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A COMPARISON OF CASE BASED LEARNING, TEAM BASED LEARNING AND REGULAR TEACHING METHODS INFLUENCES ON STUDENTS' PERFORMANCE IN CHEMISTRY IN MAARA SUB COUNTY, KENYA

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Abstract

Most concepts in Chemistry are difficult which leads to poor performance of students. The purpose of the study was to compare Case Based Learning (CBL), Team Based Learning (TBL) and Regular Teaching Methods (RTM) influences on students' performance in Chemistry. The study used a 3 x 2 x 2 quasi-experimental factorial design. The target population was eighteen thousand six hundred and eleven (18,611) students in Maara Sub County. Three schools were selected purposively. A sample of one hundred and six (106) Chemistry students were selected for the study. Simple random sampling method was used to assign groups to experimental and control. The experimental groups were exposed to Case Based Learning and Team Based Learning. The control group was instructed through Regular Teaching Methods. The instrument used was the Chemistry Achievement Test (CAT). The validity of the instrument was ascertained by experts from Egerton University. Reliability coefficient of the CAT was 0.79. Analysis of Data was done using means, standard deviations, standard error differences, t-test, ANOVA and ANCOVA at α = 0.05. Students taught using CBL obtained higher mean scores in chemistry than those that were taught through TBL and RTMs. The study concluded that CBL should be used to teach students to improve performance in chemistry. Curriculum developers, policy makers and teachers may use CBL and TBL in chemistry learning.

Keywords: *Case Based Learning, Team Based Learning, Regular Teaching Methods*

Introduction

The current practice of applying the Regular Teaching Methods could be responsible for the ineffectiveness of instruction in schools (Ihendinihn, 2013). Therefore, teachers need innovative strategies in order to increase the academic attainment of learners in Chemistry. Chabo, Babagana, Shuaib, Aliyu and Mohamed (2021) recommended from their study that Chemistry teachers should employ the Case Based Learning to permit learners in the creation of individual knowledge and engagement in learning.

According to Izueg, Arinze, Abigail, Nwanze, Pins and Emerhiona (2018) various methods of instructions are normally anchored on some theories of learning. It is upon the teachers to choose desirable teaching approaches that can best suit the topic, nature of learners and objectives. In view of this, Chemistry should best be taught using constructivist approaches. Research by Uwalaka and Offorma (2015) showed a significant difference in the mean attainment scores of students trained using constructivist process than those instructed with the regular teaching methods. A constructivist teaching method offer the learners a chance to

create ideas, skills and understanding based on their prior experiences. Jong (2005) claimed that constructivist instruction differs from other approaches. First, knowledge is a dynamic constructive method but not information attainment. Furthermore, instruction is helping the student's useful dispensation of understanding rather than passing the knowledge to the student. Thirdly, instruction is a learner-centered. Piaget (1976) encouraged students to be active and integrate all what they study. Vigotsky (1978) on the other hand advised students to learn together in groups and run through their understanding. One of the teaching strategies that are grounded on constructivism theory is the Case Based Learning. According to Herreid (2005) cases are everyday stories with an instructive message. CBL relies on cases, stories or analogies written that can be scrutinized through the discussion in the classroom. Jones (2003) posited that cases permit learners to put themselves in the person of being an actor in the given situation.

Another constructivist approach for teaching Chemistry is Team Based Learning. It involves use of group work by altering organization of course in order to develop and take advantage of the competences of groups (Michaelsen, Knight & Fink, 2004). Many studies have addressed Team Based Learning on the aspects that affect individuals' problem solving abilities and academic achievement and self -directed learning. There are insufficient studies that examine the effects of integrated learning approaches and their intellectual behavioral values. It is crucial to use techniques that will offer learners with an enhanced understanding of the difficulties and inspire them to examine the issues (Zohreh, Leilei & Rita, 2016). The Team Based Learning affords an opportunity to re-design lab sessions as active learning undertakings. Peer evaluation within teams strengthens student accountability to each other. Laboratory sessions play a critical role in most Chemistry courses, for the demonstration of chemical ideas and scientific procedures (Aires-de-sousa, Cardoso, Margarida, Luisa, Lima, Noronha, Munes & Nunes ,2017).

According to Chin-Hsiang, Youmg-Yan, Jen-Chieh, Shun-Chuan, and Chun-Te (2015) in order to enhance student team work the learning methods should be redesigned. Team based learning makes learning more effective and cultivates the team work. Team Based Learning entails a unified organized teaching approach which comprises modifications in the curriculum. Learners devote learning sessions on relating rather than only acquiring the knowledge. The individual learning outcome is associated with general establishment, growth and attainment of groups. There are few studies of Team Based Learning on learning outcomes (Paul, Adrienne, Nicole, Stuart & Dean, 2010). An assessment by Rui, Lian, Jing

and Chuang (2017) reviewed that Team Based Learning attained a teaching efficacy similar to what the regular instruction methods and exhibited a more sustained effect on instruction value. The comparison of CBL and TBL on students' performance in Chemistry have not been adequately established.

Objective of the Study

To compare students' performance in Chemistry among those taught through Case Based Learning (CBL), Team Based Learning (TBL) and those taught using Regular Teaching Methods (RTM).

Hypothesis

H_O1: There is no statistically significant difference in students' performance in Chemistry among those taught using Case Based Learning (CBL), Team Based Learning (TBL) and those taught using Regular Teaching Methods (RTM).

Research Methodology

This study used Quasi-Experimental Factorial Design that involves experimental groups and a control group with intact groups (Kothari, 2004). It permits the researcher to control the assignment to the treatment conditions (Dinardo, 2008). The Research Design is shown in Table 1.

Table 1: Quasi - Experimental Factorial Design

Group	Pre-test	Treatment	Post-test
One	O_1CBL	XCBL	O_2CBL
Two	O_1TBL	XTBL	O_2TBL
Control	O_1RTM		O_2RTM

This study was done in Maara Sub- County in Eastern region of Kenya. Maara Sub County was selected randomly from among four Sub counties in Tharaka Nithi County. It involved all learners from secondary schools. The target population was eighteen thousand six hundred and eleven (18,611) learners in fifty-two (52) secondary schools. The accessible population was two thousand three hundred and seventy-eight (2378) learners in Maara Sub- County. Researcher selected three co-educational secondary schools using purposive sampling method. The overall number of learners who took part was one hundred and six (106).

Chemistry Achievement Test was used as the instrument based on topics covered during the study period in all domains of learning. The total number of structured items were 10 comprising 30 marks. The instrument was validated by Kenya National Examinations Council examiners and science educational specialists from Egerton University. This ensured that the items in the CAT corresponded with topic Salts in Chemistry only. Piloting was undertaken in neighboring South Sub- County. The results of the pilot test were used to estimate the reliability by Cronbach's coefficient Alpha method. The value obtained was 0.79. Instructors were trained to use Case Based Learning (CBL) and Team Based Learning (TBL) in Chemistry teaching. The groups were offered with CBL TBL and RTM independently. The responsibility of the Chemistry instructor in CBL group was to direct the learners on the thought-provoking problems to encourage thinking. Students wrote answers on the worksheets. Students in the TBL group were arranged heterogeneously. They were offered personal and team quizzes based on readings done before every class lesson. The quizzes were done individually and in teams. The teacher was liable for recording the results. The researcher sought approval of Egerton University Board of Postgraduate Studies. Permit given by National Commission for Science, Technology and Innovation. A test was administered at the start of the experiment and also after treatment. Data was collected using Chemistry Achievement Test. One-way ANOVA was used to examine differences in the means in Chemistry. Kenya Certificate Primary Education scores of the sampled students were used as the covariates reduce within-group error variance. This would help to eliminate the confounding variables in order to account for the influence of an outside variable that might affect the results of the experiments. ANOVA allows for the comparison of more than two groups at different points in time (Thorne & Giessen, 2000).

Results and Discussion

This study sought to investigate whether there were differences in means of students in chemistry among the three groups. Table 2 shows descriptive results for CBL, TBL and RTM in post-test CAT.

Table 2: Results for the Post CAT Mean Scores of Students taught through CBL, TBL and those Exposed to RTM

	N	Mean	Std deviation	Std error
RTM	36	23.50	11.39	1.90
CBL	34	37.15	18.82	3.23
TBL	36	34.47	17.55	2.93
Total	106	31.60	17.10	1.66

CBL had a mean score of 37.15% while TBL group attained a mean score of 34.47%. RTM had a mean score of 23.50%. Standard deviations for CBL, TBL and RTM were 18.82, 17.55 and 11.39 respectively. Standard errors for CBL, TBL and RTM were 3.23, 2.93 and 1.90 respectively. The results from One-way ANOVA in post -test CAT mean scores are shown in Table 3.

Table 3: Analysis of variances of Post CAT Mean Scores of Students

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3705.12	2	1852.56	7.01	0.00
Within Groups	2700.24	103	262.20		
Total	30711.36	105			

The results of this experiment indicate that mean differences in CAT were significant, $F(2,103) = 7.01$, $p<0.05$.

The results in Table 4 shows Tukey Honesty Significance Differences for comparisons to establish mean differences in performance on learners instructed through CBL, TBL and RTM.

Table 4: Tukey HSD Post Hoc Comparisons of Post CAT Mean Scores

Group (i)	Group (j)	Mean Difference (i - j)	Std. Error	p-value
RTM	CBL	-13.65*	3.87	0.00
	TBL	-10.97*	3.82	0.01
CBL	RTM	13.65*	3.87	0.00
	TBL	2.68	3.87	0.77
TBL	RTM	10.97*	3.82	0.01
	CBL	-2.68	3.87	0.77

The results in Table 4 indicated that the differences in mean scores in CAT in RTM and TBL and between RTM and TBL were statistically significant $p<0.05$. However, the differences in post-test in CBL and TBL were statistically insignificant, $p>0.05$. ANCOVA was carried out using KCPE marks as the covariates as shown in Table 5.

Table 5: Analysis of Covariance using KCPE marks

Source	Sum of Square	df	Mean Score	F	Sig
Intercept	3738.69	1	3738.69	14.30	0.00
KCPE Marks	328.21	1	328.21	1.26	0.27
Groups	3430.76	2	1715.38	6.56	0.00
Error	26678.03	102	261.55		
Total	136584.00	106			
Corrected total	30711.56	105			

The ANCOVA results showed that the means were statistically significant. CBL and TBL improved performance in chemistry than the RTM. The outcomes of this study are consistent with that of Lucas, Arid, Kjell, Torstein, Mildrid and Silje (2017) that established a substantial rise in the learners' engagement when they were instructed using TBL and a noteworthy increase in student perceived learning. TBL is enabled mutually by the instructor, who offers justifications for the learning task through cooperation with others. According to Fatmi, Hartling, Hiller, Campbell and Oswald (2013) most studies have revealed that TBL

considerably increases students' understanding level although some researchers established that compared with other instruction approaches TBL showed no benefit.

Gray, Fana, Campbell, Hakim, Borok and Aagaard (2014) noted that even though TBL had been useful its influence on instructional efficacy and acknowledgement by educators more studies are required for conclusive proof for justification. TBL teaching can be effective for large classes with shortage of teachers. Rui, *et al.* (2017) showed that TBL teaching interventions on specific learners were considerably enhanced and established that TBL efficiently enriched the learners' attainment. Tan, Kandiah, Umapathi and Tan (2011) showed that preparation outside the class encouraged the learners to study frequently and get ready in advance to class and generates a good atmosphere for self-directed and dynamic learning.

A similar study by Maria, Lisa and Samantha (2015) showed that TBL improved student learning and interaction. Karen, Nicholay, Jerri, Briftany, Garner, Laranco, and Lindsay (2018) suggested from their study that a TBL approach can increase academic and social skills of learners. Annette, Inam, Jane, Chris, Roger, Nicholas and Craig (2019) reported that the use of small groups encouraged not only cooperation and team work but also provided individual learners the same chance to participate in their teams and brought about practical effectiveness in learning and instruction. Findings by Hellen (2017) revealed that the constructivist group achieved better than the Lecture group.

Rui *et al*. (2017) also revealed that in terms of the tests scores TBL group significantly outdid the lecture-based learning which are consistent to this study. Maria *et al*. (2015) noted that TBL has not been applied extensively in science, technology, engineering and mathematics though it is effective in promoting students learning in other subjects. According to Karen *et al*. (2018) TBL offers a chance for learners to acquire basic skills and apply them in the future training and work. Their findings emphasize the probable merits of TBL exposed learners to fresh thoughts, enlightening skills and creation of awareness of personal abilities and limitations. Richard and Lisa (2015) affirmed that TBL is effective for teaching science. Xingming, Yanping, Jingqiu, Lifeng, Yaling, Yufeng, Hongjuan, & Mingqiang (2019) showed that the CBL had significantly better scores in examination, provided better understanding and preparation for examinations than RTM. The outcomes revealed that CBL was a more effective instruction approach as compared to regular teaching methods. The

execution of CBL in instruction assists learners to increase their problem solving capabilities and mastery of information.

Conclusion and Recommendation

The study concluded that Case Based Learning improves performance in chemistry better than the Team Based Learning and Regular Teaching Methods**.** Hence it recommends that educators should use CBL to enhance performance of learners in Chemistry.

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