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Effect of Attending Catholic Church Organized Teachers' In-Service Training on Students' Chemistry Achievement in Secondary Schools in Likuyani Sub-County, Kenya

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Abstract:

This study was conducted with the aim of examining the effect of attending Catholic Church organized in-service teacher training on students' chemistry achievement in Likuyani sub-county, Kenya. The study was guided by Desimone's theory of professional development and adopted ex-post facto design for the reasons that the researcher has no control over the independent variable. The study population comprised of 38 secondary schools in Likuyani sub-county and 76 teachers of chemistry. Stratified sampling was used to select 24 schools consisting of 12 Catholic Church sponsored schools and 12 non-Catholic sponsored schools. A total of 40 teachers of chemistry were selected by simple random sampling. Data was collected using questionnaires and document analysis schedules. Descriptive statistics used in analysis included frequencies, percentages and means. Independent sample t-test was used to test the hypothesis at $\alpha = 0.05$. The study established that there was no significant difference in chemistry mean score of the schools whose teachers had attended the Catholic Church organized teachers' in-service training and those who had not attended. The study concluded that the chemistry mean score of schools whose teachers attended the Catholic Church organized in-service training was higher than the mean score of schools whose teachers did not attend. However, the results of the independent sample t-test revealed that there was no statistically significant difference in chemistry mean scores of schools whose teachers attended the Catholic Church organized chemistry teachers' in-service training ($\bar{X} = 3.149$, $SD = 0.590$, $df = 22$) and those whose teachers did not attend ($\bar{X} = 2.994$, $SD = 0.826$, $df = 22$), with $t(24) = 0.499$, $p = 0.623$ at $\alpha = 0.05$. The study recommended that the Ministry of Education and the Catholic Church Education Secretariat should review their in-service policy so a follow up programme is developed to ensure teachers utilize the knowledge and skills learnt in classroom.

Keywords: Catholic Church, In-service training, achievement, chemistry

1. Introduction

World over, in-service training has been embraced as a concrete strategy for capacity building in education to enhance work output. Various studies have been conducted with aim of improving teacher professionalism in teaching and learning, and they yielded various findings on teacher collaboration, training and teaching experience (Liu & Tsai, 2017). Continuous employee training equips them with latest knowledge on subject content, scope and increases level of networking in an organization (Ezeani & Oladele, 2013). Eze (2016) pointed out that continuous training has direct effect on teacher productivity. Rahmadhani (2014) explained that the training process influenced teachers and improved goal achievement. He added that trainings provided teachers with knowledge and skills to be applied in their field. Jimmi, Hutkemri, Masnaini, and Rustaman (2018) explained that although teachers are professionals, they are limited and need uplifting activities to enhance the mastering of general subject knowledge. Many studies have revealed that teacher's level of experience has a direct effect on student achievement (Chu et al, 2015). Mueni, 2014 established that students' background, attitude of teachers towards learners' ability, in adequate use of teaching and learning resource and negative socio-cultural factors as well as inappropriate learning environment were the major causes of students' persistent poor performance in Chemistry

It is believed that when teachers attend teachers' in-service training; they gain knowledge and skills that enhances teaching and hence high level of students' achievement. A number of studies that have been done in the past have revealed that teachers' level of experience has an effect on students' academic achievement (Chu et al., 2015). When teachers are

innovative, they ultimately improve the quality of teaching (Liu & Tsai, 2017). Teachers are required to master their subjects taught to facilitate improvement of student understanding.

In Philippines, Sugano and Nabua (2020) carried out a study on Meta-Analysis Effects of Teaching Methods on Academic Performance in Chemistry. The study adopted quantitative meta-analysis technique to integrate research findings done in the line of chemistry from 2005 - 2016. The study sought to describe the influence of teaching methodologies on students' chemistry achievement in secondary schools in Philippines. Studies that were done in chemistry from 2006-2016 were reviewed from the journal articles, students' theses and dissertations and rated based on the level of relevance. 51 studies that qualified were selected for use in meta-analysis. The results gave a Cohen's $d = 1.208$ that suggested a statistically positive effect in the use of teaching interventions on academic performance. The results signified that varied teaching strategies were more effective in bringing positive learning outcomes as compared to the traditional methods. The study made a suggestion that there was need for teacher to teach with visualization using mind maps, graphics, videos, images, models and materials in order to increase student's level of understanding which in turn leads to increased learning outcomes.

The study by Sugano and Nabua (2020) employed a Meta-analysis approach that involved reviewing a number of studies. Meta-analysis approach was not appropriate as it limited the researchers in carrying out independent observations based on changing trends. It was incorrect for the researchers to make assumptions that what was observed in 2006 was still relevant in 2016. The current study sought to bridge this gap by use of ex-post facto design so as to enable the researcher make independent observations.

In Uganda, Deborah, Denis, David, and Leonard (2020) carried out a study on SESEMAT In-service Pedagogical Strategies and Students' Achievement in Science at Ordinary Level in Tororo SESEMAT Region. The aim of the study was to find out whether implementation of SESEMAT in-service teaching strategies had positive effect on students' chemistry achievement in secondary schools in Tororo Region. Cross-sectional survey design was employed and used mixed approaches. The target population was made up of head teachers, teachers of science subjects (Biology, chemistry, and physics) and mathematics and students of Senior 4 in Tororo and Butaleja districts. Consequently, the target population comprised 75 schools, 9184 students in Senior 4 and 162 teachers of both science and mathematics. Students of Senior 4 were preferred because they had taken part in both pre-test and post-test of SARB. Stratified sampling was used to select schools based on geographical location, ownership, source of funding, sex of students and whether the schools were purely day schools or boarding schools. Simple random sampling was then used to select the schools from each of the stratum. A sample of 368 participants out of 9,184 students was used for the study. The head teachers of each of the selected schools were automatic respondents. Four groups of teachers were selected by simple random sampling to take part in the study. Data were collected by use of questionnaires for principals and students while focus group discussion was used to collect data from teachers. The students' questionnaire consisted of three sections. Section A sought for demographic information. Section B comprised of closed ended questions with twenty five items. The items were scored on a 5-point Likert scale as strongly disagree, disagree, not sure, agree and strongly agree. Section C sought for information concerning the subject that students passed most by use of open ended questions. The questionnaire for head teachers sought for information regarding availability of physical facilities in their schools that could aid the implementation of SESEMAT activities.

Data was coded and analyzed by statistical package for the social sciences (SPSS) system version 25. Data from focus discussion groups and open ended questions were analyzed using discursive and thematic methods. Descriptive statistics used included frequency, mean, standard deviation and percentages. Chi-square test for independence was used to test the hypotheses.

The findings of the study indicated that implementation of SESEMAT activities was high in Tororo district as compared to other areas where teachers had participated in the same programme. The level of implementation was also high in boarding schools and in girls' schools as compared to day schools and boys' schools. In terms of academic performance, some teachers reported that the performance of learners in sciences had improved because the teaching of the subjects involved hands on activities. However, a greater portion of the respondents reported that there was no improvement in the science scores despite teachers utilizing SESEMAT teaching strategies in the teaching and learning process. Teachers reported that the performance of sciences and mathematics was still low as compared to other subjects. The study by Deborah (2020) used cross-sectional design in which data were collected from the respondents at one time. The researcher in the current study found this method inappropriate because collecting data at one time represents a snap shot and could lead to biased findings based on the condition of the subjects at the time of data collection. The current study seeks to fill this gap by use of causal comparative approach which is an ex-post facto design.

A study was conducted by Mwangi and Atina (2016) on effectiveness of SMASE teacher training program and how it impacted on KCSE results in Mathematics and Chemistry subjects in Kikuyu District, Kenya. The study was done in Secondary schools in Kikuyu District in Central Province. A cross-sectional study design was used. The study limited itself to form 2 students of both public and private schools that existed in the district as at December 1999. The study population comprised of all the public schools that existed in Kikuyu district as at December 1999. Stratified sampling was used to select schools in order to ensure that all the school categories were represented. The sample size consisted of 60% (N=16) of the schools. Questionnaires, review of available documents, and focus group discussions were used to collect data for the study. The analysis for the qualitative data that was given by the focus groups discussion involved qualitative techniques. Quantitative data was analyzed using SPSS.

The study found out that of the sixteen schools sampled none of them showed a significant improvement in KCSE mathematics and chemistry since the inception of SMASE. Almost a half of the school (43.75%) had their performance remaining nearly constant over the years (1999-2008) (an increment of less than 0.05 points over the years on study);

25% of the schools showed a declining trend in the performance of mathematics and chemistry over the years involved in the study. However, 31.25% of the schools showed some improvement (an average increase of more than 0.05 points in the school's mean grade over the years under the study) in the results of mathematics and chemistry. On regression, the data from those schools that had shown some improvement since inception of SMASE showed no statistically significant difference in mean scores between the pre and post SMASE performance at $\alpha = 0.05$. The study found out that SMASE in-service training of teachers had no impact on KCSE mathematics and chemistry performance.

The study by Mwangi and Atina (2016) used cross-sectional study design representing a snapshot of one point in time hence ignoring the trends that could have been observed in other time intervals. The researcher in the current study used ex-post facto study design in order to come up with concrete findings that can meet the threshold of generalization. Kyalo (2016) carried out a study in Mbooni Sub-county of Makueni County on school related factors that influenced students' level of achievement in chemistry. The study focused on entry grades, teaching methodology, attitudes of students towards chemistry and the methods of assessment that were employed in the subject and how they affected student's performance in chemistry at KCSE level. Questionnaires were used to collect data. The study used descriptive survey design because it administered questionnaires to collect data. The population under study comprised of 38 public secondary schools, 38 principals, 76 chemistry teachers and 1920 form three chemistry students all drawn from Mbooni East sub-county. 12 schools, 12 principals and 24 chemistry teachers were selected by simple random sampling. Stratified random sampling was used to select 192 students to participate in the study. Data was analyzed using computer statistical package, SPSS. The data was then represented in form of frequency tables, pie chart and bar graphs. The study found out that teachers gave individual tasks to students, group tasks and performing demonstration of experiments in order to make them actively involved in class activities. The findings showed that most students didn't understand chemistry. In most schools, chemistry was imposed on students as a compulsory science. The study recommended that SMASE and colleges that train teachers should put greater emphasis on instruction approaches that enhance quality learning. The study by Kyalo (2016) focused on entry grades, teaching methodology, attitudes of students towards chemistry and the methods of assessment that were employed in the subject and how they affected student's performance in chemistry at KCSE level. The researcher in the current study felt that Kyalo (2016) did a study on many attributes that affect students' performance hence the depth of research was compromised. The current study sought to bridge this gap by considering only one aspect, the influence of Catholic Church organized in-service courses.

Mueni (2014) carried out a study to investigate factors influencing student's performance in Chemistry in Makindu Division in the Kenya certificate of secondary education (KCSE). The study adopted a descriptive survey design. Stratified sampling and simple random sampling was used to select 216 form three students from four schools to participate in the study. Data were collected using questionnaire from students while teachers and district quality assurance and standards officers were interviewed orally. The students were provided with questionnaires while their chemistry teacher and the District Quality Assurance and Standards Offices (DQASO) were orally interviewed. The descriptive statistics used included percentages and frequencies. The results indicated that students' background, attitudes of teachers and learners, lack of resources and negative learning environment were responsible with students' persistent low performance in chemistry. The teachers who were interviewed reported that the performance of the subject was quite dismal, a trend that caused them to get demoralized.

The study done by Mueni (2014) used only 4 schools as a sample of study. The researcher in the current study felt that the sample used was too small to make a generalization. The current study used a sample of 30 schools in the sub-county in order to bridge this gap.

2. Statement of the Problem

Secondary schools in Likuyani sub-County have continually posted poorly in chemistry with a larger number of the candidates (90.72%) scoring below C+ grade at KCSE level (Refer to appendix 1). C+ grade is the minimum entry grade to competitive courses in Kenyan universities and colleges. In the year 2019, only 6 candidates out of 2693 scored grade A in chemistry translating to 0.22%. The subject mean in the sub-County in the last five years was 2.866 in 2019, 2.953 in 2018, 2.417 in 2017, 2.644 in 2016 and 3.969 in 2015, a trend that signifies a decline in performance. This means a number of candidates who sit KCSE in Likuyani sub-county don't qualify for admission into degree courses like Medical sciences, Engineering, Technology and related courses, education science and agriculture among others. The grade attained by students at KCSE level gives the basic requirement for one to qualify for further training in tertiary colleges and university (MOE, 2005). Chemistry blends well with biology, Physics, agriculture and mathematics hence underperformance in chemistry hinders the chances of students joining institutions of higher learning to pursue science related courses and denies them chance in the job market. Catholic Church organized in-service trainings for teachers have been going on for some time and stakeholders wish to know how the program is impacting on learner performance in the sub-county.

Otieno (2017) established that the performance of candidates in mathematics and sciences at KCSE level was on the decline in the years 2014, 2015 and 2016, with an average grade of D. In 2016, 90% of the candidates scored less than C plain as compared to the 70% in 2014. Students who got D- and E were more than two thirds while only 1 % scored A and A-. A study by Ochieng, Shabaan and Sebteum (2019) found out that chemistry mean score at KCSE level lied between 26.45 and 34.81, signifying the performance was far from the normal average of 50%.

Kyalo (2016) did a study in Makueni County and established that teaching and learning methods, attitudes of teacher and learners, methods of assessment and KCPE entry grades in science contributed to the declining performance in chemistry.

Ayiro (2019) established that Kakamega County performed poorly in chemistry in the 2018 KCSE examination, with the whole county producing only 105A plains out of the 32996 candidates, translating to only 0.318%.

Considering that the Diocese of Kakamega spends a colossal amount of money on In-service training of teachers, there is need to examine how it influences academic performance of learners. Studies examining students' level of achievement in chemistry have mostly highlighted the weaknesses of teachers and students. There lacks documented data establishing how Catholic Church organized in- service training of teachers impacts on the performance of chemistry among secondary school students in Likuyani sub-County.

Therefore this study investigated into the influence of Catholic Church Organized Teachers' In-service Training on Students' Chemistry achievement in Secondary schools in Likuyani Sub-county, Kenya.

3. Methodology

The study was conducted in Likuyani Sub-County in Kakamega County, Kenya. A causal-comparative design was employed. The target population was 76 teachers of chemistry from the 38 secondary schools in Likuyani sub-county. Stratified sampling was used to select schools to ensure that the sample had both Catholic Church sponsored schools and the non-Catholic Church sponsored schools. The sample comprised of 12 Catholic Church sponsored schools, 12 non-Catholic schools and 40 teachers of chemistry. Data was collected by use of questionnaire and document analysis schedule. Data coding was done and then analyzed by use of a computer software SPSS. Descriptive statistics used in data analysis included frequencies, means and percentages. Hypothesis was tested using independent sample t-test.

4. Results

The researchers used the questionnaire responses from chemistry teachers to select the two groups of teachers, those who had attended the Catholic Church organized in-service training and those who had never attended. A document analysis schedule was used to get chemistry mean scores of the schools whose teachers had attended the Catholic Church organized in-service training and those whose teachers had not attended from the average of KCSE results of the years 2017- 2019 in the sampled schools. The results were presented in table 1 below.

	Attendance	N	Mean	Std. Deviation
Chemistry Mean Score	Attended	12	3.140	.590
	Not Attended	12	2.996	.826

Table 1: Average Mean Scores of 2017-2019 KCSE Chemistry Results of the Schools Whose Teachers Attended the Catholic Church Organized Chemistry In-Service Training and Those Whose Teachers Did Not

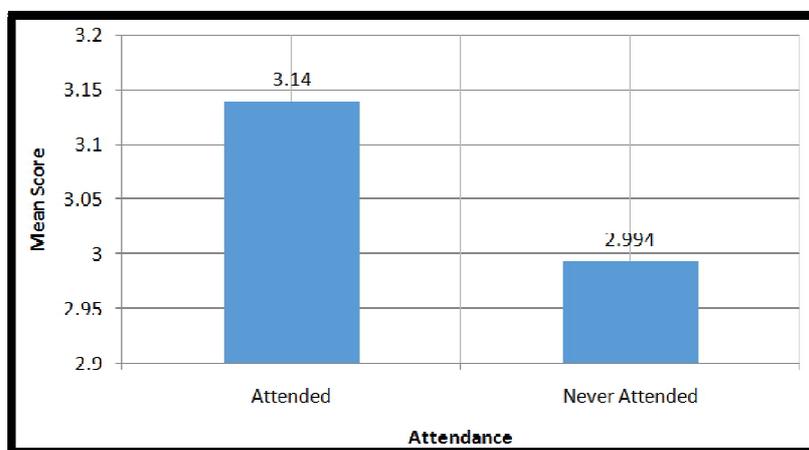


Figure 1: Mean Scores of Schools That Attended and That of Schools That Never Attended the Catholic Church Organized Chemistry Workshops Using the Average of 2017-2019 KCSE Results

The study found as shown in tables 1 and figure 1 that the mean score of the schools whose teachers had attended the Catholic Church in-service training workshops from the sampled schools was 3.140 with standard deviation of 0.590 while the mean of the schools whose teachers had never attended was 2.994 with standard deviation of 0.826. However, the two mean scores were close to each other. The findings of this study agrees well with the finding of Mwangi and Atina (2016) who established that out of the 16 schools sampled none of them showed a significant improvement in KCSE mathematics and chemistry since the inception of SMASE. Almost a half of the schools (43.75%) had their performance remaining nearly constant. This indicates that the performance of students in chemistry is still low despite measures like teacher in-service training programmes being put in place to improve teachers' content mastery and teaching skills. The findings also agree with the findings of Deborah, Denis, David and Leonard (2020) in Uganda who established that students' grades in sciences had remained low as compared to other subjects despite teachers attending SESEMAT in-service programmes.

The relationship was further tested under the null hypothesis that:

- H_0 : There is no significant difference in chemistry mean scores of schools whose teachers attend Catholic Church organized teachers' in-service training and those whose teachers don't attend in Likuyani sub-county, Kenya.

The mean scores of Chemistry of the two groups, that is, schools whose teachers had attended and schools whose teachers had never attended were compared basing on the average KCSE chemistry results of the years 2017- 2019. The results were as presented in table 2 below.

		t	df	Sig(2- tailed)
Chemistry Mean Score	Equal variances assumed	.499	22	.623

Table 2: T-Test Results Comparing Chemistry Mean Scores of Schools Whose Teachers Had Attended the Catholic Church Organized Teachers In-Service Training and Those Whose Teachers Had Not Attended

The results of the test revealed that there was no statistically significant difference in chemistry mean scores of schools whose teachers attended the Catholic Church organized chemistry teachers' in-service training (\bar{X} =3.149, SD =0.590, df=22) and those whose teachers never attend (\bar{X} = 2.994, SD = 0.826, df=22), with $t(24) = 0.499$, $p = 0.623$ at $\alpha = 0.05$. The researcher failed to reject the null hypothesis. Therefore there is no significant difference in chemistry mean scores of schools whose teachers attend Catholic Church organized teachers' in-service training and those whose teachers don't attend in Likuyani sub-county, Kenya.

5. Conclusion and Recommendations

The study found that the mean score of the schools whose teachers attended the Catholic Church organized chemistry in-service training workshops was 3.140 with standard deviation of 0.590 while the mean score of schools whose teachers did not attend was 2.994 with standard deviation of 0.826. The study concluded that schools taught by teachers who attended the Catholic Church organized chemistry training workshops had a higher mean score as compared to those whose teachers did not attend.

The results of the independent sample t-test revealed that there was no statistically significant difference in chemistry mean scores of schools whose teachers attended the Catholic Church organized chemistry teachers' in-service training (\bar{X} =3.140, SD =0.590, df =22) and those whose teachers never attend (\bar{X} = 2.994, SD = 0.826, df =22), with $t(22) = 0.499$, $p = 0.623$ at $\alpha = 0.05$.

Based on the findings of this study, the researchers made the following recommendations: The ministry of Education and the Catholic Church education secretariat should review their in-service policy so that all teachers attend in-service training at least once a year to address gaps in teacher performance at subject level. A follow-up programme should then be developed in order to ensure teachers utilize the learnt knowledge and skills in the classroom to improve performance.

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