ENHANCING STUDENTS' ATTITUDES TOWARD BIOLOGY USING CONSENSUS AND COOPERATIVE REFLECTIVE JOURNAL WRITING EDUCATIONAL STRATEGIES

Saheed Ayodeji Adejimi, Wenceslas Nzabalirwa
University of Rwanda, Rwanda
E-mail: jimmysaheed@gmail.com, wenceslasn@yahoo.fr

William A. Shivoga
Masinde Muliro University of Science and Technology, Kenya
Email: shivoga@gmail.com

Abstract

Biology is a core and required science subject offered at the upper secondary school level in the Nigerian educational system. However, students' attitude towards the subject is poor, a trend probably due to the use of teacher-centred educational strategies. Scholars have thus advocated for the need to adopt innovative educational strategies to enhance students' attitude towards biology. This study investigated the use of consensus and cooperative reflective journal writing educational strategies in enhancing students' attitudes towards biology in two Local Government Areas (LGAs) within Ibadan Metropolis of Oyo State, Nigeria. The study adopted a quantitative pre-test-post-test, control group quasi-experimental design involving a 3x2 factorial matrix, with a positivist paradigm. Purposive sampling was used to select six schools across the LGAs while an intact class of upper secondary school II students was selected from each of the schools for a total of 305 participants. Two instruments, the Biology Attitude Questionnaire (BAQ) and the Students' Verbal Ability Test (SVAT) were used during the study. The data generated were analysed using the Analysis of Covariance (ANCOVA). Results showed that, treatments enhance students' attitudes toward biology. Results also revealed that students' verbal ability had effect on students' attitudes toward biology. The interaction between treatment and verbal ability was not significant to enhance students' attitudes toward biology. The two strategies, therefore, enhanced students' attitude towards Biology in the two LGAs within Ibadan metropolis of Oyo State, Nigeria. The two strategies should therefore be adopted in teaching Biology to upper secondary school students in Nigeria and elsewhere.
Keywords: *attitude toward biology, consensus strategy, cooperative strategy, reflective journal writing, verbal ability*

Introduction

Students' attitude is one of the most important secondary school learning outcomes. Its importance at this level is premised on the fact that career aspirations are formed at this level of education. Attitude is a construct of the affective domain and has received much attention from researchers in the last 40 years (Aiken & Aiken, 1969; Koballa & Crawley, 1985; Koballa, 1988) and is still continuing. Attitude occupies a central position that determines students' disposition towards a particular school subject. Students' attitude motivates them to pursue a particular course of study and continue in their efforts to attain a mastery level in the subject matter. Students' attitude towards a particular school subject is also reflected in the way they manage their perception and behaviour to the content being learnt. Thus, attitudes do not only

facilitate learning, they are products of students' learning (Smith et al., 2012). Attitude may refer to the predisposition in responding in a way that is either favourable or unfavourable in relation to a certain attitude object (Oskamp & Schultz, 2005). This attitude object may range from things like biology, biologists, biology lessons, topics taught in school biology, inquiry-based biology laboratory experiments, biology education research, biological weapons, and biotechnology (Cheung, 2011).

Two important reasons were adduced for enhancing students' attitude towards science. First, attitude is linked with academic success. Researchers like Bennett, et al., (2001) and Salta and Tzougraki (2004) reported positive correlations between students' attitude and achievement in chemistry. Salta and Tzougraki (2004) reported that the correlation value between students' achievement in and attitude towards chemistry ranges from 0.24 to 0.41. Bennett et al., (2001) reported that the students with less positive attitude towards chemistry had low achievement score in the chemistry examination. Russell and Hollander (1975) also observed that there is a strong relationship between attitude and achievement, but a positive attitude cannot be inferred from achievement alone. They further reasoned that, there is a possibility for a student who has developed a more positive attitude towards a subject to achieve a low score in that subject and vice-versa. This means, attitude can influence achievement, but achievement may not have influence on attitude. As Stark and Gray (1999), submitted, if attitude is given utmost consideration, the much-anticipated change in cognitive domain may be achieved.

The other reason for developing students' positive attitude towards science is its ability to predict behaviours (Glasman & Albarracín, 2006; Kelly, 1988). According to Kelly (1998), the preference for biology, chemistry, or physics in schools by British students was predicated on their likeness for that particular subject. Despite receiving enough attention from researchers in the last 40 years or more, the importance of attitude has often been played down in comparison to achievement when it comes to measuring educational outcomes by the society, curriculum planners and teachers. As Stark and Gray (1999) stated, one of the major responsibilities of the science teachers is to develop students' positive attitude towards science subject. This is summarized by Mager (1968)

"The likelihood of the student putting his knowledge to use is influenced by his attitude for or against the subject. Things disliked have a way of being forgotten .... One objective toward which to strive is that of having the student leave your influence with as favourable an attitude toward your subject as possible. In this way you will help to maximize the possibility that he will remember what he has been taught and will willingly learn more about what he has been taught".

Literature Review

Students' attitude towards a subject ought to be an essential concern during teaching and learning, and it is incumbent on teachers to note their students' attitudinal disposition towards their subject. For the teacher to achieve this, they must employ an effective pedagogy. According to Ebenezer and Zoller (1993), one of the variables that defines students' perceptions and invariably determines their attitude towards science courses in a science classroom is the educational strategy adopted by the teacher. Myers and Fouts (1992) stated, a classroom environment with varieties of strategies and unusual learning activities, couple with high level of students' involvement, personal support, and strong positive interaction among class members create/promote a strong positive attitude in the students towards science. This is corroborated by Koballa and Glynn (2007) when they stated that the "approaches to positively affecting student attitudes include instructions that emphasize active learning and the relevance of science to daily life" (p. 95).

There had been extensive research on students' attitude towards science, but only a handful research had been conducted on students' attitude on a particular subject like biology

244

(Hussaini, et al., 2015; Prokop et al., 2007; Shuaibu & Ishak, 2020; Usak, et al., 2009). "Studies on students' attitude towards Biology have evolved as a targeted area of study because researchers have demonstrated the role attitude plays in students' academic achievement", (Shuaibu & Ishak, 2020, p. 173). Borghans et al., (2008) stressed the need to effectively study students' attitude towards learning, because of its volatility compared to the cognitive abilities. This is because attitude is hard to form/develop, but once formed/developed, it becomes permanent.

An important variable that affects students' attitude towards biology is the quality of teaching adopted by the teacher in the classroom. There abound several research studies on the effects of varied educational strategies/pedagogy on students' attitudes, (Gibson & Chase, 2002; Wong et al., 1997). However, the conclusions from these studies are as varied as the studies themselves. The studies by Koballa and Glynn, (2007) and Shruba, (2008) concluded that the type of educational strategy students experienced in the classroom has an effect on their attitude towards the subject, but the study by Glynn et al., (2007) concluded otherwise. In order to contribute to the study on the effect of educational strategies in enhancing students' attitude towards biology, this study employed two modes of innovative collaborative educational strategies (consensus and cooperative reflective journal writings).

Studies on attitude using both forms of collaborative educational strategies are scarce in literature. Nevertheless, a few studies had been conducted on the effects of consensus and cooperative reflective journal writing educational strategies in enhancing students' attitude. Consensus is a form of collaborative learning. It is a decision-model to arrive at a unanimous decision agreeable to all after negotiation by individuals involved. It is a practice adopted by communities, organisation, and groups from prehistoric time (Schutt, 2001). The pillar upon which consensus is built is, the will of the people is paramount in any decision-making, and each and every individual's voice must be heard. In the classroom setting, the teacher decisions become a joint decision between the teacher and the students. This procedure ensures that authority and responsibility are shared between teacher and students in the classroom (Sartor & Young Brown, 2004). The benefit of the use of consensus is in its shaping of attitudes and opinions, and the enhancement rather than the evaluation (List, 2001).

Research literature grouped the consensus applied in classrooms into two model, the whole class consensus (Blinne, 2013; Mitchell et al., 2009; Sartor & Sutherland, 1992; Sartor & Young Brown, 2004) and consensus within groups (Inoue, 2010, MacDougall, 2013). The consensus educational strategy affords students the chance to discuss and co-construct the lesson formats together with the teacher. There are studies that have attempted applying this strategy in making educational decisions, however, just few of these studies categorically stated that the consensus process was adopted (Fetavero, 2017; Fetalvero & Bagarinao, 2017). They stated further that, the limitations of the findings of the benefits and effects of consensus and its variants to the confine of the investigator's classroom cast some doubts on the generalizability of the benefits of the strategy. This is because "there was never a structured and objective attempt to investigate and test the effects of the consensus process using a comparison group, particularly on students' attitude towards biology (Fetalvero & Bagarinao, 2017, p. 2).

Cooperative reflective journal writing educational strategy combines the features of both cooperative learning and reflective journal writing strategy. Cooperative reflective journal writing educational strategy allows students to learn and reflect together in a cooperative manner at the same time. Ige and Adu (2016) defined cooperative reflective journal writing as a strategy that involves students working cooperatively as they reflect on classroom tasks. It, therefore, means that cooperative reflective journal writing allows students to reflect cooperatively in the classroom as they learn together in a group. Arguably, cooperative learning is regarded as one of the most researched strategies of all educational strategies. It is a form of collaborative work that enables students to work together within a small group to maximise each other potential. It is a pedagogical approach that helps students to gain and create both academic and social

relationships as well as to accomplish shared goals, (Johnson & Johnson, 2002; Lou et al., 1996; Slavin, 1996). Reflective journal writing on the other hand, facilitates increased and interdependent relationships among learners and the teacher (Chang, 2013).

According to Guvenç (2010), no research has been done on the effect of teaching methods supported with learning journal writing. The move to take advantage and study the effects of teaching methods combined with learning journals on students' learning outcomes prompted researchers like Güvenç (2010), Ige and Adu (2016) and Shih (2020) to combine cooperative learning and reflective journal writing educational strategies. This gives the students the opportunity to share and critique one another's idea(s). By so doing, a form of interdependent relationship is established among the group members, and the learners are able to take charge and the responsibility of their learning. According to Shih (2020), cooperative learning logs or journals provide the students a sense of belonging and fulfilment. This is due to the attention and the care each member displayed towards one another. The author concluded that, cooperative learning journal supports learners' affective domain (emotional aspect) and is beneficial in assisting their learning.

Besides the school factors like the teacher teaching style, there are also the individual factors, like the students' verbal ability that play part in affecting students' attitude towards a subject. Verbal prowess/ability is one of the greatest assets of human. It is the ability of human to express their feelings and/or thoughts through spoken or written words. "It refers to the level of students' language development as evidenced by their oral or written communication skills which they need to properly convey their opinions and feelings after reading a text" (Ezenandu, 2012, p. 15). According to Nwosu (2002) and Odiaka (2002), it is an individual level of intelligence or language development and the ability to reason abstractly. In science, verbal ability can assist an individual in explaining an experimental outcome and the conclusion derives from such (Gluck et al., 2015). They stated further that since, reasoning ability is very important and scientific knowledge been not static, verbal abilities enable individual to argue and defend their discovery or position objectively.

Biology as a science subject requires verbal skills as students are expected to understand and interpret concepts, spell correctly relevant terminologies, give detailed explanations, and analyse their answers. These skills enable the students to communicate within themselves and with the teacher, express their feelings, share ideas as well as learning from each other. Students with difficulty of expression either with the teacher or peer will likely experience conflictual relationship, while students adept at expressing themselves tend to develop close relationships with teachers and peers (Rudasill et al., 2006). Also, verbal skills are important in navigating classroom social processes like turn-taking, collaboration and demands compliance (Brocks et al., 2018). Individuals with a smaller or limited vocabulary may face/experience a lot of frustration due to inability to fully express themselves. This leads to difficulty in building relationships as they are less able to organise their thoughts or decipher what is expected of them by others (Monopoli & Kingston, 2012; Stansbury & Zimmerman, 1999). The presence or absence of these skills will impact students' disposition or attitude in the classroom. Despite the fact that verbal ability has an effect on students' learning outcomes in science in general and biology in particular, it has not received much attention from researchers.

Research Problem

The issue of students' poor attitude towards science has been a source of concerns of science researchers for a while. The Dainton (Department of Education Science (DES)) report in the United Kingdom in 1968 documented students' decline interest in science and called it "swing from science". Students decline interest in science is sweeping across countries in both Global North and South. A factor identified to have contributed to students' decline interest in

246

science is the teaching style adopted by the teacher for the teaching and learning of science. The traditional mode of classroom teaching and learning of transmitting knowledge without taking the students' interest into consideration might have contributed to students' decline in science over the years. In order to stimulate students' interest in science, schools are now changing to learner-centred education which encompasses methods of teaching that shifts the focus of teaching and learning from the teacher to the student. This study, therefore, investigated the effect of consensus and cooperative reflective journal writing educational strategies, with the moderating effect of verbal ability on students' attitude towards biology.

Hypotheses

- There was no significant main effect of treatments on students' attitude towards biology
- There was no significant main effect of verbal ability on students' attitude towards biology
- There was no significant interaction effect of treatments and verbal ability on students' attitude towards biology

Research Methodology

General Background

This study adopted a quantitative pre-test-post-test, control group quasi-experimental design involving a 3x2 factorial design. This design was employed because the participants were from intact classes in a natural school setting where random assignment was not possible, and the distraction of class structure was avoided to the minimum. The treatment was the educational strategies at three levels (consensus, cooperative reflective journal writing and conventional strategy). The moderator variable was verbal ability at two levels (low and high). Students' attitude towards biology was the dependent variable.

Sample

The targeted population for this study were the upper secondary school two students in Ibadan metropolis, Oyo State, Nigeria. A multistage sampling technique was used to select 305 (124 male and 181 female) from a total of 1,483 students for the study. At the first stage of sampling two local governments were randomly selected out of the 5 local governments within the metropolis. At the second stage, three coeducational schools that were distantly located were purposively selected in each of the local government areas to make a total of six schools. This was done in order to avoid or minimise experimental contamination. In all the schools, intact classes were used. The criteria for purposive sampling included; the schools were public funded, the schools must have been presenting students for external examinations in the last five years and participating teachers' had a minimum of bachelor's degree.

Research Instruments

The study's data were collected using the following instruments:
- Biology Attitude Questionnaire (BAQ)
- Students' Verbal Ability Test (SVAT)
- Teacher's Guide on Consensus Educational Strategy (TIGCES)
- Teacher's Guide on Cooperatively Reflective Journal Writing Educational Strategy (TIGCRJWES)
- Teacher's Guide on Conventional Strategy (TGCS)

Biology Attitude Questionnaire

The Biology Attitude Questionnaire (BAQ) adopted and modified for the purpose of this study was from Russell and Hollander (1975): A Biology Attitude Scale. BAQ was designed to look into or test: (i) the students' affective domain in relation to the two strategies, (ii) the development of sense of responsibility in providing urgent solutions to biological concepts. It consisted of 21 items and was placed on a 4-point Likert type interval scale ranging from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The scale was not intended to measure absolute attitude toward biology but was designed to detect and measure changes in attitude toward biology. Hence the scale was designed to be used at the beginning and the end of treatment. The item contained an almost equal number of positive and negative items reflecting certain attitudinal disposition to Biology.

In order to determine the face validity, the items were shown to some science educators with bias in Biology for its appropriateness in terms of clarity of ideas, language of presentation, class levels, coverage, relevance and application to the study. The reliability coefficient of the instrument as measured by Russell and Hollander averaged .90. For the purpose of this study, the reliability coefficient was determined using Cronbach alpha measure and it yielded .861.

Cronbach alpha was used because it is assumed that each test item measures the same latent trait on the scale.

Students' Verbal Ability Test (SVAT)

Students' Verbal Ability Test (SVAT) was adapted from the Australian Council for Educational Research (ACER) to assess students' verbal ability. It has gone through several modification and revalidation for use by some Nigerian authors (Aimunmondion, 2008; Awofala et al., 2011; Ezenandu, 2012; Fakeye 2006; Ige & Adu, 2016; Maduabuchi, 2002; Olaboopo, 1999) since its first introduction into Nigerian education system by Obemeata in 1974. However, the researchers re-validated the test to ascertain its suitability for this study. The SVAT was trial-tested on 20 upper secondary school II students in a school that was not chosen for the main study. The collected data was analysed using Kuder-Richardson formula 20 (Kr20) and a reliability of .78 was obtained. Kr20 was used because of the inequality of the difficulty level of the items in the SVAT. The SVAT was administered on the participants once before the treatment began.

Teachers' Guides

Teachers' Guide on Consensus Educational Strategy (TGCES), Teachers' Guide on Cooperative Reflective Journal Writing Educational Strategy (TGCRJWES) and Teachers' Guide on conventional method (TGCS) are the lesson notes, which were prepared weekly for the six weeks of the treatment for the study. The duration for each lesson was 80 minutes (double periods). The essence of these instruments was to guide the research assistants (teachers) on the use of steps and procedure followed during the treatment.

Procedure

The following procedure was used to carry out the treatment: The first week of the study was spent training the research assistants (classroom instructors), and the second week was spent administering the pre-tests.

Saheed Ayodeji ADEJIMI, Wenceslas NZABALIRWA, William A. SHIVOGA. Enhancing students' attitudes toward biology using consensus and cooperative reflective journal writing educational strategies

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 80, No. 2, 2022

248

The 80-minute sessions were used for a total of six weeks of treatment. In the final week of the trial, all groups were given a post-test.

Data Analysis

The post-test attitude scores were subjected to a two-way analysis of covariance (ANCOVA) using the pre-test scores as covariates. Analysis of covariance is used to test the main and interaction effects of categorical variables on a continuous dependent variable, controlling for the effects of selected other continuous variables, which co-vary with the dependent. The control variables are called the "covariates". It's also used to control for factors which cannot be randomized but which can be measured on an interval scale in experimental designs. The ANCOVA reduces experiment error by statistical rather than by experimental procedure (Coolican, 1994). The Bonferroni post-hoc test was used to determine which of the groups causes the significant main effect, while the interaction effect was explained by the aid of a graph. The Bonferroni post-hoc test was employed in order to be certain that the treatments (consensus and cooperative reflective journal writing) strategies have a positive effect on students' attitude in comparison to the conventional mode of teaching.

Research Results

Hypothesis 1: There was no significant main effect of treatments on students' attitude towards biology. The summary of this result is given in Table 1

Table 1
Analysis of Covariance (ANCOVA) of Post-Attitude by Treatment and Verbal ability

Source	Type III Sum of Squares	df	MS	F	p	η²
Corrected Model	9410.598	6	1568.433	103.294	p<.001	0.675
Intercept	2124.414	1	2124.414	139.910	p<.001	0.319
Pre-Attitude	8461.791	1	8461.791	557.279	.001	0.652
Treatment	98.040	2	49.020	3.228	.041*	0.021
Verbal ability	1045.855	1	1045.855	68.878	.000*	0.188
Treatment x Verbal ability	38.367	2	19.184	1.263	.284	0.008
Error	4524.864	298	15.184			
Total	1493493.000	305				
Corrected Total	13935.462	304				

R Squared = .68 (Adjusted R Squared = .67)   *denotes significant p<.05*

Table 1 reveals that there was a significant main effect of treatments on students' attitude to biology ($F_{(2, 304)}$ = 3.23; p<.05, partial $η^2$ =0 .02). The effect size, 20.0% showed a small effect size. Nevertheless, it showed that there was a statistical difference among students in the treatment groups from the conventional group. Therefore, hypothesis 1a was rejected. In order to explore the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups were carried out and the result is presented in Table 2.

Saheed Ayodeji ADEJIMI, Wenceslas NZABALIRWA, William A. SHIVOGA. Enhancing students' attitudes toward biology using consensus and cooperative reflective journal writing educational strategies

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 80, No. 2, 2022

249

Table 2
Estimated Marginal Means for Post-Attitude by Treatment and Control group

Treatment	M	SE	95% C.I for difference	
			Lower	Upper
CES	68.33	0.53	67.31	69.35
CRJWES	70.44	1.00	68.47	72.40
CS	67.63	0.50	66.65	68.61

Table 2 reveals that students in the CRJWES treatment group 2 had the highest adjusted mean score in their post-attitude to biology (70.44) followed by those in the CES treatment group 1 (68.33) and their counterparts in the CS control group (67.63). The Bonferroni post-hoc test was used to identify which of the groups was responsible for the significant main effect of treatment on students' attitudes to biology, and the results are shown in Table 3.

Table 3
Bonferroni Post-hoc Analysis of Post-Attitude by Treatment and Control Group

(i) Treatment	(j) Treatment	M Diff (i-j)	SE	p	95% C.I for difference	
					Lower	Upper
CES	CRJWES	-2.11	1.13	.188	-4.82	.61
	CS	.70	.72	.997	-1.03	2.43
CRJWES	CES	2.11	1.13	.188	-.61	4.82
	CS	2.81*	1.11	.036	.14	5.47
CS	CES	-.70	.72	.997	-2.43	1.03
	CRJWES	-2.81*	1.11	.036	-5.47	-.14

Table 3 indicated that the post-attitude mean scores in biology of students in CRJWES significantly differ from those taught with the CES and those exposed to CS. Table 3 further showed that there was no significant difference in the post-attitude mean scores of students exposed to CES and their counterparts in the CS. This suggests that the ANCOVA result revealed a significant difference not between the treatment groups (CRJWES and CES), but between the CRJWES and the control group, as evidenced by students' post-attitude scores in biology.

Hypothesis 2: There was no significant main effect of verbal ability on students' attitude to Biology

Table 1 reveals that there was a significant main effect of verbal ability on students' post-test attitude scores in biology ($F_{(1, 304)} = 68.88$; $p<.05$, partial $\eta^2 = 0.19$), according to the results of the analysis of covariance. The effect size 19.0%, showed a small effect size. Hypothesis 2 was therefore rejected. This implies that verbal ability has a main significant effect on students' attitude to Biology irrespective of their treatment status.

250

Table 4

Estimated Marginal Means for Post-Attitude by Verbal ability

Verbal ability	M	SE	95% C.I for difference	
			Lower	Upper
Low	65.28	0.75	63.81	66.76
High	72.32	0.37	71.59	73.04

Table 4 shows that students with high verbal ability had a higher adjusted mean score in the post-attitude score in biology (72.32) than students with low verbal ability (65.28). This means that students with high verbal abilities have a more positive attitude toward biology than students with low verbal abilities, and this difference was significant.

Hypothesis 3: There was no significant interaction effect of treatments and verbal ability on students' attitude to biology.

The interaction effect of treatment and verbal ability on students' attitudes toward biology was not significant ($F_{(2, 304)}$ = 1.26, $p>.05$; partial η^2 = 0.01), as shown in Table 1. As a result, hypothesis 3 was not rejected. This suggests that the interaction between treatment and verbal ability did not jointly enhance students' attitude towards Biology.

Discussion

The study was on the effects of consensus and cooperative reflective journal writing educational strategies on students' attitude towards biology. The study's findings revealed that students in the experimental or treatment groups had a more positive attitude toward biology than students in the control group, although, the attitudes of students in the consensus group and those in the control group were not significantly different. Despite this, it seems to have the potential to enhance students' attitudes toward biology. This conclusion was consistent with Fetalvero and Bagarinao (2017), who stated that while the general attitude toward biology was significant, it was not enough to conclude a significant difference between students exposed to the consensus strategy and those exposed to the conventional strategy. This was due to the fact that only three of the seven components of attitude measured by the Attitude Towards Biology Scale (ATBS) showed significant differences (perception of the biology teacher, eagerness to learn biology, and enjoyment of biology), while the other four components showed no significant differences (importance of biology, interest in biology lessons, anxiety towards biology and effort in learning biology). They argued that the lack of significance could be related to the study's short duration and the strategy's novelty. Consensus strategy, however, has the potential to improve students' attitudes toward biology since it assures inclusivity, cooperation, collaboration, maximization of agreement, relationship building, and respect for all points of view (Hartnett, 2012).

The attitude of students in the cooperative reflective journal writing strategy significantly differs from those in the conventional strategy. This result is consistent with the findings of Güvenç (2010), in which students expressed positive satisfactory feelings (f=76) compared to (f=34) expressing negative satisfactory feelings after conducting a content analysis of students' opinions on the satisfaction derived from learning journals combined with cooperative strategy. This may be attributed to the fact that as students learn in group, they reflect and share opinions together and influencing one another by so doing.

According to the findings, the two educational strategies increased social interaction among students and between students and teachers, consequently improving students' attitudes

toward biology. The strategies create a calm environment in the classroom, allowing students to communicate more effectively. They place individual responsibility for learning in the hands of each and every student in the classroom. Students developed a good mindset as a result of this. Individuals' shame and guilt are reduced as a result of this social interaction, and students have a more positive attitude while studying.

There was a significant main effect of verbal ability on students' attitude towards biology. The students with high verbal ability portray more positive attitude to biology compared to the low verbal ability students. This result echoes the findings of Fola-Adebayo (2014) and Tzu-Ling Wang (2008) who reported that students' verbal ability improved students' attitude to science and reading respectively. Their report indicates that the high verbal ability students professed more positive attitude compared to the low verbal ability students. The result of this study is however not in consonance with the result of Ezenandu (2012) and Okere (2019) who both reported that verbal ability had no effect on students' attitude to Literature-in-English.

According to the findings, high verbal ability students, regardless of their group, have a positive attitude about biology, whereas low verbal ability students have a negative attitude toward biology. Low verbal ability students may have developed a negative attitude as a result of their poor language dexterity and inability to express oneself clearly. High verbal ability students, on the other hand, were able to smoothly express themselves due to their strong command of the language, resulting in a positive attitude toward biology.

There was no significant interaction effect of treatment and verbal ability on students' attitude to biology. Treatments and verbal ability do not interact to affect students' attitude towards biology. This implied that given equal opportunities, students with high and low verbal ability would have the same attitude towards biology. This study agreed with the report from the study of Ezenandu (2012) and Fola-Adebayo (2014) who found no significant interaction effects of treatments and verbal ability on students' attitude to English prose literature and reading respectively.

The findings revealed that when students have equal access to quality language programmes, they will approach biology with the same attitude. This will reduce the difference between students with high and low verbal abilities, as well as their attitudes toward biology. Some inherent shortcomings of the strategies if not properly handled in the classroom is that it could lead to loss of focus of the discussion at hand, the high verbal ability students could hijack and dominate the class discussion at the expense of the low ability students, which could lead to negative attitude towards biology by some students.

Conclusion and Implications

This study established empirically that the use of students' centred educational strategies is capable of enhancing attitudes to Biology. The study showed that consensus and cooperative reflective journal writing were both effective in enhancing students' attitude towards biology than the conventional strategy. Although, students in the cooperative reflective journal writing educational strategy group showed more positive attitude than those in the consensus strategy, nevertheless, both strategies showed the potential in contributing to enhancing students' attitude towards biology. Students' verbal ability also played a role in enhancing students' attitude towards biology as the students need to constantly dialogue among themselves and with the teacher as the case may be. Those with high verbal ability are able to express their feelings and receive feedbacks from peers and teacher unlike those with low verbal ability that found it difficult to communicate their feeling to peers and teachers, thereby not receiving feedbacks, which invariably affected negatively their attitudes towards Biology subject. Treatments and verbal ability do not combine to enhance students' attitude towards biology. Based on the findings from this study, the following recommendations were made:

252

• Teachers should be encouraged to incorporate the use of consensus and cooperative reflective journal writing educational strategies as they showed the potential of enhancing students' attitude towards Biology.

• Teachers should endeavour to encourage development of students' verbal proficiency by engaging them in regular reading activities.

Declaration of Interest

Authors declare no competing interest.

References

Abdullahi Shuaibu, & Nor Asniza Ishak. (2020). Effect of the 7E instructional strategy on the overall attitude of students in biology in public secondary schools in Adamawa state, Nigeria. *Asia Pacific Journal of Educators and Education, 35*(2), 171–186. https://doi.org/10.21315/apjee2020.35.2.10

Aiken, L. R., & Aiken, D. R. (1969). Recent research on attitudes concerning science. *Science Education*, *53*(4), 295–305.

Aimunmondion M. C. (2008). *Effects of thought-flow knowledge and shared reading instructional strategies on senior secondary school students' achievement in English reading comprehension and summary writing*. Post Field Seminar Paper Presented at the Joint Staff/Higher Degree Students Seminar Series Department of Teacher Education, University of Ibadan, Ibadan.

Awofala, A. O. A., Balogun, T. A., & Olagunju, M. A. (2011). Effects of three modes of personalization on students' achievement in mathematical word problems in Nigeria. *International Journal for Mathematics Teaching and Learning*, *12,* 1–25. https://www.cimt.org.uk/journal/awofala.pdf

Bennett, J., Rollnick, M., Green, G., & White, M. (2001). The development and use of an instrument to assess students' attitude to the study of chemistry. *International Journal of Science Education*, *23*(8), 833–845.

Blinne, K. C. (2013). Start with the syllabus. Helping learners learn through class content collaboration. *College Teaching, 61,* 41–43.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Weal, B. T. (2008). The economics and psychology of personality traits. *IZA Discussion Paper*, 3333. https://doi.org/10.3386/w13810

Brock, L. L., Kim, H., Kelly, C. L., Mashburn, A. J., & Grissmer, D. W. (2018). Theory of mind, directly and indirectly, facilitates kindergarten adjustment via verbal ability, executive function, and emotion knowledge. *Psychology in the Schools,* 1–18. https://doi.org/10.1002/pits.22216

Chang, C. C. (2013). Using public reflective learning journals to promote autonomy: A case study of advanced English language learners. *English Teaching and Learning, 37*(4), 195–232.

Cheung, D. (2011). Evaluating student attitudes toward chemistry lessons to enhance teaching on the secondary school. *Educacion Quimica, 22*(2), 117–122.

Coolican, H. (1994). *Research methods and statistics in psychology* (2nd ed). Hodder and Stoughton.

DES. (1968). *Enquiry into the flow of candidates in science and technology into higher education (the DaintonReport).* HMSO.

Ebenezer, J. V., & Zoller, U. (1993). Grade 10 students' perceptions of and attitudes toward science teaching and school science. *Journal of Research in Science Teaching*, *30*(2), 175–186.

Ezenandu, P. E. (2012). *Effects of literature circles and scaffolding instructional strategies on senior secondary school students' achievement and attitude to prose literature in English.* [Doctoral thesis, The University of Ibadan] University of Ibadan Digital Archive. http://ir.library.ui.edu.ng/handle/123456789/130

Fakeye, D. O. (2006). Componential analysis as a model of ESL vocabulary instruction. African *Journal of Educational Research*, *10*(1–2), 14–24.

Fetalvero, E. G. (2017). Consensus-based education: Its effect on college students' achievement in bioenergetics as moderated by gender and learning styles. *Journal of Baltic Science Education, 16*(4), 533–548. https://dx.doi.org/10.33225/jbse/17.16.533

Fetalvero, E. G., & Bagarinao, R. T. (2017). Using consensus in instructional-decision making helps improve undergraduate students' attitude towards biology. *Asia Pacific Journal of Multidisciplinary Research, 5*(4), 55–65.

Fola-Adebayo, T. J. (2014). Influence of pre-question and genre-based instructional strategies on reading. *Reading & Writing*, *5*(1), Art. #51, 9 pages. https:// doi.org/10.4102/rw.v5i1.51

Gibson, H. L., & Chase, C. (2002). Longitudinal impact of an inquiry- based science program on middle school students' attitudes toward science. *Science Education*. *86*(5), 693–705.

Glasman, L. R., & Albarracin, D. (2006). Forming attitudes that predict future behaviour: A meta-analysis of the attitude-behavior relation. *Psychological Bulletin*, *132*(5), 778–822.

Gluck, L., Gilmore, M. W., & Dillihunt, M. (2015). The importance of critical thinking, verbal reasoning, and mathematics in teaching chemistry in the 21st century. *Modern Chemistry and Applications, 3*(3), 1–2. https://doi.org/10.4172/2329-6798.1000e121

Güvenç, H. (2010). The effects of cooperative learning and learning journals on teacher candidates' self-regulated learning. *Kuram ve Uygulamada Eğitim Bilimleri / Educational Sciences: Theory & Practice 10*(3), 1477–1487.

Glynn, S. M., Taasoobshrazi, G., & Brickman, P. (2007). Non-science majors learning science: A theoretical model of motivation. *Journal of Research in Science Teaching, 44*(8), 1088–1107. https://doi.org/10.1002/tea.20181

Hartnett, T. (2012). Thinking flexibly about consensus. *Communities, Winter* (*157*), 62–63.

Hussaini, I., Foong, L. M., & Kamar, Y. (2015). Attitudes of secondary school students towards biology as a school subject in Birnin Kebbi metropolis, Nigeria. *International Journal of Research and Review, 2*(10), 596–600.

Ige, T. A., & Adu, K. E. (2016). Effects of individualised and cooperative reflective journal writing strategies on secondary school students' achievement in Biology in Kwara State, Nigeria. *British Journal of Education, Society & Behavioural Science 15*(4), 1–12. https://doi.org/10.9734/BJESBS/2016/24699

Inoue, N. (2010). Zen and the art of *neriage*: facilitating consensus building in mathematics inquiry lessons through lesson research. *Journal of Mathematics Teacher Education, 14*, 5–23.

Johnson, D. W., & Johnson, R. T (2002). Learning together and alone. Overview and meta-analysis. *Asia Pacific Journal of Education, 22*, 95–105.

Kelly, A. (1988). The customer is always right: Girls' and boys' reactions to science lessons. *School Science Review*, *69*(249), 662-676.

Koballa, T. R. (1988). Attitude and related concepts in science education. *Science Education*, *72*, 115–126.

Koballa T. R., & Crawley F. E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics*, *85*(3), 222–232.

Koballa, T. R., & Glynn, S. M. (2007). Attitudinal and motivational constructs in science learning. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education*. Lawrence Earlbaum Associates.

List, D. (2001). The consensus group technique in social science. *Field Methods, 13*(3), 277–290.

Lou, Y., Abrami, P., Spence, I., Poulsen, C., Chambers, B., & d'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research*, *66*(4), 423–458.

MacDougall G. (2013). Student-to-student collaboration and coming to consensus. *Science Scope, 37*(3), 59–63.

Maduabuchi, N. (2002). *Methods of teaching vocabulary in secondary schools*. [Unpublished M. Ed Project] University of Ibadan.

Mager, R.F. (1968). *Developing attitudes toward learning*. Fearon,

Mitchell, S., Foulger, T. S., Wetzel, K., & Rathkey, C. (2009). The negotiated project approach: Project-based learning without leaving the standards behind. *Early Childhood Education Journal, 36,* 339–346.

Monopoli, W. J., & Kingston, S. (2012). The relationships among language ability, emotion regulation and social competence in second grade students. *International Journal of Behavioural Development, 36*(5), 398–405. https://doi.org/10.1177/0165025412446394

Myers, R. E., & Fouts, J. T. (1992). A cluster analysis of high school science classroom environments and attitudes toward science. *Journal of Research in Science Teaching*, *29*(9), 929–937. https://doi.org/10.1002/tea.3660290904

Nwosu, F. C. (2002). *Effects of four holistic instructional strategies on senior secondary school students' reading comprehension in Ibadan*. [Unpublished doctoral thesis]. University of Ibadan.

Obemeata, J. O. (1974). Predictive validity of intelligence tests M, ML and MQ. *African Journal of Educational Research, 1*(2), 205–211.

Odiaka, S. I. (2002). *Effects of holistic and subskill instructional approaches and content area reading comprehension among some junior secondary school students in Ibadan metropolis.* [Unpublished doctoral thesis]. University of Ibadan.

Okere, M. C. (2019). Students-led discussion learning strategies, verbal ability, and students' attitude to literature-in-English. *Transatlantic Journal of Multidisciplinary Research*, *1*(1), 83–92. https://doi.org/10.5281/zenodo.3353725

Olaboopo, J. O (1999) *Effect of error treatment model-based and skill-based instructional strategies on attitude, motivation, and achievement in English composition in Senior Secondary Schools in Ibadan.* [Unpublished doctoral thesis]. University of Ibadan.

Oskamp, S., & Schultz, P. W. (2005). *Attitudes and opinions* (3rd ed.). Lawrence Erlbaum.

Prokop, P., Tuncer, G., & Chuda, J. (2007). Slovakian students' attitudes toward biology. *Eurasia Journal of Mathematics, Science & Technology Education*, *3*(4), 287–295.

Rudasill, K. M., Rimm-Kaufman, S. E., Justice, L. M., & Pence, K. (2006). Temperament and language skills as predictors of teacher-child relationship quality in preschool. *Early Education and Development, 17*(2), 271–291.

Russell, J., & Hollander, S. (1975). A biology attitude scale. *The American Biology Teacher, 37*(5) 270–273.

Salta, K., & Tzougraki, C. (2004). Attitudes towards chemistry among 11th grade students in high schools in Greece. *Science Education, 88*(4), 535–547. https://doi.org/10.1002/sce.10134

Sartor, L., & Sutherland, K. (1992). The consensus classroom. *Education Digest, 57,* 47-50.

Sartor, L., & Young Brown, M. (2004). *Consensus in the classroom: Fostering a lively learning community.* Psychosynthesis Press.

Schutt, R. (2001). Notes on consensus decision-making. [PDF document]. http://www.vernalproject.org/papers/process/ConsensNotes.pdf

Shih, Hui-chia J. (2020). The use of individual and collaborative learning logs and their impact on the development of learner autonomy in the EFL classroom in Taiwan. *Innovation in Language Learning and Teaching,* 1–15. https://doi.org/10.1080/17501229.2020.1737703

Shruba, A. E. (2008). *Evaluation of students' attitude towards science and self-efficacy in a non-majors college biology course*. [Unpublished Master's thesis]. Christian College, Fortworth, Texas.

Slavin, R. (1996). Research on cooperative learning and achievement: what we know, what we need to know. *Contemporary Educational Psychology*, 21, 43–69.

Smith, M. C., Walker, A. D., & Hamidova, N. (2012). *A structural analysis of the attitudes toward science scale: attitudes and beliefs about science as a multi-dimensional composition*. Paper presented at the 2012 annual meeting of the American Educational Research Association, Vancouver, B.C., Canada. 1–29.

Stansbury, K., & Zimmermann, L. K. (1999). Relations among child language skills, maternal socialisation of emotion regulation, and child behaviour problems. *Child Psychiatry and Human Development, 30*(2), 121–142.

Stark, R., & Gray, D. (1999). Gender preferences in learning science. *International Journal of Science Education, 21*(6), 633–643.

Tzu-Ling Wang, M. S. (2008). *Brain hemispheric preferences of fourth- and fifth-grade science teachers and students in Taiwan: An investigation of the relationships to student spatial and verbal ability, student achievement, student attitudes, and teaching practice*. [Doctoral dissertation, The Ohio State University]. The Ohio State University Digital Archive. https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=osu1213169329&disposition=inline

Usak, M., Prokop, P., Ozden, M., Ozel, M., Bilen, K., & Erdogan, M. (2009). Turkish university students' attitudes toward biology: The effects of gender and enrolment in biology classes. *Journal of Baltic Science Education, 89*(2), 88–96.

Wong, A. F. L., Young, D. J., & Fraser, B. J. (1997). A multilevel analysis of learning environments and student attitudes. *Educational Psychology, 17*, 449–468.

Saheed Ayodeji Adejimi (Corresponding author)	ACEITLMS, College of Education, University of Rwanda, Rukara Campus, Eastern Province, P.O. Box 55 Rwamagana-Eastern, Rwanda. Email: jimmysaheed@gmail.com ORCID: https://orcid.org/0000-0002-7344-3852
Wenceslas Nzabalirwa	Professor, College of Education, University of Rwanda, Rukara Campus Eastern Province, P.O. Box 55 Rwamagana-Eastern, Rwanda. Email: wenceslasn@yahoo.fr ORCID: https://orcid.org/0000-0002-8299-2001
William A. Shivoga	Professor, Masinde Muliro University of Science and Technology, Kakamega, Kenya. Email: shivoga@gmail.com ORCID: https://orcid.org/0000-0002-1694-9339