

Learners' Written Interaction Effect on Learners' Academic Achievement in Chemistry

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ABSTRACT

This article purposed to establish the Learners' Written Interaction Effect on Learners' Academic Achievement in Chemistry. The study generated two null hypotheses: H_{01} : There is no statistically significant learner's written interaction effect on learners' academic achievement in Chemistry. H_{02} : There is no statistically significant relationship between learner's written interaction effect and learners' academic achievement in Chemistry. Qualitative and quantitative mixed methods research design approach was adopted for the study. Simple and stratified sampling was used to select 32 public secondary schools as the sample population for the study. Data was collected using five research instruments: Chemistry Achievement Test (CAT), Observation check list (OCL), Students' Questionnaire (SQ), Document Analysis Guide (DAG) and Student Discussion Guide (SDG). To ensure reliability and validity of the CAT, questions from Kenya Certificate of Secondary Education past papers were selected. Pearson Product-Moment Correlation Coefficient was used to test the reliability of the (SQ) while the DAG and SDG instruments were validated during the pilot study. Quantitative data was analyzed using inferential and descriptive statistics while thematic analysis was used to analyze qualitative data. The results of simple regression analysis revealed no statistically significant learners' written interaction effect on learners' academic achievement in Chemistry while Pearson Product-Moment Correlation Coefficient revealed a weak, linear and negative weak relationship ($r = -0.2234$) between learners' written interaction effect and learners' academic achievement in Chemistry.

Keywords. Cognitive development, written interaction, mean grade, assignment, academic achievement.

INTRODUCTION

Written interaction is the method of learning which is characterized by learners writing out the knowledge or ideas they have in mind. It means they interact with others through writing and sharing their own written documents. Through written interaction, learners perfect the skills of writing and answering of questions which will then be tested during assessments. The aim of written interaction is to allow learners to know how much knowledge they have retrieved from a concept taught in a given topic and provides the learner with an opportunity to correct mistakes on their own (Lisa, 2011). Written interaction therefore train the learners to develop the interest in seeking knowledge away from teachers making them independent in knowledge

seeking, as well as cognitive development of the learner, a factor that is likely to improve the learners' academic achievement.

Peer feedback, also referred to as peer interaction is a useful cognitive social activity that plays a critical role in improving the process of learning English writing where learners derive social benefits of peer feedback (Maryam, Seyyed & Maryam, 2013). In academia learners are generally assessed through writing and hence, writing has become a fundamental factor as a measure for academic success. This is because one way of a learner expressing what is in the mind is through writing. Traditionally, teachers were believed to be the only people to provide feedback to students' writing because they were perceived to have all the required knowledge. Educationists have however, realized that peer feedback is a critical technique for improving students' writing all around the world. Learners can therefore learn from one another through peer feedback on writing. Therefore, peer feedback on writing provides a chance to learners to perceive concepts and issues critically, improve their autonomy and eventually improve their knowledge. It is the opinion of the current researcher that, peer feedback in writing among the learners is likely to improve academic achievement of Chemistry which is the focus of the current study.

Munyaradzi (2013) noted that, the knowledge generated by the learners is easily recalled compared to what learners receive from the teacher. Learners are also encouraged to search for relevant knowledge rather than the teacher dominating the search for knowledge on behalf of the learners. This can be through reading and making own notes. Such knowledge can easily be recalled because the learner retrieved the information and hence owns the knowledge making the learning meaningful.

Perhaps the most influential thinker about education in the late twentieth century was Paulo Freire who argued that too much information from a teacher to a learner, involves 'banking' - the teacher making 'deposits' in the educatee (Torres, 1993). Such learning is not meaningful to a learner and the knowledge from such learning is not retained for long. Paulo Freire advocated that learners should seek knowledge so that, they are able to construct meaning out of the new knowledge. Therefore, learners should seek knowledge from learning resources like text books, print media and make own notes through writing rather than the common practice of receiving notes from the teacher.

Yusuf (2014) did an investigation on the effects of collaborative learning on achievement of learners' in Chemistry and level of anxiety in stoichiometry topic involving the balancing of chemical equations in secondary schools in Katsina metropolis, Nigeria. Results revealed that, learners who received instruction through collaborative learning were better in writing balanced chemical equations, had higher academic achievements and lower anxiety levels when compared with learners who received instructions using lecture method. This can be interpreted to mean that, a learner who learns by writing is likely to internalize or recall the concepts learnt. The current study focused on written interaction effect on academic achievement and was based on gas laws.

A study by Lindsay and Rosa (2000) in Los Angeles revealed that written feedback from teachers improves the writing skills of learners. As learners improve the writing skills, they are likely to improve on academic achievement. Mallozzi (2013) investigated whether certain teacher written feedback, provided to learners in the Interactive Student Notebook (ISN), enhanced the use of ISNs and benefited the learners' science process skills. The study revealed that experimental group had significantly higher scores than learners in the control group scores of Science Process Skills. Additionally, regression analysis revealed that the nature of

written feedback received by learners (process-specific, task-specific, or metacognitively-specific) does not predict learners' science process posttest scores. Further, qualitative analyses revealed that learners in the experimental group perceived learning to be enhanced by use of ISN and receiving specific written teacher feedback.

In contrast, from the teachers' perception, the ISN could be useful in certain conditions but that a combination of feedback, especially oral feedback, was more effective than written feedback. The dependent variable in this study was science process skills while the current study used academic achievement of learners as the dependent variable. More research is required to explore more on effect and type of written feedback that students receive (process-specific, task-specific, or metacognitively-specific) on academic achievement. Further, the teachers' belief that verbal feedback is likely to be more effective than written feedback need to be explored further.

Matsumura, Patthey-Chavez, Valdes, and Garnier (2002) in their study on writing assignment in English language revealed that corrections of grammar and punctuation reduced the writing convention errors. However, there was little change in the content of the writings. If such written interactions happen during the teaching and learning process in Chemistry, topics that appear difficult like balancing of chemical equations would arguably be made easy and probably improve the learners' academic achievement. However, it has been noted that, written interaction takes more of the teacher's time because for it to be effective the teacher must take time to mark the learners' work. Nonetheless, this is another criteria to determine if the learners have achieved the academic expectations. Moreover, written interaction allows the teacher an opportunity to correct responses like correct state symbols, chemical formulae and correct chemical symbols as in the example of balancing of chemical equations in Chemistry (Matsumura et al., 2002).

Findings from a study by Lisa (2011) in USA revealed that, instructors are no longer using written interactions effectively because of the time limits that different stake holders in education have put in place. In the process, written teacher interaction is given very little time and attention. One of the conclusions from this study was that students require written teacher feedback for effective academic achievement. This is the same scenario in Kenyan secondary schools where the teachers rush over to complete the syllabus so as to create adequate time for revision denying the learners the opportunity to internalize and interact through writing to enhance understanding of scientific concepts. Moreover, revision cannot be effective if the concepts learnt in class were not grasped and internalized. Therefore, teachers of Chemistry should create adequate time for learners to interact through writing. Furthermore, one method of learners' own and teacher's assessment is through putting answers in writing. Hence, writing interaction is a critical and fundamental factor during the implementation of the curriculum.

In Murang'a County, Kenya, for instance, the Chemistry County mean grade in year 2017 was D which by all standards was very low, portraying learners who lacked basic Chemistry knowledge. According to KNEC (2018), the examination demanded more of content than summarized points and candidates who relied on revision books lacked enough content. Candidates did not demonstrate mastery of content and lacked application skills especially to questions that involved explain and discuss. Additionally, questions that required critical thinking were very unpopular to candidates. Therefore, students seemed not to have understood simple Chemistry concepts which probably were the reason why, students gave sketch answers where they were required to provide elaborate answers. This is most likely

due to inadequate written interaction where teachers would have discovered the weakness early enough.

When learners are continuously given challenging assignments that require interaction with text books, writing of notes and discussion in the classroom, they will gain the skills to tackle questions that require critical thinking and application, ultimately raising the academic achievement. For instance, a learner who has no skills to answer questions involving explain, discuss and critique may face challenges when answering questions, that would have been identified by the teacher during the implementation of the curriculum. Therefore, teachers should avoid relying on revision books which just drill the learners' memory rather than creators of knowledge. It is against this background, that the current study sought to investigate if the academic achievement of learners can improve if teachers put more emphasis on written interaction. Moreover, from the reviewed studies it is apparent that the area of written interaction requires more attention and research because it seems few studies have been done. The current study sought to address this gaps.

Objective

One objective guided the study

To examine learners' written interaction effect on learners' academic achievement in Chemistry.

Hypotheses

This study generated two null hypothesis

Ho₁: There is no statistically significant learners' written interaction effect on learners' academic achievement in Chemistry.

Ho₂: There is no statistically significant relationship between learners' written interaction effect and learners' academic achievement in Chemistry.

METHODOLOGY

The study adopted a mixed methods approach employing quantitative and qualitative research design. The target population for this study was 120 public secondary schools in Murang'a County, which had consistently scored mean grade of D+ to C in Chemistry in the last eight years in KCSE and 1020 form 3 learners in the 120 secondary schools. Therefore the 120 secondary schools were purposively selected from 330 public secondary schools in the County. This study used Yamane formulae: $n = N / (1 + Ne^2)$, to calculate the sample size that was used in this study.

Where n= sample size

N = target population

e = error at 0.05 confidence level (Yamane, 1967). The formula yielded 384 form 3 Chemistry learners and 32 public secondary schools that was used as the sample size for this study. According to Kothari (2012) a sample size is chosen by using some logical process.

Therefore, 7 boys, 8 girls and 17 mixed secondary schools were used as the study sample that was selected through simple and stratified sampling so as to take care of both genders, while each school provided 12 form 3 learners and one teacher of Chemistry. The sample had more mixed secondary schools because more than 50% of public secondary schools in the target population were mixed schools. The high number of mixed secondary schools made the results of this study more credible due to gender comparison.

To gather data, five research instruments were used: Lesson Observational Checklist (LOC) and Chemistry Achievement Test (CAT) were used as the main data collection tools. Lesson Observational Checklist was used to record the written interaction behaviour of teachers and students during teaching and learning of Chemistry. In all the thirty two schools, the researcher sat at the back of the classroom in a double lesson consisting of eighty minutes during teaching and learning of Chemistry lesson and recorded the frequency of written interactions during the lesson. The instrument was found suitable because it captured the portrayed behaviour under investigations. Therefore, data captured by this instrument was objective rather than subjective and hence making the results of this study reliable and credible. A CAT was set and administered at the end of the topic which was gas laws that is normally taught in term one of form three class. To ensure reliability and content validity of the CAT, questions related to gas laws from KCSE past papers were picked. The administered CAT was marked by three teachers of Chemistry with more than five years of marking the KNEC national examinations. The awarded marks from the CAT formed the dependent variable which was the learners' academic achievement in this study. To supplement data from the LOC and CAT, more data was gathered using Document Analysis Guide (DAG), Students' Questionnaire (SQ) and Student Discussion Guide (SDG). The researcher requested the twelve students from each school to provide their Chemistry note and assignment exercise books and using the DAG, the researcher filled the research instrument as per the objective of the study. This tool was found suitable because it provided the reality on the ground regarding the written interactions involved with the learners. The SQ were administered to students who were guided on how to fill them. More qualitative data was gathered from the students using SDG.

A pilot study was conducted in two public secondary schools that were not included in the main study. During the pilot study Pearson Product-Moment Correlation Coefficient was calculated and the instruments with a reliability coefficient of 0.75 and above were retained while those with a reliability coefficient of less than 0.75 were either modified or discarded. Content validity was improved during the administration of the instruments in the pilot study. Data was coded appropriately based on the objectives of the study, arranged and grouped by use of SPSS Version 20 into sub-samples for common features and reactions coded to give basic statistical analysis.

The first hypothesis was analyzed using simple regression analysis, one way ANOVA, while the second hypothesis was analyzed using Pearson Product-Moment Correlation Coefficient. The objective was achieved through descriptive analysis and results given in frequency tables, pie-chart, percentages, means and standard deviations while qualitative data was thematically analyzed. Ethical considerations were put in place by informing the respondents about the purpose of the study and assuring them that, their identities was not to be revealed. The respondents were further allowed to withdraw if one wished to.

RESULTS AND DISCUSSION

Testing of Hypothesis (Ho₁)

The first hypothesis stated that, "There is no statistically significant learners' written interaction effect on learners' academic achievement in Chemistry". Simple regression analysis was used to test the hypothesis where the model $Y = B_0 + B_1X_1 + \epsilon$ was used. Table 1 presents the regression analysis results of the learners' written interaction effect on students' academic achievement in Chemistry.

Table 1: Regression Analysis results of learners' written interaction effect on students' academic achievement in Chemistry

Model summary						
Model	R	R ²	Adj. R ²	Std. Error		
1	0.223 ^a	0.050	0.016	14.13260		

ANOVA						
Model	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	293.880	1	293.880	1.471	0.235 ^b
	Residual	5592.450	28	199.730		
	Total	5886.331	29			

Coefficients						
Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients	T	Sig.	
	B		Beta			
(Constant)	63.527	10.473		6.066	0.001	
Written	-8.065	6.648	-0.223	-1.213	0.235	

a. Dependent Variable: Academic Performance (Student mean score)

b. Predictors: (Constant): Written interaction

Results presented in Table 1 showed that, the p-value for the test was found to be 0.235. If $p \leq \alpha$ then, the null hypothesis is rejected. The selected α for the test was 0.05. In this analysis, the null hypothesis was accepted because the p-value (0.235) was greater than selected alpha (0.05) value. This implied that "There is no statistically significant learners' written interaction effect on learners' academic achievement in Chemistry". The implication of accepting the null means that, the students had similar chances to perform well even when they were not exposed to written interaction in the post-test exams. Therefore, the regression equation $Y = 63.527 + -0.223X_1$, where Y= the dependent variable (Academic achievement), 63.527 is the constant, X_1 is the independent variable (Written interaction) while -0.223 is the slope.

Further, the outcome of this analysis shows that an increase in written interaction by a single unit, increase the academic achievement in Chemistry mean score by about -0.223 units. The statistic coefficient (R^2) provides the amount of variation that can be accounted for by the independent variable which is the written interaction. The value of $R^2 = 0.050$, implying the model explain 5% variation in academic achievement which is the dependent variable in this study. Therefore, 95% change in academic achievement resulted from other factors that were not part of the model.

Hypothesis (Ho₁)

The second hypothesis stated that: "There is no statistically significant relationship between learners' written interaction effect and learners' academic achievement in Chemistry." To achieve this hypothesis the data was subjected to Pearson Product-Moment Correlation Coefficient. Table 2 below gives the results of this analysis.

Table 2. Pearson Product-Moment Inter-Correlation between independent-independent variable and independent-dependent variables

Variables	Academic achievement	Written interaction
Written Interaction	-0.2234**	1

** Correlation is significant at $p < 0.05$ level (2-tailed)

The findings in table 2 indicated that, written interaction had weak, linear and negative weak relationship ($r = -0.2234$) with students' academic achievement. A value of r less than 0.5 can be said to be a weak relationship between any two values (Kothari, 2012). Therefore, the null hypothesis is accepted indicating that, written interaction had statistically insignificant and negative effect on learners' academic achievement. From this study written interactions like assignments, learners reporting from what they have gathered have no correlation with academic achievement of learners. This implies that, written interaction have no value as far as academic performance of a learner is concerned. The findings are consistent with the findings of Simple Regression Analysis on the learners' written interaction effect on students' academic achievement in table 1 which established that "effect of written interaction on learners' academic achievement in Chemistry was statistically insignificant."

The results of this study are in conformity with several studies. For instance a study by Trautwein (2007) established that classroom interaction through written interactions such as homework had insignificant effect on academic performance of learners'. As noted in the current study, during the students' group discussion, some students copy from their classmates or from the text books without making any efforts to do their own work resulting to lack of meaningful learning. Haddock (2006) noted that homework was of no value to learners citing it as rote and designed to take up children's time and called for its abolition without offering tangible benefits. Bennett and Kalish (2006) and Kohn (2006) opined that assignment is not useful to learners especially the young, and may have a negative impact on learning.

However, some few studies that were available differed with the findings of the current study. For instance Lindsay and Rosa (2000) in Los Angeles revealed that feedback from teachers improve the writing skills of learners while Matsumura et al., (2002) in their study on writing assignment in English language revealed that corrections of grammar and punctuation reduced the writing convention errors. The two studies were silent on academic achievement which is the focus of the current study. But Bishop (2008) opined that through homework, learners are taught how to concentrate, report writing, curiosity development, and be continuous learner and how to spend time alone which is likely to improve the academic achievement of learners.

Therefore the current study noted that, most teachers do not take assignments seriously hence the learners put little value and effort to assignments. Written interactions would probably be useful if teachers gave challenging questions for assignments, supervise, mark and allow learners to discuss in groups followed by group reporting in the class so as to involve other discussion groups. This is likely to encourage learners to read on their own seeking new knowledge. The marking of learners' assignment books will also expose the learner's strengths and weaknesses to the teacher which will finally provide remedial measures. It is important to note that, during written examinations, a learner is required to provide the knowledge being tested through writing. This implies that, if the learner was not exposed to effective methods of putting answers and ideas in writing, the same learner will face challenges during examinations leading to low academic achievements. Therefore, from this study, learners were

not exposed to effective written interaction like own note writing and seeking own knowledge like from the library and available relevant text books. This probably explain why only 5% variation in academic achievement which is the dependent variable in this study explained the regression model. Therefore, the area of written interaction need to be researched more because from the reviewed literature, there was little research studies on written interaction and its effect on academic achievement.

Effect of learners' written interaction on learners' academic achievement in Chemistry.

To enrich the findings of the statistical analysis from the hypotheses, the researcher carried out descriptive analysis to increase the credibility of this study. The study was guided by one objective which stated that: "To examine learners' written interaction effect on learners' academic achievement in Chemistry" To achieve this objective the researcher used the following sub-themes.

Students Perceptions on the use of Written Interaction

The study sought to find out the perception of learners towards various written interactions they were subjected to in Chemistry lessons. The learners were given questionnaires and guided by the researcher on how to fill them depending on the extent they agreed with the statement. Rating was done using Likert scale and presentations done in Table 3.

Table 3: Nature of Various Written Interaction in Class

Statement	SD%	D%	NS%	A%	SA%	Mean	Std.dev
We are given a lot of work for homework	5.3	15.3	4.4	65.6	9.4	3.59	1.028
We report in class what we have done in our homework	8.6	6.4	4.7	36.7	43.6	4.00	1.232
We cover part of the syllabus through homework	20.0	11.4	2.8	45.3	20.6	3.35	1.439

SA=Strongly Agree, A=Agree, NS= Not Sure, D=Disagree, SD=Strongly Disagree

Results presented in table 3, shows that, majority of the learners (75%) agreed that they were given a lot of work for homework, 80.3% of the learners further agreed that they report in class what they have done in their homework and 65.9% of the students agreed that they cover part of the syllabus through homework. The results indicate there was thorough use of written interactions in classes through use of homework and majority of students were reporting their assignments in class. Challenging questions for homework stimulate the minds of learners by making them active and seek knowledge. For instance the learners read on their own as they seek for answers. Reporting in class give the learners an opportunity to express themselves, raise their self-esteem and allows the teacher to guide the students while using written interactions by ensuring that the students did the assignment and they got the right answers and methods on the task given. However, despite the high ratings of the statements under investigations, results from the null hypotheses testing in section 3.1 and 3.2 indicated no statistically significant effect of written interactions on learners' academic achievement. Although, the learners perception could be subjective, it can be argued that, teachers were probably not planning for quality assignments that would lead to effective learning that would improve academic achievement of learners.

Evidence of group assignment

The researcher sought to find out if learners are given assignments after lesson. The learners responded through the show of hands. Figure 1 shows a pie chart indicating the percentages of yes and no responses.

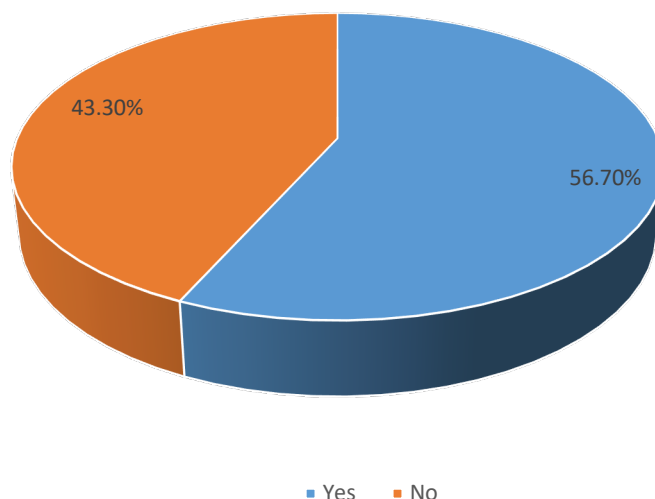


Fig 1. Student's responses on whether they were given assignments or not

The pie chart indicate that most teachers (56.7%) were giving group assignments compared to 43.3% who were not giving which is a high percentage noting that assignments are necessary for teacher's self-evaluation. This implies that there is need for those teachers whose learners did not show any evidence of group assignment to develop strategies to ensure students work in groups.

This is due to the fact that group work promotes an environment where there is collaboration and cooperation among students which could lead to better results and understanding of concepts in Chemistry classes. Topics like mole concept requires manipulation of data and therefore learning become more meaningful when learners share their learning experiences Moreover a concept that is discussed is easily recalled by learners. Therefore, the findings of this study reveal that, adequate assignments were not given to learners. This is supported by learners' responses during group discussion. Asked if they were given assignments after the lessons majority responded that, this was occasionally done while self-marking guided by the teacher was the common practice by majority of schools. Self-marking is where a teacher take learners through a question while the learners mark own work. This method has its own shortcomings since the teacher does not identify the strength and weaknesses of the learner and therefore, affect the quality of learning. From the study, written interaction was not adequately used denying the learners the opportunity to practice writing yet examinations are done through writing.

Through writing the learner get the skills of answering questions. A learner who has not practiced writing is likely to encounter challenges during examinations hence affecting the academic achievement. However, this study's findings contradicts the findings of Babelan (2012) who did a study in Albania on group learning effects on the academic achievement of students of institutions of higher learning and found that, a number of lecturers from the universities have transformed the large classes to groups that allow their students to be more involved in writing and reporting what they have gathered which enhance social interaction and academic achievement. Therefore, for assignment to be effective, quality assignment, supervision and effective marking of learners work must be well planned and executed by the teacher. Hence, more research need to be done in this area using quality assignment to determine its effect on academic achievement.

Rating of assignments given to students

The study sought details on the rating of assignments given to students in Chemistry lessons in order to understand the extent to which assignment was used as a tool for learners to interact with written work during teaching and learning in secondary schools in Kenya. This was done through document analysis where the researcherZ sampled assignment and note books from learners. The rating involved the following features: quality of assignments, nature of teachers' remarks, adequacy of assignments to engage learners in the learning process, extent of marking of assignments by the teacher and the extent of reporting by the learners during learning. Rating of the responses was done using 5-point Likert scale where 1= very poor 2= poor 3= good 4= very good and 5= excellent. The findings are presented in Table 4.

Table 4. Rating of Assignments Given to Students

Statements		Very poor	Poor	Good	Very good	Excellent
Quality of assignments	Frequency	16	12	2	0	0
	Percentage	53.3	40.0	6.7	0.0	0.0
Nature of teachers' remarks	Frequency	22	5	3	0	0
	Percentage	73.3	16.7	10.0	0.0	0.0
Adequacy of assignments to engage learners in the learning process.	Frequency	13	15	2	0	0
	Percentage	43.3	50.0	6.7	0.0	0.0
Extent of marking of assignments by the teacher.	Frequency	8	21	0	1	0
	Percentage	26.7	70.0	0.0	3.3	0.0
Extent of reporting by the learners during learning	Frequency	21	9	0	0	0
	Percentage	70.0	30.0	0.0	0.0	0.0

E=Excellent, VG=Very Good, G=Good, P=Poor and VP=Very Poor.

The results in Table 4 indicate that the quality of assignments, the nature of teachers' remarks and adequacy of assignments to engage learners in the learning process was poor in majority of schools sampled with 93.3%, 90.0% and 93.3% respectively. In relation to extent of marking of assignments by the teacher the rating was poor with 96.7% while in relation to the extent of reporting by the learners during learning the rating was very poor (70%) and 30.0% poor. The results indicate that the teachers of Chemistry were generally performing poorly in relation to assignments the teachers gave to learners and this may have a negative effect on the academic performance of learners in Chemistry. The results indicate that, teachers of Chemistry in Murang'a County are not taking assignments seriously probably because of time taken to mark or are in a hurry to complete the syllabus.

This argument is in conformity with the findings from a study by Lisa (2011) in USA which revealed that, teachers are no longer using written interactions effectively because of the time limits that different stakeholders in training have put in place. In the process, learner written interaction is given very little time. One of the conclusions from this study was that students require written teacher feedback for effective achievement academically. Therefore, one of the findings of the current study is that, teachers need to use assignments as an interactive tool of involving learners during teaching and learning of Chemistry. One method of helping learners to be independent minded and seek own knowledge is through creating a culture of reading and writing which involves the learner to interact with a wide range of learning materials. For instance, a library is a good source of learning materials while performing experiments in the science laboratory, recording observations and manipulation of data lead to cognitive

development of the learners' mind and make learning interesting and meaningful to the learner.

As much as possible the teacher should mark the learners' assignment to identify their strengths and weaknesses. Group assignments are also critical in providing students with a great opportunity to further develop their skills through peer interactions which aids in refining their understanding through discussion and explanation. This is in conformity with Caruso and Woolley (2008), who emphasized that group assignments can help students develop a host of skills that are important in the cognitive development of the learner. However, this section contradicts section 3.2.1 on students' perceptions on the use of written interaction where majority of students indicated that, there was thorough use of written interactions in classes through use of homework and majority of students were reporting their assignments in class. According to the study the document analysis is likely to be more reliable and objective compared to the learners' perception on written interaction which is likely to be subjective. It is also important to note that, learners may not be able to assess the quality of assignment.

Therefore from this study, it can be argued that written interaction was not well utilized during teaching and learning and is likely to have effect on academic achievement of learners. Probably the learners were not well supervised where some never contributed while others just copied the work of others leading to low quality learning. This explain why there was no statistically significant effect and relationship between the independent variable which is the learners' written interaction and the dependent variable which was learners academic achievement that was measured using the learners' scores in the administered CAT. These findings are supported by learners' responses during group discussions: Asked if teachers give challenging questions the study revealed that moderate questions was the common practice. Challenging questions may help the learner to read more, consult and stimulate their minds leading to meaningful learning and higher academic achievement. Further, the study revealed that there were inadequate assignments given to learners and the little that was given was marked by learners through guided marking. Most revision questions given were simple, while learners were generally not active in class. Therefore from the results of this study, written interaction was not well practiced and explain why there was no statistically significant written interaction effect on learners' academic achievement.

CONCLUSION

One of the basic practice of improving the academic achievement of learners in Chemistry is training the learner on how to seek knowledge from learning resource materials by providing them with homework, assignments and practical work in the laboratory. From this study the quality of assignment and method at which they were administered was found to be poor and of little value towards effective and meaningful learning. As such, the study found statistically insignificant association between written interaction and academic achievement in Chemistry among the learners. The two-tailed p-value associated with the test was 0.235 which was greater than 0.05, so the null hypotheses was accepted.

The statistic coefficient (R^2) provided the amount of variation that accounted for the independent variable which is the written interaction. The value of $R^2 = 0.050$, implied the model explained 5% variation in academic achievement which is the dependent variable of this study. Therefore 95% change in academic achievement resulted from other factors that were not part of the model. Further, the Pearson Product-Moment Correlation Coefficient between written interaction effect and learners' academic achievement showed a weak negative relationship ($r = -0.2234$) between the two variables. This means that the students had the

same chance of performing well even when they were not exposed to written interaction in the post-test exams. Therefore, so long as the teacher of Chemistry explains the concepts well and involves the students through verbal interactions, they could still perform well in the Chemistry assessments. However, these findings contradict many other studies an indication that, more research is required in this area.

From the learner's perception, the study found that majority of teachers were giving a lot of homework, there was reporting in class and learners were involved in doing homework individually and in groups. However, results from the observational schedule revealed that written interaction was not well utilized during teaching and learning and is likely to have a negative effect on academic achievement of learners.

RECOMMENDATIONS

- a) Since assignments were not taken seriously teachers should give challenging assignments, supervise and mark so as to identify the learners' strengths and weaknesses. This will ensure the learners get the skills of seeking knowledge on their own as well as the skills in writing.
- b) Learners need to be exposed to learning resources like libraries and be encouraged to an effective reading culture, make accurate and useful notes. Chemistry is a practical subject which requires accurate observations and manipulation of apparatus and data. Therefore, learners should be made independent minded to seek scientific knowledge using available laboratory resources. This will enhance their mental cognitive development.

SUGGESTIONS FOR FURTHER STUDIES

Given that the findings of this study revealed no statistically significant written interaction effect on learners' academic achievement in Chemistry, further research need to be done using different subjects, target groups and environments to authenticate the findings of this study.

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