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## Effectiveness of environmental education implementation in promoting participation in sustainable solid waste management Behaviours among the grade 12 pupils of the Zambia's Chipata City

Moses Phiri <sup>1</sup>, Liberty Mweemba <sup>2</sup>, Inonge Milupi <sup>3</sup>

<sup>1-3</sup> School of Education, University of Zambia, Zambia

\* Corresponding Author: **Moses Phiri**

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### Abstract

The aim of this study was to evaluate Environmental Education (EE) effectiveness in promoting sustainable solid waste management behaviours (SSWMBs) among pupils of the Zambia's Chipata City using Kirkpatrick's evaluation model in order to ascertain progress, provide feedback on the level of achievement of promoting SSWMBs among pupils as outlined in the Zambian Biology school syllabus and to suggest areas of improvement to the continued EE implementation in Zambian schools.

The study was based on cross-sectional exploratory case study design and it used quantitative approach. Quantitative data was collected using a survey questionnaire from 367 randomly selected Grade 12 school pupils from the 4 purposively selected secondary schools of the Zambia's Chipata City.

The study results revealed low levels of effectiveness of environmental education implementation in promoting SSWMBs among Grade 12 pupils of Chipata City, Zambia as only about a third of pupils were currently regularly participating in SSWMBs and the mean for pupil participation in each SSWMBs was less than 3, the mid-point score on a five point frequency score. The results imply that there were a number of barriers to promoting wide adoption of SSWMBs.

To enhance the effectiveness of EE implementation in schools, barriers to wide adoption of SSWMBs need to be overcome while the required drivers such as making waste management infrastructure available in accessible locations and incentivising waste management behaviours needed to be put in place. The study recommends in-service training of teachers for them to be competent in the use of pedagogical approaches that would enhance pupils' technical know-how, experience, skills and deeper understanding of SSWMBs during EE lessons.

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### 1. Introduction

In the current era of accountability, demonstrating the effectiveness of educational programme implementation through meaningful evaluation was a requirement. The effectiveness of an educational programme is directly linked to the level of achievement of the intended educational goal (Arnoff, 1987; Devi and Shaik, 2012) <sup>[5, 16]</sup>. In the field of education, evaluation is conducted to justify continued implementation of an educational programme and to make judgements about the level of achievement of the goals of the educational programme. Evaluation is an integral part of a continuous cycle of quality assurance that includes the philosophy of an educational programme (Bramley and Newby, 1984; McNamara, Joyce and O'Hara, 2010) <sup>[10, 33]</sup>. Unfortunately, the existing literature suggests a lack of a culture of evaluation within the field of EE (West, 2013). As such evaluation of EE programme was still rare globally. Inadequacy of evaluations in the field of EE has been attributed to the lack of awareness of or access to methods and tools for the evaluation process (Eseryel, 2002) <sup>[19]</sup>. Therefore, although evaluation of educational programmes like EE plays a vital role in measuring its effectiveness, it was a

source of frustrations for EE evaluation researchers since they had to struggle to make sense of the variety of approaches in EE evaluation.

However, as pointed out by Praslova (2020)<sup>[40]</sup>, the process of evaluation does not need to be overly complicated.

The reviewed literature suggest that previous studies that have evaluated EE implementation in Zambian schools have focused only on input and process evaluations rather than outcome evaluations. For example, focused on examining the role of inputs such as teacher qualifications and competency, availability of relevant EE teaching and learning materials and process such as appropriate teaching methods in Environmental Education (EE) implementation rather than on the outcome or products such as the level of pupil participation in sustainable solid waste management behaviours (SSWMBs). The researchers of this study argue that transfer of learning as measured by the level to which pupils were able to put into practice SSWMBs in their daily lives would be the best indicator of the effectiveness of EE implementation in schools since information deficit models have clearly demonstrate that possession of waste management knowledge alone does not always translate into action. Pupils levels of participation in SSWMBs as an indicator of effectiveness would provide insights into pupils waste management knowledge and understanding of waste management concepts.

## 1.2 Background to the study

### 1.2.1. Evaluation, effectiveness and aims of educational programme evaluation

Evaluation has been defined differently in existing in literature Duignan (2001)<sup>[17]</sup> suggesting that there are different aspects of evaluation or purpose as well as what it measures. Evaluation according Brown (2007, p. 820)<sup>[12]</sup> is “a process that may be used to determine the effectiveness and/or efficiency of instructional programmes”. With reference to providing feedback, evaluation is defined as “any attempt to obtain information (feedback) on the effects of a training programme and to assess the value of the training in light of that information” Topno (2012, p.16)<sup>[47]</sup>.

Benefits of conducting training evaluation includes serving as quality control measure of an educational programme (Bramley and Newby, 1984)<sup>[10]</sup>. As such, evaluation is an integral part of a continuous cycle of quality assurance that includes the philosophy of an educational programme (McNamara, Joyce, O'Hara, 2010)<sup>[33]</sup>. Evaluation is conducted to verify the effectiveness of an educational programme or training hence evaluation is regarded as the most appropriate method for examining the effectiveness of an educational programme (Bramley 1994; Cheng and Ho; 2001, Tennant *et al.*, 2002; Khandker *et al.*, 2010 and Farjad, 2012)<sup>[10, 15, 46, 20, 27]</sup>. Effectiveness as used in this study refers to the degree of the attainment or achievement of a desired target or goal (Arnoff, 1987; Devi and Shaik, 2012)<sup>[5, 16]</sup>. In the context of this study, effectiveness implies the extent pupil participating in SSWMBs in their daily lives as stipulated in the Zambian Biology School syllabus through EE implementation in schools (MESVTEE, 2013). Khandker *et al.*, (2010)<sup>[27]</sup> argued that the evaluation of an educational programme such as EE provides insights into its ability to achieve the intended goals. Similarly Gertler *et al.* (2011)<sup>[22]</sup> revealed that the results of an evaluation are helpful in decision making as to whether benefits of continued implementation of an educational programme such as EE

justifies the cost (Brown, 2007)<sup>[12]</sup>. Considering that implementation of EE in schools places a resource burden on the school and the government, there was need to know the results of the EE implementation to ensure that the resource outlay is reflected in enhanced performance in terms of increased participation in SSWMBs among school pupils due to wide adoption of such behaviours. Kirkpatrick and Kirkpatrick (2009)<sup>[30]</sup> and Gertler *et al.* (2011)<sup>[22]</sup> explicitly argued that educational programmes of which EE is among them must be evaluated to determine whether they should be continued or not, suggesting that evaluation is crucial to decision making as well as identifying the areas in an educational programme which require further improvement. Evaluation may also provide insights into methods that may be used to improve implementation of the training programmes (Saad and Mat, 2013; Rampun, *et al.*, 2020)<sup>[43]</sup>. Thus, Topno (2012)<sup>[47]</sup> and Rampun *et al.*, (2020)<sup>[43]</sup> recommended that educational processes should be evaluated to determine the effectiveness of different components of the educational programme. Therefore, this study aimed at evaluating the effectiveness of EE implementation in promoting pupil participation in SSWMBs among grade 12 pupils of the four secondary schools of Chipata City, Zambia using Kirkpatrick's evaluation model.

## 2 Literature review

### 2.1. Kirkpatrick's Evaluation Model

Kirkpatrick's model of evaluation was introduced by Donald Kirkpatrick in 1954 and it was originally developed to evaluate the training effectiveness in business and industry organisation but it has evolved over the years and has been adapted as an instrument for understanding effectiveness of an educational programme. The Kirkpatrick's evaluation model has four levels of evaluation namely reaction, learning, behaviours and results.

At the reaction level, evaluation focuses on understanding trainees' responses and reactions to the educational programme itself in terms of their satisfaction with the training materials, venue, training content and delivery approaches (Jain *et al.*, 2021; Kirkpatrick and Kirkpatrick, 2007)<sup>[13, 25]</sup>. At the reaction level, measures are either one dimension such as satisfaction or multiple dimensions for example training materials, content, delivery methods, trainer, timing, instructional activities and improvement (Brown, 2007)<sup>[12]</sup>.

At the 'learning level', evaluation focuses on assessing trainees learning in terms of cognitive change, skills and attitudes as a consequence of participating in the educational programme. There are three dimensions of learning outcomes which level two is concerned with, namely: skill related, cognitive and attitudinal (Kraiger *et al.*, 1993)<sup>[31]</sup>. Cognitive learning outcomes are concerned with acquisition of knowledge (Alvarez, 2004)<sup>[4]</sup>. Skill-related learning outcomes are concerned with the acquisition of technical or motor skills while attitudinal learning outcomes are concerned with a variety of aspects such as goals, motivation and attitude that are related to the objectives of the training programme (Kraiger *et al.*, 1993)<sup>[31]</sup>.

At the behavioural level, the focus of evaluation is on assessing transfer of knowledge in terms of how trainees apply what they learnt after participating in a particular educational programme. This level evaluates the effects of an educational programme on performance which in the context of this study is effects of EE on pupil participation in

SSWMBs among Grade 12 pupils in their daily life. Methods for evaluating this level includes objective indicators of performance (Ruiz and Snoeck, 2018; Arthur; 2003) <sup>[42, 6]</sup>, observation and self-assessment (Warr *et al.*, 1970; Saad and Mat, 2013) <sup>[49, 43]</sup>. Thus, in this study, a five point frequency scale ranging from never to always was deemed ideal for measuring pupils frequency of participation in SSWMBs. Regarding the best time to measure behavioural change in trainees, Kirkpatrick (1996) <sup>[28]</sup> recommended that post-training evaluation should be carried out at least three months after the training, although he acknowledges that some participants may not change their behaviour for six months or may change for a while before going back to the previous behaviours. However, Axtell *et al.* (1997) <sup>[7]</sup> reported that the amount of learning transferred after one month is a strong predictor of the amount transferred after a year. Therefore, level 3 of the model, behaviour which is also known as transferability of learning was very relevant to the current study because the primary focus of the study was on establishing the extent to which Grade 12 pupils were able to practice SSWMBs they had learnt through waste EE implementation in their schools. It could be argued that level 3, behaviour could be used to assess the first two levels because the results obtained in this level could demonstrate whether the knowledge, skills and/or attitudes learnt through EE implementation in Zambian schools transfer to personal waste management behaviours to guarantee that reduced poor solid waste disposal would be addressed in future in Zambia. Based on Level 3 of the Kirkpatrick's model, the current study investigated the Grade 12 pupils' participation in four dimensions of SWMBs as the representation of transfer of learning of waste management, namely waste avoidance, waste reduction, waste reuse and waste recycling behaviours. At the results level, evaluation focuses on assessing the level of achievement of the expected educational programme outcome. Therefore, the results criteria in the academic context may include many outcomes such as alumni employment and succession in the workplace, admission to tertiary education, responsible citizenship, enhanced participation in sustainable solid waste management behaviours. The results level was not evaluated since it was not the focus of the study.

Kirkpatrick's model has made immense contribution to educational programme assessment thinking as well as practice over the years and it has served as a foundation for the development of many other evaluation models (Bates, 2004; Kaufman *et al.*, 1995; Holton, 1996) <sup>[8, 24, 26]</sup>. Based on this argument, it can be deduced that a number of existing evaluation model present in the current literature were based on the Kirkpatrick's model (Holton, 1996; Nickols, 2005; Reio, 2017) <sup>[37, 24, 41]</sup>. Kirkpatrick's model is the most cited in academic research according to Jain *et al.*, (2021) <sup>[25]</sup> which suggests that it is the best-known and most widely used framework for classifying evaluation (Bates, 2004; Saad and Mat, 2013, Tamkin *et al.*, 2002) <sup>[8, 43, 45]</sup>. Furthermore, Kirkpatrick's model is not only simple but also practical and easy to understand hence it has significantly contributed to the theory of evaluation and its practice (Bates, 2004) <sup>[8]</sup>.

Although the hierarchical nature of Kirkpatrick's model has been criticised by among other authors Holton (1996) <sup>[24]</sup>, and Alliger and Janak (1989) <sup>[1]</sup>, there was lack of sufficient evidence in several studies and empirical results to support the argument that Kirkpatrick's model is hierarchical in

nature Bates, 2004) <sup>[8]</sup>. Other scholars have also criticised Kirkpatrick's model for causality assumption between its levels as well as its importance in terms of the increasing levels of learning outcome. Despite all these criticism, Kirkpatrick and Kirkpatrick (2006) <sup>[29]</sup> clearly pointed out that levels in a Kirkpatrick's evaluation model could be measured in any order suggesting that assumption of causality was not important in the model. Although several other evaluation models for evaluating educational programmes such as ones developed by Warr *et al.* (1970) <sup>[49]</sup>, Kaufman and Keller (1995) <sup>[26]</sup> have been developed, Tamkin *et al.* (2002) <sup>[45]</sup>, have argued that majority of them were the direct descendants of Kirkpatrick's model because they adopt much from the original model (Jain *et al.*, 2021; Nickols, 2005; Reio *et al.*, 2017) <sup>[25, 37, 41]</sup>. The main challenge with other evaluation models that have been used to evaluate educational programmes is that they were very complicated, costly to implement and time-consuming (Jain *et al.*, 2021) <sup>[25]</sup>. Therefore, Kirkpatrick's evaluation model was adopted in the current study because of its applicability, practicality and simplicity to evaluating the effectiveness of EE in promoting SSWMBs among school pupils.

## 2.2. Adaptation of Kirkpatrick's Evaluation Model to the educational setting and the purpose of educational programme evaluation

As already mentioned, Kirkpatrick's Evaluation Model was originally developed to evaluate the training effectiveness in business and industry organization. However, several scholars have adapted rather than adopted Kirkpatrick's evaluation model for use in academic contexts by determining quantifiable measurements used to assess performance, track progress and measure the success of educational programme because of its potential for use to evaluate training in an educational context Kirkpatrick and Kirkpatrick, 2006) <sup>[29]</sup>. In support of this argument Ruiz and Snoeck (Ruiz and Snoeck (2018) <sup>[42]</sup> have contended that Kirkpatrick's Evaluation Model can be applied to various types of educational programmes. To substantiate this claim, Bewley and O'Neil (1996) <sup>[28]</sup> confirmed that Kirkpatrick's model has been used successfully to evaluate different training programmes in educational settings despite its limitations (Alsalamah and Callinan, 2021) <sup>[3]</sup>.

The researchers of the current study could not find any study that has been conducted in the Zambian school context to assess the effectiveness of EE towards achieving the intended goal outlined by the Ministry of Education in the Zambian School Biology syllabus of enabling pupils to *apply* SSWMBs concepts in their daily life (MESVTTE, 2013, p.48). In emphasizing the significant role of EE in bringing about pro-environmental behaviour change, the Zambia's Ministry of Education (2000) contended that "education aims not only at providing the basic facts and understanding of the processes that lead to environmental problems but also to bring about a positive change in pupils attitudes and behaviour". In the absence of the knowledge of the effectiveness of EE in promoting such goals, it would be difficult to justify whether EE implementation should be continued in its current form or it should be improved.

According to the Zambian Biology syllabus, pupils were not only expected to learn how to reuse, reduce and recycle materials as important concepts in waste management but also to put the idea of these 3Rs in their daily life (Ministry Of Education, Science, Vocational Training and Early

Education, 2013). Based on this argument, the researcher argues that evaluation of the effectiveness of EE in promoting pupil participation in the 3Rs which are the dimensions of sustainable solid waste management behaviours (SSWMBs) was needed to compare current pupils' behaviours in these dimensions to the intended EE goal of ensuring that pupils practice SSWMBs in their daily lives after learning waste management concepts in the school curriculum as outlined by the then Ministry of Education, Science, Vocational Training and Early Education (2013) in order to verify progress, identify difficulties, and in case of non-achievement of the goal, to reorient the education implementation process to the necessary corrections in order to achieve the intended goals. explicitly contends that any evaluation should be based on the achievement of the specific outcomes. Thus, evaluation of the frequency of participation in SSWMBs among Grade 12 pupils was deemed appropriate to judge the effectiveness of EE implementation. There has been a call in literature that evaluation of the level of achievement of the environmental education outcomes outlined in the school curriculum has to be undertaken regularly (Bennet 1989)<sup>[6]</sup> in order to ascertain the effectiveness of the training process and to improve the process of teaching and learning in situations where the evaluation results reveal that the intended outcomes such as wide adoption of SSWMBs were not being achieved. This is consistent with MESVTEE (2013) argument that the quality of an educational programme could be assessed based on the outputs from the educational system. A variety of SSWMBs such as waste avoidance, waste reduction, waste reuse, waste recycling and composting were all available options for pupils living in Chipata City, Zambia to take advantage of to reduce the amount of waste requiring disposal in waste dumps. Secondary schools have a recognized role towards achieving sustainability. However, schools in Chipata City, Zambia were still facing a challenge of poor solid waste management due to unsustainable solid waste management practices of pupils (CMC, 2008). Currently, based on researchers observation, poor solid waste management were practiced by pupils all the school in Chipata City despite increasing awareness of benefits associated with sustainable solid waste management such as conservation of resources, reduction in pollution and so on.

Alsalamah and Callinan (2021, p.1)<sup>[3]</sup> explicitly contended that educational programmes have to be "evaluated to verify their effectiveness, assess their ability to achieve their goals and identify the areas that require improvement". The importance of evaluating an education programme was emphasized by who contended that "education programmes must be evaluated in order to assess their worth and monitor performance". More recently, the then Ministry of Education, Science, Vocational Training and Early Education (2013, p.60) echoed Thomas' sentiments by contending that educational "institutions should monitor, evaluate and analyse the effectiveness of their programmes". From the arguments put forward by: UNESCO-UNEP (1978), Ministry of Environment and Natural Resources (1994), demonstrating the success and value of an educational programme through meaningful evaluation was a requirement for educational institutions and training providers to ascertain its effectiveness in achieving the intended goals such as promoting participation in SSWMBs, monitor performance, developing necessary interventions and to justify public expenditure given a huge amount of resources that are required in the current era where

accountability is at the centre of decision making.

Secondary schools get engaged in sustainable development in the sense that that they promote use of knowledge to serve humanity (United Nations, 2011). Sustainable solid waste management remains an essential part of sustainable development because it contributes to not only saving of resources and energy but it also promotes public health wellbeing which were of everyone's concern (Morrissey and Browne, 2004) explicitly pointed out that institutions such as schools were one of the decisive factors which enable, constrain and shape participation in SSWMBs among the secondary school pupils.

The aim of this research was twofold, firstly to measure the frequency of pupils' SSWMBs; and, secondly, to rank the pupils SSWMBs in each dimension from the most preferred behaviour to the least preferred behaviour.

### 3. Study Design

The evaluation of the effectiveness of EE implementation in the Zambian school context in the current study was based on level 3 of Kirkpatrick's Evaluation Model and it was conducted in August, 2018. Of the 60 studies on evaluation of EE that were reviewed the researcher only found 5 studies that have evaluated effectiveness of EE in the school context and none of them had evaluated the effectiveness of EE with reference to sustainable solid waste management which implies that such studies were limited. Therefore, the current study was carried out in an exploratory style as advocated by in order to provide statistical insights on the frequency of participation in SSWMBs among pupils of the Zambia's Chipata City in order to make judgements effectiveness of EE implementation in promoting pupil participation. Therefore, since the effectiveness of EE was related to increasing participation in SSWMBs among Grade 12 school pupils, which is a positive result of EE implementation as explained in the literature, the effectiveness of EE was explored through quantitative methods with the pupils reporting their frequency of participation in SSWMBs. Specifically, the current study used a cross-sectional exploratory case study design and employed quantitative research methods. The research design was more suitable to the current study since the primary purpose of this study was concerned with evaluating the effectiveness of EE in promoting SSWMBs among Grade 12 pupils which would better be achieved through exploring the frequencies of participation in SSWMBs as they existed among pupils at the time of the study. The study design was based on the philosophy of positivism and was informed by the logic of induction.

#### 3.1. Study site and instruments

The study was conducted in four purposively selected public urban secondary school of Chipata City, Zambia. The schools were selected based on the fact that Chipata City Councils considered them among the major unsustainable waste management institutions in the city (Chipata City Council, 2008).

A closed ended self-administered paper based survey questionnaire was used to collect quantitative data from the randomly selected Grade 12 pupils at each of the four study sites (schools). Experience teachers of Geography and EE lectures at the University of Zambia checked that the items in the research instruments were appropriate to enhance validity prior to the study. Based on feedback from the two types of EE specialists, some questions were reworded to improve

clarity or comprehensiveness.

Due to similar social, economic and pupil characteristics to Chipata, the research instrument was pilot tested with 30 Grade 12 pupils in the nearby district of Katete and the results of the pilot test resulted and clarifying meaning for two questions in the survey questionnaire. The corrected version of the research instrument was used to collect data for the study.

### 3.2. Target population and study sample

The target population for the study was all the Grade 12 pupils in the four selected schools. Before collecting data, it was decided that a minimum of 331 Grade 12 pupils were needed in this study using Yamane's (1967) formula and based on the total population of 1910 Grade 12 pupils in the four secondary schools within an error margin of 5%. However, in this study, 397 Grade 12 pupils randomly selected were given the questionnaire to respond to it and out of these, 367 Grade 12 pupils returned the completed questionnaire hence the minimum requirements for the sample of 331 was met. All research participants were assigned pseudonyms to ensure anonymity.

### 3.3. Data analysis

The researchers checked the responses obtained from the Grade 12 research participants through the survey questionnaires and analyzed them using the SPSS version 16 for descriptive statistics like percentage, mean, and frequency. The Likert scale data was scored as follows: never

was scored as 1, rarely was scored as 2, sometimes was scored as 3, often was scored as 4 and always was scored as 5. The frequency distribution of scores was obtained from the tabulation of respondents' answers. Analysis of the internal consistency of the scales was evaluated with Cronbach's alpha statistic which is the most widely used statistic to determine the internal accuracy of a scale consisting of several Likert scale items (Tavakol and Dennick, 2011). Descriptive statistics in terms of means were obtained for each item and each dimensions of SSWMBs.

## 4. Results

### 4.1. Factor and Reliability analyses

A principal components analysis with varimax rotation was employed. Factor analysis of SSWMBs did not yield anticipated factors namely waste avoidance, reduction, reusing and recycling but rather yielded two factors that related to a combination of waste recycling and reuse behaviours and a combination of waste avoidance and reduction behaviours (Table 1). Factor analysis provided a new set of variables to work with.

Reliability analysis was done to check whether the different statements in each factor that emerged from factor analysis measured the same construct (Field, 2014) [21]. Cronbach's Alpha statistics were above 0.50 in all cases, which meant a strong reliability involving multiple items in each scale and this provided a good empirical basis for analysing the data from the questionnaire by summing the items (Nunnally, 1967) [38].

**Table 1:** Reliability test results for the variables

No. of item in a scale	Name of the variable	Communality	Cronbac's alpha value
13	overall SSWMBs in the past 3 months		0.811
7	Factor 1:waste recycling and reuse behaviours		0.792
4	Factor2: waste avoidance and reduction behaviours		0.657

Instead of sticking with theoretically anticipated dimensions of SSWMBs consisting of waste avoidance, waste reduction, waste reusing and waste recycling, the researcher based all further analysis on the two empirically determined dimensions namely, waste recycling and reuse behaviours and waste reduction and avoidance behaviours since the empirically determined dimensions of SSWMBs were more objective.

### 4.2. Frequency of participation in SSWMBs among the Grade 12 pupils of Chipata City

The findings revealed that the overall average SSWMBs score was 2.39, with a standard deviation of 0.73 on a scale of 1–5. Considering each dimension of SSWMBs, participants reported higher levels of participation in recycling and reuse behaviours, with an average score of 2.34 and a standard deviation of 0.86 compared to levels of participation in waste avoidance and reduction behaviours which had an average score of 2.12 and a standard deviation of 0.98 (Table 4.2).

**Table 2:** Average participation in overall SSWMBs and in each dimension of SSWMBs among Grade 12 pupils of Chipata City.

	Mean	SD	Cronbach' s alpha
Overall SSWMBs average, N=359	2.39	0.726	0.811
<b>SSWMBs dimension</b>			
Waste recycling and reuse behaviours, N=359	2.34	0.85540	0.792
Waste avoidance and reduction behaviours, N=355	2.12	0.977	0.65

Based on the average participation in each of the dimensions of SSWMBs as shown in table 2 above, it could be argued that more Grade 12 secondary school pupils in Zambia's

Chipata City prefer to participate in waste recycling and reusing behaviours rather than in waste avoidance and reduction behaviours.

**4.2.1 Levels of participation in recycling and reuse behaviours**

In order to determine research participants' levels of

participation in recycling and reuse behaviours, a response frequency index shown in table 3 was created based on the research participants' answers to the question.

**Table 3:** Frequency of participation in recycling and reuse behaviours among grade 12 pupils

Mean	How often have you participated in each of the following activities in the past 3 months?	Never	Rarely	Sometimes	Often	Always
2.22	F1-separating waste paper from the rest of waste before disposal	147	79	60	38	29
2.35	F2-separating recyclable plastics from the rest of waste before disposal	141	69	61	46	38
2.01	F3-taking various type of recyclable waste to the recycling facility	192	51	50	25	32
2.59	F7-using disposable containers such as plastic bottles and used plastic career bags to make useful things	102	72	81	51	42
2.32	F12-recycling various types of recyclable waste	148	53	64	47	33
2.36	F13-avoiding buying products which are wrapped in materials that does not decay	120	61	78	37	57
2.58	F14-Making special effort to buy products that a made from recyclable materials	133	77	65	40	38

Table 3 shows that pupils' participation in recycling and reuse behaviours was very low as the mean score in each observed behaviour was less than the mid-point score of 3 on a five point frequency scale. Table 4.3 also shows that a number of pupils who did not participate in each recycling or reusing behaviour was almost three times more compared to those who regularly (always) participated in such behaviours and that many pupils irregularly participate in recycling and reusing behaviours than those who regularly participate in such behaviours.

Based on Likert's original thinking that the phenomenon of interest should be measured by the aggregate group of items in the scale, and not just by one item on its own (Spencer, 2015), the total score for each research participant was

computed by summing together individual scores on each of the 5 Likert items (Deselle, 2005; Spencer, 2015). The dividing lines calculated using cumulative percentage were ascertained using SPSS software based on the three percentiles-33.33%, 66.67% and 100% as shown in the SPSS. The results shown in Fig 4.5 revealed that more than one third of the sampled pupils, 34% (n=122) were non-participants in recycling and reuse behaviours suggesting that they were not involved in any recycling and reuse behaviour while 32.9% (n = 118) of the sampled secondary school pupils irregularly participated in recycling and reusing behaviours and only 32.4% (n=113) out of the research respondents regularly participated in recycling and reuse behaviours.

**Table 4:** Recycling behaviour scores by category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	low level of participation in recycling and reuse	122	33.2	34.0	34.0
	moderate level of participation in recycling and reuse	118	32.2	32.9	66.9
	high level of participation in recycling and reuse	119	32.4	33.1	100.0
	Total	359	97.8	100.0	
Missing	System	8	2.2		
	Total	367	100.0		

**4.2.2. Level of participation in waste avoidance and reduction behaviour**

As in the previous section, a response frequency index shown

in Table 5 was created to show scores of waste reduction and avoidance behaviour.

**Table 5:** Levels of waste reduction and avoidance behaviour among grade 12 pupils

Mean	How often in the past three month have you separated each of the following type of recyclable waste from the rest of waste for the purpose recycling or composting it?	Never	Rarely	Sometimes	Often	Always
2.31	buying products which contain no packaging materials if available	116	85	84	46	16
1.94	Refusing to receive a free plastic bags provided by the shop owner after buying a few items.	192	47	68	25	18
2.06	refusing to buy products packaged in disposable packaging materials if the same type of products is available in non-disposable material	166	77	50	31	25
2.60	buying products which contain less packaging materials	82	80	106	42	33

Table 5 shows that pupils' participation in waste reduction and avoidance behaviours was very low as the mean score in each observed behaviour was less than the mid-point score of 3 on a five point frequency scale.

As in the previous section, the total score for each research participant was computed by summing together individual scores on each of the 4 Likert items (Deselle, 2005; Spencer, 2015). From the summed up total scores, three interval scales were created apriori as shown in Table: 4.7. It could be seen in Table: 4.7 that of the sampled pupils, 40.2% (n=143) were

not currently participating in any waste avoidance and reduction behaviours while 31.7% (n=113) of the sampled population irregularly participated in waste avoidance and reduction behaviours and only 28.1% (n=100) of the research participants regularly participated in waste avoidance and reduction behaviours. Compared to 71.9% (n=213) research respondents who irregularly and never participate in waste avoidance and reduction behaviours only 28.1% (n=100) of research participants regularly participated in waste avoidance and reduction behaviours.

**Table 6:** Waste avoidance and reduction behaviour scores by category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor	143	39.0	40.2	40.2
	Fair	113	30.8	31.7	71.9
	Good	100	27.2	28.1	100.0
	Total	356	97.0	100.0	
Missing	System	11	3.0		
Total		367	100.0		

## 5. Discussion

The findings of this study have revealed that the levels of participation among the Grade 12 pupils of the Zambia's Chipata City in overall SSWMBs as well as in the two empirically determined dimensions of SSWMBs, namely, 'waste recycling and reuse behaviours' and 'waste avoidance and reduction behaviours' were very low since the mean score in all the three cases was less than the midpoint score of 3 on a five point frequency scale. The findings of this study were in agreement with the results of the study conducted by in Nigeria which revealed that although the secondary school pupils from the sampled zones of Ogan State were aware of waste problems, they possessed poor waste management practices. Further analysis of the data revealed that only about 1/3 of the pupils regularly participate in the two dimensions of SSWMBs confirming that participation in such behaviours was low. Based on the results, the researcher acknowledged that the actual level of participation could be much lower because self-reported SSWMBs could have been overstated since the study utilised self-reported behaviours rather than actual observed behaviours.

Studies conducted by Environmental RTDI Programme (2005) attributed low frequency of participation in SSWMBs among respondents to factors such as the lack of waste management facilities in accessible locations. This implies that investment in recycling facilities was needed in order to successfully promote SSWMBs among pupils.

The current study has also revealed that pupil participation in SSWMBs located higher in the waste management hierarchy was low. The results are similar to the results of a study which was conducted by Environmental RTDI Programme (2005) which found that although respondents in their study demonstrated willingness to participate in certain waste management activities such as recycling, "there was less interest in changing consumption patterns to move from recycling to waste prevention and minimisation activities" (Environmental RTDI Programme, 2005, p.65). Another study conducted also found that recycling and reuse behaviours, as structured activities, were undertaken on a more frequent basis than waste avoidance and reduction behaviours. The findings of the current study suggests that promoting participation in SSWMBs that are located high up in the waste management hierarchy such as waste avoidance and reduction behaviours was more challenging. This finding was not surprising because as pointed out by Environmental RTDI Programme (2005, p.65), "most of the waste awareness literature focuses initially on easy actions such as recycling". Based on the results obtained in a study similar to those obtained in this study on the levels of participation in SSWMBs, in their study concluded that waste avoidance and reduction were more challenging behaviours to promote both socially and politically because these behaviours infringe more on lifestyle choices and established practices than simply taking materials to be recycled. For example, waste management behaviours that provide people with economic

benefits were much easier to adopt compared to those that do not. The findings from the current study implied that Grade 12 secondary school pupils of Chipata City prefer to participate in corrective actions such as recycling rather than preventive actions such as waste avoidance.

The findings of the current study mirrors the findings of the study conducted on greening of a campus through waste management initiatives in Thailand in which inadequate recycling infrastructure was found to be one of the barriers to public participation in recycling. Similarly, a study conducted revealed that difficulty faced in accessing recycling facilities was one among the barriers to adopting recycling behaviours among members of the public. For the school to successfully promote SSWMBs among pupils, the school management should ensure that waste management facilities were conveniently located throughout the school compass.

There was also need for the government to promote industrial/commercial recycling activities and to raise awareness about the value of the recyclable wastes and to provide recycling facilities in convenient locations for recycling behaviour to become a norm in all Zambian communities.

## 6. Conclusion

The findings revealed that only about one third (33%) of the Grade 12 pupils of the Zambia's Chipata City regularly participated in SSWMBs. However, these results should be interpreted with a lot of caution because the actual frequency of participation in SSWMBs among pupils could have been much lower than what was reported since the behaviours studied in this study were self-reported. Therefore, although this study has addressed an important research gap and despite that there was no valid reason to doubt its results, there was need to exercise caution when interpreting results on SSWMBs from the survey questionnaire because the behaviours were self-reported rather than observed and as such, the Grade 12 pupils could have overestimated their SSWMBs.

Low levels of participation in SSWMBs among pupils should be of concern to Government as a major educational provider, teachers and education policy makers because more resources were being spent on implementation of EE as an education intervention to promoting SSWMBs even though wide adoption of such behaviours had remained disappointingly low. In the absence of effective waste management education in schools, the challenge of poor solid waste management and its impacts may not be addressed both in the short and long terms in Zambia because continued provision of ineffective basic education would render the school system irresponsive to promoting SSWMBs among its citizens especially the young ones. Lower in the waste management hierarchy as most the important ones.

Based on the results of the study, it can be concluded that the effectiveness of EE implementation as an educational intervention to promoting SSWMBs among Grade 12 pupils

of Chipata City was very low. The lower mean value of 'waste avoidance and reduction behaviour' than 'waste recycling and reuse behaviours' imply that pupils' participation in the behaviours located high in the waste management hierarchy were still very low despite implementation of EE as an educational intervention in schools and that there was a need for teachers to emphasise importance of pupil participation in SSWMBs located high in the waste management hierarchy. The observed differences also suggests that the different dimensions of SSWMBs were influenced by different factors. Therefore, teachers, have to employ appropriate approaches to successfully influence each dimension of sustainable solid waste management behaviour. For policy makers, different strategies have to be crafted to effectively promote each type of SSWMBs since it was clear from the findings that different dimensions of SSWMBs were influenced by different factors.

To enhance the effectiveness of EE implementation, the focus of EE should be on how to promote practices that result in avoiding or reducing waste generation rather than on what to do with waste after it has been generated.

Although strategies identified in this study were important, none of them was enough on its own to guarantee wide adoption of SSWMBs and sustained participation in such behaviours among pupils. Based on Kirkpatrick's Evaluation Model, it can be argued that despite implementation of EE related to waste management, there was very little transfer of waste management learning among Grade 12 pupils of the Zambia's Chipata City. To enhance the effectiveness of EE in promoting SSWMBs among pupils, all the required drivers need to be place while all the barriers need to be overcome. These arguments succinctly imply that the research aim of this study was fully addressed.

### 6.1 Contribution of the study

For the first time, the current study has provided feedback on the effectiveness of EE implementation in promoting participation in SSWMBs among school pupils in Zambia.

### 6.2 Recommendations

Based on the finding of the current study, recommendations to policy makers, teachers and for future research have been made to enhance implementation of EE.

#### 6.2.1 Recommendation for practice and policy

The Ministry of Education should fully support teacher professional growth through provision of in-service training programmes aimed at enhancing teachers' pedagogical knowledge in environmental education for teacher to be effective. In addition, Colleges of Education and all teacher training institutions should ensure that environmental education becomes a significant part of the pre-service teacher training programme to ensure that teachers graduate with appropriate competencies required to teach environmental issues. In addition, EE should be made a stand-alone subject with experiential assessment methods.

There was also need for the Zambian Government to develop policies which would prohibit disposal of recyclables together with non-recyclable waste to support recycling industry. Ministry of Education should include a strong component on waste separation at source in their waste management education for learners to gain practical skills on how to separate waste at source.

The Zambian Government should also develop a policy that

would support growth of the circular economy business to enhance recycling and to make recycling a norm in communities.

#### 6.2.3 Recommendations for future research

It is recommended that future research should be conducted with all secondary school pupils for the results to be generalized to all pupils in the selected school. Furthermore, studies like the current one should be conducted in private and special education schools to provide a comprehensive picture of SSWMBs among pupils in those institutions. There was also need to conduct a longitudinal study in order to identify how pupils SSWMBs change over time. In addition, future research could replicate the current study in other urban contexts using actual measures of participation in SSWMBs rather than self-reported behaviours to improve validity of the findings.

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