



Research Article

Enhancement of environmental impact content knowledge on life sciences teachers: a realist social approach

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Abstract

The main purpose of this study was to evaluate the impact of Life Sciences teacher training workshops co-ordinated by the Fundisa for Change Programme whose aim was to strengthen environmental learning in science teacher education. As specified by the programme, Fundisa for Change's core objective is to strengthen the teaching of environmental concepts in schools. Due to continually emerging environmental crises and uncertainties, many of the environmental topics in the curriculum are new to Life Sciences teachers. Consequently, this affects how the topics are taught to learners in schools. The study employed Margaret Archers Realist Social theory as a lens. There were 12 Life Sciences teachers who took part in this study. Data was collected using qualitative approach where case study research design was employed. Furthermore, the study used purposive sampling technique of Life Sciences teachers from 10 schools. Face to face, data collection method was used and thematically data analysis technique was employed. The results showed that Life Sciences teachers need relevant professional development workshops that improves their content knowledge, pedagogical teaching methods and assessment techniques. This implies that programmes such as Fundisa for Change provided additional skills to Life Sciences teachers in teaching content based on education for sustainable development (ESD).

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Introduction

It must be accepted that there are finite limits to both the Earth's resources and the Earth's capacity to handle the environmental impacts caused by humans (Sitarz, 1994). Thomas-Hope (1998) reveals, for instance, that the environmental impact of solid waste, which is disposed of at ordinary dump sites which are not adequately prepared for such disposal, contributes greatly to land degradation. This behaviour is evident on the global arena where negative environmental impacts on natural resources are experienced. In addition, Xu (2015) emphasises that human activity is a factor that has important impact on the environment, even in remote areas, since the onset of the Holocene era. Goudie and Viles (1997) further illustrate that it normally takes some time for the causes of environmental impacts to become apparent and this makes the causes hard to identify. They also associate these changes with human impacts, which go hand-in-hand with natural fluctuations, to create massive and unpredictable changes in the environment.

This study was conducted in the Mpumalanga Province in South Africa. The province was chosen because it has been involved in programmes for training teachers on environmental impact topics that hinge on sustainability. Furthermore, the province was convenient for the researcher to conduct the study since the Fundisa for Change programme trained teachers on a Teaching Biodiversity, Life Sciences Grade 10-12 module that covered environmental impact topics. The researcher was therefore able to access information-rich participants. The aim of Fundisa for Change programme was to support teachers to engage with environmental and sustainability knowledge and skills in the curriculum, so that Life Sciences teachers may contribute towards building the environmentally

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sustainable and health society that is envisaged in the South African Constitution (Fundisa for Change, 2013). The programme focuses on enhancing three essential aspects of teaching, which are; *subject content knowledge, teaching practice* and *assessment practice* (Fundisa for Change, 2013). At a national level, the programme offered different modules taught by teachers, which included an Introductory Core Text, Methods and Processes, Teaching Climate Change, Teaching Biodiversity, Indigenous Knowledge Systems, Life and Living and Marine Biodiversity.

This study evaluated the impact of the teacher training workshops co-ordinated by the Fundisa for Change Programme whose aim was to strengthen environmental learning in teacher education (Fundisa for Change, 2019). As specified by the programme, “Fundisa for Change’s core objective is to strengthen the teaching of environmental concepts in schools” (Fundisa for Change, 2019). Due to continually emerging environmental crises and uncertainties, many of the environmental topics in the curriculum are new to teachers (DBE, 2017). Consequently, this affects how the topics are taught to learners in schools. Fundisa for Change is a collaborative partnership programme that involves many of South Africa’s major environmental organisations, including the state, parastatals, NGO’s and private companies that aims to enhance transformative environmental learning through teacher education (Fundisa for Change, 2019).

According to Le Grange (2013), environmental problems are complex and today’s solutions could become tomorrow’s problems. Human civilisation has brought about the current modern era and the associated imbalance between natural resource utilisation and sustainability of the Earth. Le Grange (2013) further believes that the complex and contingent nature of environmental problems and their associated risk cannot be captured in a few learning outcomes set out in the curriculum in South Africa.

Problem Statement

The underpinning assumption in this research is that teachers’ views on the content and nature of environmental impact issues are complex and founded upon implicit theories and personal practical knowledge. Environmental impacts have negative implications of global proportions such as climate change effects and solid waste accumulation. Negative human impacts on the environment threaten not only natural resources such as water, air and land but also the very existence of humanity itself. The education sector plays an important role in ensuring that younger generations develop appropriate skills, knowledge and principles for sustainable living. It is also assumed that it is teachers’ internal perceptions rather than external constraints that inform their pedagogical practice (Hart & Nolan, 1999). Hart and Nolan (1999) note that studies on teachers’ thinking are important, as they remain one of the under-researched areas within education platform. It is against this background that evaluation of programmes such as Fundisa for Change is essential in ensuring that learners understands the threats associated with environmental degradation through Life Sciences.

Theoretical framework

Realist Social Theory (RST) is the framework that underpins this study. This research is case study-based and guided by this theory. As Young (2008) and Creswell (2009) explain, knowledge is socially produced and it warrants exploration of social interests and the related dynamics of power and individuals seek understanding of the world in which they live and work. The global environmental crisis is a real social problem as evident in its impacts such as depletion of the ozone layer, rising levels of carbon dioxide in the atmosphere, global warming, deforestation, climate change, pollution and improper toxic waste disposal. Hartas (2010) suggests that individuals create their own realist meanings of their experiences through interactions with each other and with their surrounding environment. In this study, the interactions happen in a school environment and are supported by different structures such as teachers, learners and external support such as programmes. RST is comprised of social structure with three concepts, which are *structure, agency* and *culture*, which interact to shape and reshape the conditions people have for engaging in action (Archer, 1995). Social structures have the potential power to activate causal mechanism that results in the occurrence of events (De Souza, 2013). The cultural aspect relates to ideas and ideational influences that operate at the sphere of social interaction (De Souza, 2017). Ideational influences also have control on agential activities and may be consistence with, contradictory to prevailing, dominant ideas held by other groups, or individuals while enhancing or hindering change (De Souza, 2017:28). The ideational influences can hinder change if government policies of particular countries do not compel industries against dumping toxic chemicals into the ocean, thus hindering change. Education ideational influence can be that agents such as teachers can be positively influenced in improving teaching methods, assessment and pedagogical content knowledge of environmental impact topics.

Research Question

What is the enhancement of teacher support for teaching environmental impacts topics in Life Sciences provided through the Fundisa for Change programme?

Methodology

Research Approach and Design

This study employs a qualitative research approach using a case study design of Life Sciences teachers in Mpumalanga. An interpretive case study made a significant contribution to both theory and practice in providing results on the effectiveness of teaching environmental impact topics in Life Sciences. The researcher used this approach because it allows for multiple realities, such as understanding of social situation from participants' perspectives (Macmillan & Schumacher, 2010). According to Johnson and Christensen (2008), a case study is mostly used in education where the goal is to explore a programme and to evaluate its effectiveness.

Participants

The sources of information used by qualitative researchers include individuals, groups, documents, reports, and sites (MacMillan & Schumacher, 2010). Purposeful sampling was used in this study, where information-rich participants were conveniently sampled. The population (participants) for this research are teachers who were trained under the Fundisa for Change programme from 10 schools. A total of 12 teachers were reached out to by the researcher. It is important to note that about 6 teachers were able to participate in this study. These teachers have undergone training on the Teaching Biodiversity Life Sciences Grade 10-12 module developed by Fundisa for Change programme as participants in Mpumalanga.

Table 1.

Details of Participants

Teacher	Age And Gender	Area Of School (Mpumalanga)	Teaching Experience (Years)	Qualification	Subject Taught In Grade 12
Transcript 1	43 Years (Male)	Elukwatini	14	Bachelor's Degree in Education	Geography
Transcript 2	49 Years (Male)	Elukwatini	22	Bachelor's Degree in Education	Geography
Transcript 3	40 Years (Male)	Nkomazi	7	Bachelor's Degree in Education	Agricultural Sciences
Transcript 4	46 Years (Female)	Emalahleni	7	Higher Diploma in Education	Life Sciences
Transcript 5	45 Years (Female)	Secunda	18	Honours Degree in Education	Geography
Transcript 6	26 Years (Female)	Emalahleni	5	Honours Degree in Education	Life Sciences

Data Collection Tools

Darlington and Scott (2002) note that in-depth interviewing is one of the most commonly used data collection strategies in qualitative research. They emphasise that the concern of a qualitative researcher is to understand the meaning participants derive from their experiences from their own perspective. Teachers in this study were experts and they were able to fully describe how they experience a particular phenomenon in their schools. Yin (2011) mentions that the relationship between the researcher and the participant is not strictly scripted in semi-structured interviews, but the researcher uses a set of questions as an interview guide during the interview. This helps to keep the interview focused on the topic but still allows for further probing questions by which the researcher can elicit further information from the participant.

Reliability and Validity

Validity in this study was ensured in that interviews covered detailed and varied data and the respondents were afforded an opportunity to check the transcripts of their interviews to clarify any misinterpretations. Creswell (2009) suggests that researchers need to ensure that qualitative reliability procedures are incorporated in a study. These

procedures include member checking of the transcripts to make sure that they do not contain obvious mistakes made during transcription as well as ensuring the definition of codes which resembles the meaning during the process of coding.

Data analysis

The research used qualitative coding which is the process of generating ideas and concepts from raw data such as interview transcripts, field notes, reports and archival materials (Given, 2008). The coded data in this study was arranged according to similarities to form categories. These categories led to the derivation of relationships, patterns and themes (Creswell, 2009, Ely et al. 2005; Given, 2008). It was important in the study that coding laid the groundwork for analysis and interpretation to address the research question of this study.

Results and Discussion

Fundisa for Change programme advocates that teachers should know the environment and sustainability in different subjects. According to Mandikonza and Lotz-Sisitka (2016) education has the potential to facilitate catalytic transformation of society through development of understandings and actions that contribute to more sustainable social practices. The study results shows that in order to support transformation of society through development of understandings, teachers should also be aware of the environmental knowledge challenges and use subject-specific units to address the knowledge challenge (Fundisa for Change, 2013). The programme also equips teachers with good teaching practice, provision of teaching methods and transformative learning, learning theories, expanding the range of teaching methods used in the subject and improves the quality of teaching and learning. Fundisa for Change (2013) also states that teachers should be part of the socio-cultural and structural factors that promote teaching and learning in the community. These factors also form part of the RST theoretical framework of this study. This study has also seen ideational influences that had a favourable outcome on agential activities (teachers), and may be consistent with or contradictory to prevailing, dominant ideas held by other groups or individuals, thereby facilitating or hindering change (De Souza, 2017). According to Fundisa for Change (2013), “socio-cultural factors are factors such as learners’ prior knowledge and experiences, language, culture, histories of learners and the societal context. Structural factors are factors such as resources, availability of textbooks and relevant learning materials, size of classes, poverty conditions and structuring of the timetable”. In the context of this study, Life Sciences teachers are important agents of change who can deliver the educational response to environmental education. Since teachers are influential change agents, it emerged in this study that there is a need for them to be supported with the required skills, knowledge, strategies, values, required motivation and commitment to educationally respond to sustainable development. Consequently, Life Sciences teachers can be supported to develop resources and to access resources on education for sustainable development. Environmental education has much to offer in the building of a relevant, quality education system, not only in South Africa but also across the globe, towards attaining the Sustainable Developmental Goal’s. Therefore, in this research Life Sciences teachers who took part in the Fundisa for Change programme were also asked about the following aspects: their understanding of the importance and role of the programme; effects of the programme on teaching and learning; and improvements that can be adopted by the programme in future. Based on these three questions posed to Life Sciences teachers during interviews, the following themes emerged from this study;

T1- Life Sciences teachers’ perceptions on the contribution and role of the programme

T2- Effects of the programme on teaching and learning

T3- Improvements that can be adopted by the programme in future

Theme 1: Life Sciences Teachers’ Perceptions on the Contribution and Role of the Programme

Life Sciences teachers were asked about the training provided by Fundisa for Change in terms of improvement in delivering lessons in the classroom, the question was, “*How did the training provided by Fundisa for Change programme assist you in delivering your lessons on environmental impact topics?*” One teacher replied,

“It helped a lot; we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources.”

This assertion shows that teachers benefitted from the programme and are now able to conduct environmental impact topics lessons based on the *content knowledge* they acquired from the Fundisa for Change programme. One participant also mentioned that after attending the programme, it assisted him in learning about *other teaching methods* that helped him to teach environmental impact topics. These teaching methods learnt by Life Sciences teachers were

classified into *information and transfer, experiential, investigative, learning by doing and deliberative methods*. As a result, the learners in his Life Sciences class passed well at the end of the year. In other words, another participant mentioned that;

“It was very informative, I used to be like my learner where I was also blaming others and I learnt that they are many things that I do, which I was not aware I am contributing to climate change. You become conscious of what is going on around you don’t just litter and I don’t misuse the resources. How CAPS is interrelated. Other concepts for climate change that I learnt which we normally say these you will learn in science and we did not know about them. It gave us confidence.”

Some teachers also pointed out that the programme assisted them with *practical ways* of teaching in the classroom and that made their lessons more interesting for learners, coupled with a better understanding of environmental impact topics. The programme gave *teachers confidence* to teach environmental topics in the classroom. Another participant when asked, *“How has the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?”* The participant replied that,

“Definitely how can I dispute that one, it really assisted our school and results improvement and my subject was part of that. The learner got 100% and the learner was recognised in the province.”

The researcher do not believe the teacher’s assertion that by attending the programme he was able to get 100% pass rate for Geography. Rather, the programme may have assisted in the improvement of the results, but that could not be solely the contribution of the programme initiative. The researcher is of the notion that other factors may have contributed to learners passing well at the end of the year. The outcome of learners improving their results could also be a result of proper planning, discipline of learners, culture of the school and so forth. It cannot be disputed that results improved after attending the Fundisa for Change programme but it is likely not the only contributing factor.

Teachers’ views and appreciation of the programme also revealed that, *before* attending the programme, they *lacked knowledge* on how they could teach their learners environmental impact topics to ensure that learners understand the work. [Stanisic and Marksic \(2014\)](#) remark that, “some studies reveal environmental education (EE) delivery in the classroom has some challenges which include, teachers who are expected to teach new information in a different way without any appropriate education or training”. This situation is similar to South Africa where the diagnostic reports in subjects such as Agricultural Sciences, Life Sciences and Geography reveal that learners are still *struggling* with *environmental impact* terms used in the examinations (DBE, 2017). In support of the Fundisa for Change initiative, [Iqbal and Arif \(2011\)](#) state that, “for education to improve, all the teachers must have a global perspective, be well prepared and provided with ongoing professional development and appropriate support”. This is also supported by [UNESCO’s \(2005\)](#) approaches to EE and ESD that state that teachers should have the necessary skills and must become value driven to be able use local knowledge and contextual relevance when teaching environmental impact topics.

This research considers teachers’ voices on how changes in the curriculum have affected the teaching of environmental impact topics and how programmes such as Fundisa for Change have helped in improving their practices in the classroom. [Ramberg \(2014\)](#) mentions that “teacher studies on educational change have applied the qualitative method using case studies.” A renewed focus should therefore be advocated to spearhead the idea of teachers as agents of change.

Theme 2: Effects of the Programme on Teaching and Learning

One of the objectives of the Fundisa for Change programme is “to support teachers to develop the insight and skills necessary to ensure high quality and effective assessment practices”. When one teacher was asked, *“How has the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?”* he responded,

“Yes, I got the idea, regarding the excursions from this training, because they took us to the Nelspruit botanical garden. They took us there we are adults and we are teachers but we enjoyed it as we were learners. That is where I got my teaching ideas; I started implementing the following year until today. And you can’t teach about the environment in the classroom, some things you just can’t teach while in class, they need practical experience”.

This response by the participant revealed the positive effect of the programme on both teaching and learning in the schooling structure. The implication is that the programme not only imparted *content knowledge and skills* to teachers but it also provided *ways* with which Life Sciences teachers could deliver the environmental impact topics such as using ideas which factor the socio-cultural aspects of learners into the learning system. Teachers mentioned *excursions* as one of the ideas sourced from the programme and some were now implementing those ideas in their daily teaching activities. A study conducted by [Irwin \(2010\)](#) showed that several participants maintained that science teachers in particular were deprived by the lack of scope applied to EE in the context of outdoor education that enabled a stronger

and more critically focused content to be learnt in schools. In relation to the above, UNESCO (2005) emphasised that teachers should use multi-dimensional methods in teaching environmental impact topics.

On the other hand, participants were asked, “Did your teaching of the content improve after the training?” one teachers stated,

“The change is when I prepare my lesson, because at the training, we had time to be outside and it actually made me realise that, there are things we can use from the school and make the lesson interesting and practical within the school yard and not concentrate only on the textbook.”

The positive contribution of the programme was therefore evident in their lesson preparation. In response to the same question, one teacher mentioned that,

“Yes it did. In terms of lesson planning the objective is practical, like pollution you don’t have to refer them to the industries, because we also contribute”.

In the above instance, the teacher revealed that previously he was teaching environmental impact topics such as pollution by only referring to industries as the main polluters, thereby neglecting the fact that as individual human beings we also contribute to pollution. The researcher agree with the teachers that if you are able to gain more knowledge on how to teach in different contexts, that can be transferred to learners. Knowing how to integrate *different teaching strategies* in teaching environmental impact topics improved confidence in teachers and learners benefited by doing better in examinations, which will enable them to become good citizens whose behaviours enhance sustainability of natural resources. This showed that the programme improved the *content knowledge, pedagogical approaches* and *assessment strategies* for teachers. This conforms to UNESCO’s (2005) suggestion for a teaching approach that focuses on *applicability*, where learning is integrated into the day-to-day personal and professional context.

Teachers mentioned that the programme not only improved their content knowledge but also improved their *strategic questioning, classroom presentations* and *report writing* due to resources such as copies of the modules that they were trained on. These modules for Biodiversity and Climate Change have different assessment methods and tools, a range of possible *teaching methods* that helped them during environmental impact topics lessons.

“It helped a lot, we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources. You can use carbon footprint, you do not need resources and those are in use now or it is practical”.

In response to the impact of the programme, one teacher noted that he is still using the resources that were given in the training programme for teaching and learning in the in the classroom and outdoors. The researcher have noticed the importance of the programme to teachers in the manner that one teacher was inspired by the Fundisa for Change programme in that she managed to form an *environmental committee* in the school in the aftermath of the training. This was a practical initiative of ensuring that teachers practice (ESD), which is being cascaded to learners and members of the communities where the learners live. This is the response of the teacher when she was asked about the benefits of the programme;

“Very much, it improved such that I applied what I felt, because of the confidence we gained form training and hence we started the nature conservative group. I did not even care or know how to take care for it”.

Theme 3: Improvements that can be Adopted by the Programme in Future

Although participants mentioned that the programme was beneficial to their teaching practice, improvements could be made to future programmes of Fundisa for Change. This section analyses and interprets some of the ideas from teachers on what they thought could be done in future to improve the training which could benefit their teaching and learning in the classroom. Firstly, one teacher mentioned that:

“We felt that the time set and scheduled for the workshops was not enough because we were excited and we were anticipating more information sharing”.

It is important to mention that all of the teachers believed that the *time* for such programmes should be *increased* and they were still anticipating a lot of information on how they could change their teaching approaches. They were of the opinion *that more weeks* should be set aside for such informative training instead of just one week. On a different note, one participant when asked, “What needs to be done in future to improve the training provided by Fundisa for Change?” the participant suggested,

"I think they need to come with a method of teaching large classes, because that is our challenge and how to discipline learners without losing contact time with them."

This response revealed that teachers are still having challenges with teaching in *overcrowded classrooms*; particularly in Township schools, and that they need appropriate methods to conduct lessons on environmental impact topics under such circumstances. Contrary to most teachers, one teacher mentioned that the Fundisa for Change programme helped her to be able to conduct environmental lessons outside of the classroom using large numbers of learners. This showed that teachers still have a problem with *overcrowded classrooms* and find it easier for classroom presentations if *done outdoors*. This is what one teacher explained,

"It helped me, that I was able to take a large group of learners to the ground. I can now manage a group of learners".

Teachers believed that the programme could play an important role in providing strategies on how to deliver a lesson in large, congested classes. In this case, teachers *expected more examples of activities* that would be appropriate to teach large classes.

One teacher put forward that:

"I think it was informative and more educators need to be invited, because we were expected to transfer the information, but it would not be sufficient because we might forget other things".

In this research, all of the participants mentioned that although the training workshop was informative, the expectation was that the trained teachers would cascade the information from the training to other teachers who did not attend the workshop. However, teachers found it challenging to convey the *information to other teachers exactly* the way it was presented in the programme. On this note, teachers suggested that the Fundisa for Change programme should include *more teachers* so that they could benefit from the resources, knowledge and skills that could be included in their teaching activities in the curriculum. When one of the teachers was asked what needs to be done in future to improve the training provided by Fundisa for Change, the response was:

"I think they need to add more teachers we were few. More outdoor activities (We spent a lot of time indoors listening to presentations, we only went out once, life science its practical subject".

It can be concluded that during this study teachers appreciated the initiative of the Fundisa for Change programme. However, they suggested that in future, if such programmes were held in the province in Mpumalanga Province, more teachers needed to be *invited*; the programme organisers should also provide activities that can be used in *large classes*; and *more time* needs to be allocated for such programmes in future. They appreciated the time given for outdoor activities but it was not enough for them to be acquainted with more interesting activities provided by the programme in the training.

Teachers in this study believe that training programmes such as the one provided by Fundisa for Change should be *centralised* in the province so that *more teachers* will be in a position to attend without having to *travel long distances*. They further mentioned that the Department of Education does not fund them for the training and many teachers are then discouraged to take part. They believed that the closer the venue is to most teachers, the more it will encourage teachers to participate in the training if they are invited again. Teachers are of the view that the training should be done again so that more teachers can benefit. This is what one teacher responded concerning the training venue;

"I think it must be done again and the invitation should be open to more teachers. The venue should be close because teachers, tend to run away, because the department doesn't fund them".

Overall, it can be noted that the achievements of the Fundisa for Change programme on Life Sciences teachers are supported by Gwekwerere (2014), who states that "in order to develop an enduring understanding about the environment, teachers should ensure that learners need to be given opportunities to:

- develop ownership of the environmental knowledge they learn from the curriculum;
- engage in concrete experiences as an integral part of EE courses;
- work on action projects dealing with environmental issues in their communities; and
- participate in policy and decision-making processes.

It is important to note that Life Sciences teachers revealed that before they attended the Fundisa for Change environmental teacher professional development programme, they lacked knowledge on how they could teach their

learners environmental impact topics in order to ensure that learners understood the content in the classroom. Iqbal and Arif (2011) point out that for teachers to improve their teaching, they must be prepared and be provided with professional development and appropriate support. This kind of support is seen in this study from the work done by the Fundisa for Change programme for teachers who teach content on environmental impact topics in the curriculum. Apart from improving the skills of the teachers, the programme also assisted teachers with resources that contributed immensely to the provision of content knowledge and the effective teaching and assessment practices for use with learners. Teachers also mentioned that they learnt new ideas about how they could improve their lessons on environmental impact topics in the subjects they were teaching.

Summary of Structural, Cultural and Agential Dimensions of the Programme

Realist Social Theory (RST) states that social structures are comprised of aspects of structure, culture and agency, which interact to shape and re-shape the conditions people have for engaging in action (Archer, 1996). This section discusses conclusions based on the structural, cultural and agential dimensions of the Fundisa for Change programme.

Structural Dimension of the Programme

In this study, the focus was on Fundisa for Change programmes' aim of improving and strengthening environmental learning in schools. There were different structures aimed at improving teaching of environmental impact topics in this study. These structures were the Fundisa for Change programme's environmental teacher training workshops, resources used during the training, schools and resources used by teachers in schools. The interaction of these structures brought change in the way teachers (agents) are being *empowered* and strengthened in their *content knowledge* of environmental topics. The skills acquired by learners through teachers can be demonstrated in the outside environment to ensure that natural resources are sustained for future generations. In this study, the school social structure has contributed to change in terms of providing conducive conditions for teaching and learning. The structure of the programme in terms of presentations, activities and resources brought transformation to teachers. According to De Souza (2017), the structural dimension provides agents with contexts within which to pursue activities and interests. She further indicates that structural dimensions pertain to institutional, physical, material and human resources and relations.

Cultural Dimension of the Programme

It can be noted that the Fundisa for Change programme played an important role in ensuring that participants were able to share different ideas on how they could teach environmental impact topics in the classroom. The different teaching strategies helped teachers to develop a socio-cultural dimension where teachers' prior knowledge and experiences, language, culture, histories of learners and the societal context of learners were taken into consideration when preparation of teaching in the schools. The researcher concludes that after attending the teacher-training programme, teachers developed a *culture of using multiple teaching methods* and strategies to enhance learners' understanding of environmental impact topics. Teachers had the idea and belief that the resources and content knowledge accumulated in the programme were helpful. Finally, Dolphin and Tillotson (2015) support this view of the role that teachers' beliefs play in their decision-making in the school environment.

Agential Dimension of the Programme

In this study it can be stated that the agential dimension of the programme involved imparting skills and content knowledge in teaching environmental topics. The results of this study prove that the programme improved teachers' (agents) *content knowledge* and *skills* in teaching environmental topics. The implication of the programme is that it improved teacher's practices *inside and outside* the classroom. The actions of the teachers to accommodate *teaching strategies* learnt from the programme showed that they had been *transformed* and this had a positive influence on learners' academic achievement.

Conclusion

One of the objectives of this study was to investigate whether the Fundisa for Change programme had an impact on the teaching of environmental impact topics. Life Sciences teachers who were interviewed all participated in the Fundisa for Change Environmental Teacher Training Programme. As mentioned earlier, Fundisa for Change is a collaboration between a range of teacher education partners working with teachers across South Africa to improve and strengthen environmental learning in schools (Fundisa for Change, 2014). This study's results reveal that Life sciences teachers who participated in the programme *benefited* and *their teaching* of environmental impact topics *improved*. Participants mentioned that the programme provided *different options* that can be used in the teaching of environmental

impact topics in the classroom. Thus anchoring the view of Willott (2000) who insisted that realm of ideas have the capacity to inform action in the manner that pre-existing logical relations exert influence in the form of costs and benefits for an individual or groups who may adopt certain teaching methods over others. Certainly, most teachers were of the view that teaching methods such as *excursions and practical work* assisted them in ensuring that they were able to better prepare and deliver the lessons on environment impact topics in subjects such as Life Sciences without much challenge. In addition, teachers, as agents of change, indicated that being exposed to the Fundisa for Change programme helped them to develop *teaching strategies* in teaching environmental impact topics as an additional context of outdoor education. In line with this, Oguz (2004) indicated that some studies on teachers' perceptions about EE have shown that teachers show a desire to integrate environmental concepts into their teaching. It is against these results that the researcher agree with the participants that all teachers should be *afforded the opportunity* to attend such programmes. In this way, the high failure rate of environmental impact topics in Grade 12 examinations could be reduced. The researcher argue that the high failure rate on environmental impact topics in Grade 12 exit examinations will continue to rise if teachers are not exposed to programmes such as Fundisa for Change. To support the researchers argument on the importance of exposure, De Souza (2013) believes that a sustained transformation of the action context from a previous state would require a corresponding shift not only in the structural, material and physical aspects of the action but also in ideational aspects.

Apart from new *teaching methods* that the teachers were able to learn from the programme, teachers admitted that they also acquired *insights and skills* that they can use for effective *assessment* practices. Teachers are of the view that the programme assisted them to gain new content knowledge on current issues pertaining to the impacts of human activities on biodiversity and climate change. They believe that they are now able to use different effective assessment practices such as *strategic questioning, classroom presentations, report writing* and *observation* while on *excursions*. Above all, teachers arrived at the similar conclusion that the programme allowed them to share new ideas on teaching environmental impact topics and that they were now using the different ideas that emerged from the programme. For example, one teacher mentioned that in teaching biodiversity, they were given an example of using learner's shoes and be sorted according to size, colour, make, and so forth. This helped teachers to identify differences and that can be used in the classroom when teaching and learning resources are limited. The teachers gained teaching skills and knowledge on teaching environmental impact topics in and outside of the classroom. The acquired critical decision-making skills and knowledge not only assisted in teaching but also improved the understanding of the content for both teachers and learners, which might ensure that learners live in a sustainable natural environment. This supports UNESCO's (2005) view of the teaching approach for environmental impact topics, namely that it should be interdisciplinary and holistic.

Besides how the programme assisted teachers in delivering the lesson in and outside the classrooms, teachers were asked if their teaching of the content improved after the training. Certainly, most participants experienced *positive changes* from their lesson presentation after attending the programme. The results of this study indicated that environmental impact topics lessons became more interesting to learners because of *alternative learning strategies* that were now being used by the teachers after the training. Teachers indicated that they now use the schoolyard more often when teaching environmental impact topics and learners become *interested* and *fully participate* in outdoor activities when compared to being confined in the classroom as was the norm *before* attending the programme. Teachers recognised that their *content knowledge* improved and that they were able to bring some teaching materials that they are still using even today at schools. One participant, in contrast to others, mentioned that she is now able to manage larger groups of learners when doing outdoor activities. Most teachers indicated that they would need more workshops on how they could handle *large groups* of learners when teaching environmental impact topics. The researcher agree with most teachers that teaching large classes poses a barrier to learning because teachers are not able to focus and assist individual learners who are having challenges in the lesson. Some participants reported that after attending the programme, they have established *environmental committees* within the schools, which has fascinated the author. The impact of Fundisa for Change programme is linked to what De Souza (2013) identified as success of the educational programme to include 21st century educational practices in an action context may be determined by how competent teachers feel in carrying out their proposed responsibilities as a guide on the side.

Teachers are of the opinion that the Fundisa for Change programme can provide more assistance to the education sector. Firstly, teachers noted that the training was conducted in a *short period*, hence they did not have adequate *time* to share teaching ideas. Secondly, the study's findings revealed that teachers still need assistance with strategies (Haryono & Abdurrahman, 2020) to *teach large classes*. As mentioned above, teaching in overcrowded classrooms *inhibits*

effective teaching and learning. Thirdly, teachers are of the opinion that the venue of the programme should be *centralised* so that it can *attract* more teachers to take part in the programme. They suggest that *all teachers* need to attend the programme because it is difficult for them to *cascade* the new information to others due to time constraints. Lastly, teachers appreciate the importance of the programme and propose that the Fundisa for Change workshops should be held *periodically* in order to enhance their content knowledge and teaching strategies not only for environmental impact topics but also for all the other topics for different subjects. In support of this, Iqbal and Arif (2011) emphasise that “there is an urgent need to recognise teachers’ work as complex and demanding, and improvement in teacher quality requires a re-conceptualisation of how we prepare a new generation of teachers”.

Finally, the researcher noticed the willingness and happiness in the way that the participants expressed their appreciation of the Fundisa for Change programme. This implies that the programme materials and the different teaching and assessment strategies could be used to empower Life Sciences teachers with confidence in teaching environmental impact topics and EE in the classroom. This might be beneficial to learners and the social community they live in by promoting environmental sustainability for future generations. The Fundisa for Change programme’s aim of improving and strengthening environmental learning in schools is supported by Markaki (2014), who indicates that “innovation that should be adopted by some programmes with the sole aim of bringing together the latest trends in EE, well-tested and documented inquiry-based learning practices and cutting-edge technology used for educational purposes”

Limitations of Study

The limitations of this study are; (a) this study used the qualitative method, so the conclusion obtained cannot be generalized for other cases, (b) instrument in this study consist of one problems, (c) participant of this study taken from one subject which is Life Sciences and cannot be generalised beyond other subjects.

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