Utilization of Inquiry-Based Approach and its Influence on Students' Attitudes towards Biology in Secondary Schools in Kiambu County, Kenya

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ABSTRACT

Attitude incorporates beliefs and ideas, feelings and tendency of like or dislike about a subject or an object. Attitude towards Biology is related to motivation and influences performance (Diaz et al., 2021). One of the ways students are motivated to learn is when they are taught Biology through inquiry-based approach (IBA). They become interested, and develop positive attitudes towards Biology (Annan et al., 2019). The purpose of this study was to determine students' attitudes towards Biology when using IBA in Githunguri sub-County, Kiambu County, Kenya. The research question was, what are students' attitudes towards Biology when learning through IBA? The study targeted 37 public secondary schools, 1,194 Form 3 students and 14 teachers. Purposive sampling was employed to select 11 secondary schools with laboratories and 14 experienced teachers while simple random sampling was used to select 344 students. Questionnaires and interview were employed for data collection. Quantitative data was analysed using descriptive analysis and Statistical Package of Social Sciences. Qualitative data was analysed using narratives. The findings show that most students have positive attitudes towards Biology when taught using IBA. They found Biology as requirement for careers such as medicine. Although most students have positive attitudes towards Biology, some have inadequate understanding of basic concepts due to difficult Biology terminologies. It is concluded that a range of factors including, availability of resources which include computers and internet facilities, are key to helping students understand difficult concepts and do research in Biology. Ensuring the validity of test questions in the Biology papers set for the Kenya Certificate of Secondary Education (KCSE), will facilitate the development of positive attitudes and interest in Biology. It is recommended that Teachers should be provided with more resources to simplify Biology concepts and terminologies in order to alleviate fears, thereby encouraging students' positive attitudes towards Biology.

Keywords: Inquiry-Based Approach, Student's Attitudes, Biology, Secondary Schools, Students' Performance

INTRODUCTION

According to Kind et al. (2007), attitude is a knowledge that incorporates beliefs and ideas, feelings and tendency of like or dislike about an object. Dibiase and Mcdonald (2015) described attitude towards a variable as dislike or like. Attitude towards Biology is closely related to motivation in Biology, and it influences performance (Diaz et al., 2021; Prokop et al., 2007; Rani, 2000). The study revealed that students who participated in inquiry-based learning activities were seen to be more creative, developed better

attitudes towards Biology, acquired improved critical thinking skills, communication skills, and reading skills. Biology students who were involved in learning through IBA demonstrated positive attitude towards learning, succeeded academically, and are more skilled at using independent thinking skills.

Use of inquiry-based approach (IBA) influences students' attitudes and their performance in Biology. In Turkey, Prokop et al. (2007), found that students in Slovakia possessed positive attitudes. Nevertheless, Slovak girls showed more positive interest in Biology than the boys, but the degree of interest dropped as they grow older. Students' positive attitudes are derived from the interest they had in handling real objects during Biology lessons. Ogutu et al. (2014), argued that development of interest in Biology will influence performance. It facilitates the motivation of students to engage in the acquisition of knowledge.

According to Rani (2000), science students' attitudes about Biology were found to be influenced by their self-concept in science, teachers' encouragement, and peer attitudes. Nandasari (1995) concluded that students' attitudes will increase with a strong confidence in Biology when they are taught through inquiry-based approach. It increases and engages their level of involvement and willingness to participate in inquiry-based learning with interest rather than just taking notes. If students develop positive attitudes towards the learning of Biology according to the study, they will maintain studying the subject, perform well, and choose careers in science.

In a study which focused on the importance of improving youth's attitudes towards science in America, Diaz et al. (2021) sampled 758 students from 34 fourth-graders in Ohio and North Carolina and found that Students' opinions of science teachers, their self-confidence in science, fear of failing science courses, their value in science, how much they enjoy learning science, how motivated they are to pursue science, how their friends and peers feel about science, and how their parents or families feel about science, influenced the attitudes of students towards science (Osborne et al., 2003). Understanding more about the way science classroom activities are conducted can enhance task value. It will help teachers improve the quality of the experience of their students. Task value was defined by researchers as the level to which students believed a certain activity may benefit them in achieving their own career goals. Task value includes, interest, significance, and relevance of the activities to students' future careers (Diaz et al., 2021; Eccles & Wigfield, 1995). Tordzro et al. (2021), indicated that since students learn better by doing, practical activities are the most effective method for teaching and understanding Biology. It was also stated that having access to and using the laboratory will help teachers and students build positive attitudes towards science.

In Kenya, Owino et al. (2015), revealed that the key motivating factors for learning in Kenyan secondary schools have been to pass the performance test which opens opportunity to pursuing higher education. However, the analysis of the 2020 Biology KCSE reports revealed that the performance of students in Githunguri sub-County ranged between the grades of D and E. Waseka and Simatwa (2016) show that grades of D and E are below C^{+}. The mean score of C^{+} in Biology qualifies a person to pursue courses like Medicine, Pharmacy, Law, and engineering in Kenyan higher institutions of learning. This low performance which may be the result of students' attitudes towards the Biology, drew the attention of Kenyans. According to Waseka and Simatwa (2016) and Njue et al. (2018), the concern of Kenyans were raised over the attitudes of students towards Biology on a national level. To resolve this problem, it was discovered that if teachers use teaching strategies like inquiry-based approach to ensure that students acquire successful experiences at the beginning of learning about science, they will perform well and develop positive attitudes (Bicer & Lee, 2019).

Objective

The objective of this study was to investigate students' attitudes towards Biology when learning though inquiry-based approach in Githunguri sub-County, Kiambu County, Kenya

THEORETICAL REVIEW

The study was based on two the Experiential Learning Theory (ELT) proposed by Kolb (1984) and the theory of Constructivism proposed by Bruner (1961)**.** The experiential learning theory by Kolb is based on four different steps which include concrete experience, reflective observation, abstract conceptualization, and active experimentation. Effective learning occurs when a student has a concrete experience, observes and reflects on it. This process results in the production of abstract concepts and generalizations, which are subsequently applied to test hypotheses in new life situations. According to Kolb, learners enter the cycle of learning at any stage but the stages should be followed sequentially. Reflection is the key that would lead to new understanding. The theory indicates that students have different styles of learning which include divergence, assimilation, convergence or accommodation. While the aspect of inquiry-based teaching is recognizable in each category, the accommodation groups are most comfortable with experiential approaches.

Jerome Bruner's theory of Constructivism emphasizes students as custodians of their learning and captures learning by doing where students focus on problem-based learning. It presents science concepts by relating it to the real world. In teaching, there is always a relationship between facts and concepts for conceptual understanding to solve problems which ensures the transfer of knowledge acquired, enhances understanding of the subject under discussion, and promotes retention. These theories are relevant because, like inquiry-based approach, they engage students to learn, experience the process of learning through hands-on activities, creating their own knowledge and acquiring skills

RESEARCH METHODOLOGY

This research adopted both qualitative and quantitative research methods Shorten and Smith (2017), described mixed research method as a methodology in which qualitative and quantitative data are gathered, analyzed, and evaluated within the same study. According to Mohajan (2020), quantitative research method is used to quantify attitudes, opinions, behaviors, and other defined variables and generalize results from a larger sample population by the way of generating numerical data. Quantitative research is preferable because of its creative characteristics and strengths. The study employed the descriptive research design. It targeted 37 public secondary schools, 29 Biology teachers and 1,194 Form 3 students. Purposive sampling was used to select 11 schools with laboratories and 14 teachers with experience. Simple random sampling was utilized to select 344 students. Questionnaires were used to collect data from the students while teachers were interviewed to provide information about on the research objective. The data was analyzed using descriptive analysis.

During data collection, the researcher obtained consent from relevant institutions to facilitate the collection of data. Following approval from NACOSTI and the sub-County Education Officer, individual school principals were contacted to schedule visits with the research participants. All of the students agreed to participate in the study by signing the consent form. During the process of data collection, the researchers administered the questionnaires to the students. The tools applied to obtain information involves questionnaires for Form 3 students and interview for Biology teachers.

Research Variables

According to Gould (2001), a variable is something that changes or varies. This study's independent variable (IV) was utilization of IBA, while the dependent variable (DV) was students' attitudes towards Biology. The intervening variables are outlined as students' motivation, teachers' level of training, and availability of resources. The effective interactions of these intervening variables and the independent variable should influence the dependent variable.

STUDY FINDINGS

Findings from Students' Questionnaires on their attitudes towards Biology

Table 1: Response from students on their attitudes towards Biology.

Statements	Agree	%	Not sure	%	Disagree	%
1)I like Biology	270	78.6	24	7.1	49	14.3
2)In my Biology class, I learn about interesting things in the lesson	197	57.2	24	7.1	123	35.7
3)I enjoy learning Biology	221	64.3	24	7.1	98	28.6
4)I prefer Biology more than other subjects at school	197	57.1	24	7.1	123	35.7
5)I regret choosing to do Biology	78	28.5	0	0.0	246	71.5
6)Biology is difficult to understand no matter how hard I try	123	35.7	0	0.0	221	64.3
7)I perform poorly in Biology	172	50.0	49	14.3	123	35.7
8)I perform better in Biology	123	35.7	49	14.3	172	50.0
9)I have good understanding about Biology	147	42.9	0	0.0	197	57.1
10)Biology is one of my favorite subjects	221	64.3	0	0.0	123	35.7
11)My Biology teacher gives me opportunity to ask questions in class	271	78.6	0	0.0	73	21.4
12)I become excited doing Biology practical in my school.	270	78.6	0	0.0	74	21.4
13)I collaborate with my classmates during practical in Biology	246	71.5	0	0.0	98	28.5
14)I do not have the opportunity to do practical in Biology	246	71.5	0	0.0	98	28.5
15)I like more of practical work in Biology lessons	270	78.6	0	0.0	74	21.4
16)My interest to study Biology is to pass exam	270	78.6	0	0.0	74	2.4

N=344

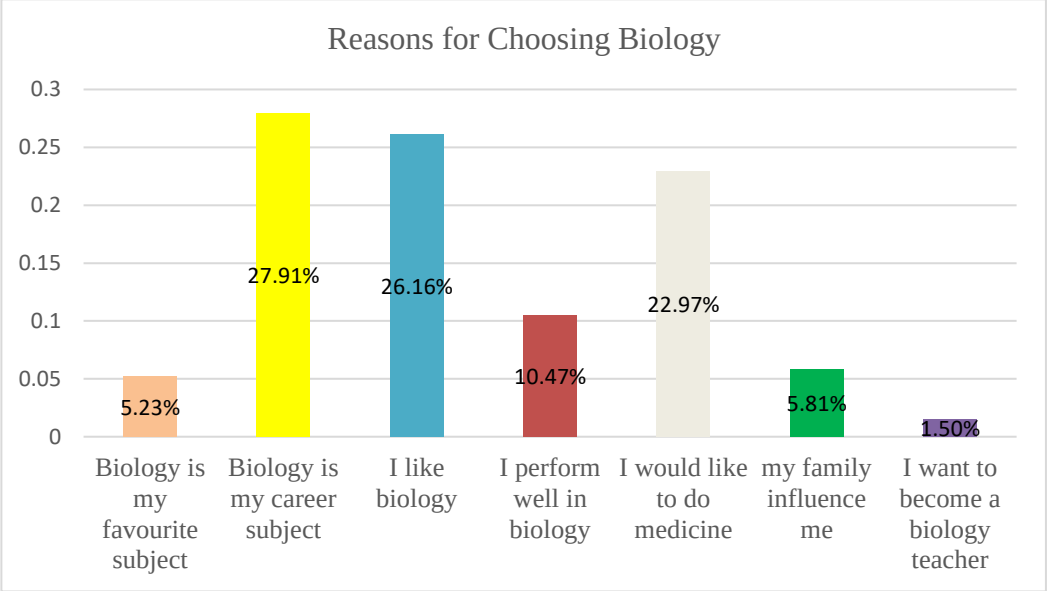
The results in Table 1, shows that 78.6% of the students agree they like Biology, 57.2% of students said, they learn about interesting things in Biology lesson, but 35.7% disagree. The data also shows that 64.3% of the students enjoy learning Biology, while 28.6% of the students disagree to the statement. The findings indicates that 57.1% of the students prefer Biology more than other subjects at school, while 35.7% disagree to the statement. The data reveals that 71.5% of the students disagree that they regret choosing to do Biology whereas, 28.5% regret choosing to do Biology. Moreover, 35.7% of the students said Biology is difficult to understand no matter how hard they try and 64.3% said Biology is not difficult. The data presented shows that 50% of the students perform poorly in Biology, while 35.7% disagree to the statement. The findings further shows that 42.9% of the students have good understanding about Biology, whereas 57.1% did not agree to the statement.

The data also shows that 64.3% of the students agree that Biology is one of their favorite subjects, while 35.7% of them disagree to the statement. Additionally, 78.6% of the students agree that their Biology teacher gives them opportunity to ask questions in class, whereas 21.4% did not agree. In the Table, 78.6% of the students agree that they become exited doing Biology practical in my school, while 21.4% were not excited. The results reveals that 71.5% of the students agree that they collaborate with their classmates

during practical in Biology, while 28.5% disagree to the statement. According to the results, 28.4% of the students do not have the opportunity to do practical in Biology, whereas 71.5% agree to the statement. The report also shows that 78.6% of the students like more of practical work in Biology lessons, while 21.4% disagree that they like more of practical lessons, 78.6% of the students agree that their interest to study Biology is to pass exam, whereas 21.4% disagree to the statement.

The students were further asked to state why they chose Biology and the results are recorded in Figure 1.

Figure 1 Reasons for Choosing Biology



N=344

Figure 1 shows that 27.91% of the students chose Biology because it is a career subjects, 26.16% selected Biology because they like it, and 5.23% selected Biology because it is their favorite subject. On the other hand, 22.97% chose Biology to become a doctor or nurse in the future, while only 10.47% chose Biology because they perform well in it. A few of the students representing 5.81% were influenced by their relatives to choose Biology, while only 5.23% chose Biology because they prefer to become Biology teachers.

Findings from Teachers' Interview Schedule on students' attitudes towards Biology

In an interview with the 14 Biology teachers, on students' attitudes towards Biology, it was found that 10 of the teachers representing 71.43% responded that students have positive attitudes towards Biology, while the rest of the four teachers representing 28.57, said students have negative attitudes towards Biology.

The teachers stated that "students have positive attitudes because they love the practical part of Biology since they relate it to nature. We use this botanical garden for practical too and it creates joy in the students. Another teacher said, "Students prefer studying Biology because Biology is associated with real life. In a statement, another teacher said "the reason students chose Biology is that Biology is linked to their dream or future career."

However, some teachers said, "Students have negative attitudes towards Biology, because they see the subject as difficult, challenging and they consider some experiments are complicated. According to the teachers, students had love for the subject at first but with time, the use of terminologies, they got discouraged. Other teachers said that, some students think that Biology is too demanding in terms of key words during writing of examinations. According to the teachers, as the students' progress from form 1 to form 3, their attitudes decrease negatively.

In finding solution to improve on the attitudes of students, majority of the teachers said "students need to be encouraged and we need more materials to help them understand those concepts they find difficult to understand. According to the teachers, "if you show the students how those things that they cannot see work, they will like Biology". Another group of teachers said**,** "There should be openness in terms of how the KCSE exam is marked. Test questions should be valid not strange questions appearing in the exams. This will motivate the students. But if they continue to see strange questions and fail, it will discourage those coming after them from taking biology."

DISCUSSION

According to Prokop et al. (2007), students' positive attitudes are derived from the interest they have in practical activities during Biology lessons. The findings in Table 1 shows that 78.6% of the students like Biology. This was crosschecked in an open-ended question for the students about why they chose Biology. According to the responses of the students presented in Figure1, 26.16% of them chose Biology because they like it, 22.97% selected Biology because they want to do medicine, and 27.91% chose Biology because it is a career subject. This is what Nandasari (1995), and Rani (2000), said that if students develop positive attitudes towards Biology, they will continue studying the subject, perform well, and choose careers in the subject.

Data in Table 1 shows that 57.2% of the students learned about interesting things in Biology lesson, while 64.3% of the students enjoy learning Biology. As a result of this, half of the students' responses show that 57.1% of the students prefer Biology more than other subjects at school. This findings correlates to that of Diaz et al. (2021) and Eccles and Wigfield (1995) who found that when students believed a certain activity will benefit them in achieving their own career goals, they will pursue and prefer it. According to the data, 71.5% of the students collaborate with classmates during practical in Biology. According to Diaz et al. (2021), students prefer more hands-on science activities, in-depth research, and engaging discussion while learning Biology. This is true of the research data, where 78.6% of the students like more of practical work in Biology lessons.

According to DiBiase and McDonald (2015) attitudes towards Biology is closely related to motivation and it influences performance. The results reveal that 71.5% of the students did not regret choosing Biology.

The data indicates that 64.3% of the students said Biology is not difficult. The researcher also interviewed Biology teachers about the attitudes of students towards Biology. According to the findings, 71.43% of the teachers said students have positive attitudes towards Biology. However, despite the responses that most students like Biology, the number of students who are well performing in Biology is low. According to the results in the Table, only 35.7% of the students perform better in Biology, while 50% of the students perform poorly in Biology.

According to Nandasari (1995), most students express interest in studying Biology, but some of them perceived Biology as difficult, challenging and complicated. This is confirmed in this study as some of the students found Biology as difficult. According to the data, 57.1% of the students agree that they do not have good understanding in Biology, except 42.9% of them who have. The data reveal that 28.5% of the students regret choosing Biology. This result corresponds to the findings found in Table, where 35.7% of the students said Biology is difficult to understand no matter how hard they try. In an interview with Biology teachers, it was found that some students find Biology difficult to understand due to hard terminologies. As recorded in the Table, 50% of the students agreed that they perform poorly in Biology. As a result, most students just study and memorize the concepts to pass the subject and not seeking to understand the concepts of Biology. According to the data, 78.6% of the students agree that their interest to study Biology is to pass the exam. This was summed up in an interview with the teachers where it was found that 28.57% of the students have

negative attitudes towards Biology.

The respondents, in an interview remarked that some students coming in Form 3 have weak entry behaviour in Biology. They are shy and extrovert and cannot present or collaborate with their colleagues making it difficult and unnecessary to frequently implement IBA. This finding mirrors that of Kaya et al. (2021), who found that students' readiness to learn through inquiry-based teaching activities affected teachers' ability to implement IBA. The finding also support that of Chichekian et al. (2016), who said that teachers' ability to utilize inquiry teaching declined because of the changes in students' academic abilities, interest in the subject, and involvement in the lesson. In finding solutions towards this problem, some teachers suggested that programmes in enhancing students' conceptual understanding of Biology should be initiated to enhance quality entry behaviours and performance among students. Teachers also need to be facilitated with resources and internet facilities to use more of IBA so as to enhance positive attitudes towards Biology and improve performance.

When the teachers were asked to suggest how to improve students' attitudes or interest towards Biology, majority of the teachers suggested that encouragements, provision of resources which include computers and internet facilities to enable students do research on some topics. They also stated that there should be openness in the KCSE examination in terms of how it is marked. Test questions should be valid and not strange questions appearing in the examinations. Moreover, the teachers said that checking on students' entry behavior in Biology before promotion is key. Thus, the 100% transition which refers to the promotion of all students at the end of each academic year despite their performance in Kenya, needs to be supplemented by organizing programs that will enhance students' conceptual understanding of Biology. According to the teachers, this will create seriousness in the students and motivate them to pursue the study of Biology with positive attitudes and improved academic performance. This finding corresponds to that of Waseka and Simatwa (2016) and Njue et al. (2018), who raised the concern over the attitudes of students that is, how they behave towards Biology on a national level in Kenya. Owino et al. (2015) and Muthoni (2012), also stated that an individual with an unfavorable attitude will lead to dismal performance.

CONCLUSION

It was concluded that most Form 3 students have positive attitudes towards Biology. Students viewed Biology as an easy subject and they enjoy learning about it. However, it was revealed that some of the students have weak entry behavior and lack basic understanding in the subject. They find Biology difficult to understand due to hard terminologies in Biology. This resulted to poor performance of some Form 3 students in the subject. As a result, the interest of the students was to study and pass Biology examinations.

On the basis of the findings, it is concluded that encouragement and a range of factors such as availability of resources which include computers and internet facilities, are key to helping students understand difficult concepts and do research in Biology. Moreover, sufficient time, motivating students and ensuring the validity of test questions in the Biology papers set for the Kenya Certificate of Secondary Education (KCSE), will facilitate the development of positive attitudes and interest in Biology.

RECOMMENDATIONS

It is recommended that students should be encouraged by motivating them. Teachers and parents should continually encourage students to take learning of Biology seriously since it is a career subject. Also, programmes that will improve students' conceptual understanding of Biology should be initiated to enhance their entry behaviours. Teachers should simplify the use of difficult terminologies in Biology to alleviate fears, thereby developing positive interest in students. Biology teachers should be facilitated with resources and internet facilities to use more of IBA so as to enhance students' positive attitudes towards Biology.

Teachers should be provided with more resources and internet facilities to simplify Biology concepts and terminologies in order to alleviate fear of Biology difficulties in order to encourage students' interest and positive attitudes towards the subject.

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