to. Every effort is made to make the experience as hands-on as possible, as well as to keep the presentation as exciting and energetic as possible. During these presentations educators make artefacts that they can take home to be used with great effect in their own classrooms. This gives the educators a sense of ownership and they feel that they have actually made something worthwhile. The deduction can be made that technology was demystified to a great extent.

A strong feature of the school-focused CPTD model is the fact that the same lecturers facilitate the training throughout. In our experience this has helped to establish a growing relationship between trainers and educators and contributes to a positive learning environment.

The continued involvement of both sponsors for the school-based and school-focused CPTD models indicates that the interventions are of an acceptable quality. This is also evident in the fact that Anglo Platinum virtually doubled their sponsorship for 2005!

CONCLUSION

Aspects usually addressed by CPTD, as well as important prerequisites for effective CPTD were cited at the hand of the literature. The following popular models for CPTD according to the literature were discussed in this paper: the off-site or centralised model and the cascade method in which it was endeavoured to link off-site and school-based CPTD, the school-based model and the school-focused model. The off-site-cascade model combination was found to be problematic.

At the hand of observation and feedback from educators it would seem that the school-based and school-focused models for CPTD are appropriate where technology educators need to be trained by HEIs, and where training is sponsored by trade and industry.

Judging by the feedback received from educators involved, both the school-based and school-focused CPTD interventions outlined, sponsored by trade and industry, were successful in providing training to educators that addressed their needs and problems, equipping them with conceptual knowledge with regard to the technological themes, procedural knowledge with regard to applying the technological process, and new insight into the instructional methodology of technology education. In the feedback a certain change in mindset has become evident, and as mentioned before the educators' positive experience of the CPTD is conducive to good classroom practice. The fact that trade and industry sponsor these CPTD interventions make it very accessible to a wide audience without finances being a limiting factor.

Admittedly this research is still in its infant stage, and more research is necessary to determine the full impact of the project. The preliminary findings discussed in this paper do however give an indication of what can be further researched.

The emerging model of trade and industry becoming involved in CPTD by forming partnerships with HEIs to provide educators with much needed training in the region where the industry is based, signals an important and valuable acknowledgement of the responsibility that trade and industry have to the community in which they operate. The benefit that such a company could give back to

the community in the form of having more competent educators in front of their children in the classroom is invaluable to the future of such a community and to the company concerned.

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Principal Author:

Mr Werner Engelbrecht

Mr Werner Engelbrecht holds a BEd Hons (Technology Education) from the Rand Afrikaans University. He is a lecturer in technology education at the University of Johannesburg, with special interests in teacher education, continuous professional development and developing learner support material. He teaches and researches in these areas and is also appointed Manager of the RAU Centre for Technology Education (RAUTEC).

His address is:

Department of Mathematics, Science, Technology and Computer Education

University of Johannesburg

Auckland Park Kingsway Campus

P.O. Box 524

AUCKLAND PARK

2006

South Africa

Tel. +27-11-489-3528

Fax: +27-11-489-2048

E-mail: we@rau.ac.za

Co-authors:

Prof Piet J Ankiewicz

Prof Piet Ankiewicz holds an MSc (Physics) and a DEd both from Potchefstroom University for Christian Higher Education. He is professor of technology education at the University of Johannesburg, with special interest in the philosophical and theoretical foundation of technology education, instructional methodology, learning programmes and learners' attitudes towards technology. He teaches and researches in these areas, and is also appointed Head of the RAU Centre for Technology Education (RAUTEC).

His address is:

Department of Mathematics, Science, Technology and Computer Education

University of Johannesburg
Auckland Park Kingsway Campus
P.O. Box 524
AUCKLAND PARK
2006
South Africa
Tel. +27-11-489-2640
Fax: +27-11-489-2048
E-mail: pja@rau.ac.za

Prof Estelle de Swardt

Prof Estelle de Swardt holds an MEd (Technology Education) and a DEd both from the Rand Afrikaans University. She is an associate professor at the University of Johannesburg and is presently involved in the training of teachers for technology education with a special focus on critical and creative thinking development.

Her address is:
Department of Mathematics, Science, Technology and Computer Education
University of Johannesburg
Auckland Park Kingsway Campus
P.O. Box 524
AUCKLAND PARK
2006
South Africa
Tel. +27-11-489-2695
Fax: +27-11-489-2048
E-mail: aeds@rau.ac.za