



# Influence of SMASSE INSET on Chemistry Teachers' Classroom Practices in Public Secondary Schools in Nandi East Sub-County, Nandi County, Kenya

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*Abstract: Strengthening of Mathematics and Science in Secondary School Education (SMASSE) is an In-Service Education and Training (INSET) course for mathematics and science teachers aimed at improving their classroom approaches and students' achievement. The study sought to find out the influence of SMASSE INSET on chemistry teachers' classroom practices on achievement of chemistry subject in Nandi East Sub-County, Nandi County, Kenya. The study targeted 98 Chemistry teachers. Simple random sampling was used to select 6 out of 30 schools. Chemistry teachers were purposively selected. Questionnaire for chemistry teachers was administered. Descriptive data was presented in terms of frequency tables, mean, standard deviation and percentages. Inferential data was analyzed using Pearson correlation, linear regression analysis statistic at a significant level of 0.05. The findings indicate that SMASSE INSET had a positive and statistically significant influence on chemistry teachers' classroom practices in public secondary schools in Nandi East Sub-County, Nandi County, Kenya. Despite the positive changes on the chemistry teachers' classroom practice, chemistry achievement has not improved as expected. This implies that more interventions have to be put in place to improve students' chemistry achievement.*

**Keywords:** SMASSE INSET, Chemistry, Teacher classroom practices, Achievement of chemistry subject

## How to cite this work (APA)

Lelei H. K., Githua, B. N. & Barmao, A. C. (2023). Influence of SMASSE INSET on chemistry teachers' classroom practices in public secondary schools in Nandi East Sub-County, Nandi County, Kenya. *Journal of Research Innovation and Implications in Education*, 7(1), 157 – 165.

## 1. Introduction

The contributions of chemistry to society are vast and almost numerous, production of vaccines, food safety practices, treatment programs for diseases, diagnostic tools in healthcare, plastics, synthetic fibers, an understanding of oil, cosmetics and cleaners. Vaccines and immunization were first popularized in the 1770s by Edward Jenner, who took pus from the hand of a victim of cowpox and used it to protect people from the much more serious smallpox (Chartier, 2014).

Chemistry teaching is supposed to be results oriented and students centered, this can only be achieved when students are willing and teachers are favorably disposed using the appropriate methods and resources in teaching the students (Brookfield, 2017). Students by nature are curious, they need to be actively involved in the learning process in which they are continuously equipping, testing, speculating and building their own personal construct and knowledge. It is only by personalizing such knowledge that it becomes valid, meaningful and useful to them. In chemistry, students need to construct their own personal awareness and

meaningful information. To substantiate the argument, Best and Kahn (2016) remarked that the brain is not a passive consumer of information, and to learn with understanding, a learner must actively construct meaning of what to be learned.

INSET is the In-service Education and Training of teachers which is meant to extend their personal education and develop professional competence. In this study, SMASSE is the Strengthening of Mathematics and Science in Secondary Schools Education In-service of mathematics and science teachers. SMASSE baseline studies indicated that there were numerous problems in Mathematics and science education (Cheruiyot, Ogoni, Kituyi & Muthoka, 2017). This included attitudes towards mathematics and science, inappropriate teaching methods and low content mastery. During teacher training suitable benchmarks that stipulate both the content and pedagogical developments and growth should be earmarked (McLaren, 2015). SMASSE project targeted teacher attitudes first because of the time they spent with the students. Teachers' negative attitudes can be impacted on the learners' attitudes towards mathematics and sciences (Gibson et al., 2014).

SMASSE came up with an Activity, Student, Experiment and Improvisation (ASEI) movement which were geared at making learning student centered as opposed to teacher centered. To achieve the ASEI condition, SMASSE came up with the plan, Do, See and Improve (PDSI) approach to teaching and learning which has to do with planning lessons with hands-on and minds-on activities for the learners which are then assessed to see the successes and failures of the lesson and hence improve on it (Entwistle & Ramsden, 2015). Njoroge, Changeiywo and Ndirangu (2014) note that improving performance in mathematics and science education is a great societal need in Kenya, not only for industrialization but also for producing scientifically empowered citizens. The challenge has been how to make mathematics and science more "alive" more "real" and more accessible. Gibson et al., (2014) therefore strongly felt that students' involvement during lessons must be enhanced to increase learners' motivation, create effective teaching/learning environment and more interesting lessons. The SMASSE INSET conducts monitoring and evaluation to improve the quality of programme activities and also to provide justification for continued allocation of resources into the programme.

Chemistry is a central subject of science that is closely related to daily life. Chemistry, being a prerequisite subject for offering sciences-oriented courses like pharmacy, nursing and medical engineering in the

tertiary institutions, it is necessary for students to get good grades in secondary education. However, poor grades in chemistry in KCSE have been attributed to several factors which include over enrolment, poor syllabus coverage, poor laboratory structures or unavailability of enough practical tools and few chemistry teachers. The Ministry of Education in Kenya, through its various organs, has made considerable efforts to curb the above problems, key among them being introduction of SMASSE INSET. The in-service program was meant to equip chemistry teachers with skills in designing relevant teaching and learning activities that promote student interest and understanding that improves chemistry performance of the students (Entwistle & Ramsden, 2015).

However, it has been noted that despite the introduction of the SMASSE INSET, students' performance in chemistry subject is still ranked low all over the country implying the problem is persistent and wanting. This indicates that there could be yet other critical factors that contribute to poor performance in the subject. The study thus seeks to investigate the influence of SMASSE INSET on Chemistry Teachers' Classroom Practices in Public Secondary Schools in Nandi East Sub-County, Nandi County, Kenya.

## 1.1 Objective of the study

The study was guided by the following objective:

To determine the influence of SMASSE INSET on Chemistry Teachers' Classroom Practices in Public Secondary Schools in Nandi East Sub-County, Nandi County, Kenya.

## Research Hypothesis

**H<sub>01</sub>:** SMASSE INSET has no statistical significant influence on chemistry teachers' classroom practices.

## 2. Literature Review

### 2.1 The Impact of SMASSE INSET on Students' Achievement in Mathematics and Sciences

SMASSE Kenya personnel conducted Monitoring and Evaluation of application and impact of the principles of ASEI movement and PDSI approach in the classroom in Malawi, Rwanda, Zambia and Zimbabwe. The project observed positive impacts in terms of

teachers' attitudes and classroom teaching and learning (Wafubwa, 2014). Teachers who had consistently undergone SMASSE training had shown positive attitudinal change towards their profession and improved on their lesson delivery. Students also had improved participation in the lessons. SMASSE is thus evaluated positively by WECSA member countries. The net impact on teachers showed that teachers planned better and more consistently; attended to students needs more; were more confident to carry out practical activities; tried out new methods; faced the challenges arising from lack of resources as well as the challenge arising from large classes as a follow up on the impact of SMASSE INSET (Wafubwa, 2014).

The net impact on students showed that, students: were actively involved in the learning process; showed great interest and responsiveness; attended the lesson more punctually and regularly; did their assignments more neatly and promptly; carried out discussions beyond class time; interest and curiosity was aroused and sustained as they related mathematics to the real life experiences; encouraged teamwork and allowed individual participation of the students; were provided with opportunities to develop key competencies such as problem solving, synthesis and application of information (Glatthorn, Boschee, Whitehead & Boschee, 2018). Midterm and end term evaluation conducted by JICA and GoK based on Development Assistant Committee criteria rated SMASSE INSET highly successful. Technical cooperation with JICA has expanded with primary mathematics and science teachers INSET launched in January 2009 for a period of five years. It is clear from the foregoing literature that SMASSE INSET has impacted positively on the teaching and learning of chemistry in the member countries (Glatthorn *et al.*, 2018). In this study the influence of SMASSE INSET on chemistry teachers' classroom practices, students' attitude and achievements was investigated.

The SMASSE INSET conducts monitoring and evaluation to improve the quality of programme activities and also to provide justification for continued allocation of resources into the programme. The monitoring and evaluation instruments developed by SMASSE are aimed at: measuring change of attitudes among INSET participants; measuring the extent to which content mastery and pedagogical skills have been upgraded; measuring upgrading in quality of teaching and learning; determining the quality of INSET sessions; and monitoring prudent financial practices (Bett, 2016).

According to Owuor (2014), the nationwide SMASSE INSET impact assessment survey conducted in 2009 established that teachers who had been exposed to the ASEI-PDSI approach planned better and more consistently, attended to students' needs better, were more open to teamwork, were more confident, tried out new methods of teaching, and were better equipped to face the challenge of large classes and lack of resources. Equally, it was established that students being handled by such teachers were actively involved in the learning process, and showed great interest and did their assignments more readily and promptly, carried discussions beyond class time, had an improved relationship with the teacher, developed teamwork, and their attitude towards mathematics had changed for the better. In the study, quantitative data was collected using questionnaires for students, teachers and school principals.

In addition, students wrote an achievement test based on chemistry and science subjects. It was found out that there was a statistically significant positive effect on students' achievement (as measured by the achievement tests) as a result of implementation of the SMASSE INSET. Equally, it was found out that the students' ability was significantly predicted by the students' attitude towards the subject. In addition, it was found out that school principals had significant effect on teachers' teaching practices. It should be noted that this kind of evaluation is internal. Evaluation for funded programmes is carried out for two reasons. Firstly, it is done to fulfill a contract or grant commitment. And secondly, it may be a kind of delaying tactic or a way to shift responsibility or get favourable publicity for the programme. For the case of SMASSE, the evaluation was possibly done to justify the continued allocation of resources into the programme. This calls for independent studies to verify the evaluation results obtained by SMASSE's internal evaluators. Some external studies relating to the usage of the ASEI-PDSI approach have also been carried out (Tom, 2017).

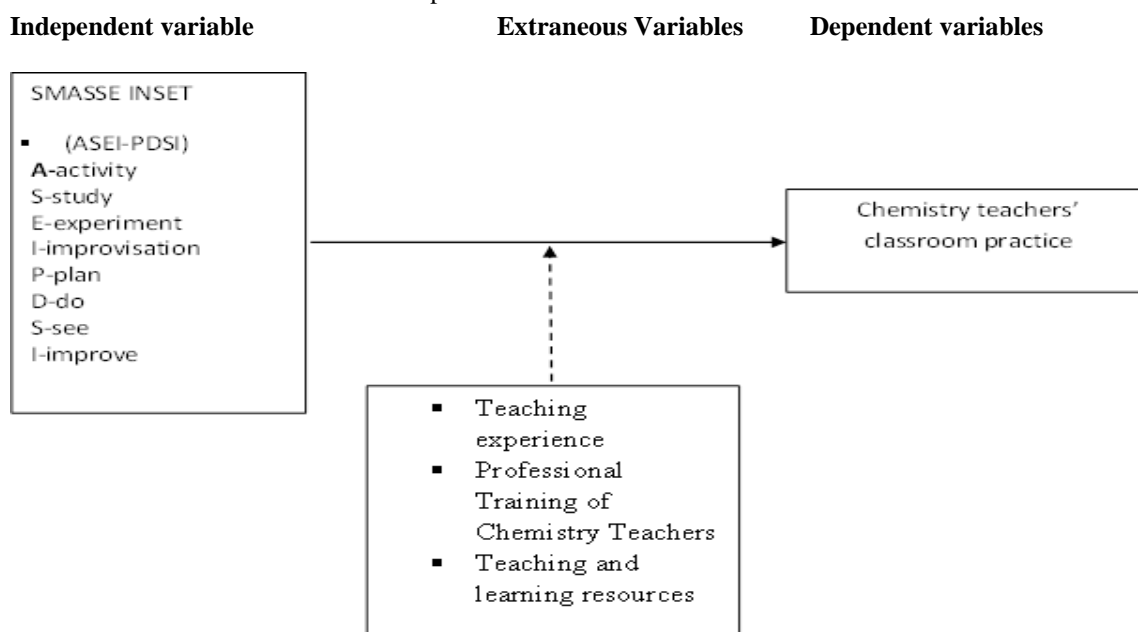
A study by Onchong'a (2013) found out that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centered approach, this was not reflected in their classroom practices which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations. The study, whose purpose was to assess the effectiveness of the SMASSE and School-based Teacher Development programmes in the Kenyan primary and secondary schools sampled four districts and held interviews with 185 teachers. The researchers

equally observed lessons and held focus group discussions with pupils and students. The study recommended that the Ministry of Education should mainstream INSET programmes in its policy for teacher development.

## 2.2 Conceptual Framework

A conceptual framework is a diagrammatic presentation of the theory which is presented as a model where research variables and the relationship between them

are translated into visual picture to illustrate the interconnections between the independent and dependent variables (Onen, 2016). The study was discussed based on the relationship between the independent variables (SMASSE INSET), extraneous variable (Teaching experience, Professional Training of Chemistry Teachers and Teaching & learning resources) and the dependent variable, teachers' classroom practices. Figure 1 is a conceptual framework showing the relationship between the independent, extraneous and dependent variables.



**Figure 1: Conceptual Framework**

In conceptualizing the study, the study sought to point out how the independent variable SMASSE INSET interacts with the dependent variable (chemistry teachers' classroom practice) as shown in Figure 1. The study hypothesized that for high educational output (achievement) to be realized, the SMASSE INSET has

to succeed in positively impacting on improving chemistry teacher's classroom practices. SMASSE INSET used the ASEI (activity, study, experiment, improvisation) and PDSI (plan, do, see, improve) strategies to measure chemistry teachers' classroom practices.

## 3. Methodology

### 3.1 Research Design

The study adopted a cross-sectional descriptive study design. According to Flick (2014), descriptive research is a process of collecting data in order to test hypothesis or to answer questions concerning the current status of the subject in the study. Cross-sectional studies are usually relatively inexpensive and allow researchers to collect a great deal of information faster. Data is often obtained using self-report assessments and researchers

are then able to amass large amounts of information from a large pool of participants. Creswell and Creswell (2017) state that descriptive study designs are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification. The descriptive research is useful because of the economy of taking a sample of the population to generalize results for the whole population.

### 3.2 Sample size and Sampling Technique

The target population was 98 chemistry teachers from 30 public secondary schools in Nandi East Sub-County, Nandi County. The study employed purposive sampling to select one extra county, two county and three sub-county secondary schools. The extra county school is a provincial school (the second tier of secondary schools; after National schools), county schools are (the third tier of secondary schools; after National and Extra County schools, respectively) and sub-county secondary schools are the lowest cadre of secondary schools in Kenya. The order of selection is based on their availability since extra county are very few, county was moderately available and sub-county are mostly available. Simple random sampling was used to select 6 out of 30 schools which constituted about 20% of the population. Kahare (2017) observes that a sample size of 10-20% of population is acceptable in a descriptive survey. Purposive sampling was used in sampling 19 chemistry teachers in the sampled schools.

### 3.3 Instrumentation

The data for this study was generated using chemistry teachers' questionnaires (CTQ). The questionnaires were administered to 19 Chemistry teachers. According to Gold and Windscheid (2020), questionnaires are good in that standard instructions are given to all subjects and the personal appearance, mood or conduct of the researcher does not affect the results. Questionnaires as Vivian (2017) observe, helps the researcher to obtain information from a large sample in diverse regions and it upholds confidentiality. The researcher developed set of questionnaires to be used to collect data from teachers; Chemistry teachers' questionnaire (CTQ).

### 3.4 Data Analysis

Responses to the survey was catalogued by the number of responses to each question and entered in SPSS program version 21 for analysis. Data was analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency tables and percentages were used for the purpose of presentations and description in form of frequency distribution tables. Inferential data was analyzed using Pearson correlation and linear regression model. Linear Regression model showed the relationship between the dependent and the independent variables.

### 3.5 Ethical Consideration

Ethical consideration was considered by allowing voluntary participation of the respondents when collecting data; seeking consent to participate in data collection. All those participating was not coerced into participating in the study as the researcher wrote notifications in advance for any of the participants thus promoting informed consent for all those to be involved. The anonymity principle on participants was adhered to. Further, confidentiality principle was adopted since all the information garnered in the study was kept confidential and protected for academic purpose only.

## 4. Results and Discussion

The main objective of the study was to find out the influence of SMASSE INSET on chemistry teachers' classroom practices in public secondary schools in Nandi East Sub-County. The study was interested in the opinion of teachers on the influence of SMASSE INSET in chemistry classroom practices. Only 18 teachers respond to the research items. The descriptive results are shown in table 1.

**Table 1: Influence of SMASSE INSET on Chemistry Teachers' Classroom Practices**

<i>Influence of SMASSE INSET on Chemistry Teachers' Classroom Practices</i>	<i>Mean</i>	<i>Std. Deviation</i>
Engage students in group work in chemistry	2.00	0.594
Use appropriate question/answer technique with reinforcement of student response in chemistry	2.11	0.583
Assign student discussion work in chemistry	2.06	0.639
Assign student practical work in chemistry	1.94	0.416
Allow students to report the results of practical work in chemistry	2.11	0.676
Give students with difficulties more exercises and practice on observation in chemistry	2.33	0.686
Practice team teaching with your colleagues in teaching chemistry	2.39	0.698
Make ASEI/PDSI lesson plans for teaching chemistry	2.28	0.669
Use lesson notes instead of lesson plans in teaching chemistry	2.39	0.608
Use both lesson plans and lesson notes in teaching chemistry	2.44	0.616
Try out experiments or any other practical work before going to chemistry class	2.17	0.514
Give students take home chemistry assignments	2.39	0.608
Invite a colleague to sit in class during my chemistry lesson	2.22	0.732
<b>Average mean</b>	<b>2.22</b>	<b>0.618</b>

**Valid N 18**

Table 1 indicates that the chemistry teachers frequently utilized various aspects of chemistry teachers' classroom practices learnt in the SMASSE INSET. For the aspect of chemistry teachers' classroom practices, respondents rated all the 13 statements at about mean average=2.22 with mean scores of between mean=1.94 and mean=2.44. Majority of the respondents at mean=2.44 stated that they use both lesson plans and lesson notes in teaching chemistry, while minority of the respondents at mean=1.94 stated that they assign students practical work in chemistry. Another response at mean=2.39 stated that teachers practice team teaching with their colleagues in teaching chemistry, they also use lesson notes instead of lesson plans in teaching

chemistry and further, chemistry teachers give students take home chemistry assignments. In another response at mean=2.33 and standard deviation =0.686, teachers give students with difficulties more exercises and practice on observation in chemistry.

**4.1 Hypothesis testing of SMASSE INSET on chemistry teachers' classroom practices**

In this study, hypothesis was also tested. ( $H_{01}$ ) of the study stated that SMASSE INSET has no statistically significant influence on chemistry teachers' classroom practices. The findings are illustrated in Table 2.

**Table 2: Hypothesis Testing of SMASSE INSET on Chemistry Teachers` Classroom Practices**

		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.076	0.179		11.592	0.000
	SMASSE INSET	0.339	0.069	0.381	4.932	0.000

**a. Dependent Variable: Chemistry teachers` classroom practices**

The study results as shown in Table 3 indicates that SMASSE INSET has statistical significant influence on chemistry teachers` classroom practices ( $\beta_1=0.339$ ;  $P=0.000<0.05$ ). The  $\beta$  factor of 0.339 implies that SMASSE INSET has a significant influence on chemistry teachers` classroom practices by 33.9%. The p-value of 0.000 is less than the predictable value of 0.05 which indicates that the SMASSE INSET has a positive and statistical significant influence on chemistry teachers` classroom practices in secondary schools. Therefore, the study rejects the null hypothesis that SMASSE INSET has no statistical influence on chemistry teachers` classroom practices.

**Discussion**

The study results in table 3 indicate that SMASSE INSET positively influenced teachers to frequently use both lesson plans and lesson notes in teaching chemistry, it also positively influenced teachers to frequently use appropriate question/answer technique with reinforcement of student response in chemistry. Respondents also observed that SMASSE INSET programs positively influenced teachers in how to assign student discussion work in chemistry, assign student practical work in chemistry and allow students to report the results of practical work in chemistry.

The study findings are in agreement with Glatthorn, Boschee, Whitehead & Boschee, (2018) who found that SMASSE INSET influences teachers to ensure students were actively involved in the learning process and showed great interest and responsiveness; attended the lesson more punctually and regularly; did their assignments more neatly and promptly; carried out discussions beyond class time; interest and curiosity was aroused and sustained as they related chemistry to the real life experiences; encouraged teamwork and allowed individual participation of the students; were provided with opportunities to develop key competencies such as problem solving, synthesis and application of information.

The study findings were contrary to Onchong`a (2013) who found out that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centered approach, this was not reflected in their classroom practices, which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations.

The study results in table 3 showed that the study rejects the null hypothesis that SMASSE INSET has no statistical influence on chemistry teachers` classroom practices. This therefore showed that SMASSE INSET has statistical influence on chemistry teachers` classroom practices. Chemistry SMASSE INSET programs has positively influence chemistry teachers to frequently give students with difficulties more exercises and practice on observation in chemistry, influenced chemistry teachers to frequent use of both lesson notes and lesson plans in teaching chemistry. Furthermore, chemistry SMASSE INSET programs guide chemistry teachers to frequently give students take home chemistry assignments and frequently invite colleague teachers to sit in their classes during chemistry lesson.

The findings agree with Koosimile and Suping (2015) who observed a positive impact of SMASSE INSET in terms of teachers` attitudes and classroom teaching and learning practices. Teachers who had consistently undergone SMASSE training had shown positive attitudinal change towards their profession and improved on their lesson delivery. Students also had improved participation in the lessons. SMASSE is thus evaluated positively by WECSA member countries. Wafubwa (2014) also observed that the net impact on teachers showed that teachers planned better and more consistently; attended to students needs more; were more confident to carry out practical activities; tried out new methods; faced the challenges arising from lack of resources as well as the challenge arising from large classes.

## 5. Conclusion and Recommendations

### 5.1 Conclusion

The study established a positive influence of SMASSE INSET on chemistry teachers' classroom practice in public secondary schools in Nandi East Sub-County, Nandi County, Kenya. The positive impact influenced chemistry teachers' classroom practice towards chemistry achievement. This implies that scheduling teachers to attend SMASSE INSET brings a positive impact in teaching chemistry. For instance, SMASSE INSET positively influenced teachers to frequently engage students in group work in chemistry and positively influenced teachers to frequently use appropriate question/answer technique with reinforcement of student response in chemistry.

### 5.2 Recommendations

1. In view of the above, the study recommends that the school management should come up with strategies that ensure chemistry teachers are given chance to attend SMASSE INSET since it brings positive influence on chemistry teachers' classroom practices in secondary schools.
2. The Ministry of education should invest more on SMASSE program to ensure that positive influence on chemistry teachers' classroom practices improve students' achievement in Kenya certificate of secondary education.
3. Also, tertiary institutions, like colleges and universities, should incorporate SMASSE initiatives in their training programs for science teachers since it has significant impact on teachers' classroom practices.

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