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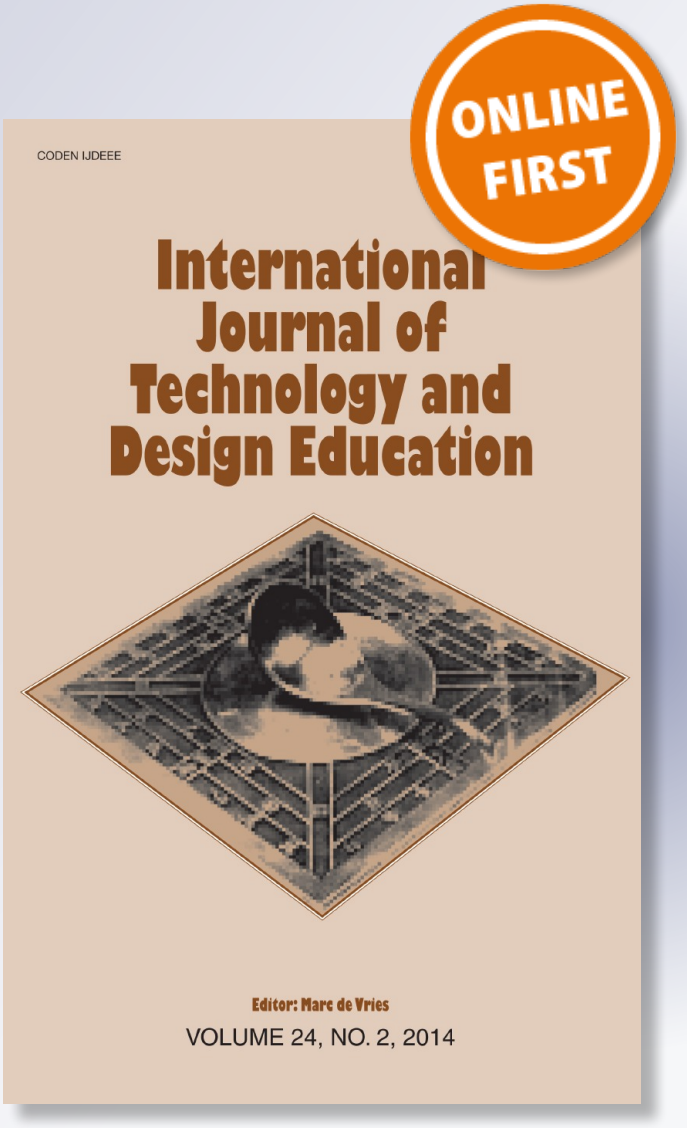

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An emancipation framework for technology education teachers: an action research study

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Abstract This article reports on how action research (AR) was influential in designing an educational instrument to contribute to emancipating teachers with no formal training to teach technology as a subject in secondary schools. The subject technology is referred to using different names in different countries. Some call it 'science and technology' (Malawi/Bangladesh), others label it as 'design and technology' (UK/Botswana), in some instances it is dubbed 'technology learning area' (SA), while others term it 'technology education' (TE) (US/NZ/SA). A sample of 18 technology teachers from five secondary schools was engaged in the AR project reported on in this study. The research was designed from both a critical theory perspective and a participatory paradigm. Instruments used to gather data included observations, interviews, field notes, video recordings of lesson presentations and logs of meetings. The research findings revealed that most technology teachers in this study were neither trained nor qualified to facilitate technology or to teach it with confidence. An AR intervention was introduced, which changed the teachers' situation by generating an instrument. The instrument generated in this study is only a framework, which could contribute towards emancipating incapacitated technology teachers. Even though this framework is applicable to TE, it could hopefully be adopted and adapted for use in other subjects as a way to enhance teachers' content knowledge and pedagogy.

Keywords Action research · Technology education · Critical theory · Participatory paradigm

Introduction

There are teachers teaching technology who have not received any formal training in the teaching and assessment of technology, but are dedicated and determined to teach

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(Marumo 2013). Technology is still a relatively new subject globally, without a large research base or well-established culture of classroom practice (Mawson 2007; ITEEA 2011). Technology education (TE) therefore is a foreign concept to many teachers and a new learning area in school curriculum both nationally and internationally. The challenges that teachers face regarding the policy of technology are articulated in terms of interpretation, analysis and implementation of the policy (Mapotse 2012). These challenges provided motivation for this action research (AR) study, with 18 senior phase technology teachers at five selected schools of Limpopo Province participating in this study. The situation for technology teaching was exacerbated by many educational changes that had taken place in South Africa in the last 20 years. These changes include the overhauling of curriculum, followed by its review which was the strategic and symbolic change since the first democratic elections in 1994.

Thus, a new curriculum known as Curriculum 2005 (reviewed twice already) was developed in which technology was introduced as a new subject. The Curriculum 2005 review process resulted in development of the Curriculum and Assessment Policy Statement (CAPS) for South Africa as from the year 2012. The National Curriculum Statement (NCS) remains a policy, while the new Curriculum and Assessment Policy Statements (CAPS) is an attempt to give clear guidelines on the implementation of the NCS (Curriculum News May 2010; De Jager 2011). These changes in the curriculum, though revised twice, affected technology education and teachers' coping demands on both the subject content and pedagogical knowledge. The Ministry of Education in South Africa confirms by reiterating that whilst educators in South African schools are qualified to teach a variety of subjects, many of the educators of technology are uncomfortable with the pedagogy of technology (Department of Education 2004).

Technology is a learning area that needs skilled teachers due to its nature, particularly as a theory–practice based subject. However, it is distressing to disclose that 99 % of the teachers teaching technology have no qualification to teach technology (Department of Education 2004). It seems the situation has not changed regarding technology teachers in Limpopo Province. Technology teachers were recently engaged with AR study in the same province and it was found that teachers are still uncomfortable with the pedagogy of technology and that many teachers teaching technology have no qualification to teach. It is against this background that this article intends to share an instrument developed during the study that could make a difference in the pedagogy of teachers who are in a similar situation. There was a need to investigate and implement an intervention to facilitate change and improvement to address the gaps in technology teaching. To improve students' ability to apply technology, teachers and scholars of technology education should focus initially on students' identification with technology and then enhance the appeal of technology, contended Yu, Lin, Han and Hsu (2011).

The aim of this article is to report the findings on the gaps that were identified in the teaching of technology by Grade 8 and 9 teachers at Mankweng Circuit of Limpopo Province. This study intended to serve as a platform to develop an emancipation instrument for technology teachers in particular so that these teachers could help their students to apply and enhance the appeal of technology. One circuit was chosen in Limpopo Province to conduct this AR study with senior phase technology teachers. The methods that were used to collect data from the participants (technology teachers) were observations, interviews, field notes, logs of meetings and audio-visual capturing of teachers' lesson presentations. The purpose of the AR reported in this study was to establish intervention strategies to emancipate senior phase technology teachers in Mankweng Circuit of Limpopo Province from the challenges that they faced in teaching technology.

There has been a trend of technology studies conducted both nationally and internationally to address diverse issues around technology education in relation to strengthening subject knowledge and pedagogy of technology teachers. Erekson and Shumway (2006), De Vries (2007), Mettas and Constantinou (2007), Nkosi (2008), Middleton (2009), Somekh and Zeichner (2013), Mapotse (2012), Potgieter (2012), Mapotse and Gumbo (2012a) and Khobidi, Chikasanda, Otrel-Cass, Williams and Jones (2013), have attempted to raise some aspects around pedagogy and content knowledge of technology education. However, little research has been conducted to strengthen pedagogy and content knowledge of technology education using AR as a methodology to deal with teachers' subject knowledge deficiency. In this study, I want to attempt to fill that gap by sharing the emancipation framework developed with technology education teachers.

By implementing an AR project in Limpopo Province at selected schools, the Mapotse participatory emancipation action research (PEAR) framework to emancipate incapacitated technology education teachers was developed. This framework can be applied spirally and cyclically with AR components of planning, acting, observation and reflecting so as to assess the impact of the model. The next section explains how critical theory found relevance in this study. The theoretical framework is subsequently followed by: the methods used to gather data; putting the cycles of the AR study adjacent to each other as a means to measure the degree of emancipation; highlighting the challenges faced by technology teachers; outlining the summary of findings; displaying and interpreting the PEAR framework developed through the study and, lastly, the study offers its conclusion.

The value and application of theoretical framework

The term 'technology' is overused and little understood, leading to confusion over its meaning. Many equate it to computers or other technological electronic products in an educational setting (Laufenberg 2009). Humans used technology long before scientific laws were discovered and practiced. For example, amongst others, the wheel and axle, melting of metals, the boat and Stephenson's rocket (De Vries 1996; Makgato 2003; Laufenberg 2009). The International Technology and Engineering Educators Association (ITEEA) delegates in 2000 reached a consensus (ITEEA 2011) in defining technology as the way people modify the natural world to suit their own purposes. Generally, 'technology' refers to the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy their needs and wants. As this study was more focused on South Africa, the concept 'technology' could be shared and compared with other definitions in different countries. The Department of Basic Education's perspective of technology is presented as follows: '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' (Department of Basic Education 2010).

Teachers are generally faced with challenges in their teaching of technology. In South Africa, these challenges can also be understood in reference to the political transformation from the apartheid education system to the current one, which has shaped the training and development of teachers in general. It is against this backdrop that Gittings (1988) and Ankiewicz (1995) postulate that no educational discussion in South Africa can be entered into without taking cognisance of the country's historical and political background. In the case of teachers moving out of the education system which was oppressive, it was then sorted out to intervene, as AR practitioner, with the teaching of technology by

incorporating critical theory as a way forward to collaborate professionally with these teachers for emancipation purposes.

Critical theory in the narrow sense has had many different aspects and quite distinct historical phases that cross several generations, from the effective start of the Institute for Social Research in the years 1929–1930, which saw the arrival of the Frankfurt School philosophers and an inaugural lecture by Horkheimer, to the present. "Critical" theory may be distinguished from a "traditional" theory according to a specific practical purpose: a theory is critical to the extent that it seeks human emancipation "to liberate human beings from the circumstances that enslave them" (Horkheimer 1982). Critical theory aims to explain and transform *all* the circumstances that enslave human beings. In this case, it refers to technology education (TE) teachers who are incapacitated to teach this subject. The philosophical problem that emerges in critical social inquiry is to identify precisely those features of its theories, methods, and norms that are sufficient to underwrite social criticism. A closer examination of paradigmatic works across the whole tradition from Marx's *Capital* (1871) to the Frankfurt School's *Studies in Authority and the Family* (1939) and Habermas's *Theory of Communicative Action* (1982) reveals neither some distinctive form of explanation nor a special methodology that provides the necessary and sufficient conditions for such inquiry. Some non-dominating, alternative conception is exhibited in Horkheimer's religiously influenced ideal of identification with all suffering creatures or Adorno's idea of mimetic reconciliation with the other found primarily in art (Horkheimer 1972; Adorno 1973). These analyses were also complemented by an analysis of the emergence of state capitalism and of the culture industry that replaces the need for consent and even the pseudo-consent of ideology. The concern for industry is that whether schools are producing students who are ready to follow the Engineering Field. Students should be introduced to technology a bit earlier in their schooling so that they can start producing artefacts.

What Tooley (2000:94–95) stated over a decade ago still holds water today, namely "in a fundamental dialectical relationship, theory and practice are indivisible". This declaration makes sense since technology education is a 'hands-on' subject. Technology and design core content and themes, based on definition, stress that the outcome should be a product, artefact, model, ornament, new systems and/or processes. The emancipation of technology teachers through critical theory is a viable option, given the need for them to develop a sense of their current knowledge and teaching of TE. Pihama (1993:40) said, "Cut off from practice, theory becomes simple verbalism. Separated from theory, practice is nothing but blind activism". Critical theory was considered with the intention to empower technology teachers.

Critical theory has an emancipatory intent (Gibson 1983). It engages real-world challenges. In the context of this study, it engages conventional technology teaching practices and ideas, including ideals of developing understanding of how the collaboration actions justify technology research (Gibson 1983). A distinctive feature of AR is that those affected by planned changes have the primary responsibility for deciding on courses of critically informed action which seem likely to lead to improvement and for evaluating the results of strategies tried out of practice. Above all, AR is a group activity (Kemmis & McTaggart 1988; Centre for Technology in Education 2010; Dick 2010). As an AR practitioner, I used theoretical lens which provides an overall orienting lens for the study of TE teachers' emancipation. This lens becomes the transformative perspective that shapes the types of question asked, inform how data were collected and analyse and provide a call for action and change (Creswell 2014). The data collection methods were therefore chosen to support the use of AR as a vehicle to lead to the development of an instrument to emancipate technology education (TE) teachers. Those methods are highlighted in the next section.

Sample and data collection methods

The collection of data is an important step in deciding which action needs to be taken, especially in AR. Multiple sources of data were used in this study to better understand the scope of happenings in the classrooms of five selected high schools. Of the five selected schools, three schools have four (4) teachers teaching TE in both grades eight and nine, whereas two had three (3) teachers responsible for TE. There was a total of 18 sample of technology education teachers involved in this study. There are many methods which can be used for the collection of data. In this case, those that seemed most appropriate for the issue being researched were selected. Sources used during the main AR study were readily available and data collection was systematically organised and logically structured with the participants well in advance. Data were collected during different cycles of this study.

Cycle 1 was the pre-assessment stage called reconnaissance study or initial reflection in AR for fact-finding purposes. Cycle 1 was the minor stage of the study with one cycle activity as AR 1st cycle. The teachers' technology challenges identified during Cycle 1 were turned into a plan of action in the main and major cycles. Cycle 2–5 was the main and major stage of this AR study, with four contact sessions of cycle and spiral activities. This main stage reflected data collection after the four AR contact session cycles. Figure 1 gives a summary schedule of the AR contact sessions per cycle per theme with the participants. All sessions were captured on both digital still and digital video for co-coding purposes. Some topics per cycle have been shortened to indicate what goes into that particular theme.

Data were organised in a way that made it useful to identify trends and themes. They were collected from senior phase technology teachers of Mankweng Circuit through non-participant observations, audio-visual tapes of lesson presentations and pictures of technology classrooms, samples of learners' work (projects and portfolios), semi-interviews, field notes, photographs and logs of focus group meetings. Data were collected from participants during the cycles of contact sessions. Topics per contact session of AR cycle were addressed based on the local circuit work schedule, findings of a preliminary research and on the participant's request. All sessions started with the reflection of the previous one, observation of what was agreed upon, re-planning and action. Participants took the lead in empowering each other while the AR practitioner facilitated the process to ensure focus on what the participants and I planned together. All sessions were a week long, except the last

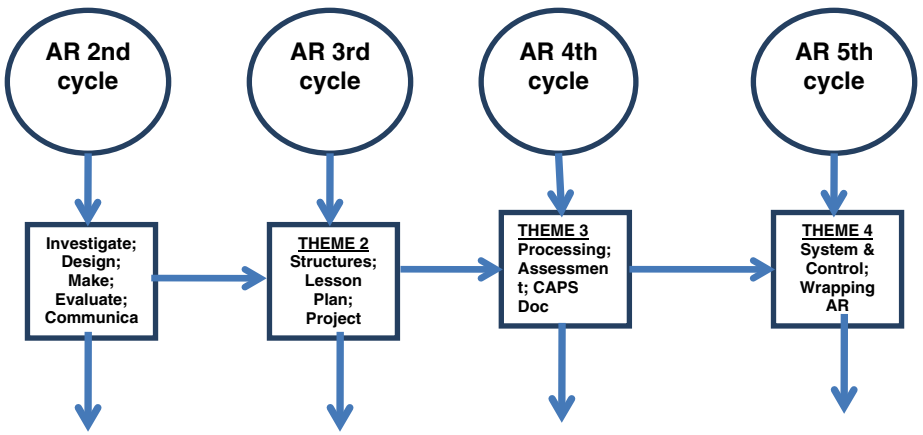

Fig. 1 Main stages of AR intervention sessions

one for 2 weeks, and almost 2–3 h per day in the afternoon. Cycles are contrasted in the next section to depict the teacher level of development.

Juxtaposing action research Cycle 1 and Cycle 2 to Cycle 5

Findings from the developed themes during action plans and data sets from AR instruments are juxtaposed in accordance with the 'before' and 'after' AR cycles. Figure 2 displays the AR journey travelled from Cycle 1 to Cycle 5. Cycle 1 depicts the state of affairs before AR interventions while Cycle 2–5 shows the after effects of strategic interventions.

The intention of Fig. 2 is to map out the process of the emancipation of technology teachers from their challenges to the stage where they feel confident with their knowledge of technology and its pedagogy. The participants were asked the same questions before and after the AR cycle so as to gauge their extent of growth within their technology teaching practices. This is in line with what the Centre for Technology Education (2010) stressed, as it asserts that before one begins with intervention one needs to gather baseline data. The centre further emphasised that knowing how participants performed before the beginning of the study gives a starting point for comparing the results as highlighted in Fig. 2.

During Cycle 1, challenges were identified and through Cycle 2 to Cycle 5, they were addressed. What follows are some examples of the technology teachers' voices before and after AR interventions. The teachers were responding to this interview question: "How do you find the teaching of technology? Share you experience." Before AR intervention, the teacher responded by saying, "*I need to be equipped with drawing skills and designing the projects. I also need to be taught how to design a case study as a form of assessment." After intervention, one teacher had this to say, "Now, I'm very confident to teach this*

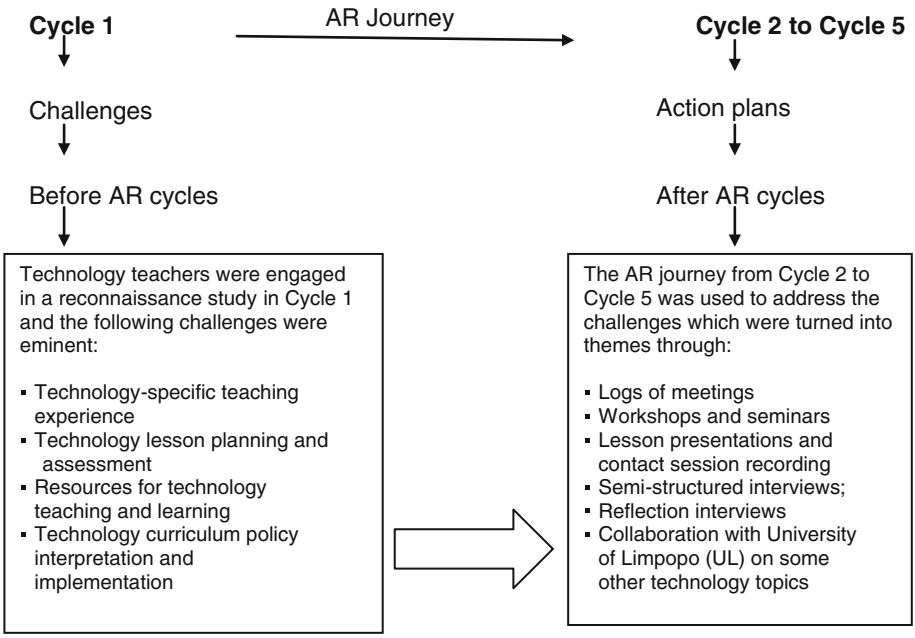

Fig. 2 Comparing findings between minor and major AR stages

subject to my school. I now have the knowledge and understanding or what is required about the subject and how to present it. The skills from our mentor has also contributed a lot to the little that I had, I'm now skilful than before." According to Ndaba (2002:38), action research "is concerned with every practical problems experienced by teachers in their encounter with learners in the teaching process". This AR study demonstrated just that. The interesting thing that this study unravelled was the participatory AR framework that technology teachers need in order to rise above their challenges in their practice. In the next section, challenges that flow from comparing cycle activities are presented.

Technology teachers' challenges

The devastating challenge experienced by most technology teachers is that they have been coerced to teach this subject without any qualification. The availability of suitably qualified teachers to fill all allocated posts was one of the critical priorities in the 3Ts of Teacher, Text and Time or the concept that is coined by many educationists as teachers in the classroom during teaching time (Malgas 2012). Challenges affecting technology teachers can be divided into two areas, namely internal and external factors:

- The first are challenges created by external factors (e.g. time allocation of 8 % per week, resources, movement of teachers in and out of TE, and planning by district and other stakeholders).
- The second are the internal factors related to teachers themselves (e.g. qualification, creativity to cope with limited resources, systems and control, and teaching, assessment and reporting practices, especially through design process, and integrating technology core themes into tasks).

Teachers' conceptualisation of technology is complex and influenced by a range of factors, including how willing they are to change their own concept of technology and technology education, their background experiences, the sub-culture of the subject, and the level of support given to teachers during any change process (Jones, Buntting and De Vries 2011). The participants' background among others was one of the gaps this study manages to unravel. In engaging participants to disentangle their challenges that emerged from the study led to the following findings:

Findings of the study

From cycle activities: contact sessions

Action research, as argued, in this case aims to develop the teaching situation and the teacher researcher. AR aims to generate findings that are useful within a specific context rather than findings that are applicable across many different situations (Jantan 2010). The generated findings of the study are as follows:

- Technology teachers at selected schools in Limpopo Province reported that they did not have an ordered environment (workshop or lab) earmarked for technology teaching, learning and practices.
- Most technology teachers engaged with this AR study are under-qualified to teach technology.

- Teacher–learner ratio impedes the 'hands-on' nature of technology as classes are overcrowded, and class management and assessment are negatively affected.
- Technology teachers could not handle some of the themes in technology until AR was structured and introduced to them. This endeavour contributed, to a large extent, to enhancing teachers' pedagogy and content knowledge.
- It was difficult for senior phase technology teachers in Limpopo Province to practice enhancement activities within their lesson presentations because of their technological incapacity.
- Resources and support were the major concerns for technology teachers.
- Action research with technology teachers took them out of technology survival activities as they could now teach technology with confidence, do projects with their learners, and interpret, analyse and implement technology policy.
- Self-achievement in handling some of the technology themes that they could not handle before the AR cycles had boosted their self-esteem to handle technology and design.
- Each contact session was a platform to transform technology teachers and nourish their desire to learn more; hence, a call to keep the relationship intact for professional development.

During member-checking with the participants, in the mist of their heads of departments and in the presence of their circuit manager, one teacher contended, "*Technology teachers should be allocated technology subject every year. We want to be rooted in this technology subject and we expect the honourable Mr Mapotse to continue to support us*."

This summary of the main findings is closed with the words of Nelson (2008), who states that each person has unlimited potential. Humans are the only living things able to improve the quality of their lives. Technology teachers in Limpopo Province have realised their potential and the possibilities of improving their technology education teaching through AR cycles. Juxtaposing Cycle 1 and Cycle 2 to Cycle 5 of this study highlighted the challenges technology teachers encountered and outlined the findings of this study based on the cycle activities. These activities led to the development of an emancipation instrument, which can be used to emancipate technology teachers who have no formal training to teach technology education. Participants' responses from the activities within cycles are presented follows:

From cycle activities: reflective questionnaires

Teachers suggested the following:

- More contact workshop/sessions should be held on a regular basis, at least once per month.
- Let the Department of Education partner with universities to develop curriculum advisors in the field of technology.
- "I suggest that we have more workshops so that we can equip ourselves. I don't have more knowledge of technology. I need to learn more; the more the workshops, the more knowledge", pleaded one participant.
- Schools should be supplied with relevant and updated materials such as textbooks, study guides and other technological gadgets.
- Certificate of attendance at the end of the training should be issued so as to encourage educators to attend workshops.

Table 1 Interventions with technology teachers

Area of emancipation	Before intervention	After intervention
Technology lesson planning	Only ten teachers could plan a technology lesson whereas eight indicated that they needed some help	Teachers could plan a technology lesson after being shown how. They could design projects following the design process and teach their lessons
Teaching of Technology	Lack of technology content knowledge, qualification/experience to a greater extent; discomfort with pedagogy of technology (as observed and revealed from interviews); some teachers had interest in teaching technology, but they encountered challenges during their teaching	Teachers can now teach technology with some degree of confidence compared to before intervention (see findings of Phase 2 above in Fig. 2). Planning and implementing lessons together helped to build courage and knowledge into teachers; they could, for the first time, design projects with their learners
Technology assessment	Almost all teachers confined themselves to giving assignments, class work, homework, tests and examinations as it was observed during Phase 1	After the teachers had engaged their learners in the containerization project, some new ways of assessing were evident in addition to the ones that they were accustomed to; a milestone being that they were able to design a rubric for their choice projects
Technology curriculum policy interpretation and implementation	Teachers' responses to the questionnaire and interviews pointed out that before they did not have the policy document, there was nothing to interpret	After the policy document was organised and teachers shown how to interpret and implement it; they managed to develop an understanding of the learning outcomes, their relationship, and planned lessons successfully

These suggestions are very closely related to the identified gaps above. Thus, they raise the same situation like that explained in the gaps above. A way forward was agreed upon with teachers and the Department of Basic Education officials promised to develop a plan to expand the study and training to other schools in the province. Some degree of emancipation happened to teachers who participated in this study (see Table 1), despite some more areas of need.

Few areas of emancipation through AR interventions have been highlighted in Table 1. AR cyclic and spiral activities did take some days to be executed. The process was guided by the participants' technology work schedule. The PEAR framework is the summary of those AR activities that were addressing challenges raised during Cycle 1—AR Reconnaissance study.

Mapotse PEAR framework envisaged to make a difference in teaching technology

The framework proposed for teacher emancipation was persuaded by action research's cyclic and spiral activities undertaken with technology teachers. The framework intended to empower under-qualified technology teachers. Figure 3 is a framework developed to empower technology teachers through participatory emancipation action research (PEAR). The Mapotse PEAR framework has the following features:

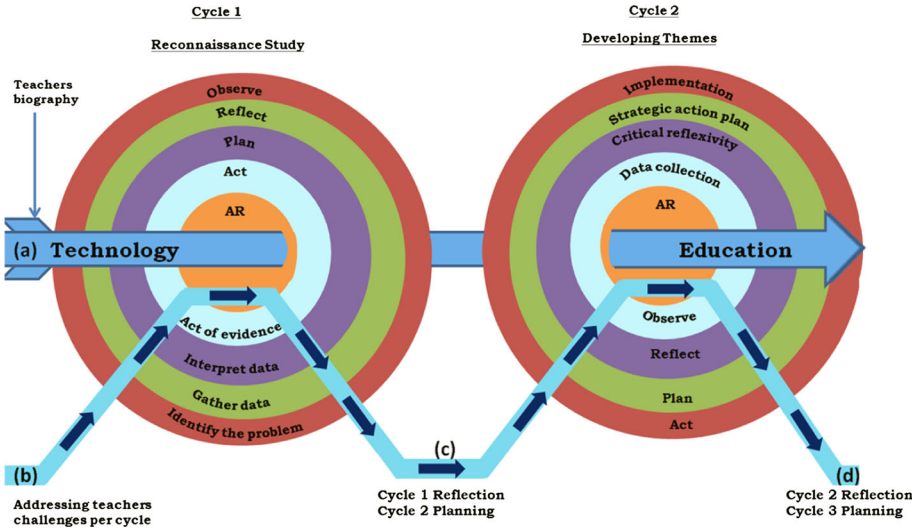

Fig. 3 Mapotse PEAR framework

- Following the framework from Cycle 1—reconnaissance study

In this framework, the AR practitioner should start by identifying the subject earmarked for emancipation purposes. In Fig. 3, technology education was identified as a subject for intervention purposes. Thereafter, the practitioner should embark on a fact-finding mission termed 'reconnaissance study' or 'initial reflection'. Then the AR practitioner further observes the situation against the identified problem. In the next step, the practitioner should reflect on the observations and the problems surfaced during observation activity and use of other instruments to gather data, so as to support what was observed. Thereafter, the gathered data should be interpreted and that will help in the planning phase of the whole AR project. The last part of Cycle 1 will culminate into putting the plan into action based on the evidence acquired. That will be setting the scene for Cycle 2.

- Continue with the framework in Cycle 2—developing action plans or themes

The AR spiral activities of observing, planning, acting and reflecting still repeat themselves in Cycle 2. The difference between Cycle 1 and Cycle 2 is the practitioner's interaction in leading the activities. Challenges (if any) identified together by the research team in Cycle 1 should be used as a springboard to shape this study. The team should list and code challenges accordingly. Coding can be *open coding*, which fractures the data and allows one to identify some categories, their properties and dimensional locations, or it can be *axial coding*, which puts the data back together in new ways by making connections between a category and its sub-category. It can also be *selective coding*, in which data required are selected for analytical purposes (Straus & Corbin, in Ndlovu 2004). From the coding, a choice of themes could be tabulated as a means of paving the way forward for the study. The team should strategically implement its action plan, observe the actions and as the actions unfold, critically reflect on them. Lastly, the team should collect data and process it in the same way that it did in Cycle 1. The findings will then feed into Cycle 3.

Conclusion

Action research, among other routine, can be used by government to promote school reform and teacher development (Somekh and Zeichner 2013). The newly democratically elected government in South Africa has overhaul, reform, review and transform the country old curriculum. In this process of curriculum reform technology was introduced as a new comer in the new curriculum. The technology teachers countrywide have some challenges of implementing this new subject as well as the pedagogical coping demand of grasping the new terminologies. Curriculum reform in many education systems appear to have largely failed to also reform teachers' classroom practices for better student achievement (A-Daami and Wallace 2007, Macdonald 2003). Hence AR came handy to emancipate these technology teachers who are under-qualified to teach technology. AR in this study engenders findings that led to the development of an emancipation instrument for technology teachers. Action research aims to generate findings that are useful within a specific context rather than findings that are applicable across many different situations (Jantan 2010).

A total of 18 technology teachers from five secondary schools formed part of a sample population for this AR. A reconnaissance study was conducted to confirm the research problem and for fact-finding purposes. Since the study was designed from both critical theory perspective and participatory paradigm, it helped the participants to realise their gap in technology content knowledge and pedagogy. The challenges highlighted during the initial reflection were turned into action plans for this study. Both the participants as co-researchers and the AR practitioner (I) collaboratively structured a schedule for contact sessions with an intensive plan of action to address the identified challenges. This plan of action included incorporating a variety of instruments to gather data as mentioned under the data collection section. As the plan took shape, it brought forth five cycles of the study. Cycle 1 brought to surface most of the practical problems experienced by technology teachers in their encounter with the learners' teaching process. It implied that teachers need to link theory and practice regarding the pedagogical aspects of technology education (De Vries 2005, Barlex and Rutland 2004). Cycle 2 to Cycle 5 embarked on both cyclical and spiral activities of AR to resolve the teachers' challenges by addressing the research problem.

Seeing that TE is a foreign concept to many teachers and a new learning area in the school curriculum both nationally and internationally, the challenges that teachers face in this regard are the interpretation, analysis and implementation of the technology policy. There was a definite problem regarding the interpretation of technology curriculum policy document, programme, schedule and lesson planning and failure to take advantage of the available resources (Mapotse and Gumbo 2012b). Action research with senior phase technology education teachers has been instrumental in emancipating teachers from their lack of technology pedagogy and content knowledge. In generating knowledge and improving social action at the same time, AR challenges the normative values of two distinct ways of being—that of the scholar and the activist (Somekh and Zeichner 2013) as evident in this study.

I had engaged myself on two levels with these senior phase technology teachers as both the scholar and the activist. A scholar who followed scientific principles of gathering and analysing data per cycle activity and an activist who participated in the intervention strategies of AR—observations, planning, action and reflection. The AR activities and findings of this study were influential in developing the Mapotse PEAR framework to capacitate technology teachers who have no formal training. This participatory

emancipation AR framework can be adopted and adapted to other subjects as a model for teachers' professional development.

References

A-Daami, K. K., & Wallace, G. (2007). Curriculum reform in a global context: A study of teachers in Jordan. *Journal of Curriculum Studies, 39*(3), 339–360. doi:10.1080/00220270601057790.

Adorno, T. W. (1973). *Negative dialectics*. New York: Seabury.

Ankiewicz, P. (1995). The planning of technology education in South African schools. *International Journal of Technology and Design Education, 5*, 1–10.

Barlex, D., & Rutland, M. (2004). Developing trainee teachers' ability to teach designing within secondary school design and technology in England, Proceedings PATT-14 Conference. http://www.itaewwww.org/PATT14/PATT14.pdf. Accessed 20 Nov 2011.

Centre for Technology in Education. (2010). *Action research*. Baltimore: Johns Hopkins University.

Creswell, J. W. (2014). *Research design. Qualitative and Quantitative approaches* (4th ed.). Thousand Oaks: Sage.

Curriculum News. (2010). Improving the quality of teaching and learning. A message from the Minister of Basic Education. Improving curriculum implementation: Update. Pretoria: Government Printers.

De Jager, R. (2011). Latest changes in the Technology education curriculum in South Africa. Paper delivered at the 25th Annual PATT: CRIPT 8 Conference, "Perspective on Learning in Design Technology Education", University of London, London. 30 June–05 July 2011.

De Vries, M. J. (1996). Technology education: Beyond the "technology is applied science" paradigm. *Journal for Technology Education, 8*(1), 7–15.

De Vries, M. J. (2005). *Teaching about technology*. Dordrecht: Springer.

De Vries, H.J.M. (2007). Scenarios: Guidance for an uncertain and complex world?, in *Sustainability or collapse*? *An integrated history and future of people on earth.* R. Constanza, L. Graumlich, W. Steffen (Eds.). MIT Press: 378–398.

Department of Basic Education (DBE). (2010). *Curriculum News: Improving the quality of Learning and Teaching*. Pretoria: Government Printers. Poliah@dbe/gov.za.

Department of Education. (2004). *Revised National Curriculum Statement Grades R-9 (Schools): Teacher's guide for developing learning programmes technology*. Pretoria: Government Printers.

Dick, B. (2010). Action research theses. Thesis resource paper. You want to do an action research thesis? www.scu.edu.au/schools/gcm/ar/art/athesis.html. Accessed 02 Sept 2010.

Erekson, T., & Shumway, S. (2006). Integrating the study of technology into the curriculum: A consulting teacher model. *Journal of Technology Education, 18*(1), 27–38.

Gibson, R. (1983). *Critical theory and explanation*. London: Hodder & Stodder.

Gittings, J. (1988). Conference impressions. Newsletter of Southern Association for Learning and Educational Disabilities, 7 (3) Sept 1988. London: Sage.

Horkheimer, M. (1972). *Bemerkungen zur Religion*. Frankfurt: Fisher Verlag.

Horkheimer, M. (1982). *Critical theory*. New York: Seabury Press.

ITEEA—International Technology and Engineering Educators Association (2011). What is technology teaching? www.iteaconnect.org/Resources/whatistechteaching.htm. Accessed 15 May 2011.

Jantan, J. (2010). Action research workshop. King Mongkut's University of Technology Thonburi, Matriculation College February 5th–6 the 2010. http://drjj.uitm.edu.my Accessed 22 Sept 2010.

Jones, A., Buntting, C., & De Vries, M. (2011). The developing field of technology education: A review to look forward. *International Journal of Technology and Design Education, 23*(2), 191–212.

Kemmis, S. & McTaggart, R. (1988). *The action research planner*. Victoria: Deakin University.

Khobidi, V., Chikasanda, M., Otrel-Cass, K., Williams, J., & Jones, A. (2013). Enhancing teachers' technological pedagogical knowledge and practices: A professional development model for technology teachers in Malawi. *International Journal of Technology and Design Education, 23*, 597–622.

Laufenberg, V (Ed). (2009). About technology. file://B:\TE KIT\AboutTechnology.mht. Accessed on 15 May 2011.

Macdonald, D. (2003). Curriculum change and the post-modern world: Is the school curriculum-reform movement an anachronism? *Journal of Curriculum Studies, 35*(2), 139. doi:10.1080/0022027032000106261.

Makgato, M. (2003). The development of a curriculum for technology teacher education and training—A critical analysis, PhD thesis, University of South Africa, Pretoria.

Malgas, H. (2012). Teacher demand and supply in Department of Basic Education. The parliamentary monitoring group (PMG) of the ANC meeting on 21 August 2012, chaired by Ms H. Malgas. www.pmg.org.za/report/20120821-briefing-department-basic-education. Accessed 29 Aug 2012.

Mapotse, T.A. (2012). The teaching practice of senior phase technology education teachers in selected schools of Limpopo Province: An Action Research study. D.Ed. thesis, University of South Africa, Pretoria.

Mapotse, T. A., & Gumbo, M. T. (2012a). Identifying Grade 8 and 9 technology teachers' areas of need for intervention in Limpopo Province. *Journal of Social Science, 36*(1), 19–28.

Mapotse, T.A. & Gumbo, M.T. (2012b). Action Research study with technology teachers in Limpopo Province of South Africa: An emancipation recipe for Technology teachers, in Pupils attitudes towards technology (PATT)—Technology Education in the 21st Century. Proceedings of the 26th Annual meeting on Science and Technology. Sweden, Stockholm, 26–30 June 2012.

Marumo, K. N. (2013). Challenges facing FET teachers in the implementation of technology in the further education and training band in North West, in Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE). Proceedings of the 21st Annual meeting on "Making Mathematics, Science & Technology Education—socially and culturally relevant in Africa". South Africa, University of Western Cape, Cape Town, 14–17 January.

Mawson, B. (2007). Factors affecting learning in technology in the early years of school. *International Journal of Technology and Design Education, 17*(3), 253–269.

Mettas, A. C. & Constantinou, C. P. (2007). The development of optimization decision-making skills within the area of technology education through a technology fair.

Middleton, A. (2009). Beyond podcasting: Creative approaches to designing educational audio. *ALT-J Research in Learning Technology, 17*(2), 143–155.

Ndaba, J.J. (2002). Teacher's use of learning materials to develop thinking in a classroom. MEd dissertation, former Vista University, Pretoria.

Ndlovu, A.T. (2004). The alignment of assessment with teaching and learning in the technology learning area in Grade 7. MEd dissertation, former Vista University, Pretoria.

Nelson, D. (2008). *Technology Education: classroom Management*. Madison Metropolitan School District: Vern Laufenberg. tokiweb.mason.k12.wi.us/articles Accessed 17 Feb 2012.

Nkosi, D.F. (2008). Technological process as a framework for the improvement of instruction of technology. MEd dissertation, University of Johannesburg, Johannesburg.

Pihama, L. (1993). Tungia te Ururua Kia Tupu o te Harakeke: a critical analysis of parents as first teachers. MA dissertation, University of Auckland, Auckland.

Potgieter C. (2012). Linking learning activities and assessment activities to learning outcomes and assessment standards when teaching technology: a case study. International Journal of Technology and Design Education. http://link.springer.com/article/10.1007/s10798-012-9226-4/fulltex.html. Accessed on 09 May 2014.

Somekh, B., & Zeichner, K. (2013). Action research for educational reform: Remodelling action research theories and practices in local contexts. *Education Action Research, 17*(1), 5–21. doi:10.1080/09650790802667402.

Tooley, W. R. (2000). Political rationality & government mechanisms: Maori education policy in the new millennium. MEd dissertation, University of Auckland, Auckland.

Yu, K. C., Lin, K. Y., Han, F. N., & Hsu, I. Y. (2011). A model of junior high school students' attitudes toward technology. *International Journal of Technology and Design Education, 22*(4), 423–436.