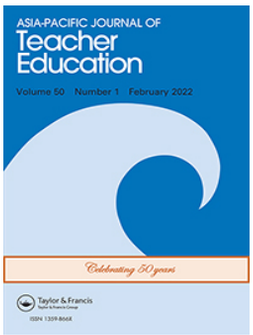

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Improved attitudes towards littering through progressive action research activities in an environmental education context

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ABSTRACT

Smooth implementation of environmental education at public schools in South Africa is hindered by various factors. Consequently, teachers have been unsuccessful or have had only partial success in implementing environmental education in their classrooms to conscientise learners about the environment and the harmful impact of littering. The purpose of this research was to indicate how teachers could mitigate the hindrances to effective environmental education teaching and learning in their respective schools. By employing progressive environmental action research activities through participatory spirals of action research cycles, learners could be conscientised to littering. This research is underpinned by critical theory and an applied cooperative paradigm. Fourteen learners referred to as co-researchers or participants in this research were randomly selected from seven classes. Participants' observations were used as a research instrument to collect data. Thereafter, a coding process and analysis were conducted. The results of the study show that progressive environmental action research activities were successfully implemented in the conscientisation of learners to littering and that these interventions mitigated some of the environmental education barriers experienced by teachers at schools. This led the authors to conclude that if progressive environmental action research activities are conducted through the participatory action research approach, this can empower teachers to mitigate factors hindering environmental education implementation and subsequently raise learners' awareness of littering.

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Cooperative paradigm; critical theory; environmental education; participatory action research; progressive environmental action research

Introduction

Curricula are the main means through which knowledge and skills to promote sustainable development and global citizenship are conveyed to learners (United Nations Educational, Scientific and Cultural Organization, 2016). At the same time, the shift in many countries in the 21st century, which is to standardise teaching, means that teachers and school leaders are required to account for their teaching practices in ways that they were not previously required to do (Allen, Singh, & Rowan, 2018). This observation is evident from the policy of the South African government to review the education system regularly. The South African education system underwent several intrinsic educational

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transformations post 1994 with the implementation of the new curriculum approach, namely Curriculum 2005 implemented in 1998; the Revised National Curriculum Statement in 2002; the National Curriculum Statement in 2006; and the newly implemented Curriculum and Assessment Policy Statements adopted in 2012. All these curriculum transformations and reviews in South Africa were aimed at dealing with political and socioeconomic factors that adversely affect our educational progress and our environment. Politically, the changes within the curricula are meant to combat the educational inequalities of the past, while socioeconomically, they are meant to deal with the poor state of the environment.

All the curriculum reviews stated above integrated environmental education as a cross-curricular discipline and more recently, are referred to as environmental content in the Curriculum and Assessment Policy Statements document policy. There is still a commitment to active learning in the curriculum and most interestingly, a strong commitment to environmental content in several subjects (O'Donoghue, 2013). Nonetheless, this requires all teachers in all subjects to consider an environmental focus (Irwin & Lotz-Sisitka, 2014). However, scholars such as Makokotlela (2016) indicate that factors such as the lack of relevant resources hinder teachers from delivering environmental education effectively to their learners. Makokotlela (2016) further states that schools lack the finances to sustain environmental education activities, and this has resulted in schools discontinuing these activities. These factors may have a negative effect on learners' environmental awareness and knowledge. This study intends to highlight the practicality of progressive environmental action research (PEAR) activities in mitigating the obstacles to environmental education to raise learners' awareness of littering and to improve their environmental knowledge further. Progressive environmental action research activities are used progressively to emphasise the continuity of the activities and actions that are taken throughout the research process.

Participatory action research is an action research (AR) approach that is unique because it integrates theory, research and social justice and is a way to produce the knowledge that is required for progressive social action (Bywater, 2014). Additionally, participatory action research promotes hands-on environmental activities in environmental education. Progressive environmental action research activities stem from this approach since it forms part of the participatory methods and situated learning process and refers to school-based environmental activities that could empower teachers to conscientise learners to litter in their schools. Participation is a central feature of participatory action research (Le Grange, 2009). Both PEAR activities and the participatory action research approach have the common element of encouraging co-researchers to participate in the research process in order to address and propose solutions to environmental education barriers. Participants in this study are referred to as co-researchers.

Contrary to the goals expressed in the *Incheon Declaration* 2030, the year 2018 was dominated by the issue of waste related to marine plastic litter, with the concern that most plastic litter eventually ends up in the ocean (United Nations Environment Programme, 2019). Improper disposal of plastics results from human littering behaviour. This research responded to the following research question: *How can we use progressive environmental action research activities to mitigate factors that hinder environmental education in schools that conscientises learners to littering*?

The function of a theoretical framework in a study is to guide researchers through data analysis and interpretation. A theoretical framework provides guiding principles and a specific perspective through which we examine a topic (Bezuidenhout, 2014).

Theoretical framework

According to the critical theory framework, environmental education should focus on empowerment and action and not on the transference of scientific knowledge about the ecological crisis (Tsevreni, 2011). Usually, knowledge does not translate into action. In the current study, PEAR activities were intrinsically intended to conscientise the co-researchers to litter in the school, while critical theory aimed to alleviate environmental education barriers such as the lack of resources that teachers and learners are facing in their schools and enable them to overcome such barriers. In the study, co-researchers were taken through PEAR activities to mitigate the environmental education barriers that confront government schools and simultaneously, to raise learners' awareness of littering. These PEAR activities were undertaken through cyclical and participatory processes of planning, acting, observing and reflecting on the implemented activities. As such, participatory action research created the path for the researchers to multitask as facilitators, dedicated participants and learners in the research process. These features became even more salient when the co-researchers came from diverse backgrounds (Balakrishnan & Claiborne, 2017).

Critical theory originated from the writings of Karl Marx and the works of Jürgen Habermas of the Frankfurt School that were steeped in German intellectual tradition (Tooley, 2000). Critical theory is considered valid only if it meets the following three criteria: it must be **explanatory**, that is, explain what is wrong with current social reality; it must be **practical**, that is, identify the actors needed to change it; and it must be **normative**, that is, provide both clear norms for criticism and achievable practical goals for social transformation (Horkheimer, 1972). Hence, critical theory must satisfy all three criteria simultaneously to combat the challenges experienced by teachers to increase learners' awareness of littering in their respective schools.

The three abovementioned criteria emphasise that critical theory intends to transform the current situation, in other words, bring about a paradigm shift. In this study, critical theory transformed the situation by engaging co-researchers in PEAR activities that addressed the environmental education hindrances that confronted teachers and learners in public schools in addition to conscientising learners to littering. In turn, this has helped relevant stakeholders to learn how to contextualise resources at their disposal in order to achieve the intended objective of the curriculum. This was achieved by utilising resources such as waste materials (Table 4) to mitigate environmental education hindrances at school through the practice of PEAR activities with co-researchers in a group effort. For instance, waste materials became teaching/learning materials that addressed the lack of funding/finance for resources and in turn, recycled waste materials served as teaching aids. Reusable materials support children's fantasy, ingenuity and creativity because reusable materials do not offer predefined activities and play but rather stimulate children's curiosity, invite playful approaches and strengthen children's ownership of the toys that they have participated in making (Jørgensen, Madsen, & Læssøe, 2017).

The most important aspect of critical theory is emancipation.

> Emancipation is formulated through a process of conscientisation within which the oppressed identify the contradictions that exist socially, politically and economically and engage and develop action against those oppressive elements that perpetuate their positioning and lived realities. (Tooley, 2000, p. 95).

In the current research, co-researchers explored PEAR activities that teachers could use to mitigate environmental education barriers. For this reason, participatory action research was preferred in this study. Participatory action research is about the "art of what is possible", given a myriad of constraints (Le Grange, 2009, p. 12). Participatory action research and PEAR are intertwined in their approach and require active participation to alleviate the environmental education barriers that hinder teachers in their goal to raise learners' awareness of littering and to propose solutions. The qualitative research tradition of critical theory was chosen as a means of inquiry in this study because researchers believe in its efficacy in changing situations (Mapotse, 2015).

Environmental education by its very nature is a hands-on discipline that involves the mind and the hands. Critical theory is an ideal approach for the application of PEAR and participatory action research within schools because it emphasises hands-on learning activities to mitigate the environmental education barriers that confront schools in their education of learners on the topic of littering. Thus, the co-researchers involved in the PEAR activities and the participatory action research projects used their senses, muscles and brains and were able to enjoy nature. However, through the entire process, the co-researchers were also addressing the factors that hinder environmental education to raise awareness of littering (Torkos, 2017). Furthermore, outdoor and schoolyard activities as opposed to indoor activities, support children's cognitive, linguistic and social-emotional development (Erdem, 2018), and while participating in PEAR activities, the co-researchers developed personal growth (Albert, 2018). The PEAR activities and participatory action research projects combined both theory and practice to afford co-researchers the opportunity to be critical thinkers and the ability to action competence and offer solutions in cooperation with the researchers. The holistic approach introduced through the change projects rooted in their participation connected the co-researchers to the project activities and helped them to view themselves as an integral part of the transformation brought about by these projects (Ketlhoilwe & Silo, 2016). Thus, cooperative inquiry enables learners to connect, think, reflect and learn (Scholl, Nichols, & Burgh, 2016).

Cooperative inquiry is an inquiry strategy in which all those involved in the research endeavour are both co-subjects participating in the activity that is being researched and co-researchers whose thinking and decision-making contribute to generating ideas, to designing and managing the project and to drawing conclusions from the experience (Reason, 1999). Thus, the co-researchers were afforded the opportunity to engage in the research process in a group effort to reduce the environmental education barriers that obstructed effective teaching and learning and to raise learners' awareness about littering. Thus, as was the case in this study, everybody contributed their ideas to the design of the environmental programme (outlined in Table 2). This empowered the co-researchers with environmental skills and knowledge to address littering.

The cooperative paradigm is referred to as the "collaborative paradigm" (Heron & Reason, 2006). It was first proposed by John Heron in 1971 and later expanded upon by

Peter Reason. The researchers reviewed the status of environmental education in South Africa to recommend activities that would help the teachers to adopt other approaches in educating their learners about littering and to address environmental education hindrances in their schools (Mapotse & Mashiloane, 2017). Activities were conducted in a co-participatory manner to ensure success and to avoid imposing instructions on the co-researchers. This approach gave all the co-researchers a chance to contribute towards finding solutions to environmental education hindrances and to act towards improving the status quo (see Table 2). Participatory action research was effective because the learners were the co-researchers who were recognised as having the skills needed to solve the environmental education hindrances (Bywater, 2014). Engaging co-researchers in critical theory eased the hindrances that the teachers encountered in their schools and contributed towards improving learners' awareness on littering. Collaborative inquiry is, therefore, a social, interactive, co-constructive and connected learning process (Scholl et al., 2016). In a collaborative manner, problems were mitigated.

Research problem

Purpose of the research

This research explored the effectiveness of PEAR activities to mitigate factors hindering environmental education in schools aimed at developing learners' awareness of littering.

Problem statement

One type of education that is currently receiving less emphasis in schools is experiential outdoor education (James & Williams, 2017), and this omission could be the cause of the environmental challenges in schools. As a result, both local and international scholars have conducted studies over the years in the environmental education field by exploring the different aspects that create barriers to the effective implementation of environmental education. Factors that hinder environmental education in our schools include a lack of teaching/learning materials (Anderson & Jacobson, 2018; Damoah & Adu, 2019; Edwards-Jones, Waite, & Passy, 2018; Maluleke, 2015; Mathenjwa, 2014; Mohammed, 2016; Mwendwa, 2017; Siddiqui, Pathak, & Akhtar, 2014; Zwelibanzi, 2016); lack of funding/finance (Anderson & Jacobson, 2018; Edwards-Jones et al., 2018; Makokotlela, 2016; Mwendwa, 2017); lack of initiative or a narrow learning approach (Anderson & Jacobson, 2018; Kao, Kao, & Tsai, 2017; Maluleke, 2015; Mathenjwa, 2014; Mwendwa, 2017; Siddiqui et al., 2014; Yeshalem, 2013; Zwelibanzi, 2016); lack of support (Kao et al., 2017; Mwendwa, 2017; Zwelibanzi, 2016); lack of policy (Edwards-Jones et al., 2018; Mathenjwa, 2014; Siddiqui et al., 2014); and lack of physical space (Edwards-Jones et al., 2018; Mohammed, 2016). Ham and Sewing (1988) categorised some of these barriers as logistical, educational, attitudinal and conceptual barriers.

These challenges hinder the teaching and learning process and delay progress in achieving the goals outlined in the Education 2030 *Incheon Declaration*. As such, learners may receive limited environmental knowledge from their teachers regarding the life skill to consider their environment in whatever they do. Furthermore, the United Nations Educational, Scientific and Cultural Organization (2016) reports that since the 1950s,

coverage of the environment is a theme that has grown in importance in textbooks. However, as noted by the scholars above, this drastic increase in the coverage of environmental themes in textbooks further worsens the situation and places teachers under pressure and probably lowers their ability to deliver environmental education in schools.

Consequently, teachers opt to use the most common teaching method to deliver content regarding the environment, namely lecturing (Stanišić, 2016; Wang, 2016). In addition, Joseph (2014) found that teachers' teaching methods limits them to the classroom. Lecturing about the environment simply suggests that teachers in the confined classroom ask **questions** and provide **explanations** and the learners provide **answers**, which equates to a teacher-centred approach. The lack of an environmental programme in some schools is also to blame for the fact that children often unwittingly litter or pollute their environment (Mapotse & Mashiloane, 2017). Thus, the pedagogical shortcomings of teachers do not promote reflection, critical engagement or a contextualised action-taking approach for learners to consider when addressing litter problems in their schools, homes and communities.

Several consulted studies revealed that various factors impede the integration of environmental education, and these factors differ according to the school and the pedagogical style of the teacher. Scholars also identified that the factors that hinder environmental education stem from both inside and outside the classroom and can be categorised as either school-based or extraneous factors. These studies were conducted among primary and secondary school teachers at both private and government schools. All the aforementioned scholars have used common instruments or similar approaches to collect data. These studies such as Damoah and Adu (2019) and Mwendwa (2017) used interviews to collect data from the participants. It should be noted, however, that little has been done to explore PEAR activities in mitigating some of these hindrances. This research intends to close the gap.

To a large extent, the contributions of environmental education scholars such as Anderson and Jacobson (2018), Mwendwa (2017) and Ham and Sewing (1988) appear to have not been implemented effectively. Consequently, communities today are experiencing the same hindrances to the implementation of environmental education that were identified by scholars more than two decades ago. As a result, environmental education has not realised its objectives. Although we have seen the emergence of environmental policies and curriculum changes within the South African education system over the past two decades, these abovementioned barriers to the implementation of effective environmental education still hinder the conscientising of learners to environmental issues. Therefore, this study aimed to examine a few of these hindering factors by using a participatory action research approach with the co-researchers to conscientise them to littering. With the application of appropriate research methodology to explore the problem.

Methodological approach

Research approach

This research originates within the environmental education field and its aim was to explore PEAR activities as a possible solution to ease the factors hindering environmental education in government schools. Research design and research methods are the main

components of research methodology. This qualitative research reports on the findings derived from a single government school, using the participatory action research approach. The term "participatory action research" consists of three words, namely participatory, action and research. Participatory refers to both researchers and co-researchers engaging in the research process; McNiff (2013) states that the "action" part of action research refers to what you do, while the "research" refers to how you find out about what you do.

The main aim of participatory action research is to pursue action and knowledge in an integrated fashion through a cyclical and participatory process (O'Leary, 2014). In this research, participatory action research was used as a means of exploring the effectiveness of PEAR activities to reduce the factors that hinder environmental education in schools. Furthermore, participatory action research offers more possibilities for ongoing engagement of co-researchers than standard forms of teacher-led action research (Balakrishnan & Claiborne, 2017) because it enforces cooperative learning inquiry.

This research employed a cooperative paradigm to assess the success of PEAR activities to mitigate factors that hinder implementation of environmental education aimed at developing learners' awareness of litter.

Research field

The researchers chose the secondary school where one of the researchers was working as a secondary school teacher. The researchers together with the co-researchers conducted the research over a period of four years. The data were collected from the field over a period of nine months during the third year. This article gives an account of the instrument used to collect the data. The researchers together with the Grade 8 learners as co-researchers co-generated these data in the school in question.

Sample population

Qualitative sampling is done to increase the utility of information obtained from small samples (McMillan & Schumacher, 2010). In this case, the sample comprised two learner volunteers per class. Class lists were used to select the learners. The researchers selected from a group of learners who had volunteered to participate in the study. Two learners from each of seven classes were chosen and hence, a total of 14 learners served as co-researchers in this study. The selection took place randomly without regard for age or any other factors. Convenience sampling was employed to ensure a manageable population. Consequently, the findings of the study could be generalised only to the school that took part in the study since this sampling technique ultimately adds bias to the study. The secondary school was selected from five secondary and 12 primary schools in the area. This school was selected because of its proximity to one of the researchers and to avoid financial constraints.

Instrument for data collection

In qualitative research, words are descriptive tools through which the researchers undertake transcription and coding processes (Mapotse & Mashiloane, 2017). A participatory action research design was chosen to evaluate the effectiveness of PEAR activities in easing the hindering factors of environmental education in schools. The researchers also

engaged with co-researchers through the processes of planning, action, observation and reflection. For the purposes of this article, the results reflect the participants' observations. An observation schedule to capture the daily activities (Table 1) adds to the trustworthiness of the research results.

The objective was to observe the learners by noting their behaviour and responsibilities. The aim was to determine if the proposed programmes displayed in Table 2 are carried out both inside and outside the classroom (as discussed below in the section regarding the unfolding of PEAR activities). This was done to assess the value of the PEAR activities in the school.

One of the researchers collected data during breaks and after school. The researcher would move around the school to note everything connected to the study and ask questions if a certain behaviour was noticed. This instrument was used to collect data when the researcher engaged co-researchers in PEAR activities.

By using observation as a qualitative data collection method, researchers obtain richness and depth of data collected from complex and multi-faceted phenomena in a specific social context (Strydom & Beziudenhout, 2014). The aim was to understand and explore the implications of PEAR activities in mitigating the factors that hinder environmental education in government schools. The ensuing section discusses the data collected from the PEAR activities.

Data collection during progressive environmental action research activities

The PEAR activities explained in this study were the results of continuous observations and reflections with the co-researchers to devise solutions to mitigate the barriers to environmental education on the school premises and in turn, to increase the co-researchers' awareness of littering. These activities were chosen based on the absence of environmental activities at the school, which contributes to the failure to raise learners' environmental

Table 1. Observation schedule.

OBSERVATION SCHEDULE
(1) Main activities/events at school during break/lunch periods _____
(2) Type of food bought or consumed at school _____
(3) Place where food is consumed: □Classroom □ School grounds □ Other _____
(4) Disposal of waste materials: □ Bins □ On the ground □ Classrooms
(5) Availability of disposal bins: □ None □ Few □ Many
(6) Types of disposal bins: □ Dustbins □ Movable bins □ Rubbish pits
(7) How often litterbin is emptied: □ Everyday □ Once a week □ Once a month
(8) Is there a cleaning duty roster: yes/no _____
(9) Who is responsible for cleaning: □ Learners □ Teachers □ Ground staff
(10) Learners' environmental behaviour concerning litter: □ Use bins □ Place waste on the ground □ Leave waste in classrooms
(11) Teachers' environmental behaviour concerning litter: □ Use bins □ Place waste on the ground □ Leave waste in classrooms
(12) Availability of school mission statement: yes/no _____
(13) Mention of environmental issues by the school mission statement: yes/no ____
(14) If yes, availability of school environmental policy: yes/no _____
(15) Is there a litter pick up duty roster: yes/no _____
(16) Daily school routine: □ Sweeping classroom □ Assembly □ Litter pick-up
(17) General cleanliness of the school: □ Bad □ Fair □ Good □ Better
(18) Other observations _____
(19) Comments _____

Table 2. Progressive environmental action research activities programme.

Term	Learning circle	Strategy
One	Environmental campaigns	Co-researchers pick up papers around the school and address learners at assembly through poems to raise awareness
	Litter pick-up duty roster	Learners and teachers included on the roster to encourage taking responsibility and reducing littering
	Designing school environmental policy	Copies distributed to teachers to provide guidelines and address littering
	Environmental calendar	Copies distributed to teachers and co-researchers in order to keep them informed
	Vegetable garden	Cultivate seeds and seedlings to nurture co-researchers' awareness
Two	School registered as eco-school	Influence school members to take part in the environmental activities
	Designing and installing bins	Reduce littering and raise learners' awareness
	Watering plants	Make use of containers to water trees
	Paint litter bins	Use school uniform colours to catch learners' attention
	Installing boards, naming plants	Use boards and steel to name the plants
Three	Crocheting	Make use of plastic bags and crochet hook
	Class competition	Buy cleaning materials and purchase a voucher to be won
	Celebrating Arbour Day	Use environmental calendar
	Make manure	Collect waste materials from the school kitchen
	Draw on litter bins	To catch learners' attention to use litterbins and stop littering
	Attach emblems on school walls	Make use of drum lids and paints

awareness and to equip them with environmental awareness and knowledge. However, before the implementation of the PEAR activities, the researcher and the co-researchers held a meeting to discuss and put forward PEAR activities. Subsequently, a programme was designed to engage the co-researchers in the PEAR activities (as displayed in Table 2). During the meeting, the co-researchers made the following comments:

> "This programme will assist in keeping the school clean as learners during breaks leave litter on the ground" Co-researcher[2].

> "I think we should include litter pick up roster on our programme so that everyone takes part in cleaning the school since we rely on ground staff to clean the school" Co-researcher[8].

> "I do not understand why the school is using grounds staff to pick papers on the ground and not learners because we litter the school" Co-researcher[3].

> "[G]round staff will be happy as they always complain about us littering the school" Co-researcher[5].

This affirms the aspect of cooperative inquiry since the co-researchers had an opportunity to help to define the inquiry topic, the criteria for joining the inquiry, the arrangements for the meeting and the structure of the meetings and related matters (Heron & Reason, 2006) to mitigate environmental education barriers. Furthermore, the researcher and co-researchers met weekly during the third year of study to discuss progress on the PEAR activities. In this study, the word, "term" was used to refer to the four quarters in the school calendar year in South Africa of which one term comprises three months.

Data analysis, ethics and trustworthiness

Qualitative content analysis was used to analyse the data collected from the observations. This process involves looking at data from different angles with a view identify themes and patterns in the text that will help researchers to understand and interpret the raw data (Nieuwenhuis, 2008). Verbatim words and coding processes were used to analyse the data by using the Microsoft Office package (Word Processing and Spreadsheet). The completed observation schedules were coded intensively to engage collected data and to address the issue of trustworthiness. The researchers used tables to outline details of the data collection process such as the participatory action research process. The aim of using qualitative content analysis was to explore and identify overt and covert themes and patterns embedded in the text (Bezuidenhout & Cronje, 2014).

This research was based on voluntary participation and the co-researchers were free to withdraw at any time. No incentives to participate were offered. In addition, the co-researchers and their parents signed a consent form. All the data collected remained confidential. The following sections discuss the findings.

Findings

The findings of this article are divided into two sections. The first section discusses the lessons learnt from the co-researchers' reflections. The second section presents the findings established from the experience gained through progressive action research cycles.

Findings 1: lessons learnt from co-researchers' reflections

This section shares the voices of the co-researchers while they were engaged in the study. These voices indicate the success of the PEAR activities that were conducted in a cooperative manner to alleviate environmental education barriers in government

schools. When the individual works collaboratively with more capable peers, the potential level of development will be increased. In other words, with the help of an expert, the individual can do more things, and this is referred to as potential development (Lin, 2015).

In this regard, Co-researcher[9] states: "This garden besides producing vegetable but also makes us to respect [*sic*] the environment and learn how to plant seedlings and seeds because at home, some of us don't have vegetable garden [*sic*]." This shows the effectiveness of outdoor education activities. Learning in an outdoor environment contributes to building relationships (Torkos, 2017). In addition, feedback was given in response to the intervention to address the shortage of litter bins in the school. Co-researcher[6] indicated, "Installing these litter bins, we are leaving the legacy in the school since they will be used for the next coming decades."

The co-researchers also commented on how they experienced the opportunity to be outside the classroom. Co-researcher[12] remarked, "It was refreshing to engage in this activity and being [*sic*] away from the classroom. I wish the school could continue to celebrate environmental days". In addition, some learners were even hesitant to return to their classes after planting trees in the morning. Additionally, comments such as that made by Co-researcher[8] show commitment from the learners' side, "Sir, when you are free, please come to our classes and request the teacher in class that we have to water the garden". This was an indication that outdoor learning influences the learners and enhances their awareness of the environment. In support of the echoed sentiments, the use of voices and perspectives that have been traditionally excluded are vital in critical theory (Steinberg & Kincheloe, 2010).

Lack of monitoring by class teachers creates problems among learners. Co-researcher[1] commented, "In my class, if our class teacher does not monitor us, some learners would leave without sweeping, but since we started with this programme, my classmates are progressively sweeping our classroom." To some extent, this study managed to ease problems among learners and instil a sense of responsibility.

In the next section, the findings focus on some of the PEAR activities conducted with the co-researchers.

Findings 2: experience gained through progressive action research cycles

This section discusses the activities conducted with the co-researchers through the cyclic process (spiral of action research cycles), as illustrated in Figure 1. The participatory action research spiral cycles were conducted with the co-researchers to mitigate the factors hindering environmental education in government schools. Hence, several cyclic PEAR

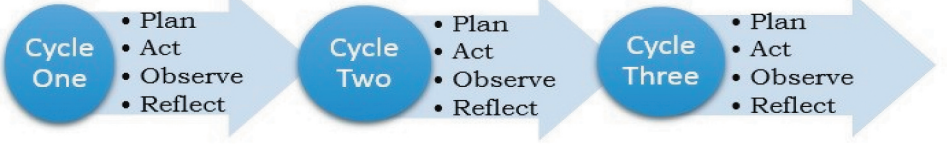

Figure 1. Progressive action research spiral cycles.

activities were undertaken with the co-researchers. These PEAR activities focused on three aspects, namely the exploration of soil, wastes and litter bins.

For the first PEAR spiral cycle (illustrated in Figure 1), co-researchers were engaged in identifying a suitable location and in preparing the soil for the vegetable garden and the celebration of Arbour Day. Owing to the absence of a vegetable garden at the school, the co-researchers identified a dumping site in the schoolyard for the garden. The identified land was prepared months in advance by removing hazardous items and fertilising the soil. Subsequently, the land was irrigated in preparation for cultivation. Co-researcher[10] remarked, "I can't believe we actually transformed this land to be a garden though it was tough to work the land because I don't do heavy work at home, but I learnt something". A dumpsite was effectively converted into a vegetable garden, which addressed the lack of physical space (see Table 4). Moreover, the co-researchers celebrated Arbour Day by planting flowers. Co-researcher[4] commented, "The school should encourage learners to bring flowers on this day to beautify the school, and this could teach us to know about environmental days." This showed that the activity was effective and fun.

The second PEAR spiral cycle activity shown in Figure 1 aimed to conscientise co-researchers that waste materials and objects can be used for environmental activities. For this activity, the co-researchers collected vegetable waste materials from the school kitchen to make compost for the garden. This mitigated the lack of teaching and learning aids, as presented in Table 4. The comment from Co-researcher[14], "[B]esides learning how to make manure, I'm also learning ways of saving money as we don't buy manure from the shop, but we utilise garbage materials" proves that there was environmental education learning in progress. It was found that learners who actively participate in extracurricular activities of waste management consider there is economic gain from waste management because they are able to perceive that waste management in high school gives financial benefit and a clean environment (Prabawati, Martuti, & Isnaeni, 2018).

Co-researchers also brought plastic bags to school, which they cut into strips and used to crochet plastic mats. Co-researcher[13] mentioned,

> "I never thought I will ever carry out this task because usually I see my mother crocheting. So, I thought crocheting is done by women only, but I am happy to be part of this team since I am learning new things".

The co-researchers also managed to convert cut-off drum lids into emblems, which were then fixed to the school walls. The success of the activities conducted in this cycle mitigated some of the factors that hinder environmental education in schools such as lack of teaching and learning resources (see details in Table 4).

The third PEAR spiral cycle (displayed in Figure 1) arose after the co-researchers observed that there was a shortage of litter bins at the school. Steel drums were bought, converted into litter bins and installed on the school grounds. These litter bins were then painted, and images were drawn onto them to attract learners' attention and encourage them to use the litter bins.Co-researcher[6] reflects,

> "It was nice doing this activity because usually I make drawings inside my exercise book but now drawing this on the bins I was overwhelmed, and when I look at these litter bins, I still can't believe we produced such beautiful drawings".

This cycle showed improvement in the learners' environmental awareness and less littering since the school now had enough litter bins on the premises.

Table 3 presents a summary of the co-researcher's activities per spiral cycle, which was developed from Figure 1.

The PEAR activities involved four steps, namely planning, action, observation, and reflection. Socially critical approaches to environmental education advance the idea of authentic participation in which all participants are involved in all dimensions of the research (conceptualisation, planning and execution) (Le Grange, 2009). For instance, Co-researcher[11] suggested, "tracing this structure on the litter bins will help us to avoid making mistakes and to complete this activity much faster". All PEAR activities were hands-on and achieved their objectives, which were to mitigate some of the factors that hinder environmental education in government schools such as lack of funding. Table 4 details alleviation of such barriers. These PEAR activities ranged from physical activities to quiet and reflective exercises (Ballantyne, Packer, & Everett, 2005) and enlightened the co-researchers in a unique and inspiring way (Albert, 2018). Literature suggests that extracurricular activities can strengthen and complement classroom interventions and textbook contents (United Nations Educational, Scientific and Cultural Organization, 2016). This was evident in this study and could be witnessed throughout all the interactions with the co-researchers. The activities to mitigate factors that hinder environmental education proceeded from activity to activity in a progressive cyclical manner. The discussion of the results and interpretation of the data follow.

Results discussion and data interpretation

Environmental education is a cross-curricular discipline that aims to integrate environmental aspects in all school subjects. The integration of environmental education in schools requires teachers to be innovative and critical thinkers, as discussed above. In this case, PEAR activities explored innovative ideas to mitigate the hindrances such as lack of relevant materials that teachers must deal with when they want to educate learners *about, for* and *in* the environment. Utilisation of vegetable waste addressed the economic

Table 3. Synopsis of co-researchers' activities per cycle.

PEAR CYCLE	CO-RESEARCHERS' ACTIVITIES
Spiral cycle 1	Soil exploration and Arbour Day celebration
Spiral cycle 2	Reuse and recycling of waste materials
Spiral cycle 3	Design and installation of drums as litter bins

Table 4. Outlines how identified barriers were addressed in this study.

Category	Coding	Barrier	Action taken
Internal	Support	Lack of support from the school	Worked as a group
	Resources	Lack of teaching/learning materials	Waste served as teaching aid
		Lack of funding/finance	Activities conducted using waste materials
		Physical space	Dumpsite converted to vegetable garden
	Approach	Lack of imitative/learning approach	Used schoolyard to celebrate Arbour Day
			Dumpsite converted to vegetable garden
	Policy	Lack of environmental policy	Designed environmental policy
		Lack of environmental programmes	Designed and executed action plan
External	Resources	Lack of funding/finance	Activities used waste materials

or financial aspect, as argued above. This was an indication that the PEAR activity influenced the co-researchers and partly addressed the issue of lack of funding.

Kimaryo's (2011) study revealed that teachers encountered several barriers in the teaching of environmental education, including a lack of teaching and learning resources. These barriers make teaching and learning of environmental education very difficult. Regardless of these challenges, the researchers in this study in collaboration with the co-researchers mitigated some of these hindrances through PEAR activities. For instance, co-researchers converted plastic bags into crocheted mats. This provided a solution to the lack of teaching and learning resources (see Table 4).

Edwards-Jones et al. (2018) and Mohammed (2016) found factors such as the physical space and the lack of teaching resources to be hindrances to the implementation of environmental education in schools. This seems to suggest that teachers are not sufficiently creative in using the resources at their disposal. The researchers and co-researchers in this study used a PEAR activity that proved to be flexible and innovative in mitigating the physical space aspect; the co-researchers turned a dumping site into a vegetable garden. Therefore, schoolyards are areas that can support and complement classroom learning (Erdem, 2018).

Govender (2011) found that waste and recyclable materials are not used in classroom activities. This confirms that teachers are not attempting to use the suggested environmental education methodologies (Mwendwa, 2017; Zwelibanzi, 2016). In this case study, the PEAR activities proved that recyclable materials such as drum lids could be converted into emblems that serve as a teaching and learning resource. Co-researcher[7] stated,

> "Since we have started with this project, I have noticed that we have been utilising discarded objects. I never thought lids removed from the drums could be turned into emblems. Thank you, Sir, for opening our eyes".

Reuse of materials enables children to integrate recycling into their creations and imaginations of the future (Jørgensen et al., 2017). Both learners and teachers thus engaged in the learning process. The benefit for the co-researchers was that they were exposed to a different pedagogical and ideological path in environmental education and in school (Tsevreni, 2011).

Table 4 details the barriers and the actions that were undertaken to increase co-researchers' awareness about environmental problems.

In summary, schoolyards afford learners opportunities to learn about their immediate environment. In the current study, the dumping site was converted into a vegetable garden as an approach to ease the barriers to environmental education that teachers encounter at schools. Vegetable gardens can be used as teaching resources to enlighten learners about the process of photosynthesis, the effects of climate change, absorption and other phenomena (Maluleke, 2015). Moreover, environmental education promotes hands-on learning activities. Progressive environmental action research activities serve as an appropriate method for teachers to teach environmental education, which in turn, will impart environmental knowledge and action skills to learners. For example, learners can use waste materials to make manure and fertilise their own vegetable gardens. This approach addresses environmental and economic aspects through litter reduction and cost savings. The PEAR activities made learning fun for both teachers and learners since both participated in the learning process. These activities prompt action and develop competence.

Critical theory helped us devise questions and strategies to mitigate the environmental education barriers obstructing teachers from effectively conducting environmental education (Steinberg & Kincheloe, 2010). Critical theory and participatory action research connect education with environmental emancipatory ideals (Tsevreni, 2011). Hence, this study shows that PEAR activities serve as a teaching strategy that can be used to alleviate some of the hindering factors that teachers encounter when teaching environmental education in schools.

Conclusions and recommendations

Progressive environmental action research activities stimulate learners' awareness about littering (Matsekoleng, 2017). In addition, the PEAR activities not only made environmental activities fun but also ensured that learning occurred. These activities were aimed at mitigating the hindrances that teachers experience when they teach environmental education in their schools. The results of the study revealed that PEAR activities successfully addressed some of the hindering factors stated in Table 4. Progressive environmental action research activities include education *about, for* and *in* the environment, and teaching in a hands-on manner stimulates learners' environmental awareness (Coertjens, Boeve-de Pauw, De Maeyer, & Van Petegem, 2010). Therefore, it can be deduced that participatory action research is an effective environmental tool to mitigate factors hindering environmental education in schools. Hartley et al. (2018) assert that after participation in an environmental education project, the school learners in their study were more concerned about the problem and perceived greater negative impacts and causes of marine litter.

Progressive environmental action research activities must be conducted under the supervision of the teacher to ensure that the intended objectives are achieved. The researchers of the current study, therefore, conclude that participatory action research can be used to mitigate some of the factors that prevent teachers from implementing environmental education in their schools.

Ethics statement

The ethics protocols have been observed as per university requirements since this study is emanating from my Doctoral study (2020/06/10/48502928/28/AM).

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