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Research Article

Teachers' and Students' Perceptions of Integrated Environmental Education in the Secondary School Curriculum for Managing Environmental Degradation in Machakos Sub County, Kenya

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ABSTRACT: This study investigated implementation of integrated environmental education in the secondary school curriculum for managing environmental degradation in Machakos Sub-County. The study was thus informed by Fullan's theory of educational change (1991, revised 2006, 2007). The theory views educational implementation as a model of interactions between characteristics of change (need clarity, complexity, quality & practicality) as independent variables on the one hand and teachers' and students' environmental literacy (awareness, knowledge, attitudes, skills, participation) as dependent variables. The study employed cross-section survey design under the quantitative approach. Probability sampling designs were used to select participants of the study. The target population of this study included public secondary schools, principals, and teachers and form 4 students from public secondary schools in Machakos Sub-County. Instruments for data collection included questionnaires and document analysis schedules. Quantitative analysis techniques were used to analyse data. The t- test statistic was used to test the null hypotheses at 0.05significance level. Study findings demonstrated that both teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum were generally weak hence little attention was paid to adequate integration of EE in the school curriculum. This negatively impacted teachers' and students' involvement in and commitment to implementation of EE in the school curriculum hence the persistence of environmental degradation in Machakos Sub County. The study confirmed that some elements of environmental education were integrated in the subjects that were taught in the secondary school curriculum albeit inadequately and unevenly distributed, apparently marginalizing particularly climate change and land degradation hence reducing the crosscutting nature of EE. The study recommended that KICD should include a given percentage of EE topics in the curriculum; The Ministry of Education should clearly define environmental policies and prescribe them for schools.

Key words: teachers and students' perceptions; commitment to implementation environmental education; secondary school curriculum and environmental degradation.

Introduction

Admittedly, the current planet that we share with other living organisms is in no doubt different from the world of the agricultural and the industrial revolution. This is because the natural limits of the environment are persistently being defied by the growing demands imposed on environmental resources by some human and natural activities. This has in effect occasioned environmental deterioration through climate change scenarios and land devastation collectively described as environmental degradation.

Areas of the world vulnerable to land degradation cover about 33 per cent of the land surface (World Meteorological Organization [WMO], 2005) threatening our capacity to feed a growing world population estimated at over 9 billion by 2043 (United Nations, 2015). According to Chronicle (2014) 70% of Africa's 500 million people who depend directly on environment for livelihood will be affected. At the national level, 80% of Kenya's landmass that lies within the eastern end of Africa's Sudano-Sahelian belt, classified as ASAL (Kenya, UNDP & FAO, 2005) is already affected by drought and desertification.

At the local level, Machakos Sub-County, a microcosm of Kenya's ASAL areas is already undergoing land degradation through loss of vegetation cover, soil erosion and degraded river banks. Study findings by Baaru, Gachene, Onwonga, Mbuvi & Gathaara (2010) in Kathekakai Location of the Sub-County show that vast land has been heavily degraded and therefore this remains a major threat to the provision of environmental services and the ability to meet the growing food demand for the residents.

To ultimately reverse environmental degradation, integrated environmental education (IEE) in the secondary school syllabus has generally been considered an important intervention strategy. It encourages students to conserve and protect the natural environment in their schools and in their neighbourhoods where they would eventually settle after school.

A global collaborative effort initiated by many countries of the world therefore recommended integration or inclusion of EE in the school curricula. How EE should be taught is more generally how EE should be included into the school

curriculum (Lane, 2006). This conception was backed by the Tbilisi Conference (1977) through developing the objectives which formed the basis for implementation of IEE (Figure 1)

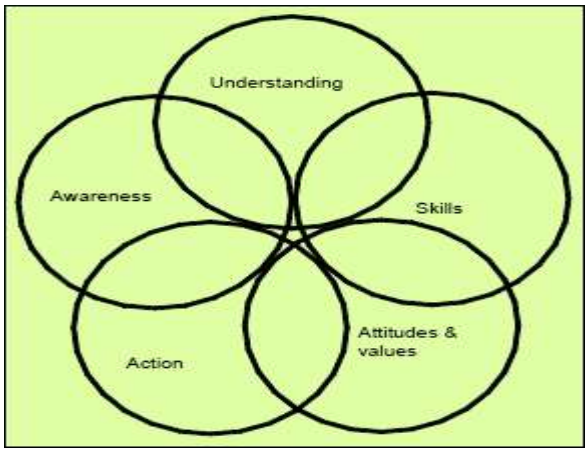

Figure 1: A model of environmental education based on Tbilisi objectives (1977)
Source: Bartosch (as cited in Sterling & Cooper, 1992)

At a regional level, the New Partnership for Africa Development (NEPAD) developed strategies to implement global environmental conventions (NEMA, 2005). Nationally, the Government of Kenya took initiative of preparing and implementing several pieces of legislation and policies to mainstream environmental education (EE) as a cross-cutting issue in the school curriculum in 2002.

The mandate to integrate EE into the school curriculum as a response to environmental problems took various forms such as the interdisciplinary model by which EE content was added (insertion) into the curriculum as an environmentally-focused activity, unit, or a single subject (Figure 2). In this case, something else is also sometimes removed from the curriculum to make room for the EE unit (EETAP, 2004). However, as observed by Kelani (2015) this model was rarely used because the curriculum was already overloaded. Besides, the problem with this approach is that just as easily as the activities can be added to the curriculum, they can be taken out given that EE occurs in isolated bits and pieces (Lane, 2006).)

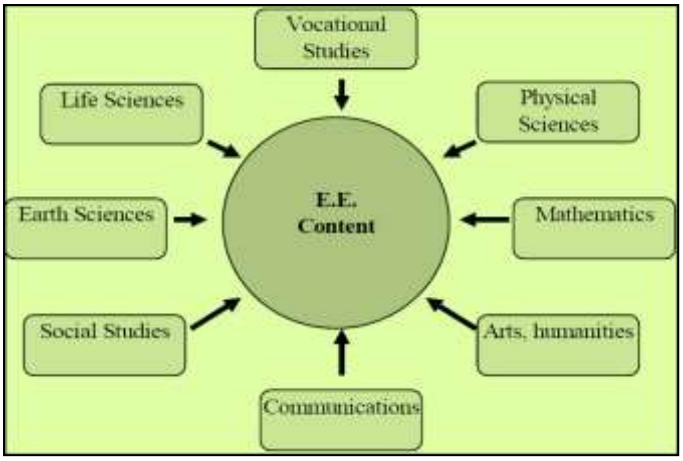

Figure 2 Interdisciplinary (single subject / insertion) model
Source: Adapted from eNotes for education (2016)

To promote an improved way for EE implementation, Haris and Afdaliah, (2016) point out that multidisciplinary approach (Figure 3) was generally conducted while integrating EE content within subjects. This involved blending (infusion) of EE contents into existing lessons of other diverse subjects when the opportunity arose. This approach was largely adopted in the Kenyan secondary schools because infusion did not require significant changes to the existing curriculum. Such an approach also recognizes that environmental issues cut across traditional disciplinary lines (Lane, 2006)

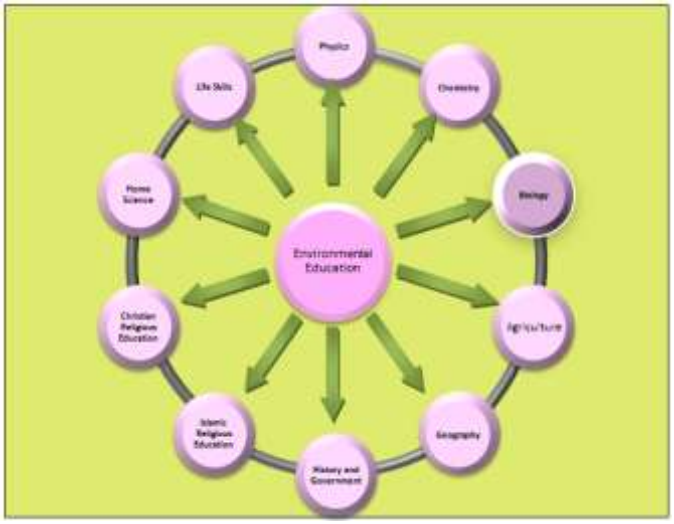

Figure 3 Multidisciplinary (infusion/Framing) approach
Source: The Researcher, 2016

Both infusion and insertion are approaches to integration (Lane as cited in Monroe & Cappaert, 1994).However; the task of integrating EE in the school curriculum has been left, in most cases, to individual schools and individual teachers. Given that EE is not tested under the national mandates, it is up to the teachers to implement EE the way they perceive it (Bengtson, 2013). Consequently, even with IEE being implemented particularly in Machakos Sub County, Archie (2001) points out that relevant literature shows the environment is still under the threat of degradation. This view accords with that put forward by Nijhuis (2011) demonstrating that the implementation of IEE is seemingly not keeping pace with environmental degradation. In general, this argument implies that implementation of integrated environmental education in the school curriculum is still a topic of concern.

Success or failure of implementing IEE is largely dependent on the teachers' and students' perceptions of integration. "Perception may be defined as a process by which individuals organize and interpret their sensory impressions of their environment" (Kashyap, nd). According to Kashyap (nd) perception can determine the needs of various people and such perception is in turn influenced by their needs.

Perception is very important in understanding the human behaviour, because every person perceives the world and approaches the life problems differently (Kashyap, nd). What teachers do in the classroom is said to be governed by what they believe and these beliefs often serve as a filter through which instructional judgments and decisions are made (Utami,

2016). Efforts to develop and implement environmental education (EE) in classrooms … need to be grounded in understanding teachers' perceptions of EE (Bengtson, 2013). Teachers are the link between the ignorant world of their pupils and their later knowledge and mastery of their field (Jekayinfa & Yusuf, 2008). Handal and Herrington (2003) further stress the central role of teachers in implementing the curriculum and calls on policy makers to take teachers perceptions into account.

Studies have also shown that students take an active role in environment related activities at schools, if given an opportunity (Tesfai, Nagothu, Simek, Fucik, 2016). According to Erdogan (2013) students comprise an important segment of a society and warrant attention in terms of studying their perceptions of integrated environmental education.

In the same vein Hart (2003) asserts that teaching and learning are strongly influenced by the individual's perception and action. Elen et al. (2007) further posts that the extent to which this process occurs and result in positive outcomes for students depends on the congruence between teacher and student perceptions.

Therefore, if environmental education is to be implemented by secondary school teachers and students during mainstreaming it into the content of the subjects that they teach and learn, their perceptions of environmental education as an integrated constituent need to be established.

Statement of the problem

Although there have been heightened efforts to integrate EE into the secondary school curriculum in Kenya, little attention has been focused on its implementation especially in Machakos Sub County. As a result, there is growing concern that integrated environmental education (IEE) might not have realized its desired objectives and therefore environmental degradation continues to defy the acclaimed educational solutions (Toili, 2007; Odeke, 2009; Kimaryo, 2011). If no immediate action is taken to resolve concerns of implementing IEE, efforts to avert environmental degradation in Machakos Sub County might be futile and may well have far reaching implications for the vulnerable population whose very means of survival is wholly dependent on the natural environment.

Current literature (Ronnie & Valenciano Jr., 2012; Eraslan, 2013) supports the premise that teachers and students as front-line curriculum implementers are among the most frequently cited factors which make and unmake the curriculum by their active and direct involvement. However, despite the fact that existing research has begun to shed light on teacher perceptions of IEE, the richness and complexity of the perceptions have yet to be explored (Bengtson, 2013) This is problematic considering that there still exists a deficiency of proper information on perceptions of students and teachers as key implementers of integrated environmental education (IEE). Stewart (as cited in Bevan et al., 2007; Rubie-Davies et al., 2011; Saabe & Aelterman, 2007; Wilson et al., 1984), further argues that individual and contextual factors influence perceptions. Yet, studies conducted on environmental education have surprisingly hardly had simultaneous investigation of students' and teachers' perceptions of IEE and the related outcomes in the context of Machakos Sub County.This study therefore investigated both students' and teachers' perceptions of integrated environmental education in the secondary school curriculum to fully understand how they were implementing it to manage environmental degradation in Machakos Sub County.

Research questions and hypothesis

The following two research questions and one null hypothesis directed this study:

i. What are the teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum in Machakos Sub-County?
ii. To what extent is environmental education (EE) integrated in the secondary school curriculum in Machakos Sub-County?
iii. $H0_1$: There is no statistically significant difference between the mean scores of teachers' and students' perception of the integrated environmental education in the secondary school curriculum in Machakos Sub-County

Theoretical Framework

Fullan's Theory of Educational Change (2007) served as the primary theoretical framework for this study. Fullan's Theory viewed success or failure of an innovation through dynamic lenses of four characteristics of change thus need /relevance of the advocated change, clarity of objectives for the change, complexity or level of difficulty of the change, quality/ inward bound support for the change and practicality/how well the change fits in with the teachers' current work conditions

Drawing on his experiences, Fullan established that dynamics of implementing the change also required a synergy of all stakeholders (local and external) for support in terms of perceptions, creativity, collegial cooperation, policies, technical support, resources and monitoring to assess failure or success of the implementation.

Conceptual Framework

The conceptual framework (Figure 4) was anchored on Fullan's theory of educational change which explains implementation processes of educational innovations such as integrated environmental education (IEE) in the school curriculum. In this implementation arrangement, the independent and intervening variables are represented by smaller circles on the periphery of the super circle (Figure 4). The dependent variables are represented at the centre of the super circle (Figure 4). Figure 4 articulates the conceptual framework for this study.

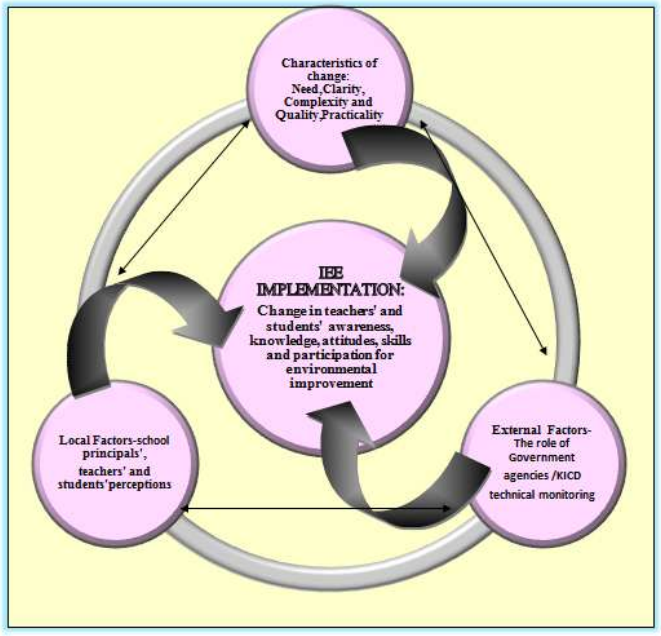

Figure 4 Dynamics of interactions among variables that influence the implementation of an IEE program.
Source: Adapted from Fullan (2007)

This conceptual framework therefore described connections between characteristics of education change (need, clarity, complexity, quality & practicality) as independent variables and environmental literacy (awareness, knowledge, attitudes, skills, participation) of teachers and students as dependent variables. Intervening variables in this respect were local factors (role of school principals, teachers & students) and external factors (role of the Machakos Sub County and other Government agencies /KICD).

Review of related literature

Thang and Kumarasamy (2006) investigated Malaysian secondary school students' perceptions of the environmental contents in their English language classes. The findings of the study established that through integration of environmental content in the English, students irrespective of their gender developed a more positive perspective towards the environment.

The influential work by Ko and Chi-kin (2003) was an exploratory study of Hong Kong secondary school Integrated Science teachers' perceptions of environmental education. Findings of the study showed that teachers' perceptions toward environmental education influenced them to teach more environmental education in Integrated Science than in the other subjects.

In another study, Kearney (1999) determined teachers' perceptions of environmental education and school improvement in Washington. The findings of the study established that the depth of participants' conceptualizations of EE increased with increasing experience.

Methodology

This study adopted quantitative approach and the cross sectional survey design because according to Cohen, Manion and Morrison (2007) cross sectional survey gathers large data at a particular point in time on a one shot basis, hence economical and efficient. This study targeted sixty four (64) public secondary schools; sixty four (64) public secondary school principals; seven hundred twenty four (724) public secondary school teachers (358 male & 426 female) and four thousand and thirty (4030) form 4 students in the Sub-County. Data was also collected from four (4) KICD officers in Nairobi City. Additionally, the study targeted chemistry, biology, geography and history subjects as examples of integration points for EE. Stratified sampling; simple random sampling and proportionate sampling techniques were employed in selection of thirty (30) secondary schools, 250 secondary school teachers and 360 form four students.Data was collected using document analysis and questionnaires for teachers and students. The questionnaires for teachers and students were structured into three sections thus informed consent for the research participants; background information; the extent to which the curriculum for secondary schools integrated environmental education; Respondents' perceptions of the integrated environmental education in the secondary schools curriculum. In documents analysis schedule, the following 16 aspects of EE were identified.

1. Waste Management	2. Agro-Forestry	3. Water &Sanitation	4. Food Security
5. Finiteness of resources	6. Materials cycles	7. Health	8. Population
9. Land degradation	10. Pollution	11. Climate Change	12. Gender
13. Poverty	14. Conflict Resolution	15. Violation of Human Rights	16. Cooperation

Lists of topics for each of the four (4) subjects: Chemistry, Biology, Geography and History were tabulated. Tallies were then made against each tabulated topic of the carrier subject, each time the

EE aspect was identified. Research instruments were dully validated and reliability determined before they were used. Instrument validation employed face and content validity while reliability was determined using Cronbach alpha. The computed reliability coefficients for teachers' and students' Likert type items ranged between 0.545 and 0.625. According to Stack Exchange Inc (2016); George & Mallery (2003); and Kerlinger (2000) these coefficients were considered to be within the acceptable range of reliability. Based on these results it could be concluded that the instruments were reliable and valid.

Data was analysed using simple descriptive statistics such as frequencies, percentages, means and standard deviations and presented in tables, graphs, diagrams and charts generated by the Statistical Package for Social Sciences (SPSS version 20). All hypotheses were tested at a minimum of .05 level of significance using independent samples t-test statistic.

Findings and Discussions

i. Teachers' and students' perceptions of integrated environmental education in the secondary school curriculum

To measure teachers' and students' perceptions, quantitative data from the Likert-type items were presented and teachers and students recorded their order of agreement and disagreement on various statements. The response options for each item were on a five-point scale in which the choices ranged from 5 to 1: strongly agree-5; agree-4; undecided-3; disagree-2 and strongly disagree-1. Respondents' percentage (%) response was entered in table 1

Table 1: Percentage of teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum (Teachers n=119; Students n= 229)

STATEMENT	SA		A		U		D		SD	
	%T	%S	%T	%S	%T	%S	%T	%S	%T	%S
i. The integration of EE into the school curriculum is a priority need	47.9	5.7	42.0	9	.8	1.7	4.2	39.7	2.5	44.1
ii. I understand environmental education concepts in the secondary curriculum well enough to effectively teach /learn them	21.8	4.4	47.9	9.6	5.9	8.3	18.5	44.1	2.5	25.3
iii. I can design enhanced learning activities in environmental education for my students	16.0	5.7	54.6	10.0	10.9	9.2	12.6	45.9	3.4	21.0
iv. Teachers receive training for integration of environmental education in their teaching	8.4	9.6	32.8	14.0	5.9	22.7	30.3	26.6	19.3	17.9
v. Teaching/learning is more complex since EE was introduced in the school curriculum	8.4	23.1	11.8	25.8	15.1	11.8	38.7	18.3	23.5	12.2
vi. Integrated EE often relies on motivated teachers to succeed	30.3	7.0	42.9	13.1	1.7	8.7	13.4	34.9	9.2	27.1

Key: SA=strongly agree, A= Agree, U= Undecided, D=Disagree**,** SD= strongly disagree,
T% = Teacher percentage S%=Student percentage
Source: Field data, 2017

From table 1 "Strongly agree" and "agree" choices were evaluated together and disagree and strongly disagree were treated collectively. Teachers' perceptions of integrated environmental education in the school curriculum were generally higher than the students on four items *i, ii, iii, and vi, in the order of 89.9%; 69.7%; 70.6% and 73.2% compared to students' perceptions that were persistently in disagreement with the statements in the order of 83.8 %, 69.4%, 66.9% and 62.0 %.*

It is clear that while students held negative perceptions towards integrated environmental education in the secondary school curriculum, most teachers were of the opinion that integrated environmental education was being implemented in the desired way.

However students' negative perception seemed contradictory to a study by Thang and Kumarasamy (2006) in Malaysian secondary schools which reported that students developed a more positive view towards the environment through use of environmental content in their class. Irwin (as cited in Odege, 2009) laments "Where then do we stand with this wide range of viewpoints? How do we both celebrate diversity and have a sense of direction for environmental education?" To reconcile the dilemma, Laughlin, Zastavker, and Ong (2007) argue strongly that students perceived greater subject matter integration when they learned this from their teachers. It is therefore reasonable to assume that students in Machakos Sub-County did not support integration of EE in the school curriculum because they had not been actively engaged by their teachers in the integration process hence they did not see it as necessary.

Therefore the overall implication of these findings was that most teachers appeared to support the integration of EE in the school curriculum and they seemingly perceived that they had

self-efficacy of implementing it while most of the students appeared to have had a contrary view probably due to their low learner knowledge on integrated EE. A study by Ledden and Kalafatis (2010) related to perceptions found that learner knowledge influenced their perceptions. Perhaps the students needed additional knowledge and experience with integrated EE before they were ready to make judgment on the value that integrated EE holds for them and for environmental sustainability.

In order to figure out whether there was a significant difference in the levels of perception for teachers and students about integrated environmental education in the school curriculum, the researcher conducted hypothesis testing as follows

Null Hypothesis 1

$H0_1$: There is no statistically significant difference between the mean scores of teachers' and students' perception of the integrated environmental education in the secondary school curriculum in Machakos Sub-County. T- Test was tested at 0.05 significance level and the results summarized in table 2. The findings in Table 2 were summed up as: **t (344) =341.307, p=0.000.**

Table 2 Independent samples T- Test Output on the Difference between teachers' and students' perception of the integrated environmental education in the secondary school curriculum

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
percept	Equal variances assumed	12.827	.000	-4.989	344	.000	-.62994	.12627	-.87829	-.38159
	Equal variances not assumed			-5.852	341.307	.000	-.62994	.10765	-.84168	-.41820

The findings indicated that **the p- value 0.000 was less than 0.05 level of significance (**$p<0.05$), therefore the Null hypothesis was rejected. This confirms that there was a significant difference between the mean scores of teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum in Machakos Sub-County. This view is consistent with earlier researches by Ko and Chi-kin (2003) in Hong Kong and Kelani's (2015) in Benin. Their findings showed that all teachers indicated support for the importance of EE in the secondary science curriculum. However, students' perceptions indicated *negative* support for the importance of EE in the secondary science curriculum. These opposing perceptions likely result in a negative classroom social environment as well as adverse outcomes for students and teachers (Konings et al., 2014; Vermetten et al., 2002) and might have undesirable implications for IEE implementation.

Overall, teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum on all the items in table 1 posted variable but weak (< 50%) viewpoints on integration of EE. A possible interpretation of this finding is that teachers and students did not perceive IEE as worthy pursuance in the curriculum and therefore it gave the impression that they did not adequately integrate it in the school curriculum. This finding has some major implications to implementation of environmental education in the school curriculum in Machakos Sub-County.

ii. Integration of environmental education into the secondary school curriculum

The overall finding to the research question "To what extent is environmental education (EE) integrated in the secondary school curriculum in Machakos Sub-County?" was that there were some environmental topics in the secondary school curriculum albeit inadequately covered (<50%) and not stated as separate topics in the teaching subjects. It was further revealed that the said EE topics were not logically organized in the syllabus (teachers 52.1 %; students 35 %). Furthermore, the topics were difficult to identify in the syllabi as pointed out by 87.4% of teachers and 86% of the students. Kimaryo (2011, p.39) asserts that "Environmental education components which are to be taught in different topics are not shown clearly in the subject syllabi". **"If what is to be taught as environmental education is not prescribed in the syllabus, then it will not be taught" (Kimaryo, 2011, p. 167)**

Another very important finding that was revealed through

data analysis was the apparent marginalization of climate change topics (4% & 5%) in Chemistry and Biology syllabi respectively and land degradation topics (0%) in the in the Chemistry and Biology syllabi yet the topics happen to border on the most critical environmental issues in Machakos Sub-County. The researcher found this development a matter of concern for implementation of integrated environmental education in the secondary school curriculum in Machakos Sub-County.

Further analysis of syllabus documents showed that Social Studies subjects (Geography & History) combined covered more (70 %) environmental education topics in the school curriculum than the science subjects (Chemistry & Biology) combined (30%). A comprehensive portrayal of the percentage coverage of EE topics in the four subjects is demonstrated in figure 5

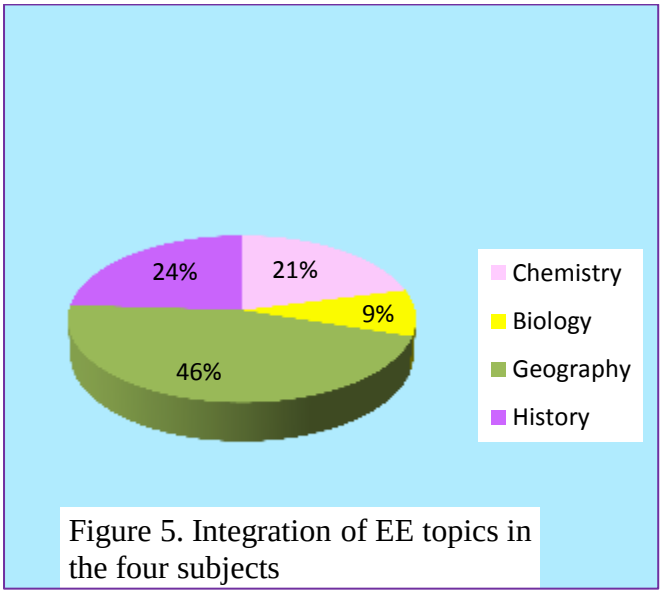

Figure 5. Integration of EE topics in the four subjects

In support of these findings Kimaryo (2011) observes that environmental education is built in the school curriculum, although some subjects have more environmental content than others. The way integrated environmental education topics are unevenly distributed in the curriculum raises misconceptions amongst teachers and students. The majority of them would think that environmental issues are more related to the social studies subjects (Geography & History) hence reducing its crosscutting nature to other fields especially the science subjects (Chemistry & Biology). This outcome dampened teachers' and students' felt need for effective implementation of EE in the school curriculum. According to Fullan (as cited in Hammonds, 2002) "If people cannot find meaning in any reform it cannot have any impact"

The results reported here therefore provide clear empirical evidence that the research question "To what extent is environmental education (EE) integrated in the secondary school curriculum in Machakos Sub-County?" has been reasonably addressed.

Conclusions

Based on the findings of the study there is sufficient evidence to draw the following conclusions:

First, both teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum were generally weak (< 50%) hence little attention was paid to adequate integration of EE in the school curriculum. According to Dangerfield **(as cited in Lozzi,** 2017) "EE just doesn't get any respect" **thus** relegated to after-school activity status. This negatively impacted teachers' and students' involvement in and commitment to implementation of EE in the school curriculum hence the persistence of environmental degradation in Machakos Sub County. This confirms that there was a significant difference between the mean scores of teachers' and students' perceptions of the integrated environmental education in the secondary school curriculum in Machakos Sub-County.

Second, this study conclusively confirmed that some elements of environmental education were integrated in the subjects that were taught in the secondary school curriculum albeit inadequately and unevenly distributed, apparently marginalizing particularly climate change and land degradation hence reducing the crosscutting nature of EE. It is therefore evidently clear that teachers and students did not have stronger intentions (felt need) for effective implementation of EE within the school curriculum and therefore mitigation of environmental degradation in Machakos Sub-County through education as an intervention strategy was compromised. According to Fullan (as cited in Hammonds, 2002) "If people cannot find meaning in any reform it cannot have any impact"

Recommendations

This study therefore makes practical recommendations that should address these challenges as a prerequisite to successful implementation of IEE to alleviate environmental degradation in the Sub-County.

Regarding teachers' and students' weak appreciation of and little attention to integrated environmental education in the secondary school curriculum, the study recommended that:

- The Ministry of Education should leverage on the appropriate and operational national environmental policies and clearly define them to put teachers and students on the right path to improve their *perceptions* for successful implementation of EE in the school curriculum.
- The Kenya Institute of Curriculum Development (KICD); The Directorate of Quality Assurance and Standards (DQAS) and school principals should monitor teachers and students in order to leave up to their EE implementation expectations.

With regard to the challenge of inadequate EE themes /topics in the syllabi, the study recommended that:

- The KICD should make a purposeful move to include a given percentage of EE topics, stated separately for easy identification and distributed throughout all the relevant subject areas of the curriculum, thus providing a multidisciplinary approach making it possible for each teacher to know what the others are teaching at each grade level.

- Teacher training institutions should include environmental education topics in all course content and methodology to ensure that the pre-service teachers are trained on the use of environmental concepts in teaching the traditional subjects.
- Authors of books in the various subjects taught in schools should integrate environmental issues in their text books particularly climate change and land degradation demonstrating how each topic or lesson could be used to promote knowledge, skills and awareness of the environment, to reinforce implementation of EE in the curriculum. This move would be a direct manifestation of the felt need for integration of EE in the school curriculu

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