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Teachers' attitude towards implementation of learner-centered methodology in science education in Kenya

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This study aims to evaluate teachers' attitude towards implementation of learner-centered methodology in science education in Kenya. The study used a survey design methodology, adopting the purposive, stratified random and simple random sampling procedures and hypothesised that there was no significant relationship between the head teachers' attitudes, the teachers' attitudes and the level of implementation of Activity-focused methods, Student-centred activities, Experimenting and Improvisation through the Plan, Do, See and Improve (ASEI/PDSI) classroom practices. A sample of 68 head teachers, 147 science teachers and 16 trainers was used for the survey. The study established that majority of the teachers (75%) were partial implementers, and a few (5%) were full implementers. The Chi-square findings for the head teachers were: Biology χ^2=72.35>66, Chemistry χ^2=69.38>66, and Physics χ^2=67.03>66. The teachers were: Biology χ^2=55.3429>54, Chemistry χ^2= 54.4581>48 and Physics χ^2=69.4286>58 meaning that they were significant. The conclusion was to reject the null hypothesis, and accept the alternative hypothesis that there is a significant relationship between the teachers' and head teachers' attitude, and the level of implementation of the ASEI/PDSI classroom practices. The study recommended that since the level of implementation was found to be related to the teachers' and head teachers' attitudes towards the innovation, the national Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) inset should then have strategies to bring on board those who still have a negative attitude in order for the implementation to be successful.

Key words: Teachers attitude, science education, learner-centred methodology, constructivism, in-service training, implementation of innovations.

INTRODUCTION

Innovation is the creation of better or more effective products, process, services, technologies or ideas that are accepted by markets, governments, and society. According to Dylan (2007), successful innovation implementation depends on its acceptance by the targeted end users. Implementation of innovation is confirmed when an innovation has been institutionalized to the point that it is no longer construed as a new idea or

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practice in an institution.

The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) in Kenya is charged with responsibility of building teachers' capacities to enable them to cope with the pedagogical related challenges faced in the process of curriculum delivery in the area of mathematics, sciences and technology. These subjects according to the Republic of Kenya (2012) are the foundational subjects for science and technology innovations which support the education pillar of Kenya's vision 2030. In 1998, Kenya adopted the CEMASTEA approach which currently coordinates the Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) In-service Training (INSET) project. According to CEMASTEA (2008) and Ministry of Education Science and Technology (MoEST) (2005), the professional development uses a constructivist methodology to improve the performance in science with emphasis on Activity-focused methods, Student-centred activities, Experimenting and Improvisation (ASEI) through the Plan, Do, See and Improve (PDSI) approach; hence the ASEI/PDSI classroom practice innovation.

Fullan (2008) asserts that adopter commitment is the key variable in determining whether or not an innovation survives the implementation process, thus producing lasting changes in educational practices. There are various factors that would influence the science teachers' attitudes towards implementing the ASEI/PDSI classroom practices. The main ones are the attitudes of the change agents, and particularly those of the principals and the teachers. The perceived characteristics of the ASEI/PDSI innovation that is; how easy or difficult it is to use, the time factor in terms of lesson preparation, the implementation climate, facilities/equipment required and the accrued benefits - in this case the improved performance of the learners. In addition, the teachers' overall concerns and needs on the implementation of the innovation are part of it (Loucks – Horsley, 1996; Ndirangu and Nyagah, 2015; Ndirangu, 2006).

The Concerns Based Adoption Model (CBAM) according to George et al. (2014) alludes to the fact that change takes place in individuals. It also acknowledges that change is a process and that supporting implementers during change is critical for learning to take hold. Many education innovations focus on the needs of the learners while ignoring the needs of the teachers who are critical in the implementation where it matters most, the classroom (Fullan, 2007). Havelock and Huberman (1977) observed that when an innovation is introduced, the change agent perceives it differently from the users. The principal may view an innovation primarily in terms of resources, time tables and punctuality. The teacher, on the other hand, might view it in terms of job prospectus or status and. The parents and the general public may view it in terms of its implications on improved examination performance. The role of the principals, according to SMASSE (2006a) is to support teachers where necessary, provide teaching and learning materials on time, and if science based - attending SMASSE INSET, and monitoring of classroom activities. Generally, the reception of the user system determines the success, or failure, of the implementation of an innovation (Hall and Hord, 2011).

Despite the ASEI/PDSI classroom practice intervention, there has been minimal change in the students' performance in sciences. The first cohort of teachers trained in 2003 and in 2007 had been in the field for well over 10 years. Yet the Kenya National Examination Council (KNEC) results still indicate that the majority of the grades scored (over 65%) by the students at the end of the secondary school examination were between D and E (KNEC, 2016).

An Organisation for Economic Co-operation and Development (OECD) (2009) study, Teaching and Learning International Survey (TALIS), covering over ten countries across the world found a significant relationship between teachers' beliefs and instructional practices. The constructivist beliefs are associated with more frequent uses of practices that aim at creating a stimulating, challenging and individually adapted learning environment supportive of students' constructive knowledge. According to the Republic of Kenya (2016), there is a need for teachers who are adequately prepared to implement science and mathematics curricula for the nation to achieve its Vision 2030 agenda.

Hypotheses of the study

The null hypotheses were:

Ho1: There is no significant relationship between the head teachers' attitude and the level of implementation of ASEI/PDSI classroom practices.
Ho2: There is no significant relationship between the teachers' attitude and the level implementation of ASEI/PDSI classroom practices.

LITERATURE REVIEW

This study adapted the Innovation Theory, which is also referred to as the Diffusion Theory. The proponent of the Diffusion Theory, Rogers (1995), defines diffusion as the process by which an innovation is adopted, and gains acceptance by individuals or members of an institution. Diffusion has four elements included within innovation which are; an idea, practice(s) or object(s) that is perceived as new by individuals or a group of adopters. In this study, ASEI/PDSI classroom practice is the innovation. The other elements are; communication channels, time and a social system - the latter is a set of interrelated units that are engaged in joint problem solving activities to accomplish a goal(s) (Rogers, 2004).

Marsh’s (2001) points out that the theory offers a scientific approach to understanding the rate of adoption as well as factors which may lead to the rejection of an innovation. The simplicity of the Diffusion Theory may ironically be its strength; it is limited in explaining complex human systems. The theory may not explain the complex humans systems in relation to the implementation of the ASEI/PDSI classroom practices by the teachers but, it gives insight on the factors that influence the readiness of teachers’ to implement this innovation in Kenya.

The SMASSE project uses the cascade system of INSET with two levels of training, one at the national level and the other at the district level. The national trainers train district key trainers, and district trainers train teachers in their respective districts. Further, the SMASSE project has four cycles, one for each level, of 10 working days annually. The curriculum of INSET is based on the findings of the needs assessments conducted for each district. The SMASSE INSET therefore, has four cycles and four themes, to cover the issues identified during the needs assessments.

Cycle one is on attitude; the sessions are used to enlighten the participants on the issues that strongly influence how they perceive and conduct their duties as teachers, and how learners perceive and react to their lessons. Cycle two is on ‘hands-on’ activities; it provides participants an opportunity to put into practice the principles of ASEI/PDSI classroom practices innovation. The trainees work in small groups where they prepare ASEI lesson plans, prepare practical lessons, improvise apparatus and materials and present sample lessons to their peers. Cycle three is on actualization; whose main focus is implementation of the ASEI/PDSI classroom practices in schools. Finally, cycle four is on monitoring and evaluation; where the SMASSE internal evaluation team evaluates the project on the basis of efficiency, effectiveness, sustainability, relevance and the impact on the student learning and achievement (CEMASTEA, 2008, SMASSE, 2006b).

According to Fullan (2008), the attitude stakeholders have towards an innovation is critical to its success. In this particular study, the attitudes that teachers, head teachers and students hold towards the ASEI/PDSI classroom practices have a significant impact on the quality of implementation of this innovation. Teachers’ beliefs play an integral role in predicting human behaviour. Ajzen and Albarracin (2007) define beliefs as the perceptions of information concerning an object or an idea. A better understanding of teachers’ beliefs, that inform their resistance to implement an innovation used in the classroom, may help in the development of professional training to address teachers’ uneasiness and resistance related to instructional methodologies (Hall and Hord, 2011).

Simply put, beliefs are typically the catalyst for or impediment against individuals’ engagement in specific behaviours, such as learner-centred pedagogy (Fishbein and Ajzen, 2010). For instance, if a teacher does not believe that the ASEI/PDSI classroom practices facilitates student learning, the teacher will probably not use this innovation in the classroom. In general, beliefs lead to action. However, in one study conducted by Nadelson et al. (2013), it was found that teachers described their instructional methodologies as learner-centred but observation of these teaching practices starkly contrasted with the beliefs; while the teachers professed learner-centred beliefs, they behaved in teacher-centred ways. Chen (2008) suggested that the challenges of classroom teaching often constrain the teachers’ abilities to teach in ways that are aligned with their beliefs. Despite teachers’ stated beliefs, this study suggested that teachers’ actions were significantly influenced by classroom contexts.

This dissonance between beliefs and actions could result from the fact that what teachers’ believe is at best in theory. In this case, learner-centred education does not always translate into action when faced with the reality of actually having to change their practice in order to implement those beliefs. The teachers concerns about what will happen when they are asked to actually implement an action may contribute to the disconnection between their beliefs and their actions in the classrooms. According to Green and Michelle (2013) epistemological beliefs may be domain or discipline specific. Either way these beliefs are relevant to understanding the educational strategies of both learners and teachers.

During the implementation of an innovation, individuals have concerns. Concerns are an individual’s set of feelings, perceptions, preoccupations, thoughts, considerations, motivations, satisfactions, and frustrations, related to the target of innovation. Concerns towards objects or ideas have been linked to an individual’s willingness to adopt classroom innovations. For example, ones concerns about their personal ability to implement an instructional practice may set up a contradiction that inhibits the individual from acting on positive beliefs about that instructional practice (George et al., 2014).

Beliefs and concerns can be used to predict behaviour (Fishbein and Ajzen, 2010). However, what is less clear is the impact of certain specific beliefs, such as learner-centred beliefs about teaching and learning, and concerns regarding one’s ability to implement specific practices such as ASEI/PDSI classroom practices. Together, these variables may be a powerful influence on teacher behaviour. The lack of more than superficial or mechanical use of the ASEI/PDSI classroom practices on the part of many teachers may be related to a fundamental conflict between teachers’ beliefs about the nature of teaching and learning. It may also be related to the teacher perceptions about the ways this learner-centred methodology fits into their beliefs, along with the concerns about the consequences of implementing ASEI/PDSI classroom practices in their classrooms.

According to Klein and Sorra (2003), innovation implementation is so challenging that many adopting organizations and individuals fail to realize the optimal expected benefits of innovations. This is usually by reason of failure to successfully implement the innovation and not necessarily due to the failure of the innovation itself. Implementation is defined as “the process of gaining targeted organizational members’ appropriate and committed use of an innovation” (p.1055).

Klein and Knight (2005) expanded the view of implementation by pointing out that if targeted organizational members use the new idea regularly, and in a consistent and committed manner, only then can one say that they have succeeded at implementation. The successful implementation of the ASEI/PDSI classroom practices depends on all the teachers using the knowledge and skills imparted during in-service training fully.

A number of challenges associated with innovation implementation have been well documented in literature. Klein and Knight (2005) and Klein and Sorra (2003) reviewed various issues of innovation implementation. First, problems of unreliability and deficiencies in the design of innovations based on digital technologies, such as computers and related software programmes hamper innovation implementation. Second, many new ideas demand end-users to acquire new knowledge and skills to effectively use such ideas - some targeted organizational members may find this process unpleasant or laborious.

Third, decisions to adopt organizational innovations are often made by high-ranking personnel without the participation of targeted organizational members. End-users may resist the actual use of such innovations because of the uncertainties associated with the innovation or because they are comfortable as they were and want to maintain their status quo.

Fourth, the usually expected benefits associated with innovation implementation, may be observable after a longer period of time, thereby casting shadows of doubt in the mind of the end users on the actual benefits and perceived observable results from using the innovation (Rogers, 2004). As noted by Klein and Knight (2005), organizations invest in innovations with the sole aim of realizing higher levels of performance or productivity therefore, the end-users and managers may experience undue panic where ensuring that existing levels of performance or productivity while implementing the innovation, are either maintained or improved. Klein and Knight (2005) further, observed that, this may be the case as the implementation of new ideas may not only be time consuming and expensive, but may also decrease performance especially during the early stages of the implementation process.

Fifth, poor innovation-value fit has been documented as one of the stumbling blocks to innovation implementation. Klein and Sorra (2003) defined innovation-value fit as “the extent to which targeted users perceive that the use of the innovation will foster or, conversely, inhibit the fulfilment of their values” (p.1063). This is consistent with the perception of compatibility or the extent to which the innovation fits or aligns well with pre-existing values, previous experiences or ideas, and identified needs of the implementers (Rogers, 2004).

Sixth, Klein and Knight (2005) contended that apart from the innovation-value fit, as a facilitator of innovation implementation, the challenge for organizations is to establish a strong climate for innovation implementation. They described an organizational climate for innovation implementation as “targeted employees shared summary perceptions of the extent to which their use of a specific innovation is rewarded, supported, and expected within their organization” (p.1060). The concept of climate for implementation appears broad and subsumes numerous aspects associated with innovations, the provision of the following to end-users helps create a strong implementation climate:

1. Training to ensure skill acquisition
2. Post innovation continued support services
3. Adequate time for users to learn to use the innovation
4. Feedback on concerns and complaints
5. Incentives and disincentives for use and non-use, and
6. Access to the innovation (Klein et al., 2001).

In the absence of effective implementation, the benefits of innovation adoption are likely to be nil. Wu (1988) and Dylan (2007) on the other hand contends that it is necessary to deal with the ‘how’ and the ‘what’ of change in the process of examining the individual and collective settings. Constructivism is a theory of learning rather than of teaching, and there are some researchers who have raised doubt over its implementation (Brown and Adams, 2001).

Many researchers believe that the essential elements of effective constructivist teaching are still unknown. Again, there is also a disregard for a constructivist approach amongst some teachers, especially the veterans, who believe that the approach creates a chaotic and disruptive classroom environment. Many teachers thus lack a strong belief in the effectiveness of constructivist teaching methods in the classroom and are unlikely to use these practices. The study of Abbott and Fout (2003) completed by a research centre in Washington revealed that, out of a total of 669 classrooms observed in 34 schools, strong constructivist teaching was observed in only 17 per cent of the lessons. This study observed teachers lessons to determine whether they were using learner-centred methodologies in their teaching.

On the other hand, many teachers have a strong belief in constructivist practices and do their best to implement them, but they often lack administrative support (Haney and McArther, 2002). Many principals do not want to take the time or resources to reform programmes to include constructivism. Teachers also complain that principals do not understand the need for financial support for hands-on manipulation in lieu of textbooks. Many head teachers view the constructivist classroom environment as chaotic and lacking teacher control. One may ask if the ASEI/PDSI classroom practices in secondary schools in Kenya do increase students' autonomy and control over their classroom learning situations. Fullan (2013) posits that teachers and students are learning partners in the new pedagogy.

METHODOLOGY

The study used a survey design methodology. It adopted the purposive, stratified random and simple random sampling procedures. To carry out the sampling process for the target population, the schools were categorised as high performing, medium and low performing schools, with regard to the Kenya Certificate of Secondary Education national examination mean scores. Stratified sampling based on this criterion identified 68 schools, whose head teachers participated in the study. Purposive sampling of 147 science teachers was carried out, targeting those who had attended the SMASSE in-service training in Nyeri County, Kenya. Simple random sampling was applied to select 16 key informants, namely the SMASSE Science sub-county trainers. The data were collected using questionnaires, interviews and a lesson observation schedule. The lessons were observed without giving the teachers prior notice. To enhance the validity of the instruments, a pilot study was conducted in 8 schools. The pilot sample was 10%, according to Mugenda (2008). The pilot study selected: 8 head teachers, 38 teachers, 5 district trainers and two lessons were observed. The reliability test was carried out using the Cronbach's Alpha (Kothari, 2004). The item analysis resulted in coefficients of internal reliability of 0.80 for the head teachers' questionnaire and 0.78 for the teachers' questionnaire. The instruments were therefore considered reliable for collecting data for the main study. The hypotheses were tested using the Chi-square statistic and the Fisher Exact Test.

RESULTS AND DISCUSSION

Analysis of the data collected from the field draws interpretations based on descriptive and inferential analysis. The main issues discussed include the following: background information of the respondents, responses to research questions and the testing of the two hypotheses of the study.

Background information of respondents

In order to gain understanding of the respondents involved in the study, each respondent was asked to indicate their personal data. The background data from the head teachers and teachers included their gender, professional qualifications, their experience, and the work load of the teachers. The data provided important information on the calibre of all the respondents involved in the study. The questionnaire return was 51 out of 68 for the head teachers (75.0%), and 147 out of 147 for teachers (100.0%). The lessons observed were 15. Table 1 shows head teachers' and teachers' age by gender.

The data indicates that majority (68.5%) of the head teachers were male while only 31.4% were female. The data on the age of the head teacher indicate that most were in the age category of 40 to 49 years (64.7%), followed by age group 50 to 60 years (21.6%); and the lowest age bracket 30 to 39 years (13.9%). Most of the head teachers involved in this study were mature and majority may probably be in a leadership position for another ten years since the retirement age is 60. It is therefore important to involve them in the proper implementation of the innovation. The findings also indicate that majority (73.7%) of the science teachers were male, and 26.3% were female. This implies that there is gender disparity in the teaching of sciences.

With regard to the age of the teachers, the data shows that 41.4% were in the age bracket of 40 to 49 years. This was followed by age group 30 to 39 years with 35.2%, with the lower age bracket of 20 to 29 years at 15.8%. The older teachers in the age bracket of 50 to 60 were only 7.6%. Most of the science teachers involved in the study may be teaching for another ten years or more, thus continuing to influence science learning in schools. The teachers were also asked to indicate their teaching experience. The findings are presented in Table 2.

The results indicate that most of the teachers (42.7%) had a teaching experience of between 11 to 20 years. The data further indicated that 42.1% of the science teachers had a teaching experience of 1 to 10 years; while 15.2% had taught for between 21 and 30 years. This implies that teachers, involved in this study, are highly experienced in their areas of specialization, and many have had a chance to interact with the skills and knowledge acquired from the SMASSE in-service training for more than 10 years. According to the findings of a study conducted by Cassel and Vincent (2011), varied experiences of teachers shape their attitude about learning and teaching of mathematics and sciences. The teachers had other responsibilities other than teaching as indicated in Table 3.

The results indicate that a substantial number of the teachers involved in the study were Heads of Departments, that is 37.9%. This implies that they were familiar with the requirements of the ASEI/PDSI classroom practices and what should be implemented. The subject heads were 15.1% and the class teachers were 25.5%. Those involved in the SMASSE in-service training were 27 or 18.6% and were familiar with the ASEI/PDSI classroom practices skills and knowledge. This suggests that other than having heavy teaching loads, science teachers were engaged in other demanding responsibilities and this could interfere in their preparation of ASEI/PDSI lessons. The study also sought to find out the weekly teaching load of the science teachers, and the findings are represented in Table 4.

Many of the science teachers (43.5%) had a weekly

Table 1. Head teachers and teachers age by gender.

Age category (Years)	Head teachers		Teachers	
	Male	Female	Male	Female
20-29	-	-	8.9	6.9
30-39	11.8	2.0	25.5	9.8
40-49	43.1	21.6	32.4	8.9
50-60	13.7	n7.8	6.9	0.7
Total	68.6	31.4	73.7	26.3

n=196.

Table 2. Teaching experience of the teachers.

Years of teaching	Frequency	Percentage
1-10	*61*	42.1
11-20	*62*	42.7
21-30	*22*	15.2
Total	145	100.0

Table 3. Teachers' other responsibilities by gender.

Category	Male	Female	Total	Percentage
Deputy head teacher	6	1	7	4.8
Head of department	43	12	55	37.9
Subject head	15	7	22	15.1
Class teacher	24	13	37	25.5
SMASSE trainers	15	12	27	18.6

n=145.

Table 4. Teaching load of the science teachers**.**

Teaching load lesson per week	Frequency	Percentage	Cumulative
Less than 15	*2*	1.4	1.4
15-20	*16*	11.0	12.4
21-25	*63*	43.5	55.9
26-30	*62*	42.7	98.6
No lessons	*2*	1.4	100
Total	**145**	**100.0**	**100.0**

load of 21 to 25 lessons. The lightest load was 14 lessons, and the heaviest load was 30 lessons per week. The recommended maximum teaching load for secondary school teachers is 30 lessons per week. This implies that 62 or 42.7% of the science teachers have the recommended load of 26 to 30 lessons per week. However, they could be considered to have heavy loads because they also indicated that they have other duties other than teaching. Most schools have on average 35 lessons per week. This means that on average teachers have about 5 free lessons per week to prepare lessons, mark the students' work and attend to other duties assigned to them. The respondents were asked to indicate whether they had attended the SMASSE in-service training, the roles they played, and to indicate the cycles they had attended. Result presented in Table 5 indicates the head teachers' roles in the SMASSE in-service training.

There were 22 head teachers or 43.1% who attended as trainees in Mathematics, Chemistry, Biology or Physics. Data also implies that 29 or 56.9% did not attend the teachers SMASSE In-service training. Amongst the head teachers involved in the study were 2 trainers, 3 centre organizers and 7 SMASSE in-service

Table 5. Head teachers' roles during the SMASSE INSET.

Responsibility	Total	Percentage
Trainees	22	43.1
Trainers	2	3.9
Centre Organizers	3	5.8
SMASSE INSET Organizers	8	15.7

n=51.

Table 6. Head teachers' attendance SMASSE INSET.

Attendance	Male	Female	Total	Percentage
Teachers INSET				
Yes	19	3	22	43.1
No	16	13	29	56.9
Heads INSET				
Yes	5	2	7	13.7
No	30	14	44	86.3

n=51.

Table 7. Teachers' attendance of SMASSE INSET's cycles.

Attendance		Frequency	Percentage
Cycle 1	Yes	119	83.2
	No	24	16.8
Cycle 2	Yes	120	83.9
	No	23	16.1
Cycle 3	Yes	113	79.0
	No	30	21.0
Cycle 4	Yes	117	81.8
	No	26	18.2

n=143, Missing 2.

training organizers. This implies the study had a representation of head teachers from the various categories of SMASSE in-service training activities. The head teachers' attendance of the two SMASSE INSETs; the teachers and the heads is presented in Table 6.

Results on head teachers' attendance of the teachers' SMASSE in-service training indicated that only 43.1% of the head teachers' involved in this study attended the teachers' SMASSE in-service training; while 56.9% had not attended. Those who attended the teachers SMASSE in-service training were mainly science oriented head teachers. Both the arts and the science oriented head teachers are also expected to attend the heads SMASSE in-service training which guides them on the monitoring and implementation of the ASEI/PDSI classroom practices.

The results further indicate that 7 or 13.7% of the head teachers attended, while 86.6% did not attend. This means that majority of the head teachers missed out on the opportunity of being trained on the SMASSE ASEI/PDSI classroom practices and what was required of them in order to support the implementation. Science teachers are expected to attend all the four cycles of the SMASSE in service training in one area of specialisation. If they fail to attend any of them, they are given an opportunity to attend the mop-up in-service training offered periodically. Table 7 presents the data of the teachers' attendance of SMASSE INSET cycles.

The data indicate that Cycle 1 was well attended; 83.2% of the teachers involved in this study attended and only 16.8% did not attend. It also indicates Cycle 2 as the best attended cycle by the science teachers, whereby 83.9% attended and 16.1% did not attend. The lowest teachers' attendance was in Cycle 3 at 79% and only 21% of the teachers involved in this study did not attend. Cycle 4 was attended by 81.8%; while 18.2% did not attend. Failure to attend all the in-service trainings implies that the science teachers have knowledge gaps about the ASEI/PDSI innovation and are therefore unlikely to use all its paradigms in the classroom.

This information on the overall attendance raises two concerns. First, the majority of the head teachers did not attend any of the SMASSE in-service trainings; implying that they do not have information on the innovation whose implementation they are supposed oversees. Over 86% of the head teachers did not attend the head teachers' forum that informs them on how to handle change during the implementation of innovations. Secondly, majority of the head teachers who had missed the in-service training were aged between 40 and 49 years of age, and are likely to be in leadership for another 20 years. Therefore, efforts should be made to ensure they attend the SMASSE in-service trainings to guarantee successful implementation of the ASEI/PDSI classroom practices.

Head teachers' attitudes towards the implementation of ASEI/PDSI classroom practices

The head teachers' questionnaire had several items to determine the attitudes of head teachers' towards the implementation of ASEI/PDSI classroom practices. It was developed using a Likert scale for each item as follows:

Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2 and Strongly Disagree = 1.

The response indicating the least favourable degree or a negative attitude towards the implementation of ASEI/PDSI classroom practices is given the least score of '1' and the most favourable or the positive attitude is given the highest score of '5'. The head teachers' instrument consisted of 24 statements related to their attitudes towards the implementation of ASEI/PDSI classroom practices. The score values were:

24 × 5 = 120, most favourable response possible (Positive attitude); 24 × 3 = 72 a neutral attitude; 24 x 1 = 24 most unfavourable attitude (Negative attitude)

The scores for the head teachers fall between 24 and 120. If a score is above 72 the head teacher is said to have a positive attitude towards the implementation of ASEI/PDSI classroom practices, a score below 72 means a negative attitude towards its implementation and a score of exactly 72 is suggestive of a neutral attitude. These findings are presented in Table 8. The data indicates that most of the head teachers (56. 9%) had a negative attitude towards the implementation of ASEI/PDSI classroom practices and 39.2% had a positive attitude towards its implementation, while 3.9 % were neutral.

Hypothesis one

The study also hypothesized that there was no significant relationship between the head teachers' attitudes and the level of implementation of ASEI/PDSI classroom practices. The Chi-square test was used to establish the relationship between two variables, both of which were categorical in nature.

In this hypothesis, the researcher tested the alternative hypothesis that there was a relationship between the head teachers' attitudes and the level of implementation of the ASEI/PDSI classroom practices. The independent variable head teacher attitude was categorized as "positive" above 72, "negative" below 72 and "neutral" equal to 72. The dependant variable level of implementation was categorized as fully 3; partially 2 and not at all 1. The test was done for the three science subjects because the level of implementation was determined separately for each subject. The results of this test are presented in Table 9.

The data obtained indicated that the chi-square value is greater than the critical value for each of the science subjects at 1 degree of freedom, that is, Biology $X^2 = 72.35 > 66$, Chemistry $X^2 = 69.38 > 66$ and, Physics $X^2 = 67.03 > 66$; meaning that they are significant. The conclusion would have been to reject the null hypothesis and accept the alternative hypothesis that there is a significant relationship between the head teachers' attitude and the level of implementation of the ASEI/PDSI classroom practices. However, the Fisher Exact Test (FET) was computed in addition to the Chi-square test because the contingency table consisted of cells where the expected number of frequencies was fewer than 5.

The Fisher Exact Test examines the significant deviation from the null hypothesis, in other words gives a probability value (p-value) which reflects the strength of the evidence against the null hypothesis. If the p-value is below 0.05, then the null hypothesis is rejected while a p-value above 0.05 provide weak evidence against the null hypothesis and therefore cannot be rejected. The Fisher Exact Test results for the relationship between the head teachers' attitudes and the level of implementation was Biology p-value 0.68 > 0.05, Chemistry p-value 0.56 > 0.05 and Physics p-value 0.55 > 0.05. The Fisher Exact Test p-values are not significant at the 5% level of significance as the p-values are greater than 0.05. When there is no significance, the null hypothesis cannot be

Table 8. Head teachers' attitudes towards the implementation of ASEI/PDSI.

Head teachers' attitude	Frequency	Percentage
Negative <72	29	56.9
Neutral 72	2	3.9
Positive >72	20	39.2
Total	**51**	**100**

Table 9. Chi-square results of head teachers' attitudes and the level of implementation.

Attitude	Undecided	Not at all	Partially	Fully	Total
Biology					
Negative	2	1	18	8	29
Neutral	0	0	1	1	2
Positive	4	0	11	5	20
Total	6	1	30	14	51
(X^2 Value = 72.35, critical value =66, df = 1, Pr = 0.28)					
Chemistry					
Negative	2	1	21	5	30
Neutral	0	0	2	0	2
Positive	4	1	11	4	20
Total	6	2	34	9	52
(X^2 Value =69.38, critical value = 66, df = 1, Pr = 0.364)					
Physics					
Negative	2	1	16	10	29
Neutral	0	1	1	1	3
Positive	6	1	10	3	20
Total	8	3	27	14	52
(X^2 Value = 67.03, critical value = 66, df = 1, Pr = 0.44)					

rejected or accepted.

It means that the alternative hypothesis, that if the head teachers had a positive attitude towards implementation of the ASEI/PDSI classroom, they could influence its implementation, was not accepted. It implies the negative attitude of majority of the head teachers cannot conclusively be attributed to determining the level of implementation of the ASEI/PDSI classroom practices; the null hypothesis was therefore neither accepted nor rejected.

However, it nevertheless suggests that if the head teachers had a positive attitude towards the innovation, they would have been keener in their supervision. The findings on the supervision of the head teachers in relation to the implementation of the ASEI/PDSI indicated that they were not supportive of its implementation in the classroom. This means that their negative attitude has a bearing on the implementation of the ASEI/PDSI innovation.

Teachers' attitudes towards the implementation of ASEI/PDSI classroom practices

To establish whether there is a significant relationship between the teachers' attitudes and the level of implementation of ASEI/PDSI classroom practices, the teachers answered several questions on their attitudes towards its implementation. Just like the head teacher attitude scale, in order to obtain the dividing point between negative attitude and positive attitude, computation was done. The teachers' instrument consisted of 22 statements related to attitude towards the implementation of ASEI/PDSI classroom practices the score values were;

22 x 5 = 110 most favourable response possible (Positive attitude); 22 x 3 = 66 a neutral attitude; 22 x 1 = 22 most unfavourable attitude (Negative attitude)

If a score was above 66, the head teacher was said to

Table 10. Teachers' attitudes towards implementation of ASEI/PDSI.

Teacher's attitude	Frequency	Percentage
Negative <66	26	17.9
Neutral 66	5	3.5
Positive >66	114	78.6
Total	**145**	**100**

have a positive attitude towards the implementation of ASEI/PDSI classroom practices. A score below 66 meant a negative attitude towards its implementation and a score of exactly 66 was suggestive of a neutral attitude. The results are indicated in Table 10. The data indicates that a majority of the head teachers (78.6%) had a positive attitude towards the implementation of ASEI/PDSI classroom practices; while 17.9% had negative attitude towards its implementation and 3.5% were neutral. However most of the teachers who had a positive attitude were clustered around the score slightly above 67%.

Hypothesis two

The study hypothesized that there was no significant relationship between the teachers' attitudes, and the level of implementation of ASEI/PDSI classroom practices. In this hypothesis, the teachers' attitudes towards the ASEI/PDSI implementation were categorized as (positive) above 66, (negative) below 66 and, (neutral) equal to 66. The level of implementation was categorized into three; fully = 3, partially = 2 and not at all = 1. The chi- square compared the teachers' attitudes to the level of implementation. The chi-square values from the teachers' attitudes towards the implementation were calculated for the teachers of each of the science subjects. The results are indicated in Table 11.

Results indicate that the chi-square value is greater than the critical value at one degree of freedom - Biology χ^2=55.3429>54, Chemistry χ^2=54.4581>48, X^2 and, Physics χ^2=69.4286>58 meaning that they are significant. The conclusion made was to reject the null hypothesis and accept the alternative hypothesis that there is a significant relationship between the teachers' attitudes and the level of implementation of the ASEI/PDSI classroom practices. It means that if the teachers' maintain their positive attitude towards ASEI/PDSI classroom, they could influence the implementation of the ASEI/PDSI classroom practices.

However, the scores in the table were less than 5; therefore the Fisher Exact Test was carried out. The Fisher Exact Test results for the relationship between the teachers' attitudes and the level of implementation was Biology p-value 0.03 < 0.05, Chemistry p-value 0.17 > 0.05 and Physics p-value 0.15 > 0.05. The Fisher Exact Test p-values are not significant at the 5% level of significance as the p-values are greater than 0.05 for Chemistry and Physics but are significant for Biology, where the p-value was less than the 0.05 significance level. The null hypothesis was therefore rejected and the alternative hypothesis accepted for Biology. However, the null hypothesis was neither accepted nor rejected for the teachers' attitudes towards Chemistry and Physics.

In this study, the positive attitude of the teachers towards ASEI/PDSI classroom practices can influence its implementation from partial to full implementation of this innovation. The positive attitude of majority of the teachers towards the implementation of the ASEI/PDSI implies that the level of implementation of the ASEI/PDSI can improve from partial to full implementation. However, there is still a group of teachers who have a negative attitude towards the implementation of ASEI/PDSI classroom practices. According to Fullan (2007), a critical mass of users for an innovation has to be met if the implementation is referred to as successful. The negative attitude of this minority can therefore not be overlooked. The negative attitude of this group also suggests that there are learners who will not get the benefits of the ASEI/PDSI classroom practices if this group of teachers fails to implement these practices during teaching and learning.

Other results from the research finding indicate that, the negative attitude towards the ASEI/PDSI classroom practices seems to be rooted in the in-service programme itself. According to the interviews conducted with district trainers, it was indicative that they are facing challenges in disseminating the information to the trainees. The success of the training, according to Fullan (2008), depends on the full participation of the trainees of which these district trainers did not get.

The ASEI/PDSI paradigm is a learner-centred pedagogy which relies on the active participation of its users. When the training adopts the same technique, it gives the trainees a chance to experience its constructs. During the interviews conducted with the teachers, head teachers and the district trainers, it was revealed that the real problems were as follows:

1. The teachers were protesting because the SMASSE INSET was organized during the holidays yet, they were not given any incentives such as per diem. Some felt the training interfered with their tuition activities which

Table 11. Chi-square results of teachers' attitudes and the level of implementation.

Attitude	Not at all	Partially	Fully	Total
Biology				
Negative	3	5	1	9
Neutral	1	0	0	1
Positive	3	30	9	42
Total	**7**	**35**	**10**	**52**
(X^2 Value = 55.3429, Critical Value =54, df = 1, Pr = 0.424)				
Chemistry				
Negative	1	9	0	10
Neutral	2	2	0	4
Positive	5	36	7	48
Total	**8**	**47**	**7**	**62**
(X^2 Value = 54.4581, Critical Value = 48, df = 1 Pr = 0.242)				
Physics				
Negative	2	8	0	10
Neutral	1	1	0	2
Positive	3	33	6	42
Total	6	42	6	54
(X^2 Value = 69.4286, Critical Value = 58, df = 1 Pr = 0.145)				

supplements their earnings.

2. The conditions of training were harsh including sleeping in dormitories and the quality of the food offered was not adequate. Some suggested that the in-service training should be offered in hotels as in the case for civil servants and other professional organizations.

3. Some of them indicated that the training should be offered by facilitators from higher learning institutions rather than fellow teachers from the secondary schools.

4. Some of the teachers strongly felt that the ASEI/PDSI classroom practices should be taught during pre-service training, arguing that these were the same concepts they were taught during their teacher training.

In a study by Waititu and Orado (2009) on how physics teachers' attitudes affects the reality in the classroom, a lesson was observed of a teacher who strongly believed in learner-centred pedagogy only to discover that it was quite the opposite. The teacher did the talking 90% of the time. Where an activity was prepared for the learners, the students listened to the instructions 50% of the time leaving them with very little time to carry out the experiments and draw conclusions. This may explain the partial implementation of the ASEI/PDSI classroom practices in this study. Studies by Dylaon (2007), Cuban (2009) and Yero (2002) have revealed a high degree of agreed teachers' attitudes and their practice of teaching where as others have identified inconsistent. This study found discrepancies between teachers' positive attitudes towards ASEI/PDSI classroom practices and their level of implementation of this innovation. In this study 78% of the teachers were found to have a positive attitude but only 5% were implementing it fully and 65% were implementing ASEI/PDSI classroom practices partially. The conclusion is that there is a relationship between the attitude of the teachers and the level of implementation of ASEI/PDSI classroom practices. However, the study found that the head teachers' attitudes do not influence the teachers' implementation of the innovation.

Conclusion

Based on the findings, the level of implementation of the ASEI/PDSI classroom practices in the public secondary schools is partial, and the conclusion is that the implementation of this innovation has not been successful. The study also concluded that the most significant variable influencing the level of implementation of the ASEI/PDSI classroom practices was the attitude of the teachers. However, there was a dissonance between the majority of the science teachers' positive attitudes towards the innovation and their level of implementation. The study further concluded that the negative attitude of the head teachers towards the implementation of the ASEI/PDSI classroom practices and them missing the SMASSE in-service training has had an indirect bearing on the teachers' level of implementing the innovation. This is because teachers lack a supportive administrative environment to implement the ASEI/PDSI classroom practices.

RECOMMENDATIONS

Based on the findings, the study therefore recommends that first, since the level of implementation was found to be related to the teachers' and head teachers' attitudes towards the innovation; the national SMASSE inset should have strategies to bring on board those who still have a negative attitude. This is because the success of the implementation is deemed effective when the majority or all the implementers are using it fully. Secondly, the head teachers in the SMASSE in-service training should be involved from the onset, so that they can be aware of the new skills acquired by the teachers. The government should put in place a clear policy on the head teachers' roles in innovation implementation and a plan to develop their skills on change issues. This will give them confidence as they oversee the implementation of the innovations in the institutions.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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