EFFECTIVENESS OF EXPERIENTIAL LEARNING APPROACH ON STUDENTS' ATTITUDE TOWARDS BIOLOGY IN SECONDARY SCHOOLS IN MAARA SUBCOUNTY, KENYA

Joshua Mong'are Gisoi
P.O. Box 76-60401 Chogoria
&
Prof. Mercy Wanja Njagi & Dr. Juster Nthinga Mungiria
Chuka University P.O Box 109-60400

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Abstract: The study aimed at investigating the effect of experiential learning approach on students' attitude towards biology in Secondary schools in Maara sub-county, Kenya. Quasi experimental research design was employed and in particular Solomon four group design. The target population was 22,640 biology students in secondary schools in Maara sub-County, Tharaka Nithi County. The accessible population consisted of 1,557 form two students in the Sub-County mixed secondary schools. The purposive sampling was used to draw four sub-County mixed secondary schools from a list of mixed secondary schools in Maara the Sub-County. The sample size comprised of 118 students. The research instruments used was Biology Attitude Questionnaire (BAQ). The instrument was piloted to determine its reliability in a Sub-County mixed secondary school in Meru-South Sub-County. Reliability coefficient for the instrument was 0.762. The validity of the research instrument was ascertained by experts in the department of education of Chuka University. Experimental groups (E1 and E2) were taught using experiential learning approach while control groups (C1 and C2) were taught using conventional teaching approach. Statistical Package for Social Science (SPSS) version 26 aided in data analysis. The raw data obtained was analyzed using descriptive statistics (mean, percentages) and inferential statistics (Mann-Whitney U Test, Kruskal Wallis Test and Turkey post hoc analysis). The null hypothesis was tested at $\alpha = 0.05$ significant level. The findings indicated that there was a significant difference in students' attitude towards biology among students taught using experiential learning approach and conventional approach. It was therefore recommended that the experiential learning approach should be applied to improve students' attitude towards biology and thus improved academic performance. The findings of the study may be help curriculum planners and learning institutions to incorporate innovative techniques in classroom teaching to improve learners' motivation to learn biology subject in Kenya. The findings also form a ground upon which likely further research could be built for innovative teaching techniques in secondary schools.

Keywords: Experiential learning approach, attitude, conventional teaching approach.

1. Background Information

Globally, biology significantly advances biotechnology, medical engineering, and microbiology (Joda, 2019). Biology is a prerequisite for professional health courses in human and veterinary medicine, pharmacy, and dentistry (Daniel & Githui, 2011). Through the use of Deoxyribonucleic Acid (DNA) sequencing and profiling, genetics, an aspect of biology, has revolutionized our ability to resolve paternity disputes and pinpoint the perpetrators of significant crimes with certainty and accuracy (Tsevreni, 2021). Biology has aided in the development of new and improved medications and vaccinations to treat a variety of human and animal diseases such as malaria, measles, and polio (Daniel & Githui, 2011). According to Tsevreni (2021), biological expertise and knowledge also contribute to scientific literacy, which aids people in understanding the world and protecting endangered species in the ecosysterm.

Not with standing the significance of biology in the society, students' performance in the subject has remained unsatisfactory over the years, a tendency that is probably caused by students' negative attitudes towards the subject. According Etobro and Fabinu, (2017) students' attitude is a significant predictor of their performance in science subjects. According to Adesoji (2008), individuals' attitude is their general mental disposition toward other people,

things, ideas, and events. Most attitudes are the outcome of either personal experience or environmental observational leaning. Three main reasons account for the significance of attitudes in science (Martin, Sexton, Franklin, Gervovich, & McElroy, 2010). Attitude of a child is the first indicator of his or her mental state of preparedness to perceive science-related objects, topics, activities, and people positively. A child who is apprehensive or unprepared for whatever reason will be less inclined to engage with those who work in the scientific field. A child experiences this readiness factor unconsciously, without previous consideration or apparent consent.

Second, attitudes are neither inherent nor born with them. According to modern psychologists, as children grow, attitudes are learned through experiences and may be acquired (Craker, 2006). Additionally, the attitude of a child may be altered by experience, and parents and instructors have the most impact on a child's attitude toward science (Martin et al., 2010). Thirdly, attitudes are dynamic outcomes of experiences that serve as guiding principles when a student engages in new experiences. Because of this, attitudes have both an emotional and an intellectual tone, which influence decision-making and the creation of evaluations. A child may establish priorities and have diverse preferences as a result of their decisions and evaluations.

Attitude is an important concept in learning. Among learners, it denotes interest or feeling towards studying particular subjects. Students' attitude towards science play a significant role in determining their science achievement. Understanding how attitudinal factors impact student learning in the cognitive field is a key goal of studying them in science education. According to Soltani and Nasr, (2010) students' science learning experiences have a positive effect on their attitudes, raise their interest in studying science, and consequently boost their performance in the subject. Students' attitudes regarding science are influenced by poor teaching approaches (Mafhenya, 2020). According to Andresen, Boud and Cohen (2020) when students feel encouraged to participate in their group, they learn communication and cooperation skills and consequently feel more confident. Andresen, Boud and Cohen further assert that motivated students are more likely to go deeper into a subject by relying on their own experiences. Since affective dispositions are strong predictors of students' academic performance, teachers should place a high priority on students' attitudes.

Teaching and learning biology are greatly impacted by students' attitudes toward the subject. In their 2010 study, Bakar, Tarmizi, Mahyuddin, Elias, Luan, and Ayub investigated the relationships between Malaysian students' academic performance in the humanities, sciences, and agriculture, as well as their motivation for achievement and attitudes. There were 1484 students from a local university institution that participated in the descriptive correlational study design (1102 females and 382 men). The findings showed a strong correlation between students' attitudes and academic achievement. According to this study, students' attitude affects their academic success. In the current study, the relationship between student attitude and achievement when students are taught using experiential learning approach were investigated.

Kabunga, Habiba, and Mnjokava (2018) conducted research on academic achievement and student attitudes toward science in Uganda. Three hundred advanced level students from high schools in Mbarara district in Uganda constituted the sample size. The study generally showed that having a positive attitude contributes to good results. According Etobro and Fabinu, (2017) students' attitude is a significant predictor of their performance in science subjects. George (2006) conducted a study in America on the cross-domain analysis of change in students' attitudes toward science and attitude towards the utility of science. The results showed a generally good trend in students' attitudes towards the value of science, but attitudes toward science declined in middle and high school.

To support students' achievement in science, emphasis should therefore be on the usage of active learning approaches to provoke students' interest. Experiential learning is one of such approaches. Experiential learning approach is a form of experience-based learning where learners make meaning of the actual experience (Okuakaji & Sukolatambaya, 2020). The process of experiential learning encompasses a variety of processes that give students a hands-on, group-based, and reflective learning experience that aids in their full acquisition of new knowledge and skills, thus sparking students' interest (Morris, 2020). According to Kolb & Kolb (2017), one develops knowledge in ELA by transforming their own experiences. A learning experience is not simply something that happens; it is a planned activity with a purpose and the learners confirm the purpose. According to Kolb and Kolb, experience-based learning is inductive, learner-centered, and activity-focused. Adeyemi & Awolere, (2016) asserted that experiential learning involves the process of making sense of one own actual experience, which lessens reliance on teachers.

According to Beard and Wilson (2018), the role of the teacher is to facilitate experiential learning. The teacher takes on the role of a facilitator, a less dominant position in the classroom, adopting a constructive and non-dominating mentality while approaching the learning process. Teachers that are experts in their fields aid students in organizing and connecting their reflections to the subject's base of knowledge (Awolere, 2015). In order to enhance their knowledge and skills, teachers should be aware of changes in their field and not wait for official, top-down training. For subjects with precise performance requirements, the standard-setter or evaluator position is essential. In this position, teachers frequently adopt an objective, goal-oriented style to assist students in assessing their learning (Kolb & Kolb, 2017). This method encourages the growth of learning styles that involve thinking, deciding, and acting. Case studies and simulations are common activities in education.

Students actively participate in the activity that requires them to reflect on, conceptualize, and apply their newly acquired knowledge to events in the real world in an experiential learning setting. Morris (2020) contends that a learner must possess a number of qualities in order to benefit from an activity. These qualities include the willingness of the learner to participate completely in the experience, their capacity for reflection and conceptualization, their ability to develop and apply analytical skills, and their capacity for applying the new knowledge that they gained from the event. Experiential learning helps students manipulate real-world activities and work cooperatively in groups, sparking interest in learning.

Despite biology being a prerequisite to many lucrative courses and the government interventional SMASSE and ICT integration programs, students' academic performance in biology at the secondary school level is still not satisfactory, particularly in Maara Sub-County, Kenya. According to reports from the Kenya National Examination Council, students record low academic achievement in the subject, a tendency that is probably caused by students' negative attitudes towards the subject. If the poor academic performance in the subject continues, the Kenya 2030 vision and the national goals of education are likely not to be met. In order to negate this trend, scholars suggest that active learning instructional approaches be adopted. Although research has shown how experiential learning approach can improve students' attitude in physics, chemistry, and mathematics, there is little information available on students' attitude towards biology. Therefore, the current study will examine how well the experiential learning approach influences students' attitude towards biology in the Maara Sub-County of Tharaka Nithi, Kenya in an attempt to bridge the gap.

2. Methodology

2.1 Location of the Study

The study was conducted in Maara Sub-County in Tharaka Nithi County which lies 186km due North of Nairobi City. In the Northern, Tharaka Nithi County borders Meru County; to the East the County is bordered by Kitui County and to the South it is bordered by Embu County. To the Western side, Tharaka Nithi is bordered by slopes of Mount Kenya.

2.2 Research Design

The study employed the quasi-experiment, and more particularly the Solomon four group design. (Ogunniyi, 1992). The Solomon four-group main feature is that participants are randomly assigned to either a treatment or a comparison group. This design is preferred because it is based on groups of respondents rather than individuals. However, it is advised against dividing and reconstituting secondary school classes after they have been formed as whole groups for research. The design enables the researcher to conduct studies in natural and real-life settings while controlling and measuring the main effects of testing. The experimental and control groups received the Biology Attitude Questionnaire before and after the treatment. The experimentation went unnoticed by learners since they were being taught by their teachers. To prevent subjects' interaction, the experimental and control groups were drawn from different schools.

2.3 Target Population

The target population was 22,640 biology students in secondary schools in Maara Sub-County, Kenya. The accessible population was composed of 1,557 form two students in the Sub-County mixed secondary schools where the study

sample was drawn. The researcher purposively sampled Maara Sub-County out of the 4 sub-counties in Tharaka Nithi County based on the low academic performance in biology. The researcher used purposive sampling to draw a total of four Sub-counties mixed secondary schools from a list of 58 secondary schools in the Sub-county. The selection of schools was guided by low academic achievement and mixed sub-county secondary schools. Simple random sampling technique was used to assign selected schools to experimental groups (E1 & E2) and control groups (C1 & C2). In case a school had more than one stream taking biology, all the streams were subjected to the study using similar method of teaching but only one stream was considered for analysis. The sample size of the study was 118 students. A list of all sub-county secondary schools from the county was obtained from county education office before sampling to establish whether they were suitable for the study. During the visit the researcher obtained information on the extent of syllabus coverage in form three chemistry classes.

2.4 Sampling Procedures and Sample Size

The units for sampling in this study were schools and not individual students. The researcher purposively sampled Maara Sub-County out of the 4 sub-counties in Tharaka Nithi County based on the low academic performance in biology. The researcher used purposive sampling to draw a total of four Sub-counties mixed secondary schools from a list of 58 secondary schools in the Sub- County. The selection of schools was guided by low academic achievement and mixed sub-county secondary schools. Simple random sampling technique was used to assign selected schools to experimental groups (E1 & E2) and control groups (C1 & C2). In case a school had more than one stream taking biology, all the streams were subjected to the study using similar method of teaching but only one stream was considered for analysis.

2.5 Research Instruments

This questionnaire contained 28 closed-ended items adopted from Tapia and Marsh (2004) and adjusted to suit the study. Based on attitudinal scales, the Biology Attitude Questionnaire was developed to collect students' views on biology. The scale was divided into four sections: the fun factor scale, which had seven items, the practical investigations scale, which had seven, the committed scientist scale, which had seven, and the career scientist scale, which had seven. These questions are based on a 5-likert scale, with strongly agree (SA)-5, agree (A)-4, undecided (U)-3, disagree (D)-2, and strongly disagree (SD)-1 (See appendix 2).

2.6 Data analysis

The data obtained was analyzed using Mann-Whitney U test, Kruskal Wallis test and post hoc analysis using the statistical package for social sciences version 26.

3. Results and Discussion

3.1 Gender

The number of males and females that took part in the study is as shown in Table 1.

Table 1: Gender Distribution of Respondents

	Gender					
	Male	%	Female	%	Total	%
Experimental Group 1	6	18.18	27	81.82	33	100.0
Control Group 1	13	39.39	20	60.61	33	100.0
Experimental Group 2	13	44.83	16	55.17	29	100.0
Control Group 2	9	39.13	14	60.87	23	100.0
Total	41	34.75	77	65.25	118	100.0

Information in Table 1 shows that there were 33 students for experimental group 1 of which 81.82% were females while 18.18% were males. Out of 33 students for control group 1, 39.39% were males while 60.61% were females. For experimental group 2, 44.83% were male while 55.17% were females. For control group 2, 39.13% were males

while 60.87% were females. The total sample was 118 students of which 41 (34.75%) were males while 77 (65.25%) were females.

3.2 Effects of Experiential Learning and Conventional approach on Attitude

To determine whether there was a discernible difference in the attitudes of students toward biology when taught using the experiential learning technique verses when taught using the conventional teaching approach, the null hypothesis was tested. The attitudes toward learning biology were examined before and after the treatment using a five-point Likert scale with the following values: Disagree Strongly (SD)=1, Disagree (D)=2, Undecided (U)=3, Agree (A)=4, and Strongly Agree (SA)=5. The Man Whitney U test was designed to determine whether the utilization of experiential learning versus conventional teaching approaches affected students' attitude. The results are summarized in Table 2.

Table 2: Mann-Whitney Test of the Pretest of Student Attitude on Experimental Group 1 and Control Group 1

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Sig.
Experimental Group 1	33	37.55	1239.00	411.000	972.000	1.714	0.087
Control Group 1	33	29.45	972.00				
Total	66						

According to results in Table 2, experimental group two mean rank was 37.55 whereas control group mean rank was 29.45. The results show that there was no statistically significant difference in the attitudes of students in biology between those who were taught using an experiential learning approach and those who were taught using conventional approach at α=0.005, (U=411.0, p=0.087). After the intervention, the experimental (E1) and control (C1) groups' attitudes toward experiential learning and conventional instructional approaches were compared using the Mann-Whitney U test. Table 3 demonstrates the outcomes.

Table 3: Mann-Whitney Test of the Post-test of Students Attitude on Experimental Group 1 and Control Group 1

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Sig.
Experimental Group 1	33	43.41	1432.50	217.500	778.500	4.197	0.000
Control Group 1	33	23.59	778.50				
Total	66						

The results in Table 3 demonstrates that experimental group one mean rank (MR=43.41) was higher than control group one mean rank (MR=23.59). From the table, it can be deduced that there was a statistically significant difference in students' attitudes towards biology between those who were taught using the experiential learning approach and those who were taught conventionally at alpha = 0.05 (U=217.5, p=0.000). This means that experiential learning approach improved learners' interest to learn biology. As shown in Table 4, the Mann-Whitney U test was used to determine whether attitudes of students varied when experiential learning and conventional teaching approaches were used in the experimental (E2) and control (C2) groups.

Table 4: Mann-Whitney Test of the Pretest of Students Attitude on Experimental Group 2 and Group 2

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Sig.
Experimental Group 2	29	25.57	741.50	306.500	741.500	0.498	0.618
Control Group 2	23	27.67	636.50				
Total	52						

The mean rank for experimental group 2 was 25.57, and for control group 2, it was 27.67, as shown in Table 4. It is clear that there was no statistically significant difference in the attitudes of students in biology between those who were taught using an experiential learning approach and those who were taught using a conventional approach at alpha =0.05 (U=306.5, p=0.618). The Mann-Whitney U test of the post test was conducted after the 4-week treatment

to see whether attitudes of students in the experimental (E2) and control (C2) groups varied when conventional teaching and experiential learning approaches were employed. The results are presented in Table 5.

Table 5: Mann-Whitney Test of the Post-test of Student Attitude on Experimental Group 2 and Control Group 2

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	Sig.
Experimental Group 2	29	30.57	886.50	215.500	491.500	2.177	0.030
Control Group 2	23	21.37	491.50				
Total	52						

The Mann-Whitney Test of post-test Table reveals that experimental group two mean rank (MR=30.57) was greater than control group two mean rank (MR=21.37). It can therefore be concluded that there was a statistically significant difference in students' attitudes toward biology between those who were taught utilizing an experiential learning approach and those who were taught conventionally (U=215.5, p=0.030). Table 6 gives the summary of the results of the Kruskal-Wallis test on the pre-test BAQ for the four groups.

Table 6: Independent-Samples Kruskal-Wallis Pretest Summary of Attitude for the four Groups

Total N	Test Statistic	Degree Of Freedom	Sig.
118	3.703[a,b]	3	0.295

a. The test statistic is adjusted for ties.
b. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

The Kruskal-Wallis test revealed no statistically significant difference in the attitudes of students toward biology between those who were taught using the experiential learning approach and those who were taught conventionally, H(3)=3.703, p=0.295. The Kruskal-Wallis test of post-test was conducted in order to test the null hypothesis, which states that there is a statistically significant difference in the attitudes of students toward biology between those who were taught using the experiential learning approach and those who were taught conventionally. Table 7 presents the Kruskal-Wallis test results of the post-test BAQ for the four groups.

Table 7: Independent -Samples Kruskal-Wallis Post-Test Summary of Attitude for the Four Groups

Total N	Test Statistic	Degree Of Freedom	Sig.
118	24.210[a]	3	0.000

a. The test statistic is adjusted for ties.

According to the Kruskal-Wallis post-test Table, there was a statistically significant difference between the attitudes of students who were taught biology using the experiential learning approach and those who were taught using the conventional approach, with H (3) =24.210, p=0.000. Based on the results, the null hypothesis was rejected. The study concluded that there was a significant difference between the attitudes of students who were taught biology using the experiential learning approach and those who were taught conventionally. A post hoc analysis was done to establish if there were any group differences. With Bonferroni adjusted alpha levels, a post hoc test was used to compare all group combinations. Table 8 summarizes the results.

Table 8: Post Hoc Comparisons of Post-test of BAQ Mean Scores For the Four Groups

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.
Experimental Group 1	Control Group 1	0.40368*	0.10970	0.002
	Experimental Group 2	0.03724	0.11342	0.988
	Control Group 2	0.47144*	0.12104	0.001

Control Group 1	Experimental Group 1	-0.40368*	0.10970	0.002
	Experimental Group 2	-0.36644*	0.11342	0.009
	Control Group 2	0.06776	0.12104	0.944
Experimental Group 2	Experimental Group 1	-0.03724	0.11342	0.988
	Control Group 1	0.36644*	0.11342	0.009
	Control Group 2	0.43419*	0.12442	0.004
Control Group 2	Experimental Group 1	-0.47144*	0.12104	0.001
	Control Group 1	-0.06776	0.12104	0.944
	Experimental Group 2	-0.43419*	0.12442	0.004

According to the results in Table 8, there was no statistically significant difference in students' attitudes towards learning biology in the two experimental groups (E1 and E2) and those in the comparison group (C1 and C2) (P=0.944, P=0.988). The results showed that groups E1 and C1, E1 and C2, E2 and C1, and E2 and C2 had statistically significant difference of learning biology (P 0.002, P 0.001, P 0.009, P 0.004). The findings showed that, for the experimental group 1 and control group 1, there was a significant difference in students' attitudes about biology when taught using the experiential learning approach compared to conventional approach (p=0.0020 <0.05). This indicates that, compared to conventional approach of instruction, the experiential learning approach significantly boosts the students' interest in learning science.

The findings of this study concurred with Kupucu (2017) study findings in Turkey where Kupucu observed that students who had a good attitude toward mathematics performed better in physics. The research points out that students' attitude toward mathematics has an influence on their performance in science subjects including biology. The findings of the study are consistent, with those of Kabunga, Habiba, and Mnjokava (2018) study in Uganda. The study generally shows that a positive attitude contributes to good academic results in sciences. According Etobro and Fabinu, (2017) students' attitude is a significant predictor of their performance in science subjects. Once developed, attitudes influence how an individual student interacts with teachers. Affective dispositions are strong predictors of students' academic performance. Additionally, the results of Weinberg, Basile, and Albright (2011), who used a mixed-methods approach to examine how well experiential learning affected middle school students' motivation and interest in mathematics and science in Nigeria were in line with the results of the current study. The results revealed that after experiential learning program, interest in mathematics as a whole improved. Students attitude in mathematics influence positively the academic performance in science because of the interdisciplinary relationship among the subjects.

The results of this study also agree with those of Prokop, Tuncer, and Kvasniák (2007) who found that after a one-day field trip was organized to enhance students' ecological knowledge and investigate short-term consequences in Slovak, there was a considerable improvement in students' attitudes toward biology, the environment, and future careers in the subject. Additionally, students demonstrated a greater understanding of ecological concepts like food webs and ecosystems. Similarly, the results are in line with those of Soltani and Nasr, (2010) who asserted that students' science learning experiences have a positive effect on their attitudes, raise their interest in studying science, and consequently boost their performance in the subject. Students' attitudes and understanding of concepts are influenced by their pleasure in field trip experiential based activities connected to their real life situations. Correspondingly, the findings of the study were in collaboration with those of Wahi, Sutrisno, & YL (2019) who examined how students' attitudes toward chemistry were affected by incorporating problem-solving techniques and vocational skills education to laboratory training. The results showed that adopting a modernized laboratory teaching methodology considerably enhanced students' attitudes toward learning chemistry.

However, the results of this study negate the assertions made by Sadi and Akrolu (2011) that students' attitudes about biology did not significantly change despite the implementation of hands-on activities in teaching. In the study, students' performance on sense organs and attitudes toward science were assessed using the Science Achievement Test and the Science Attitude Scale, respectively. In total, 140 sixth grade students and two teachers took part in the study. Each teacher was given two classes, one of which was designated as the experimental group and received enriched instruction involving hands-on activities, and the other was designated as the control group and treated with convention instruction. In order to assess students' achievement and attitudes, the Science Achievement Test and the Science Attitude Scale were given to both the experimental and control groups three times as pre-tests and once after the three-week treatment period as a post-test.

Conversely, the study findings were in contradiction with those of a cross-domain analysis which George (2006) conducted in the United States on changes in students' perceptions of the significance of science. The researchers employed cross domain analysis to examine how students' attitudes toward science changed from middle school to high school. A total of 444 students made up the sample size for the longitudinal study of American youth. The findings revealed that students' attitudes toward science deteriorated as they progressed through middle and high school.

4. Summary of Research Findings

The study compared the students' attitude towards biology when taught using experiential learning approach and when taught conventionally. According to the research findings, there was a statistically significant difference between how biology is taught using an experiential learning approach and how it is taught conventionally. The results revealed that experiential learning approach is crucially important in improving the learner's interest in the subject. The students had a higher mean rank on attitude towards biology (E1 and E2) when experiential learning approach was used than those taught using conventional teaching approach (C1 and C2). There was a significant difference in the mean ranks on learners' attitude when taught using experiential learning approach and when taught using conventional teaching approach.

5. Conclusion

The study compared the students' attitude towards biology when taught using experiential learning approach and when taught conventionally. According to the research, there was a statistically significant difference between how biology is taught using an experiential learning approach and how it is taught conventionally. The results revealed that experiential learning approach is crucially important in improving the learners' interest in the subject. The students had a higher mean rank on attitude towards biology (E1 and E2) when experiential learning approach was used than those taught using conventional teaching approach (C1 and C2). There was a significant difference in the mean ranks on learners' attitude when taught using experiential learning approach and when taught using conventional teaching approach.

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