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Effects of Two Instructional Strategies on Students' Engagement in Biology Classes

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Abstract. Biology has a wide area of application which includes clothing & textiles, food &beverages, bio- entrepreneur, protecting oneself and educating others. Additionally, Engagement of students in the instructional process is expedient if their interest and attention are to be sustained. Despite the importance, students are not properly engaged in classes. Thus, this study examined the effects of two instructional strategies (Enhanced Inquiry and 5Es Model) on students' engagement in Biology classes. Mental ability and gender were incorporated as moderator variables. The theory of constructivism guided the study. Three hypotheses were tested at 0.05 level of significance. The research adopted the pretest, post-test non-equivalent control group, quasi experimental design. A total of 345 students in six intact classes and six Biology teachers were involved in the study. Data were collected using Classroom Engagement Inventory (CEI) and Mental Ability Test (MAT). ANCOVA as an inferential statistics was used to test the hypotheses. The results revealed that treatment had a significant effect on students' engagement. However, Enhanced Inquiry instructional strategy had the most significant effect on students' engagement. There was no significant effect of mental ability/ gender preference on students' engagement in Biology classes. It can therefore be inferred that enhanced inquiry is an effective strategy. Mental ability and gender are not prerequisites for being engaged in classes. Recommendation included that teachers should embrace Enhanced Inquiry strategy during the instructional process in order to foster student engagement. Inaddititon, both male and female students should be treated equally with no preference for one.

Keywords: Enhanced inquiry, 5Es model, mental ability, gender, engagement

1. Introduction

Student engagement involves interaction between time, exertion and other vital resources devoted by both students and schools with the drive of improving student's experience and increasing their learning outcomes and improvement .Fredericks, Blumenfeld & Paris (2004), showed three dimensions to student engagement namely: behavioural, emotional and cognitive engagement. Emotional engagement can be described as students' affective reactions to classroom activities, (i.e. students are enjoying the lessons; Van Uden, Ritzen, and Pieters 2014). Students are seen as being behaviourally engaged when they participate in observable behaviour directly linked to the learning process (Skinner 2016). Nguyen, Cannata, and Miller (2018) divided behavioural engagement into passive behavioural engagement (e.g. paying attention in class) and active behavioural engagement (e.g. asking questions, putting effort into assignments). Cognitively engaged students know the benefit of their education (i.e. formulate their own learning goals; Distinguishing these different aspects of student engagement does not mean, however, that they are independent or exclusive (Van Uden, Ritzen, and Pieters 2014). For students to enjoy the lesson (emotional engagement), they also have to pay attention (behavioural engagement).

Engaging students during the learning process has been shown in literature to raise their attention and focus, inspire them to practice higher level critical thinking skills and stimulate meaningful learning experiences (Ruglin Anisa, S. & Zalizan, 2014; Brennan, 2017; Ahmad,Ardy, & Rosnainis, 2017). Engaged students are seen as taking possession for their own learning (Velden, 2013). Also, students'

engagement is an essential requirement for excellent learning (Barkoukis et al 2014, Skinner, 2016).

According to Programme for International Students' Assessment (PISA), the assessment of science literacy revolves around students' capacity to engage with science-related matters, and with the thoughts of science, as an insightful citizen. In 2018, PISA result indicates that there was a decline in the average science literacy scores as compared to a previous cycle. Out of the 53 education systems that took part in both 2006 & 2018, only 19 education systems showed an increase in science literacy scores while 34 education systems showed a decrease in science literacy scores. It therefore implies that there was a decline in students' engagement in science. Additionally, the West African Examinations Council (WAEC) statistics indicated that the percentage of credit pass in Biology was below 40% from 2007-2012 while there was increment from 2013-2016 because the percentage of credit pass was significantly over 50% however, 2018 witnessed a drastic reduction to 49.9% of credit pass compared to 59.21% of 2017. This can be linked to a decrease in students' engagement during instructional processes.

The importance of student engagement as a predictor of academic success has been reported in literature. (Rodgers, 2008, Roberts & McNeese, 2010). Researchers discovered that effectively performing an activity can positively impact subsequent engagement (Schunk & Mullen, 2012). The 21st Century students, are intensely social and interactive learners. The students sampled by Willins, Fresen & Milton (2009) showed that students wanted to interact with people both within and beyond the classroom and school environment. Today's learners want to connect and communicate constantly and want an environment to support these connections. In addition, it is discovered that students who were formerly enthusiastic are becoming disengaged with science education as they move through the mandatory school system (CBI, 2015). This problem has been associated with the manner science is taught in primary and secondary schools. (Archer et al 2012). It therefore implies that instructional strategy has a role to play in students' engagement during classes.

2. Instructional Strategy and teaching of Biology

Instructional strategy is a method used in teaching and learning process which assists to induce students' curiosity about a topic, engage students in learning and explore critical thinking skills for comprehension of the content taught. Different strategies such as animated media instructional strategies, collaborative learning strategy, problematic analogy strategy of instruction have been used in teaching Biology. Specifically, in biology, according to Jeronen, Palmberg and Yli-Panula (2016) who reviewed selected articles published in peer-reviewed scientific journals from 2006 – 2016 on teaching biology found twenty-two different teaching methods used in teaching biology. The most frequently used were fieldwork, interactive, experiential and experimental methods.

Jeromes et al (2016) emphasized that teaching methods are context and subject depended. So, it cannot be arranged in order of least effective or most efficacious. They however, give ideas of how to utilize the methods for increasing sustainability areas in teaching. They also reiterated the importance of inductive teaching methods with student centered approaches. Likewise, problem-based activities were emphasized as requirements for promoting students' interest in and knowledge of sustainability. The results of their analysis highlighted the necessity of research on comparison of different teaching methods.

Researchers have consistently compared different teaching methods in order to highlight their strengths and weaknesses. Among these researchers are Ajaja (2013), Abdullahi and Duyilemi (2013), Shamsuddeen & Amina (2016) and Amusa (2016). In recent times, research has shifted from comparing methods to integrating methods in order to enhance learning. It is in view of this that this research work is carried out and 5Es is integrated into inquiry to form enhanced inquiry. This is now tested in this research work in order to determine its efficacy.

2.1 The 5Es Model

The 5Es Instructional Model was developed by Roger Bybee (1997) and situated on constructivist-learning theory.

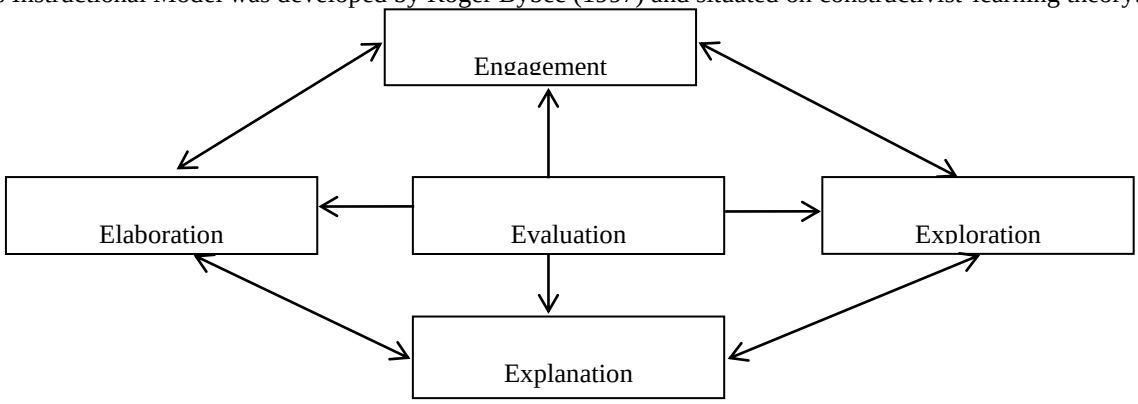

Figure 1: The 5Es Instructional Model
Source: *Science Education Review*

Engagement: This is the first phase where teacher identifies student prior knowledge and misconceptions. It is a student-centered phase. It can allow for the development of interest in learning of the new topic by the students.

Exploration: This is the phase that provides students with a usual, valid knowledge acquired. It is also a student-centered phase that integrates functional search. Students are motivated to put in process skills. The teacher acts as a facilitator

Explanation: This is the phase that allows students to explain their comprehension and be interrogated about the concepts they have been examining. The students explain their own ideas first before the teacher tries to give explanations. This phase allows student misconceptions that may emerge during the engagement or exploration phases to be clarified.

Elaboration: This phase is filled with activities which should motivate students to make use of their new comprehension of concepts, while strengthening new skills. Students are motivated to scrutinize their comprehension with their peers. They are also motivated to plan new experiments or models as a result of the updated skills or concepts they have gotten.

Evaluation: This phase is different from the assessment done in traditional science lesson. The assessment here includes both formal and informal. Portfolios, physical models, journal logs, concept maps can be used and might be evidence that students are learning. Students can also self-assess or peer assess. The evaluation could also be a summative one such as quiz or exam.

Research has been carried out on the use of 5Es among the researchers are Ezugwu (2019) who carried out a research on the comparative analysis of the impact of 5Es constructivist instructional and lecture methods on students' achievement in biology. Findings from this study showed that 5Es Constructivist Instructional Method had significant effect on students' achievement than the conventional lecture method. Also, Nwagbo and Obiekwe (2010) investigated the effects of constructivist instructional approach on students' achievement in basic ecological concept in Biology. The result revealed that constructivist instructional approach was more effective in facilitating students' achievement in ecological concepts. Ibe (2017) ascertained the effects of engaging learners with Constructivist-Based Instructional Model (CBIM) for achievement and self-concept in Biology in a learner-centered Science classroom. The constructivist instructional approach used here is the 5Es. Students taught with constructivist method show evidences of knowledge retention than those taught with lecture method. Most of the researches carried out using 5Es is to determine its effectiveness on students' achievement. It is expedient to explore its effect on students' engagement as students' engagement is also an important variable that must be studied as it also determines students' present and future success.

2.2 Enhanced Inquiry

Enhanced inquiry as it is being used in this study entails integrating 5Es with inquiry. Inquiry used in this study involved the following:

Use of Pictures and Materials

Pictures allow for quick absorption of great amounts of data. A photograph is valued like a thousand words through which a complex idea can be transferred with just a single still image. Pictures make it possible to absorb large amounts of data quickly. Alenizi(2015) worked on the use of photography to support the learning process of science teachers and established that visual media such as images and photographs allow students to grasp some concepts of science subjects, precisely biology, physics, and chemistry. He therefore, advocated for the inclusion of visual media in the curriculum. Quillin & Thomas (2015) opined that it is challenging to imagine teaching, learning, or doing biology without the use of pictorial representations. They emphasized that as in other STEM disciplines, the three-dimensional and time-based dimensions of biology span many orders of enormousness and involve difficulty that dares the confines of human understanding. Pictorial representations are potent tools, because they help to make the unnoticed seen and the difficult simple.

Reflection and Students Personal Journal

Reflection involves considering, examining and thinking about the content of the lesson. Students' personal journal refers to a place for personal ideas, where students record their thoughts, actions and outcomes in the process of building their knowledge. Awodun(2020) in his study on reflective teaching strategy found that the students taught using this strategy produced better achievement . Scharmann, & Butler, (2015) in their study found that students' journaling helps in assessing their learning and it assisted students' to shift from the level of not informed to being informed. Al-Rawahi& Al-Balushi(2015) discovered in their study that students reflective journal writing allows better performance in their self-regulated learning strategies

Class Project and Small Group Discussion

Project based learning is a student-centered pedagogy that requires a changing classroom approach. Project based learning (PBL) centres education on the students, not the curriculum a shift directed by the global world, which rewards intangible assets such as drive, passion, creativity, empathy and resiliency. Hugerat (2016) worked on project based learning strategies and how it affects the classroom learning environment. He discovered that students who learnt science by project based learning strategies observed their learning environment as being enjoyable with more teacher supportiveness and teacher-student interactions as expressively more progressive.

Small group discussions renew thoughts and find answers to problems. A small group is an operational method used by diverse schools with anticipated learning results Meo (2013).There is no set number for an ideal small group. We usually define a small group as 8–12 learners facilitated by a teacher. It is a student-centered method where all students connect with each other in an unrestricted discussion on a specific topic and participate in dynamic learning. It stimulates interrelated worldview, relations among disciplines and presents an extended opinion of subject matter (Kingston, 2018). Anammalia, Manivel & Palanisamy(2015) worked on a research titled "Small group discussion: Students perspectives" and found that small group discussion was collaborating, pleasant, and bridged the gap between the teacher and student. The student's communication abilities were also enhanced.

Hugerat (2016) worked on project based learning strategies and how it affects the classroom learning environment. He discovered that students who learnt science by project based learning strategies observed their learning environment as being enjoyable with more teacher supportiveness and teacher-student interactions as expressively more progressive. For this study, the strategies stated above were combined and 5Es integrated into it to form enhanced inquiry. Its effect on students' engagement was now explored.

Gender And Mental Ability

Gender in this study was used as a moderator variable. Gender is the state of being male or female in relation to the social and cultural roles. One of the millennium development goals (MDGs) is gender equality. Odagboyi & Fatokun (2011) observed that in most societies, the roles of women are knocked to the floor preventing them from participating in development efforts. They also discovered that subjects like science and mathematics are branded as masculine while home economics, secretarial studies are branded as feminine. Nwona & Akogun(2015) also noted imbalance against women in science, technology and mathematics.

Gender differences in academic achievement of students have been examined. Gender is one factor that has effect on students' academic performance especially in science .Olasehinde & Olatoye (2014) indicated that there was no significant difference in achievements between male and female students in their various science subject.

In Nigeria, it is a belief that male students are at the forefront in comparison to their female counterparts (Adigun, Onuhunwa Inunokhai, Soda and Adesina, 2015). However, educational statistics and worldwide media have reported a clear gender gap in academic

achievement between males and females with boys lagging behind girls (Van Zanden & Parker, 2018). Majzub & Rain (2010) found that girls were outperforming boys in almost all subject whether they were science majors or not. In addition, mental ability is also a moderator variable in this study. Mental ability refers to the power to learn or retain knowledge. It is also referred to as the possession of the qualities required to do something or get something done.

Mental ability is manifested through intelligent behavior of an individual. The person with normal intellectual ability will be able to observe, understand, learn, think, remember and deal with situations effectively. Onabayo (2007) states that mental ability is related to mental perception, ability for abstract thinking and capacity to identify patterns in things. It is also related to sequence and order in nature and ability to do logic and interpret data, resulting in the generation of important information. Sangodoyin (2011) found students' mental ability to have significant effect on achievement in Biology as students with high mental ability performed better than those with low mental ability.

2. Statement of the Problem

In 2018, PISA result indicated that there was a decline in the average science literacy scores as compared to a previous cycle. Out of the 53 education systems that took part in both 2006 & 2018, only 19 education systems showed an increase in science literacy scores while 34 education systems showed a decrease in science literacy scores. It therefore implies that there was a decline in students' engagement in science. WAEC statistics of students' performance in biology also showed a decline. Students who were formerly enthusiastic are becoming disengaged with science education as they move through the mandatory school system (CBI, 2015). This problem has been associated with the manner science is taught in primary and secondary schools (Archer et al 2012). Instructional strategy therefore plays an important role in determining how students are engaged in biology classes and have been identified to be critical in students learning. Also, the 21st Century workforce demands that learners should have acquired certain skills such as; collaborative, critical thinking, imaginative, and valiant innovative in order to function effectively at job places and imbibe lifelong learning. Therefore, there is the quest for instructional strategies that can support these features. It is against this backdrop, that this study sought to examine the effect of enhanced inquiry and 5Es model instructional strategies on students' engagement in biology classes.

3. Purpose of the Study

The main purpose of the study was to examine the effects of enhanced and 5Es instructional strategies on students' engagement in Biology classes.

Specifically the study sought to:

- Determine the effect of enhanced inquiry and 5Es model instructional strategies on student' engagement in Biology classes
- Determine the effect of gender on students' engagement in Biology classes
- Examine the effect of mental ability on students' engagement in Biology classes

4. Research Hypotheses

The following hypotheses were postulated to guide the study:

Ho_1: There is no significant main effect of enhanced inquiry and 5Es model on students' engagement in Biology classes.

Ho_2: There is no significant main effect of gender on students' engagement in Biology classes.

Ho_3: There is no significant main effect of mental ability on students' engagement in Biology classes.

5. Methodology

The research design adopted for this study was the pretest, post-test non-equivalent control group, quasi experimental design. The study employed the 3x2x3 factorial design to match the independent and moderator variables.

Table 1: 3x2x3Factorial Matrix of the Study

Instructional strategies	**Gender**	**Mental ability**		
		High	**Medium**	**Low**
Enhanced inquiry (Treatment)	Male Female			
5Es (Treatment	(1) Male (2) Female			
Lecture method (Control)	(1) Male (2) Female			

The study specifically involved all SS II Biology students in six public co-educational secondary schools. The class was chosen because the topics to be treated in the study are in SS 2 syllabus and because they are not writing any public examination such as WAEC, NECO and JAMB as this will not interfere with the study. The six schools that were selected are co-educational schools because gender effect was investigated in this study.
Multi stage sampling technique was used to select the samples for the study.
For this study, two stages of multistage sampling technique were used to select the samples.

Stage 1: Random sampling technique was used to select two educational districts out of the six districts in Lagos State.
Stage 2: Stratified random sampling was used to select six co-educational schools out of the two educational districts selected for the study. The strata used were districts, local governments, co-educational schools and teachers' qualification.
This was done by selecting three schools from each educational district making a total of six schools that were utilized for the study. Random sampling was used to select two schools for each experimental and control group. Two schools for 1st experimental group, 2nd experimental group and the control group that is the three groups utilized two schools each. Six intact classes in these schools were used for all the streams. A total of 345 students and six teachers were involved in the study.

6. Data collection

The pretreatment was administered for one week and it involved the administration of classroom engagement inventory (CEI) and mental ability test (MAT) to both the experimental and control groups. The use of treatment was implemented over a period of 8 weeks to SS 2 Biology students in the two treatment groups while the control group was exposed to lecture method. During engage phase of enhanced inquiry the students observe the pictures and material given to them, reflect on these and give idea of what they already know or think about them. Exploring phase involves the use of personal science journal and reflection where the students construct their understanding of the topic being taught. During explanation, students are involved in small group discussion, where students connect their previous experiences with current learning, make conceptual change of the main ideas.
In addition, Elaboration here involves applying the experiences gained/knowledge acquired to work on the class project. Also here, the students will see how what has been taught could help in the project which is a new situation. Evaluation here involves oral knowledge of the concept taught.

The 5ES treatment involves engagement, exploration, explanation, elaboration and evaluation phases. Classroom engagement inventory was also given to each student after the intervention period to determine the effect of each strategy on their engagement in class. The data collected using these instruments was therefore analyzed using descriptive and inferential statistics. The descriptive statistics used was mean. The inferential statistics tool used was ANCOVA precisely for testing the hypotheses which was rejected at a probability value less than or equal to 0.05 (5% alpha level). It was used because a covariate was involved.

7. Results

The descriptive table for the pre and posttest mean scores of students' engagement based on independent and moderator variables can be found below:

Table 2: Pre and Post-test Mean Scores of Students Engagement in various groups

Variable	Category	N	Pre-test mean Engagement	Post-test mean Engagement	Mean Difference
Treatment	Enhanced Inquiry	345	5.155	5.931	0.776
	5ES model	345	4.432	4.844	0.412
	Control	345	3.5137	4.094	0.581
Gender	Male	192	4.343	4.874	0.531
	Female	153	4.235	4.869	0.634
Mental ability	High	41	4.446	5.084	0.639
	Medium	75	4.439	5.024	0.585
	Low	229	4.202	4.763	0.561

Testing of Hypothesis

Table 3: Summary of Analysis of Covariance (ANCOVA) of Engagements by Treatment, Gender and Mental Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	212.832	24	8.868	20.255	.000	.565
Intercept	142.246	1	142.246	324.892	.000	.464
Pre Engagement	.000	1	.000	.001	.980	.000
Treatment	67.474	3	22.491	51.370	.000	.291
Gender	.048	1	.048	.109	.742	.000
Mentalability	.863	2	.432	.986	.374	.005
Treatment * Gender	1.009	3	.336	.769	.512	.006
Treatment * Mentalability	1.332	6	.222	.507	.803	.008
Gender * Mentalability	.058	2	.029	.066	.936	.000
Treatment * Gender * Mentalability	5.957	6	.993	2.268	.037	.035
Error	164.184	375	.438			
Total	9870.271	400				
Corrected Total	377.016	399				

Table 4: Parameter Estimates of Treatments for Engagements

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval Lower Bound	Upper Bound	Partial Eta Squared
Intercept	4.157	.220	18.872	.000	3.724	4.591	.474
Pre Engagement	-.018	.061	-.297	.767	-.137	.101	.000
5Es	.766	.103	7.439	.000*	.564	.969	.123
Enhanced Inquiry	1.866	.132	14.189	.000*	1.608	2.125	.338
Control	0[a]	.	.	.	.	.	.

a. This parameter is set to zero because it is redundant (Control). Dependent Variable: Post Achievement.
* Main effect is significant at 5% level.

Table 5: Post-Hoc Tests: Pairwise Comparisons of Means for Engagements

Dependent Variable: Post Engagement

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
5Es						
	Enhanced Inquiry	-1.100*	.104	.000	-1.375	-.825
	Control	.766*	.103	.000	.493	1.039
Enhanced Inquiry	5Es	1.100*	.104	.000	.825	1.375
	Control	1.866*	.132	.000	1.518	2.215
Control	5Es	-.766*	.103	.000	-1.039	-.493
	Enhanced Inquiry	-1.866*	.132	.000	-2.215	-1.518

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

Ho_1: There is no significant main effect of enhanced inquiry and 5Es model on students' engagement in Biology.

The test for significant main effect of treatment on students' classroom engagements in Biology is determined using analysis of covariance (ANCOVA).The results in Table 4.72 revealed a significant main effect of treatment on students' classroom engagements in Biology at $F_{(3,375)}= 51.37$, $p=0.000$ ($p<0.05$).Hence, there is significant main effect of treatment on students' classroom engagements in Biology. Therefore, hypothesis 1 is rejected. The most significant treatment effect is determined using parameter estimation.

The parameter estimates results revealed that enhanced inquiry has the most significant main effect on students' classroom engagement at $t = 14.189$ ($p<0.05$), followed by 5Es at $t = 7.439$ ($p<0.05$). Further, enhanced inquiry and 5Es treatment methods are 0.338 (33.8%) and 0.123 (12.3%) times more likely to increase students' classroom engagement than lecture method (control) respectively. Also, a unit increase in enhanced inquiry and 5Es will increase students' classroom engagement by1.866,

and 0.766 respectively. The results are further supported using pairwise comparison of main effects (post-hoc analysis).
The pairwise comparison results indicated that enhanced inquiry is the most effective teaching method which significantly influences students' classroom engagements, since there is significance mean difference compared to other teaching methods at 5% level.

H_{O2}: There is no significant main effect of gender on students' engagement in Biology.

The test for significant main effect of gender on students' classroom engagement in Biology is determined using analysis of covariance (ANCOVA). The summary of ANCOVA from table 4.72 results indicated that gender had no significant main effect on students' engagement in Biology after controlling for the effect of pretest engagement scores $F_{(1,375)} = 0.11$, $p = 0.74 (P > 0.05)$. Therefore, hypothesis 2 is accepted. Hence, there is no significant main effect of gender on students' classroom engagement in Biology. Consequently, there is no gender preference on students' classroom engagement in Biology.

H_{O3}: There is no significant main effect of mental ability on students' engagement in Biology.

The test for significant main effect of mental ability on students' classroom engagement in Biology is determined using analysis of covariance (ANCOVA) from table 4.72. The summary results indicated that mental ability has no significant main effect on students' engagement in Biology $F_{(2,375)} = 0.99$, $p = 0.374 (p > 0.05)$. Therefore, the hypothesis is accepted. Hence, there is no significant main effect of mental ability on students' classroom engagement in Biology. Further, there is no mental ability preference on students' classroom engagement in Biology.

8. Discussion and Conclusion

The test of hypotheses indicated that there was significant effect of treatment on students' engagement. The enhanced inquiry was significantly effective in enhancing students' engagement better than the 5Es model. This may be as a result of various activities, learn more sessions, class projects among others incorporated into enhanced inquiry. This will increase students' enthusiasm towards learning and they see themselves as being involved in their learning activities. Enhanced inquiry involved small group discussion where students can learn how to respect each other's view. During the class project students learned how to cooperate with others in order to accomplish task given. The discussion improved students understanding of a particular concept and even benefit more than what a textbook can offer. Both class project and discussion helped in developing students' inquiry, interpersonal and creative skills. Students' use of personal science journal assisted in the development of their thinking skills. Students who were shy penned down their ideas in their personal science journal at first and were encouraged to contribute their ideas as the lesson went on. Furthermore, reflection done by students allows them to learn something new.

The finding in this study is in consonance with the work of Kennedy et al. (2018) in which inquiry method allowed students to be more engaged, focused and on task, discover, draw conclusions and report their findings, reasoning and problem solving abilities indicating the positive effect of inquiry on students' engagement. Similarly, Brennan (2017) found that inquiry method promoted students' engagement and skills in discourse and argumentation increased indicating the positive effect of inquiry on students' engagement'. Wheatley (2018) also found that there was a positive shift in students strongly agreeing with being more on task, enjoying the lesson and becoming more curious.

The study also revealed that gender had no significant effect on students' engagement. It therefore indicates that gender should not be a determinant of students' engagement in classes as both male and female students could be engaged in class with no preferential treatment. This result is in agreement with the work of Kulitu (2014) who found that there was no statistically significant difference between male and female students in academic engagement. However, it is contrary with the study of Ronel (2016) who found that boys showed a more maladaptive profile in terms of engagement. Udeani and Odogwu (2011), Udeani (2012) have shown that girls appear to lose interest in STEM subjects with age and Ahmad et al (2017) study revealed that girls were significantly better than boys in affecting cognitive and behavioural engagement.

Irude & Elsa (2019) discovered in their study that female student were more behaviourally engaged than male students. This result is in disagreement with the present study.

In addition, the test of hypotheses indicated that mental ability had no significant main effect on students' engagement. It can therefore be deduced that students' mental ability does not determine their engagement in Biology classes as everyone has equal

chance of being engaged in class. Mental ability is not a prerequisite for being engaged in classes as students can be engaged irrespective of their mental ability level

This is in disagreement with the study of Mariam & Intan (2012) who found that mental ability levels may affect emotional engagement of those with low mental ability levels. Also, they found that cognitive engagement could be determined through the level of mental ability.

In addition, the study by Roger et al (2015) indicated that intellectual engagement (cognitive engagement) was significantly associated with level of cognitive performance (mental ability). This study is in disagreement with the present study in that mental ability had no significant effect on students' engagement.

Enhanced inquiry and 5Es instructional strategies utilized in this study have been found to affect students' engagement positively. However, enhanced inquiry had the most significant effect on students' engagement. The study indicated that enhanced inquiry is an effective strategy in enhancing students' engagement in biology classes. In addition, mental ability did not meddle with students' engagement. Also, gender did not affect students' engagement.

9. Recommendations

- Biology teachers should embrace enhanced inquiry in order to improve students' engagement in Biology classes.
- Gender did not affect the engagement of student therefore both female and male students should be treated equally by the teachers with no preference for one.
- Teachers should ensure that during group discussion, values such as listening to opinion of other students, not ignoring other students' views/ claims, evaluation of claim presented, judging the claims scientifically and accepting the claim that is superior and reaching a consensus must be adhered to.
- Enhanced inquiry should be included in the curriculum of teacher's education. Teacher Educators should be trained and professionally advised on the use of enhanced inquiry so that teachers-in-training in turn become acquainted with the strategy before they graduate from schools.

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