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Impact of SMASSE Programme on Secondary School Students' Achievement in Physics in Bomet County, Kenya

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Abstract
Science subjects are the backbone of the scientific and technological advancements in the world. Achievement in science subjects in secondary schools in Kenya has been below average. The low achievement in the national examinations has been attributed mainly to teacher centered teaching approaches used by teachers. In an attempt to address the low achievement in Physics, the Strengthening of Mathematics and Science in Secondary Education (SMASSE) teaching program was introduced through In-service Education and Training INSET) in the whole of Kenya in 2004.Therefore, this study was an attempt to fill this gap. The objectives of the study were; to find out whether SMASSE approach had impacted the achievement in physics and whether there was a gender difference in the achievement in Physics among secondary school students in Konoin sub-county. The study used expost-facto research design as well as a survey research design. Stratified and systematic sampling was employed to select schools for this study. The population was the KCSE candidates in Konoin Sub- County and the accessible populations were the 2000-2003 candidates before SMASSE was introduced and 2012-2015 KCSE candidates immediately after. There was a total of 5017 candidates in this target class in 24 secondary schools in Konoin Sub-County in period 2000-03 and 5204 in the period 2012-15. The schools were in 3 categories, these were extra-County, county, and sub-county schools and both stratified, systematic sampling and purposive sampling were used to select 12 schools with a total of 826 students for the period 2000-2003 and 1390 in the same 12 schools for the period 2012-2015 took part in this study. The research instruments used for the study were a Document analysis tools. Descriptive and inferential statistics were used in the analysis of data t-test and ANOVA were used as inferential statistic to test the null hypothesis. All statistical tests were subjected to a test of significance at coefficient alpha (α) of 0.05. The study found out that there was no statistically significant difference between those students who were exposed to SMASSE and those who were not. The findings may inform decisions and action towards improving teaching and learning of Physics in Kenya. The study also may help to sensitize teachers, curriculum planners, policy makers and other education stake holders as far as SMASSE program is concerned on the areas that require improvement.
Keywords: SMASSE, Kenya, teaching and learning of Physics
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Background information

Science education is crucial in human lives and in the development of nations around the world, as it contributes much towards economic empowerment of nations (Aoki, 2001). Science knowledge has been utilized in scientific inventions in medicine, engineering and technology towards solving most of the human problems (Das, 1985). Over the years, science has contributed to the improvement of quality of human life (Mori, 2017). Most basic Human needs have also been met through scientific inventions. Furthermore, Science education yields a new knowledge, new skills and new desirable attitudes for the learners (Kerich, 2004). Teaching science would therefore equip students with the established body of scientific knowledge appropriate to their needs, interests and capacities (Millar, 2004).

There have been several changes in science teaching approaches and methods. A number of innovations came into being with far reaching effects across many parts of the world. In the United Kingdom, Nuffield Science Project (NSP) was launched in 1962.This project was sponsored by the Nuffield Foundation. In Kenya, Science subjects were included in school curriculum through the School Science Project (Kenya Institute of Education, 1969). The School Science Project (SSP) was designed especially for those schools with well-equipped laboratories. The SSP required students to carry out investigations and discuss their findings and finally draw conclusions with the help of their teacher. Wachanga (2005) pointed out that in 1984 the 8-4-4 education system was introduced in Kenya with the aim of making education more relevant to the needs of Kenyan society. The 8-4-4 education system revised syllabi of Biology, Physics and Chemistry in all secondary schools in Kenya was done by Kenya Institute of Education (KIE,1992), currently called Kenya Institute of Curriculum Development (KICD). These science syllabi emphasized on science content and methods which could be directly applicable to the immediate environment of the students.

Physics curriculum has also undergone several changes starting from 1958 when physical Science Curriculum Study (PSCS) was established in the United States with the following objectives; to examine classroom Physics materials available before 1960, produce a Physics curriculum which encourages creative and imaginative approach to the study of Physics, and the teaching and learning of Physics through inquiry and use of leaner's environment as the starting point in Physics education. PSCS influenced the launch of Nuffield Science Project (NSP) in United Kingdom in 1962.In Kenya, the development of Physics curriculum was initiated by the Kenya Institute of Education, United Nations Educational Scientific and Cultural Organization (UNESCO) through the African Curriculum Development Centre (ACDC) in 1963.There was the Nuffield Science Project of 1969 which adopted the learning of the natural science (Biology, Physics and Chemistry) in selected secondary schools in Kenya. The introduction of the 8-4-4 secondary school Physics syllabi followed a recommendation of the Presidential Working Party in 1981 that stipulated the 4-year Physics course. The importance of studying Physics are; relate and apply relevant Physics knowledge and understanding to social and economic development in rural and urban settings, demonstrate resourcefulness, technical skills and scientific thinking necessary for economic development, acquire firm foundation of relevant knowledge, skills and attitudes for further education and training in related scientific fields (Majani, Kelemba&Maina,2003).

A national assessment survey carried out in 1999 by the Ministry of Education (MOE), resulted in the revision of secondary education Physics curriculum in Kenya. The revised curriculum was to address aspects necessary for industrial transformation by the year 2030 (MOE, 2002). The revised syllabus has many practical activities unlike the previous one that had small scale practical activities; this is still the syllabus in use to date. The consistently low performance in the science subjects in the KCSE is what prompted the ministry of education in Kenya to introduce SMASSE as an intervention measure. The table 1 below gives the picture of the achievement in the science and mathematics just before the introduction of SMASSE to the whole country.

Table 1:
Number of Students per Grade in KCSE Science and Mathematics Nationally in 2003

Subject	B+ and Above	%	D+ and Belo	%	Total candidature
Biology	11,339	6.1	103,282	55	185,319
Physics	5,571	9.8	26,768	47	56,333
Chemistry	12,341	6.2	140,455	71	197,608
Mathematics	9,903	4.8	158,867	77	205,232
Overall	39,154	6.34	429,372	69	617,492

Source: KNEC Results, (2003). Pg. 64

Poor performance in Physics and other science subjects in terms of quantity and quality grades is what prompted the Government of Kenya through the Ministry of Education, Science and Technology (MOEST) in conjunction with the Government of Japan through Japan International Co-operation Agency (JICA) to jointly launch Strengthening of Mathematics and Science in Secondary School Education (SMASSE) project. The project then introduced the SMASSE programs. The low achievement in science is seen in poor performance in examinations and it's an indicator of poor teaching approach (Oyaya & Njuguna, 2000). SMASSE program was then launched in 1998 in nine pilot districts of Kisii, Gucha, Kakamega, Makueni, Kajiado, Murang'a, Maragua, Butere-Mumias and Lugari in Kenya as phase one to cover 4 cycles. This project was eventually extended to cover the whole country in 2004.

In order to address the situation, the SMASSE teaching program was introduced. SMASSE project was therefore conceived as an intervention measure to upgrade the capability of young Kenyans in science and Mathematics. The project was aimed at identifying those factors that contribute to this state of affairs. On the basis of this, a program was formulated for intervention through In-service Training (INSET) of teachers and sensitization of key stake holders. The main problem areas that the project was supposed to address were: poor attitude of the learners and key stakeholders, inappropriate teaching methods and approaches, poor content mastery by the teacher, poor utilization and distribution of school resources and inadequate supervision from Ministry of Education, Science and Technology (SMASSE, 2004).

SMASSE project was an In-Service Education Training (INSET) program that sensitized teachers on teaching strategies that will address the above problems and improve science performance in national examinations. The institutionalization of INSET was for capacity building with the aim of changing the teachers' attitudes, teaching approaches and methods along with prudent use of school resources and improvisation as far as academic activities are concerned (SMASSE, 2004). SMASSE teaching program involves; Activity, Student - centered, Experiments and Improvisation (ASEI) condition and Plan, Do, See and Improve (PDSI) movement (CEMASTEA, 2016). ASEI is a SMASSE initiative whose focus was to assist teachers to reflect on their teaching strategies and acquire skills for effective teaching and for efficient learning to occur (Oyaya & Njuguna, 2000). It also aimed at encouraging teachers to focus on institutional strategies that will support meaningful learning and make lessons interesting to learners. The ASEI teaching approach advocated for a shift in both the teachers' thinking and practice from the teacher centered approaches to student-centered approaches (Ogolla, 2001). PDSI is a teacher's approach to teaching that involved proper planning of the lesson, actual teaching, seeing it and including feedback from other teachers and improving where it requires, making the lesson delivery effective (SMASSE,2005).

Konoin sub-county had been posting below average performance in science subjects in the Kenya Certificate of Secondary Examinations (KCSE) over the years. This had been attributed partly to poor preparedness and approaches employed in teaching of science (SMASSE, 2004). The Kenya Certificate of Secondary Education results analysis before INSET on SMASSE teaching program in Konoin Sub-County is shown in Table 2.

Table 2.
Students' KCSE Performance in Science Subjects in Konoin Sub-County (2000-2003) before the INSET

	2000	2001	2002	2003	
Subject	Mean Score	Mean Score	Mean Score	Mean score	Average
Biology	4.162	4.733	4.833	5.023	4.790
Physics	3.896	4.092	4.647	4.789	4.344
Chemistry	3.841	3.443	3.723	3.952	3.783
Overall	3.963	4.087	4.400	4.588	4.306

Source: District Education office, Konoin (2004) pg 3

Table 2 shows the performance of the three science subjects before the inception of the SMASSE in KCSE in the sub-county. The average score for the three subjects is below 50% or 6 points on a 12-point scale, where A= 12 points is maximum possible score and E=1point, is the least score.

SMASSE program was introduced in the whole of Kenya in 2004.This was with a view of improving the performance in the science subjects. Physics teachers were supposed to implement the teaching approaches in their own schools.

Students' motivation towards science and achievement has been found to be related and in turn affect student's motivation towards science learning (Barchok, 2006). What a teacher expects the students to achieve and how he conveys it carries a lot of influence. Motivation is the desire to do something (Oyaya &Njuguna, 2000).Veroff (2016) found that poor performance in national examinations makes the students lose motivation and consider it a waste of time to concentrate on subjects they will not pass. On the contrary, Wachanga (2000) in his findings on effect of inquiry teaching approach in learning Chemistry noted that the cause of most failures in schools might not be due to the teaching approach or inadequate instruction, but perhaps due to the inability of learners to change their attitude towards the subject. Furthermore, it was found that Biology male students in Bomet were positively influenced by SMASSE teaching approach in terms of achievement while female students were not (Mutai ,2018). This program was also expected to bridge a gap that exists in the performance of boys and girls in Mathematics and science subjects in the majority of the schools. Given the above scenario the study investigated the impact of SMASSE on the students' achievement in secondary school Physics in Konoin Sub-County.

Statement of the problem

Students' achievement in Physics in Kenyan secondary schools was and is still below average. In an attempt to address this poor achievement, the Government of Kenya introduced SMASSE program. It is not clear how this program has impacted on the students' achievement in Physics in Konoin Sub-County of Bomet County. The study therefore aimed at examining whether SMASSE program has had any impact on students' achievement in secondary school Physics in Konoin Sub-County. The teaching of physics by teachers requires the use of a lesson plan which normally has three sections namely; a short introduction, a body of content and a brief conclusion. The SMASSE approach introduced Activity, Student-centered, Experiment and Improvisation (ASEI) in the body of the conventional lesson plan for the students and the Plan, Do, See and Improve (PDSI) for the teacher. There is always an activity for the learners in the lesson before the summary by the teacher.

Objectives of the study

The study was guided by the following objective;

To find out whether there was a difference in students' Physics achievement before the introduction SMASSE program (2000-2003) and after the introduction of the SMASSE program (2012-2015) in Konoin sub-county in terms of gender.

Scope of study

The study was undertaken in Konoin sub-county, Bomet County. This study involved the use of student KCSE records of results before the introduction of INSET (2000-2003) and the period after the four SMASSE cycles (2012-2015).

Keywords; Science Education, National Examinations, Public Secondary Schools, Konoin Sub- County, Bomet County

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Research Design

This study employed expost-facto research design using comparative research method. The expost facto research design utilized the document analysis tool to review and evaluate documents. Like other analytical methods in qualitative research, document analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge (Corbin & Strauss, 2008).In this particular study it looked at the Physics achievement in KCSE before the inception of SMASSE (2000-2003) and after (2012-2015) in terms of gender For this study it was hypothesized that any improvement in Physics achievement would be due to the students' exposure to SMASSE approach after its inception in 2004 employed by the individual schools.

Location of the study

The study was undertaken in Konoin Sub-County, Bomet County, Kenya.Konoin Sub-County is one of the five Sub-Counties in Bomet County. Konoin Sub-County was chosen because of two reasons; the first is the proximity to the place of work of the researcher and the fact that there is no similar study that has been done in the Sub-County. This necessitated the study to be carried out in the sub-County.

Population of the study

The target population for the study was secondary school students who did Physics in Konoin Sub-County before and after SMASSE was introduced. The accessible population was the 5017 Form four students who did KCSE before the inception of SMASSE (2000-2003) and the 5204 students that did their KCSE after SMASSE inception (2012-2015) in Konoin Sub-County. SMASSE was introduced in the whole country which was undertaken in four INSET Cycles in the years from 2004 to 2008.The target population were all the physics students in Konoin; accessible population were form 4 KCSE candidates in Konoin.

SMASSE training is an annual event done in every county and is still ongoing. The four years before and four years after inception of SMASSE was to give us an understanding of the impact of the program on students' physics achievement. The INSET cycles take four years to complete

Table of selected schools

Sample and sampling procedure

The study used stratified, systematic and purposive sampling techniques to select the participating schools and students from the different categories of schools in the sub-county. There were 55 established secondary schools in Konoin Sub-County within 3 divisions. These divisions are Konoin with 21, Kimulot with 17 schools and Cheptalal with 17 schools. The sampling procedure ensured that every division was represented by proportionate number of schools. The schools were further categorized as extra-county, county and sub-county. To ensure that the characteristic of the sample reflect the characteristics of the population, the sampling ensured students were picked from each category of schools in the sub-county. Nassiuma (2000) recommend the formula shown below for determining sample size for a finite population. This formula was used to obtain the number of the sampled schools.

$$N = \frac{NC^2}{C^2 + (N-1)e^2}$$

Where: -

n=required number of schools

N=the given number of schools

C= Coefficient of variation in th

The study involved three categories of schools i.e., four extra county, four county and four

Sub-county schools. All the physics students in the sampled schools were analyzed. Stratum of schools in the sub-county is shown in Table 3.

Table 3
The stratum of schools in the sub-county

Division	Extra County School		County Schools		Sub-County Schools
	Boys	Girls	Boys	Girls	Mixed
Konoin	1	1	0	0	19
Kimulot	1	0	0	1	15
Cheptalal	0	1	2	1	13
Total	2	2	2	2	47

Table 4 shows number of students for period 2000 -2003and Table 5 shows the number of students for the period 2012-2015.

Table 4
Sample Size per School Category (2000-2003)

Type of Schools	Number of Schools	No. of Boys	No. of Girls	Total Students
Girls' Schools	4		119	119
Boys School	4	119		119
Mixed Schools	4	119	119	238
Total	12	238	238	476

Table 5 is the number of physics students in the sampled schools for the period 2012-2015 that's after SMASSE was program.

Table 5: Sample *Size per School Category (2012-2015)*

Type of Schools	Total Number of Schools	Total Number of Boys	Total Number of Girls	Total Students
Girls' Schools	4		121	121
Boys School	4	121		121
Mixed Schools	4	121	121	242
Total	12	242	242	484

The total sample size was 960 from Table 5, all the extra county and county schools participated in the study while systematic sampling and purposive sampling was used to select the sub-county mixed schools which were old enough to have done KCSE by the year 2000 or earlier for the study.

Instrumentation

The study used document analysis tool to collect data which was used to extract the physics results from KCSE results score sheets from the sampled schools.

Document Analysis Tool

The document analysis tool was the instrument which had the period as the heading under study with five columns, these were the type of school, gender of the students, number of students, the mean per gender, the overall mean of the school and the fifth column had the remarks. The tool enabled us to collect the specific school document in our case the KCSE physics result per school for a specific year and the period under study.
The document analysis tool enabled us to get specific information from the school records for the two periods under study. The student's physics KCSE results for the period 2000-2003 before the INSET and after the INSET, 2012-2015.It consisted of five columns; the document selected which was the KCSE results for the specific period and the data analyzed which was the physics results for the particular period. This instrument was used to collect the data for each period and separate the data per gender for further analysis.

Validity

The document analysis instrument which was used to collect the data in this study was developed and validated in the department of Curriculum and Instruction Department of the Faculty of Education and Community Studies, Egerton University.

Data collection procedures

The permission to carry out this study was sought from the National Commission for Science, Technology and Innovation (NACOSTI) through Graduate School of Egerton University and getting a written consent from Egerton research ethics committee. A copy of the research proposal was submitted to both NACOSTI and the University research ethics committee before the permission was granted. After obtaining the permission to carry out the research, the researcher visited the County Director of Education and County Commissioner of Bomet to get permission and inform the heads of schools. The researcher then visited the schools to collect the data from school records using the document analysis tool.

Data analysis

Data collected using the document analysis tool was analyzed in order to obtain the information required in the study. Data analysis was based on the objectives and the hypothesis of the study. These data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0. The ANOVA were used to analyze scores on achievement in Physics at a significance alpha level of 0.05 which determined whether to accept or reject the null hypotheses of the study. The hypothesis was tested at 95 % level of significance and the data presented in form of tables. The-test in this study was used to test if there was any statistically significant difference in the means before and after exposure to SMASSE while the ANOVA was to test if there was any significant difference in the means of the two groups i.e., Boys schools and Girls schools before the exposure to SMASSE and after.

Demographic characteristics of the population

Tables of distribution of students before and after SMASSE

The overall students' achievement in physics is as shown in Table 12 and Table 13, the Mean scores of the two periods were used to asses the overall achievement.

Table 6:

KCSE Physics results before SMASSE was introduced for the sampled schools 2000-03

Year	Gender	Entry	Score
2000	Boys	180	5.37
	Girls	59	4.91
2001	Boys	208	4.95
	Girls	70	4.84
2002	Boys	102	5.67
	Girls	85	5.42
2003	Boys	195	4.91
	Girls	114	3.86

Average mean Boys = 5.22 Girls = 4.88

From table 6, results show that four years before SMASSE approach was introduced the boys and girls mean score was 5.24 and 4.88 respectively

Table 7 shows the results after the four SMASSE INSET cycles were completed, the boys and girls mean score were 5.13 and 4.76 respectively

Table 7:

KCSE Physics result after SMASSE was introduced 2012-2015

Year	Gender	Entry	Mean Score
2012	Boys	253	5.93
	Girls	96	5.29
2013	Boys	248	5.18
	Girls	103	5.02
2014	Boys	225	5.01
	Girls	81	4.75
2015	Boys	283	4,40
	Girls	101	4.49

Four years before the SMASSE approach the mean grades of students from mixed schools were 5.94 and 4.60 for boys and girls respectively as shown in tale 9.

Table 9:
KCSE physics results before SMASSE was introduced for the sampled mixed schools

Year	Gender	Entry	Mean Score
2000	Boys	62	6.02
	Girls	29	4.33
2001	Boys	64	6.03
	Girls	27	4.77
2002	Boys	46	6.01
	Girls	24	5.22
2003	Boys	104	5.23
	Girls	38	4.07

Table 10 shows achievement in KCSE four years (2012-2015) in the sub-county after SMASSE was introduced; the mean grades of mixed schools were 5.22 and 4.46 for boys and girls respectively.

Table 10: KCSE Physics results after SMASSE was introduced in the sampled mixed schools 2012-2015

Year	Gender	Entry	Mean Score
2012	Boys	76	5.78
	Girls	27	5.05
2013	Boys	70	4.07
	Girls	26	3.83
2014	Boys	73	5.80
	Girls	20	5.13
2015	Boys	84	4.83
	Girls	24	3.83

The tables above clearly show the means in physics achievement in mixed schools with the introduction of SMASSE approach. The results show that four years before SMASSE approach was introduced; the achievement mean were 5.24 and 4.88 respectively. Four years after SMASSE approach was introduced the achievement was 5.13 and 4.76.

Results analysis and Discussion

This section presents the results of the analysis of the collected from the 12 sampled schools and the discussion of the analyzed results. Table 11 Shows the entries from the 12 schools, the entries are the overall mean grade of the school regardless of the gender. These entries were obtained from school records from the sampled schools in the sub-county.

Table11 *Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
2000	12	2.83	8.81	5.705	1.832
2001	12	2.87	8.08	5.464	1.611
2002	12	3.24	6.65	4.490	1.196
2003	12	2.23	7.56	4.462	1.621
2012	12	3.77	7.59	5.235	1.116
2013	12	2.78	7.82	4.879	1.385
2014	12	4.11	7.18	5.544	0.894
2015	12	1.7	7.95	4.599	1.636
No of student (Entry number)	12	23	273	90.750	68.484
Average grade before SMASSE	12	2.79	7.395	5.0302	1.560
Average grade after SMASSE	12	3.99	7.96	5.064	1.487
Valid N (list wise)	12				

Table 11 Shows the entries from the 12 sampled schools. The entries are the overall mean grade of the school regardless of the gender.

The objective of the study was to find out if there was a difference in physics achievement before the introduction of SMASSE program (2000-2003) and after the introduction of the SMASSE program (2012-2015) in Physics achievement by KCSE students in Konoin sub county in terms of gender.

Table 12: Means per school in terms of gender

Year		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
2000	Boys	8	5.5912	1.43428	4.3921	6.7903	4.02	8.06
	Girls	8	4.9861	1.29270	3.9054	6.0668	3.11	7.11
	Total	16	5.2886	1.35554	4.5663	6.0110	3.11	8.06
2001	Boys	8	5.2018	1.61251	3.8537	6.5499	2.78	8.21
	Girls	8	4.8283	1.45308	3.6135	6.0431	2.92	7.42
	Total	16	5.0151	1.49531	4.2183	5.8119	2.78	8.21
2002	Boys	8	5.7554	.96457	4.9490	6.5618	4.78	7.44
	Girls	8	5.3721	.89300	4.6255	6.1187	4.11	7.18
	Total	16	5.5638	.91951	5.0738	6.0537	4.11	7.44
2003	Boys	8	4.9940	2.26466	3.1007	6.8873	1.70	8.80
	Girls	8	4.4199	1.20721	3.4106	5.4291	3.11	7.09
	Total	16	4.7069	1.77802	3.7595	5.6544	1.70	8.80
2012	Boys	8	6.0833	2.04817	4.3709	7.7956	3.22	9.52
	Girls	8	5.2767	1.91405	3.6765	6.8769	2.44	8.11
	Total	16	5.6800	1.95980	4.6357	6.7243	2.44	9.52
2013	Boys	8	5.6654	1.77772	4.1792	7.1517	3.18	8.51
	Girls	8	5.2615	1.73285	3.8128	6.7102	2.55	7.64
	Total	16	5.4635	1.70868	4.5530	6.3740	2.55	8.51
2014	Boys	8	4.6874	1.03362	3.8233	5.5515	3.63	6.24
	Girls	8	4.1774	1.35210	3.0470	5.3078	2.84	6.65
	Total	16	4.4324	1.19209	3.7972	5.0676	2.84	6.65
2015	Boys	8	4.4504	1.58435	3.1259	5.7750	2.58	7.37
	Girls	8	4.4263	1.86402	2.8679	5.9846	1.88	7.56
	Total	16	4.4383	1.67123	3.5478	5.3289	1.88	7.56

The mean of mixed schools was separated into the two entries of boys and girls for the two periods from (2000-2003) and (2012-2015). The table shows the standard deviation as indicated for each year in both periods before and after.

Table 13: ANOVA sum of squares

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
2000	Between Groups	1.465	1	1.465	.786	.390
	Within Groups	26.098	14	1.864		
	Total	27.562	15			
2001	Between Groups	.558	1	.558	.237	.634
	Within Groups	32.982	14	2.356		
	Total	33.539	15			
2002	Between Groups	.588	1	.588	.680	.423
	Within Groups	12.095	14	.864		
	Total	12.683	15			
2003	Between Groups	1.318	1	1.318	.400	.537
	Within Groups	46.102	14	3.293		
	Total	47.421	15			
2012	Between Groups	2.602	1	2.602	.662	.429
	Within Groups	55.010	14	3.929		
	Total	57.612	15			
2013	Between Groups	.653	1	.653	.212	.652
	Within Groups	43.141	14	3.082		
	Total	43.794	15			
2014	Between Groups	1.041	1	1.041	.718	.411
	Within Groups	20.276	14	1.448		
	Total	21.316	15			
2015	Between Groups	.002	1	.002	.001	.978
	Within Groups	41.893	14	2.992		
	Total	41.895	15			

Table 13 shows the ANOVA test for the two periods before the exposure (2000- 2003) and after (2012-2015)

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and their associated F-Value.

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		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Average before SMASSE	Boys	8	5.386	1.251	4.340	6.431	3.99	8.13
	Girls	8	4.902	1.004	4.062	5.741	4.00	6.79
	Total	16	5.144	1.124	4.545	5.743	3.99	8.13
Average after SMASSE	Boys	8	5.222	1.534	3.939	6.504	3.15	7.91
	Girls	8	4.785	1.556	3.485	6.086	2.43	6.93
	Total	16	5.004	1.510	4.199	5.808	2.43	7.91

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Average before SMASSE	Between Groups	.937	1	.937	.728	.408
	Within Groups	18.014	14	1.287		
	Total	18.951	15			
Average after SMASSE	Between Groups	0.761	1	.761	.319	.581
	Within Groups	33.427	14	2.388		
	Total	34.188	15			

Table 14 shows a comparison of the average means of the boys and girls in the two periods. The standard deviation in the above study for the boys achievement was 1.251 while that for the girls was 1.004 which shows that the spread of the means of the boys is higher than that of the girls before the introduction of SMASSE .The standard deviations for boys and girls was 1.543 and 1.556 respectively before and after the exposure to SMASSE .This could be explained by that only girls who had a higher academic ability selected physics while boys of varying academic abilities selected the subject before the exposure to the SMASSE .It could also mean that teachers were no longer discouraging weak students from taking up the subject after undergoing the SMASSE training.

Hypothesis of the study

The null hypothesis of the study stated that there was no statistically significant difference in students' achievement in physics in Konoin sub-county before (2000-2003) and after (2012-15) the introduction of SMASSE program in terms of gender.

H_O $\mu_0=\mu_A$:

The alternative hypothesis H_A stated that there was a statistically significant difference in students' achievement in physics in Koinon sub-county before (2000-2003) and after (2012-15) the introduction of SMASSE program in terms of gender.

H_A $\mu_A\neq\mu_O$

The significance level α=0.05, the computed value of the test F = 0.319 statistic as shown in table 14 and the critical value $F_{0.05(1,14)} = 4.60$.

Since 0.319 <4.60 we therefore fail to reject the null hypothesis. At α=0.05 of significance, there is not enough evidence to conclude that there is a statistically significant difference in achievement by physics students before (2000-2003) and after exposure (2012-2015) to SMASSE in terms of gender in Koinon sub-county.

The findings of this study agree with findings of Langat (2009), Ndiku (2011) and Sifuna & Kaime (2007) who established that the SMASSE INSET had not improved student's performance in mathematics in some secondary schools in Kenya. Similarly, Keitany K (2014) in his study on the impact of SMASSE INSET on student's performance in Physics, teaching approaches and methodologies and teachers and student's attitude towards Physics found out that despite improvements in the student's attitude and teacher's teaching instructional practices, performance was still poor.

However these findings disagree with findings of Kwamboka (2012) who in her study on the application of the principles of Activity-Student-Experiment Improvisation/Plan-Do-See Improve (ASEI/PDSI) by mathematics teachers in secondary schools of Nakuru District, found that schools had adequate, professional and SMASSE trained teachers, school facilities and teaching-learning resources were adequate while mathematics instructional sessions were teacher-dominated with little or no active involvement of students. Prevalent during lessons was the use of text books and the chalkboard, lessons lacked extensive student activities. Application of ASEI/PDSI principles was invisible, teachers' and students' attitude towards mathematics and ASEI/PDSI principles was relatively positive albeit factors that hinder their application. Similar findings were also found by Kisangi (2009), who investigated the extent to which lessons in Japanese schools were interactive and student-centered for purposes of adaptation in the Kenyan situation. Findings revealed that learning at senior high school level was less interactive. Similarly, in his study, Yara & Otieno (2010) postulates that student achievement in mathematics depends on the way it is presented to learners, the way learners actively interact with the learning experiences presented and the environment within which these interactions are taking place.

REFERENCES

Aoki, M. (2001).The importance of in-service teacher training program on Mathematics and science education. A paper presented at the closing of INSET program on SMASSE at Kenya Science Teachers College on 27th April 2001.

Barchok, H. K. (2006). The influence of secondary school student's self –concept of ability and gender stereotyping of science subjects on their attitude towards science. Unpublished Med Thesis. Egerton University.

Centre for Mathematics, Science and Technology Education in Africa. (2016). Enhancing Pedagogical leadership in the implementation of SMASSE activities at school level.

Nairobi CEMASTEA in Science and Technology in Kenya. Journal of Education and Human Resources.1.14

Changeiywo, J.M.(2001).Gender Perspective -30

Das, R.C. (1985). Science Teaching in Schools. New Delhi: Sterling Publisher Ltd.

District Education office, (2004). Bomet district results. Report on Results by Examination officer.

District Education office, (2012). Konoin district results analysis report. Results by the Examination officer. Eisner, E. W. (1991). The enlightened eye: Qualitative inquiry and the enhancement of educational practice. Toronto: Collier Macmillan Canada.

Fraenkel, L. & Wallen, N.E.(2009).How to design and evaluate research in Education (7thEdition). New York: McGraw-Hill Inc..

Kenya National Examinational Council, (2003). KCSE results Analysis for 2003. Retrieved From www.knec.org.ke

Keitany,V.K.(2014)Impact of Strengthening Mathimatics and Science in Secondary Education on Student Performance and Attitude towards in Physics in Marakwet West Sub-county

Kisangi, A. & Ogwel, A. (2009). Enhancing Teachers' Capacity Through In-Service Education and Training: A Reflection on Projects for Strengthening Mathematics and Science Education. Nairobi: CEMASTEA.

Kwamboka J. (2012). Application of SMASSE's ASEI/PDSI Principles When Teaching Mathematics In Secondary Schools Of Nakuru District. Kenyatta University, Kenya: Unpublished M.ED Thesis

Langat R. K. (2009). Impact of SMASSE Inset on students 'Attitude and performance in Mathematics in secondary schools in Bomet District. Unpublished Med Thesis. Moi University.

Millar, R. (2004). The role of practical work in teaching and learning of science. Unpublished Paper prepared for meeting: High School Science laboratories: The role and Vision. National Academy of Sciences, Washington, D.C.

Ministry of Education, (2006). Teachers' handbook for secondary Physics. Nairobi: KIE. Ministry

Mutai .R.K.(2018) Influence of SMASSE Teaching Approach on Secondary School Students' Motivation and Achievement in Biology in Bomet Sub-county, Unpublished MED Thesis, Egerton University

Nassiuma. D. K. (2000). Survey sampling: theory and methods. Nairobi: University of Nairobi Press.

Ogolla, K. (2001). ASEI movement and PDSI approach. A Paper Presented at SMASSE Conference in 2004 at Tenwek High. School, Kenya.

Oyaya, E & Njuguna, B. (2000). In-service training for Mathematics and science. A paper Presented at SMASSE Conference in 2004 at Tenwek High School, Kenya.

Veroff ,J. (2016, April,30) .Psychology and its Applied Disciplines. Retrieved on April, 30 Fromhttp://www.greenwood.com./catalog/author/v

Wachanga S.W.(2005).An Introduction to Chemistry teaching Methods. Njoro: Egerton University Press