FACTOR THAT INFLUENCE TEACHERS' PERCEPTION TOWARDS THE IMPLEMENTATION OF STRENGTHENING MATHEMATICS AND SCIENCE IN SECONDARY EDUCATION (SMASSE PROGRAMME) IN BUNGOMA COUNTY

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ABSTRACT

Dismal performance in Mathematics and Science subjects poses a challenge towards realization of the Kenya National development goal of industrialization by the year 2020. The government of Kenya in liaison with the Japanese government came up with Strengthening of Mathematics and Science in Secondary Education (SMASSE) to remedy the situation. This was to be achieved through in-service training for mathematics and science teachers to improve on teacher classroom practices and student's learning.This paper presents a study on motivation as a strategy that influence mathematics and science teachers' participation in the in-service training. The study was guided by Rogers's innovation-implementation diffusion theory. Descriptive survey design was used and thetarget population was 1450 teachers teaching in 275 secondary schools and 9 sub-county Quality Assurance Officers (QASO). Simple random sampling and purposive sampling techniques were used for a sample size of 438. Data was collected using questionnaires, interview schedules and an observation guide. It was analyzed using both descriptive and inferential statistics and it was found out that provision of motivation to teachers influence their participation. It was concluded that all teachers would attend INSETs if motivated. From the conclusion, it was recommended that the national SMASSE office and the MoEST should consider teachers' views on motivation.

INTRODUCTION

Background

Modern learning theories emphasize that learners learn better if they are accorded autonomy in classroom, time and facilities to construct knowledge for themselves and others (Brown, 1998). One of the goals of education in Kenya is to prepare learners to contribute to the economic development of the country. In order to realize this goal, it is envisaged that Mathematics and science will play a significant role. Because of this, the Government has put emphasis on mathematics and science as being critical for the achievement of this goal. According to Brown and Adams (2001), for such goal to be attained teachers must shift their attention away from themselves as effective presenters of scientific informationto focus on student's developmental needs to learn science with understanding.

Efficient human capital development depends on the quality and effectiveness of teachers. It is probably for this reason that the Koech report (RoK, 2000) recommended the Totally Integrated Quality Education and Training (TIQET) for teacher trainees in teacher training institutionsapproved by thegovernment of Kenya. The report of the National Committee on Educational objectives and policies (RoK, 1976) suggests that improvement of the quality of the teacher is possible through training and retraining. It has been noted that many teachers of science graduating from training institutions have not been exposed to all aspects of science education (Hodson, 1993). He observed that teachers are ill prepared to teach effectively in the science laboratory because they were brought up on a diet of content dominated cookery book type of practical work.

The Center for Mathematics, Science and Technology Education in Africa (CEMASTEA) aims at building teachers' capacities to enablethemcope with pedagogical related challenges encountered during curriculum delivery. CEMASTEA coordinates SMASSE through In-Service Training (INSET) programmes. Skills

acquired during SMASSE INSETs support the Social Pillar of Kenya's Vision 2030 (RoK, 2012). The SMASSE Project Impact Assessment Survey (SPIAS) results indicate that the level of implementation of Activity-focused, Student-centered, Experimenting and Improvisation through Plan, Do, See and Improve (ASEI-PDSI) classroom practices innovation is low (SMASSE, 2002). This implies a glaring industrial skills gap in Kenya. The alarming poor performance in mathematics and sciences puts the prospects of Kenya becoming industrialized nation in jeopardy.

The SMASSE project was therefore,initiated to address the following factors deemed to affect the performance of Mathematics and Sciences: teachers and learners attitude; teaching methodology; teachers' mastery of content and development of teaching and learning materials (SMASSE, 1998). These factors were to be addressed through INSETs for Mathematics and Science teachers in the whole country. Despite the efforts and the objectives of the SMASSE project aimed at improving performance of mathematics and science, very little has changed over the years. The continuous poor performance by students in these subjects in national examinations has drawn concern from various stakeholders.

Mathematics and science teachers are expected to attend all the four INSET cycles as planned by the MoEST. In cycle one; INSET emphasis is laid on attaining a positive attitude towards these subjects among the stakeholders, the teachers and the learners.In cycle two, INSETs adopt a more practical oriented approach by providing hands-on experience. This cycle provides opportunities to put into practice the principles of the ASEI movement and PDSI approach. Cycle three focuses on classroom implementation of the ASEI/PDSI classroom practices and, cycle four involves monitoring and evaluation which aims at improving the quality of the project activities.

In Bungoma County, the training takes place at Cardinal Otunga Girl's High school, Bungoma High School, Friends School Kamusinga and Lugulu Girls's High school. Despite the government's involvement as a matter of policy, the number of teacher's attending SMASSE in-service training has continued to decrease as shown in table 1.2 below.

Table 1.2 Mathematics and science teachers attending SMASSE INSET between 2010 and 2013

INSET Center.	2010	2011	2012	2013
Cardinal	295	250	245	188
Kamusinga	420	367	340	242
Lugulu	395	333	314	198
Bungoma	340	318	255	216

County Director of Education (2014)

There have also been cases of discontent amongst the participants during in-service training (QASO, 2014), and performance in these key subjects continue to be dismal causing concern to all education stakeholders as to what ails education in Bungoma County. This is the scenario necessitated an investigation on how

motivation factor influence teachers' perception on the implementation of SMASSE programme in Bungoma County.

OBJECTIVE

.The objective of this paper was to find out the influence of motivational strategies on the teachers' participation in the SMASSE in-service training Programme in Bungoma County.

RESEARCH METHODOLOGY

Introduction

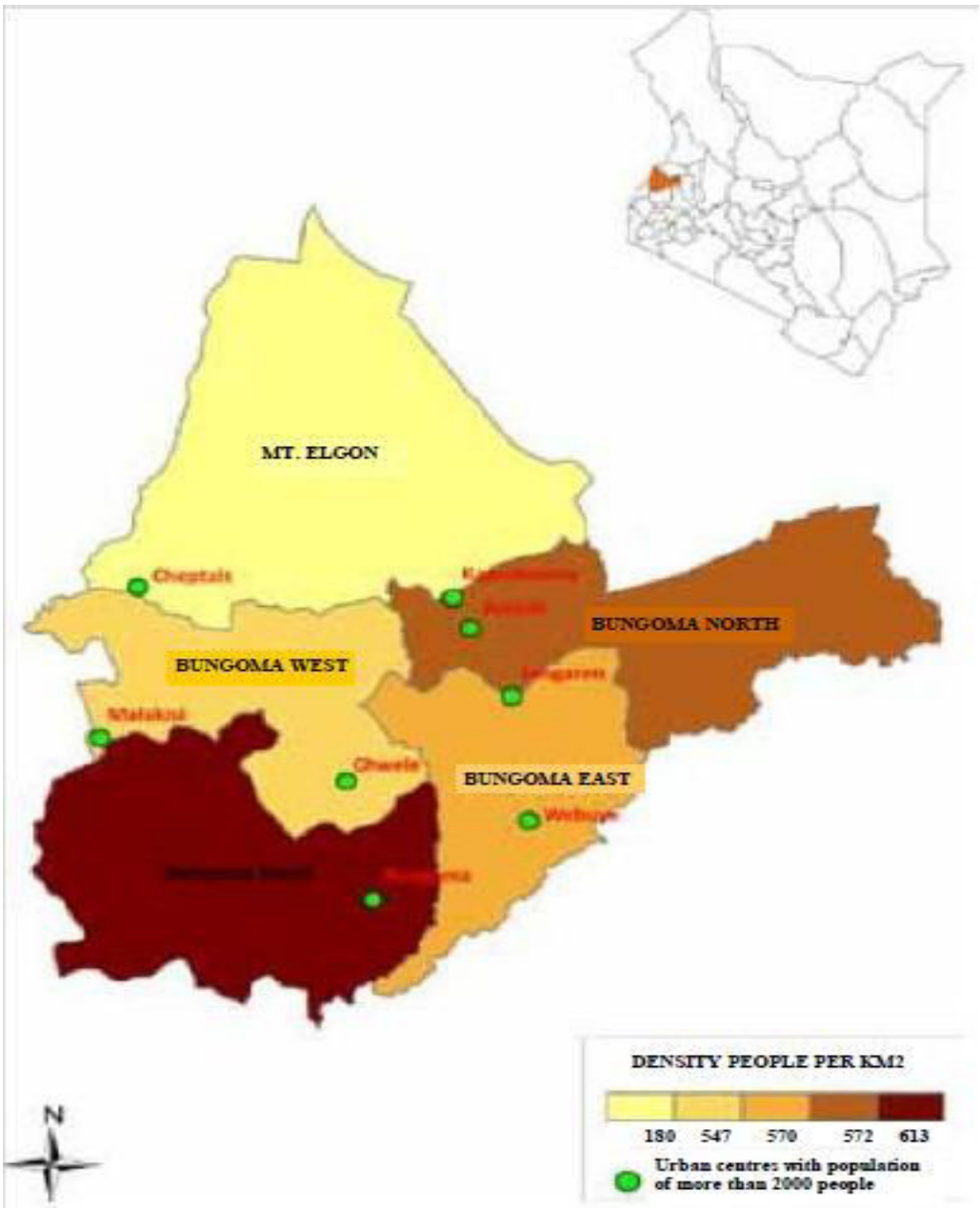
This part of paper presents the research design; location of the study; target population; sample size and sampling techniques; data collection instruments; data collection procedure; validity and reliability of the research instruments; data collection and analysis procedures.

Research Design

This study was conducted through descriptive survey design. Descriptive survey involves collecting the information by interviewing or administering a questionnaire to a sample of individuals (Orodho, 2003). This design enabled the researcher to determine the present status of the population of the study with regard to a number of variables. It enabled the researcher to collect information about teachers' perception towards implementation of SMASSE ASEI-PDSI tenets in classroom teaching and learning. The study examined the situation as it is in Bungoma County. According to Mugenda (2003), descriptive survey involves collection of data in order to determine whether and to what degree a relationship exists between two or more quantifiable variables.

Area of Study

This study was conducted in the secondary schools in Bungoma County together with sub-county Quality Assurance and Standards Officer (QASO). Bungoma is one of the four counties in the former Western province in Kenya. It is bordered by Busia County to the South, Kakamega County to the West and Trans Nzoia County to the East. Figure 1 below shows the map of bungoma County.



According to the Ministry of Planning and Development, the population of Bungoma County is estimated at 1,630,939 which make it the third most populated County in Kenya. The Taskforce Report on Education in Bungoma County released in September, 2014 shows Performance in Mathematics and Science subjects have been poor.The County was ranked last among the Counties bordering it.

Study Population

The target population for this study was one thousand four hundred and fifty nine (1459). Out of this population, one thousand four hundred and fifty (1450) weremathematics and science teachers, nine (9) Sub-County QASOs. The researcher generalized the findings to this population. Table 3.1 shows target population for schools per sub-county, number of mathematics and science teachers in each sub-county, number of QASO and the INSET centres.

Table 3.1 Target Population

Sub-County	No. of Schools	No of Science & Mathematics Teacher	No of QASOs	No of IN-SET Centres
Bungoma Central	26	157	1	Nil
Bungoma East	48	218	1	1
Bungoma North	39	180	1	Nil
Bungoma South	43	250	1	2
Bungoma West	22	150	1	Nil
Bumula	36	198	1	Nil
Cheptais	14	45	1	Nil
Kimilili	31	165	1	1
Mt Elgon	16	87	1	Nil
Total	**275**	**1450**	**9**	**4**

Source: QASOs 2014 .

Sampling Techniques and Sample Size

The sample size was determined using the following technique;

Sampling Techniques

Since the study could not be conducted in all schools in Bungoma County, a representative sample was selected from nine sub-counties for the study. Simple random sampling methodwas used to select 30% secondary schools from each sub-county at a time that gave a representative sample. This was done using a rotary method so that the remaining schools had equal opportunities of being picked. The researcher picked a paper at a time and recorded the school's namebefore picking the next school. The picking continued until (30%) of the schools had been picked before sampling from the next sub-county. The process continued for all the nine sub-counties and a total of 83 (30%) schools were sampled for this study as shown in table 3.2.

Table 3.2 Sampling Procedure

Sub-County	No. of schools per sub-county, N	No. of schools sampled, n, was given by {n=0.3xN}	No. of teachers sampledfor study was given by[T_s=0.3xteachers per sub-county]
Bungoma Central	26	08	48
Bungoma East	48	14	66
Bungoma North	39	12	54
Bungoma South	43	13	76
Bungoma West	22	07	45
Bumula	36	11	60
Cheptais	14	04	14
Kimilili	31	09	50
Mt Elgon	16	05	22
Total	**275**	**83**	**435**

The researcher used systematic random sampling procedure to sample out mathematics and science teachers per sub-county. All the possible respondents were index from 1 to a maximum in each sub-county and the researcher picked respondents at an interval that provided 30% respondents from each sub-county. The procedure was done for all the nine sub-counties and a total of 435 (30%) respondents were picked for this study. The researcher used simple random sampling to select 3 (33%) QASOs.

Sample Size

The main factor to consider in determining the sample size is the need to keep it manageable enough (Orodho and Kombo, 2002). Therefore by studying the sample, one can be able to know more about the population without having to study the entire population. Although Bungoma County has 275 public secondary schools, only 83 (30.2%) schools were randomly sampled. A total sample of 438 (30.0%) respondents was selected from the target population for the study. This sample consisted of 435 (30%) teachers of mathematics and sciences, and 3 (33.3%) sub-county QASOs. This is considered as a representative sample since it falls within the range advocated by Mugenda and Mugenda (2003) who argues that, a representative sample for a descriptive survey study that fulfils requirements of efficiency, reliabilityand flexibility, shouldbe in the range of 20% to 30%. Table 3.2 shows respondents sample size.

Table 3.3 Sample Size

Respondents	Population N	Sample Population n	Percentage %	Sampling Technique
Teachers	1450	435	30.0%	Simple Random Sampling
QASOs	9	3	33.3%	Purposive Sampling
Sample Size		**438**	**30.0%**	

Instruments for Data Collection

The research instruments for this study were Questionnaire, Observation and Interview schedules which were developed by the researcher.

Questionnaire

The questionnaire is a research instrument that gathers data over a large sample (Kombo and Tromp, 2013). A questionnaire ensures anonymity that gives respondents freedom to respond without fear of victimization while allowing them to make their suggestions. The researcher used a questionnaire which had both open ended and closed ended items. It had three sections. Section A sought the teachers' background information including age and academic/professional qualification. Section B had items that sought to establish how motivational strategies influence respondents' participation in the in-service training. Section E aimed at finding suggestions for improvement of the implementation of SMASSE programme.

Interview Schedule

According to Koul (1993), interview method is often superior compared to other research tools. Once a rapport has been established and confidence assured, certain confidential information can be divulged that would otherwise have escaped the researcher (Platton, 1990). In addition, follow up can be made on incorrect or incomplete answers to certain questions and the interviewer has the opportunity to gauge the sincerity of the respondents' information (Koul, 1993; Platton, 1990). This gave the researcher a complete and detailed understanding of motivation provided to respondents and attributes of trainers.

Observation Schedule

It was used to obtain data on the use of ASEI-PDSI practice during teaching and learning. The researcher was able to evaluate the lesson sampled by indicating the frequency use of teaching and learning method, teaching techniques and improvisation during teaching and learning process.

Ethical Consideration

The permission to carry out this research and to use information obtained was sought from relevant authorities and the concerned parties. Permission was obtained from the university, NACOSTI and the participating schools. The researcher kept any personal information confidential and did not allow any unauthorized person to access it.

Data Analysis Procedure

Data was gathered from the field, coded and entered into the computer for analysis using Statistical Package for Social Sciences (SPSS). Data collected was presented using pie charts, tables and bar graphs.

FINDINGS

Gender of Respondents

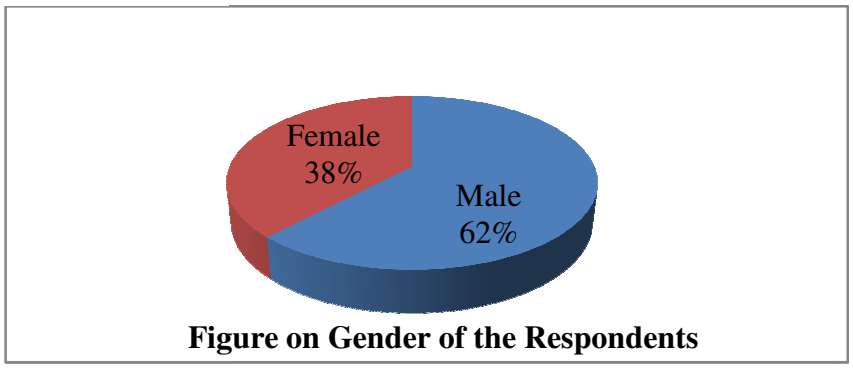


Figure on Gender of the Respondents

There were 266 (62%) male and 163 (38%) female mathematics and science teachers who attended SMASSE in-service training in Bungoma County.

Professional Qualification of the Respondents

Respondents were asked to indicate their professional qualifications and the findings were represented as shown below.

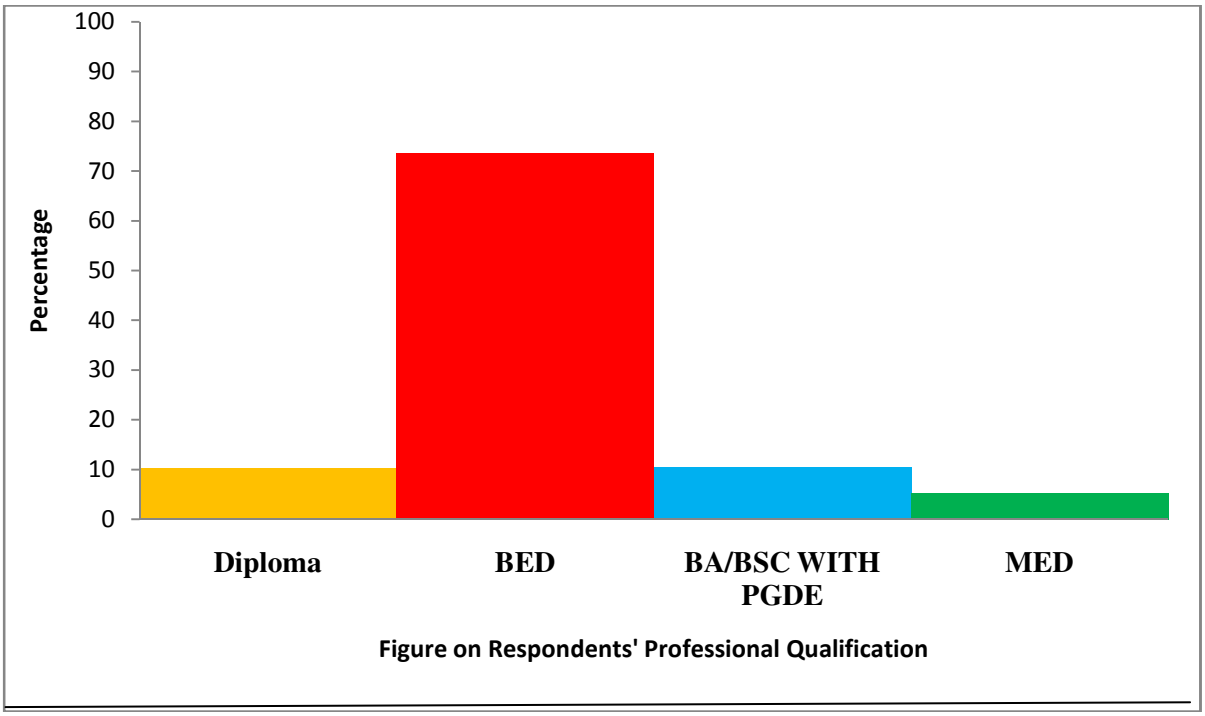
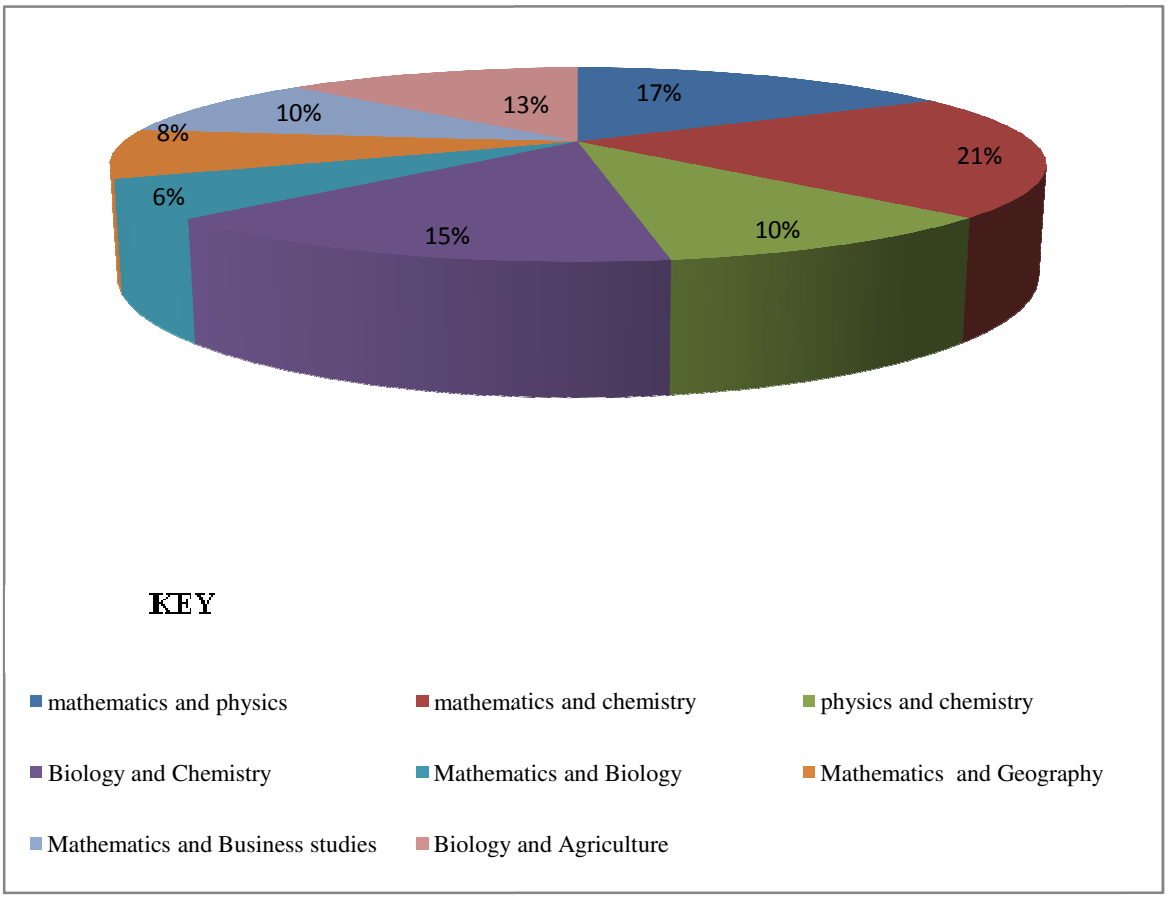


Figure on Respondents' Professional Qualification

The finding shows that 318 (74%) respondents were Bachelor of Education degree holders, 47 (11%) respondents were holders Bachelor of Science with a Post Graduate Diploma in Education, 43 (10%) were Diploma holders in Education while 21(5%) respondents were Master of Education Degree. The findings indicate that all the mathematics and science teachers were professionally trained.

Subjects Taught by Respondent



The findings shows that 90 (21%) respondents teach Mathematics and Chemistry, 73 (17%) teach Mathematics/Physics, 64 (15%) teach Chemistry/Biology and, 26 (6%) teach mathematics/biology. It is established that 176 41%) respondents teach mathematics and other subject apart from physics, chemistry and biology.

INSET Subject for Respondent

The finding shows that respondent participated in the in-service training as represented in the table below.

INSET Subjects for Respondents

SUBJECT	FREQUENCY	PERCENT
Biology	110	25.5
Chemistry	105	24.4
Mathematics	133	30.8
Physics	81	18.8
Total	**429**	**100.0**

From the data, 110 (26%) of the respondents attended Biology INSET, 103 (24%) Chemistry INSET and 81 (19%) respondents attended Physics INSET. A total of 133 (31%) respondents attended mathematics INSET. This reveals that most mathematics teachers have attended SMASSE in-service training in Bungoma County.

Number of INSET Cycles Attended

Teachers are expected to attend all the four cycles of the SMASSE INSETs. Ifthey fail to attend any of them they are given an opportunity to attend themop-up INSETs. The science and mathematics teachers are expected to attend one INSET inone of their teaching subject areas.

Number of INSET Cycle Attended

Cycle	Frequency	percent
One	429	100
Two	400	93
Three	204	48
Four	155	36

From the table, 429 (100%) respondents attended cycle one of SMASSE in-service training, 400 (93.2%) proceeded to attend cycle two. Only 204 (47.6%) respondents attended cycle three and 58 (13.5%) respondents attended the fourth cycle.

The main theme of cycle one is attitude change and pedagogical skills. Since 100% respondents attended in-service training, it implies that all mathematics and science teachers benefited from the theme of cycle one and therefore are able to influence learners' attitude.

Participation in cycle two by respondents was 93%. Cycle two of SMASSE INSET provides an opportunity for participants to put into practice the principles of ASEI-PDSI paradigm. The respondents work in groups in order to focus on the problem areas of each subject. They also prepare ASEI lesson plans and present them to their peers. Therefore, by simple calculation, it implies that 30 (7%) who did not attend the INSET missed the "hands-on" training of the ASEI-PDSI classroom practices.

Cycle three of the INSET focuses on classroom implementation of the ASEI/PDSI principles. Activities of the INSET have been designed to transform the concept of ASEI from the theory to practice, a process known in SMASSE as actualization of ASEI. The cycle involves implementing of ASEI lessons and peer teaching session done during cycle two into actual classroom implementation in schools within the locality. Lessons are taught to different classes during the holidays (Waititu & Orado 2009). 225 (52%) respondents missed out on the actualization of the ASEI-PDSI classroom practices. Cycle four of the INSET involves monitoring and evaluation. The purpose is to improve the quality of the project activities. However, only 155 (36%) respondents participated in the in-service training. By simple calculation, 274 (64%) respondents missed essential knowledge on how the ASEI/PDSI should be monitored and evaluated in order to determine its impacts on the learners.

Influence of Motivational Strategies on Respondents' Participation in the SMASSE INSET

Respondents were asked to respond either as Very Low Priority (VLP); Low Priority (LP); Undecided (U); High Priority (HP) or Very High Priorities (VHP) to the questionnaire items.

A score of 1 was given to VLP, 2 to LP, 3 to Undecided, 4 to HP and 5 to VHP. For each motivational strategy, the mean score was computed for the cumulative responses. The mean was used to explain the level of influence of the motivational strategy on the respondents' attendance of the SMASSE in-service training.

Influence of motivational strategies on respondents' attendance in the INSET

How has the provision of the following motivational incentives influenced your attendance of the SMASSE INSET:	**VLP**	**LP**	**U**	**HP**	**VHP**	**Mean $\ddot{X}$**
1. Provision of quality meals for participants during in-service training.	2 (0.5%)	6 (1.4%)	9 (2.1%)	21 (5.0%)	390 (91%)	4.84
2. Adequate supply of training materials during in-service training.	3 (0.7%)	9 (2.1%)	11 (2.5%)	66 (15.5%)	339 (79%)	4.69
3. Enabling easy accessibility to SMASSE resources after in-service training for the purpose of teaching & learning in your school.	9 (2.1%)	26 (6.0%)	26 (6.0%)	88 (20.4%)	279 (65.0%)	4.40
4. Provision of adequate allowances for participants.	1 (0.2%)	1 (0.2%)	1 (0.2%)	3 (0.7%)	421 (98.2%)	4.95

5. Provision of entertainment and recreational facilities	112 (26%)	124 (29%)	56 (13%)	43 (10%)	94 (22%)	2.73
6. Provision of adequate security during the in-service.	1 (0.2%)	3 (0.6%)	3 (0.6%)	32 (7.4%)	390 (91%)	4.88
7. Consideration of SMASSE INSET certificates by TSC as basis of promotion of participants at end of 4th-cycle.	2 (0.5%)	7 (1.6%)	2 (0.5%)	10 (2.3%)	406 (94.7%)	4.90
8. Accessibility to SMASSE in-service training centre	1 (0.2%)	3 (0.7%)	1 (0.2%)	13 (3.0%)	409 (95.4%)	4.91

Results from table 4.4 show how respondents prioritize different motivational strategies. The mean for cumulative response for every motivational strategy was calculated from the following relation:

$$\text{Mean} = \frac{\text{Sum of product of responses and priority score}}{\text{Number of respondents}}$$

The computed mean was used to explain how the strategy influenced participation in the in-service training. Respondents were asked to prioritize provision of quality meals during in-service training. A mean of 4.84 was obtained implying that provision of quality meal to respondents highly influence their participation in the in-service training. Similarly, respondents highly prioritize provision of adequate training resources during the INSET. A mean of 4.69 was calculated showing that adequate resources during SMASSE in-service training highly influence respondents' participation.

From table 4.4, 367 (86%) respondents indicate that accessing SMASSE resources for the purpose of teaching and learning in their school highly influences their attendance. The response on provision of allowance to participant indicated a very high priority. A mean of 4.95 was obtained implying that provision of adequate allowance to participants highly influence their participation.

Respondents were asked to prioritize how provision of entertainment and other recreational facilities during in-service training influence participation. The findings were represented in table 4.4 from which a mean of 2.73 was computed. This implies that provision of entertainment does not influence participation.

Provision of adequate security during in-service training was considered as a very high priority by respondents. A mean for cumulative responses on provision of security was presented in table 4.4. It implies that good security at the INSET centre will motivate participation by respondents.

Respondents were asked to prioritize how consideration of SMASSE INSET certificates by Teachers Service Commission (TSC) for promotion. The findings were presented in table 4.4 from which a mean of 4.90 was obtained indicating a very high priority. This implies that consideration of certificate by TSC will highly influence participation.

Finally, the researcher asked respondents to prioritize how accessibility to in-service training centres influenced participation. A mean of 4.91 was calculated from the findings presented in table 4.4 under accessibility to INSET centres implying a very high priority. From the mean, accessibility to training centres highly influence respondents' participation in the INSET.

Therefore, from the aforementioned analysis, the findings show that provision of motivation to participant influence participation. The mean of motivational strategies were ranked as shown.

Ranking of Prioritized Motivational Strategies

Motivational Strategy	Mean
1. **Provision of adequate allowances to participants.**	4.95
2. **Accessibility to SMASSE in-service training centre.**	4.91
3. **Consideration of SMASSE certificates for promotion.**	4.90
4. **Provision of adequate security at INSET centres.**	4.88
5. **Provision of quality meals during in-service training.**	4.84
6. **Adequate training materials during in-service training.**	4.69
7. **Accessing SMASSE resources for teaching/learning.**	4.40
8. **Provision of entertainment and other recreational facilities.**	1.73

The responses on provision of adequate allowance and accessibility to INSET centres highly influence their participation. Respondents will not attend in-service training if certificate for participation have no value attached; security at the INSET centre is not adequate and; meals provided are not of good quality. However, provision of entertainment and other recreational facilities will not influence participation. Respondents will attend with or without entertainment.

From table 4.5, the study concludes about objective one that provision of adequate allowance; accessibility to in-service training centres; consideration of certificates for promotion; provision of adequate security and quality meals highly motivate teachers to participate in the in-service training. Availability of sufficient training materials during training and accessing SMASSE resources by mathematics and science teachers to use in their schools for teaching and learning motivates respondents' participation. Provision of entertainment and recreational facilities do not motivate respondents to participate in the in-service training.

A study by Ndirangu, (2013) on factors influencing teachers' level of implementation of strengthening of mathematics and science in secondary education, did not consider provision of adequate allowance to participants and accessibility to INSET centres as motivational strategies influencing participation. This study therefore sought to fill the gap.

CONCLUSION

The study concludes that respondents will attend in-service training if adequate allowances are given and the INSET centres are easily accessible. If certificates of participation are considered for promotion, then respondents will participate in the in-service training. Provision of adequate security, quality meals and adequate training materials during in-service training highly motivates respondents to participate in the SMASSE INSET programme.

It was concluded that motivation is a driving force behind respondents' participation in the SMASSE in-service training. If respondents are not motivated, they will not participate in the in-service training implying that implementation of SMASSE tenets are at risk. This is reflected in poor performance by students at national examinations.

RECOMMENDATION

Based on the findings and conclusions above, it was recommended that the national SMASSE office and the MoEST should consider the views of teachers on motivation when planning for INSETs to enhance effective implementation of ASEI-PDSI innovation.

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