Action Research study with Technology teachers in Limpopo Province of South Africa: an Emancipation recipe for Technology teachers

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Abstract

The extent of South Africa's (SA) un- and under- qualified teachers amongst technology senior phase teachers has intensified and reinforced that action research (AR) be regarded as a tool for emancipation in the teaching of technology as is apparent from this study. The purpose of the paper is to report DEd inquiry findings from the action research activities that took place in selected schools of Limpopo Province. For technology education – a foreign concept to many teachers and a new learning area in the school curriculum both nationally and internationally – has found its way into the school environment successfully and effectively through engaging informants with the action research approach. In all the spiral activities of planning, observation, action and reflection during the AR cycle contact sessions with participants, the main goal was to address the following research question: *How can an action research intervention be used to improve the teaching practice of senior phase technology teachers who are under qualified?* The presenters argue that inadequate training of technology teachers impacts negatively on their teaching practice. The study did identify the gaps and an appropriate progressive intervention was embarked on.

The research was designed from both a critical theory perspective and a participatory paradigm. The following instruments were used as a means to gather data: observations, interviews, questionnaires, field notes, video recording of lesson plans and logs of meetings. The research findings reveal that most technology teachers were not trained or qualified to teach technology with confidence and every chance of success until an intervention in the form of action research was introduced which has successfully change their situation.

Orientation and motivation for the study

The implementation of Technology Education within the school curriculum has been a hurdle for both teachers and learners (Pudi, 2007). The successful implementation of the technology cur-

riculum is dependent on teachers having a solidly established personal construct of technology equivalent to that of the curriculum (Tholo, Monobe and Lumadi, 2011). Over a decade many countries, South Africa included, have reformed their school curriculum to establish technology as a recognised learning area with a focus on developing students' technological literacy and to prepare students for the new industrial demands (Gumbo, 2010). Jones, Buntting & de Vries (2011) concur that the last two to three decades have seen technology education emerge as a subject in its own right in many countries around the world. It is obvious that if technology education is introduced as a completely new learning area (subject) in the curriculum of any country it will engender the need for extensive in-service teacher training (Potgieter, 2004).

The advent of technology education, nationally and internationally, has posed challenges different from those experienced in regard to other learning areas, contends Rauscher (2010). Amongst the multiple challenges that can be mentioned, teacher development and emancipation becomes prominent as it is the technology teachers that are placed at the forefront to teach students this relatively new subject. Ever since the introduction of technology education, the teachers are still grappling with its pedagogy and didactics. Technology learning area (TLA) needs skilled teachers. It is poignant to disclose that 99% of the teachers teaching technology have no qualification to teach the subject (DoE Gauteng Memo 202, 2004; Nkosi, 2008; Lovington, 2009). The situation seems worse in Limpopo Province which is among provinces known to be underperforming. We therefore chose one circuit in this province to conduct this study.

The study reports on the interventions in technology teaching that has yielded some improvement with the senior phase technology teachers. These emancipation activities of applying action research (AR) cycles help to answer the teachers' training demand that overwhelms the Department of Education (DoE). So many studies have been carried out previously by other scholars concentrated on other aspects of teaching technology. However, little research has been conducted on AR with technology teachers. Therefore we attempt to fill this gap by engaging technology teachers with a critical theory perspective through a participatory paradigm.

Value and application of critical theoretical framework

In the context of this study, critical theory is a social theory oriented towards critiquing and changing technology teachers' circumstances, i.e. their limited technological knowledge and how to teach it. This study would hopefully create enough awareness in these teachers to be able to pass judgment on their didactics of technology and to evaluate their knowledge base of technology with the sole purpose of being emancipated from this situation (Creswell, 1994).

Critical theory indicates that there is a fundamental dialectical relationship which confirms that theory and practice are indivisible (Tooley, 2000), especially in technology. This aligns well with our understanding of technology education, that it is fundamentally a hands-on enterprise. Hands-on in technology must be taken to refer to learning through experiences, that is, through practical engagement in investigating, designing, making, evaluating and communicating ideas and plans (DoE, 2003). Approaching technology theoretically is unfathomable.

Research question

These activities were undertaken to respond to the following research question:

> *How can an action research intervention be used to improve the teaching practice of senior phase technology teachers who are under qualified?*

In responding to the above mentioned question we came with up a research design that is comprehensive. The next section is dedicated to the research design of the AR main study phase 2.

Research design

This is an action research (AR) study. The purpose of AR is to solve classroom problems through the application of a scientific method (Gay, 1987). The AR cycles with technology teachers was undertaken as follows:

The cycles were conducted with the participants as scheduled in table 1.

Table 1: Schedule for action research cycles

Cycle	1-One	2-Two	3-Three	4-Four	5-Five
Date	08 till 12 March 2010	31 January 2011 till 04 February 2011	18 till 22 April 2011	30 May 2011 till 03 June 2011	01 August 2011 till 12 August 2011
Purpose	Reconnaissance study & participants lesson presentations	Feedback & feed-forward of cycle on findings.	Addressing thematic challenges.	Showcasing technology projects.	Wrapping up AR cycles. Participants presented lessons.

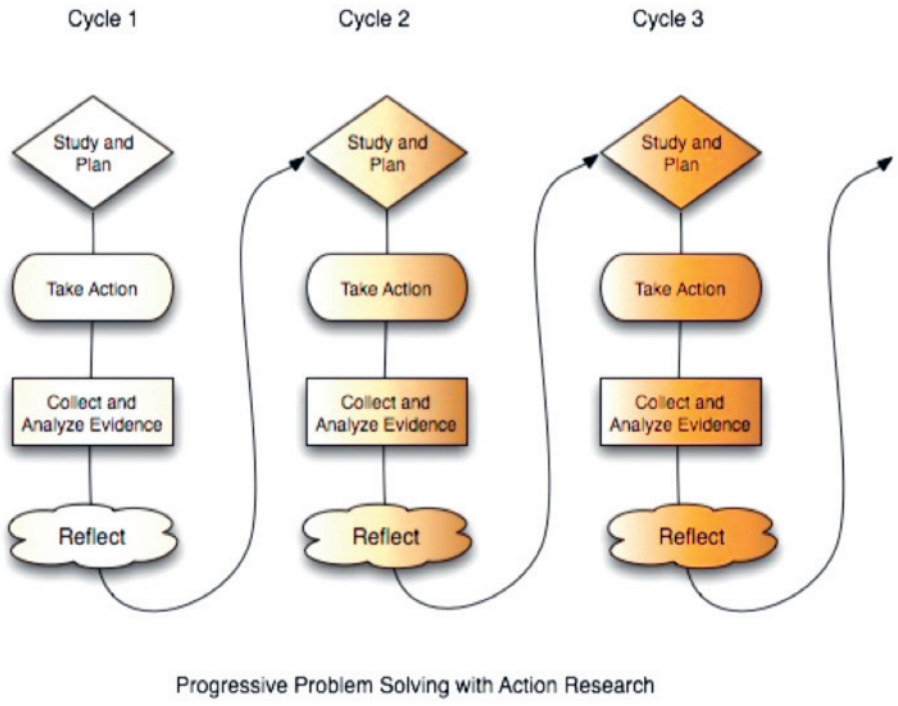

Figure 1: Progressive problem solving with action research

Action Research (AR) is a way of learning from and through one's practice by working through a series of reflective stages that facilitate the development of a form of "adaptive" expertise as displayed in figure 1. Different instruments for data collection were incorporated in line with the nature of activities per each cycle as indicated on the cycles and their findings below. We hoped that both the novice and experienced teachers involved in this AR study would be empowered to teach technology in the General Education and Training (GET) band irrespective of their contextual setting. The study would contribute significantly to action research studies in the field of technology education.

The sample was drawn from Capricorn Region at Mankweng Circuit of Mankweng District in South Africa. The choice of Mankweng Circuit was prompted by the lack of technology knowledge

observed previously by one of us as stated above. The aim of delineating the scope of the study was to implement some intervention strategies to a manageable sample of technology teachers teaching these grades. Mankweng Circuit was chosen for a cluster sampling strategy. In this cluster sampling, groups of senior phase technology teachers were randomly selected (Gay, 1987) in terms of their schools.

The total number of the sampled technology teachers is reflected per school in table 1. Some taught Grade 8 only; some taught Grade 9 only while some taught both grades.

Table 2: Sampled schools and technology teachers

School name	Sampled technology teachers				School milieu
	No. per school	Grade 8	Grade 9	Both grades	
KMK High	7	2	2	3	Rural
VMV High	3	1	2	none	Urban
RMR High	3	1	1	1	Rural
BMB High	3	1	2	none	Rural
WHW High	2	2	2	2	Urban
Total	18	7	9	6	

Cluster sampling was drawn from five high schools (see table 1 in this regard) in Mankweng Circuit. Cluster sampling is characterised by some degree of homogeneity (Maree & Pietersen, 2010). The sampled high schools are located in varied milieus, that is, rural and urban schools. It should also be noted that our focus was on a total of eighteen technology teachers sampled from these schools. Pseudo names were assigned to the schools to conceal their true identity.

A variety of data collection techniques were incorporated; those are non-participative observations, structured interviews, qualitative questionnaires, field notes, logs of meetings, audio and video recordings. Data analysis followed a thematic and narrative form. Themes emerged from the analysis. This process of data analysis focused on understanding the teaching and learning actions and events within the participants' settings and contexts (McNiff, 1988; Ferrance, 2000). According to Wadsworth (in Maree, 2010), multiple methods help the researcher to overtly seek different kinds of views and perspectives from data sources and also helped us to overcome the bias that could result from the use a single method.

A day was spent at each school to observe technology teachers presenting their lessons. A designed observation grid was completed. The observation was followed by interviewing the teachers using the code of responses on a prepared printed schedule. During the observations video recording of participants' lesson presentations were undertaken. Finally, they were given a questionnaire to respond to. On the last day of the contact session the participants and I have a meeting to reflect on the completed session and plan a way forward for the next cycle.

Findings

From participants' biographical information

We start by presenting the findings from technology teachers' biographical information as captured in table 2.

Table 3: Senior phase technology teachers' biographical information

Gender		Technology teaching experience		Technology qualification		School milieu		Can plan technology lesson	
m	f	less than 6 yrs	more than 6 yrs	yes	no	rural	urban	yes	no
9	9	11	7	7	11	13	5	10	8

Participants in total from the five participating high schools, nine males and nine females. Eleven participants had less than six years of technology teaching experience when seven had more than five years of technology teaching experience whereas seven had more than six years technology teaching experience. Eleven participants did not have any technology education qualification; seven had some form of qualification. Thirteen of the participants worked in rural areas whereas five worked in urban areas. Ten participants could plan the technology lessons whereas eight still needed some help.

Integrate data sources for the reflection of findings

The themes were selected to cover aspects of technology teaching from policy interpretation to the classroom practice. These themes include technology-specific teaching experience, technology lesson planning, technology assessment, and level of internal and external support for technology teaching.

Displaying participants' responses of technology learning area (TLA) teachers in two versions, before AR (i.e. cycle 1) and after AR cycles (refers to last day of cycle 5) of contact sessions under the following themes:

Technology-specific teaching experience
How do you find the teaching of TLA? Share some of your technology teaching experience.

Before AR cycles

Bearing in mind the above question, most of technology teachers are generally uncomfortable with the pedagogy of technology as it was observed and revealed from the interviews. Some did not even have any interest in teaching technology as one contended:

> "It just came along while I am already teaching and I didn't develop any interest in the subject"

The response and reaction of the technology teaching experience after the AR cycles sounded different as mentioned below.

After AR cycles

The response to the same question after the AR cycles is really quite opposite to the initial one. It's evident of the impact that the intervention strategies applied from cycle 2 to cycle 4 had on the technology teachers. The impact can be evaluated from the statement below uttered confidently by one teacher during our last AR meeting:

> "I find it to be interesting and practical. Since I started teaching technology I realised that demonstrations make a lesson interesting and realistic".

The situation of technology teachers has serious implications on their level of capacity in terms of planning lessons for technology teaching.

Technology lesson planning
Why are you teaching the learning area (technology)?

Before AR cycles

Many teachers of technology were asked to volunteer to teach technology. As a result many do not have any qualifications in technology education. Some may be qualified and experienced in other subjects, but not specifically in technology education when they were asked to cross over into technology. In responding to the interview one teacher responded by saying:

"It was just allocated to me".

After a consent form was signed by all the participants, a full roll out of AR was undertaken. A teacher response is stated below after the AR cycles which reflect a better insight of technology.

After AR cycles
Given the background before the AR cycles, and the findings from the teachers' biographical information in table 3, technology teachers held reasons for teaching technology which ranged from being coerced into teaching it to basically having the no option than just being assigned to teach it. There was a new mind set for teaching technology after the AR cycles. For instance, the interviews revealed one teacher stating:

"It makes me to be more interested in teaching the technology field because my mind is now broad".

Technology assessment
What are we assessing and what are forms of assessment are you are using in technology?

Before AR cycles
Assessment should ideally be integrated with planning so that teaching and learning activities are not devoid of it. An interview question sought to establish the assessment methods that technology teachers applied during their teaching. One teacher responded by not really giving the answer that we sought in this regard:

"We are assessing skills, knowledge, attitude and values. We evaluate learners' performance''

After AR cycles
One of the Mathematics, Science & Technology Head of Department commented during the last cycle after assessing his staff member report that: "The strategy of assessment implemented was appropriate, guided by the gathered information. The assessment tasks relate to Learning Outcomes and Assessment Standards".

Level of internal and external support
The participants have to rate their support from within the school and outside.

Before AR cycles
Technology, being relatively new in the curriculum, may not thrive without a concerted commitment to empowering technology teachers. Teachers were keen to see support both from within and outside their schools to help them develop in the knowledge and teaching of technology. They expressed this need as follows during the interviews:

"The principal should develop an interest in technology education so that he cannot have a problem in allocating a budget for technology education".

After AR cycles
Based on the internal and external support we will present what one teacher has said on the questionnaire open question: "Could you still be our mentor even next year (2012) since we haven`t specialised in technology. Your presence is making a huge difference in our schools and in our lives. We really understand that now we are the same with other provinces that had technology long before us. Please come back next year to iron out issues that are still problems. Thank you and wish you a wonderful journey in your research project. God bless".

Conclusion

This study set out to emancipate senior phase technology teachers teaching in Grade 8 and 9 at Mankweng Circuit of Limpopo Province in South Africa regarding their knowledge and didactic of technology. The paper report about the next step embarked on after reconnaissance study, which is the main action research study phase 2. The study employed action research spiral cycles to intervene in the challenges that the teachers faced as a way of addressing the research problem. The findings from the study confirm to a great extent that interventions strategies during AR cycles of contact sessions can be employed as a recipe for emancipation in favour of un- and under-qualified technology teachers.

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