EFFECT OF VEE-MAPPING INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS BIOLOGY

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Abstract
This paper investigated the effect of Vee mapping instructional strategy on students' attitude towards Biology in senior secondary schools in Gwagwalada area council of the Federal Capital Territory. The research design was quasi experimental design. The sample comprised 100 students selected from two senior secondary schools. The instrument that was used for data collection was the Biology Attitude Scale (BAS) which was validated and considered suitable for data collection for this study. There was significant difference between the mean attitude scores of the experimental group and the control group in favour of the experimental group. Again, respondents of both sexes in the experimental group did not differ significantly in their post-test attitude score. The study revealed that therefore, it was concluded that Vee-mapping instructional strategy enhances students' attitude and it is also gender friendly in this enhancement. The following recommendations were, therefore made; there is need to introduce Vee-mapping instructional strategy in pre-service science education programs in tertiary institutions. Also, regular workshops should be organized for science teachers to acquaint them with the knowledge of such innovative strategies as Vee-mapping instructional strategy. Science teachers especially Biology teachers should be encouraged to use Vee-mapping instructional strategies in the classroom through regular supervision and monitoring

Introduction
Education in Nigeria is an instrument "par excellence" for effective national development (FRN, 2014). As a result, the government has stated that for the benefit of all citizens, the country' educational goals shall be clearly set out in terms of their relevance to the needs of the individual and those of the society, in consonance with the realities of our environment and modern world. Nigeria's philosophy of education believes that education fosters the worth and the development of the individual for each individual's sake and the general development of the society.

Science and technology have connected the world into what is now referred to as globalization which may be considered as a process embodying a transformation in the spatial organization of social relations and transactions assessed in terms of their intensity, velocity and impact (Gyuse & Adejoh, 2010). In addition, science education helps to reduce illiteracy and poverty which are impediments to national development. Science is the basis of technology and mathematics which promote skills and creativity to solve various problems. It plays a critical role in providing knowledge, skills and technology advancement for social and economic development. Akpan (2008) noted that science contributes significantly to the quality of life in many areas like health, nutrition, agriculture and industrial development. Through science education, life and material resources are invented to modify things to human advantage or uses (Bajah, 1983). Science education identifies natural phenomena appropriate to a child's interest and skills, equips teachers, learners and the society with knowledge, skills, and freedom to perform noble tasks useful for improving socio-economic standard**.**

According to Leghara and Mba (2010), the relationship between science and technology education and economic development is obvious; they are of the opinion that science education is the critical instrument needed to uplift the economy of any nation. Science education is aimed at producing a scientifically literate citizenry as well as producing potentially scientific and technology manpower with in depth knowledge or skills. Critics of public education have argued that many Nigerian students do not possess the knowledge or skills to ensure either personal life success or national economic competition. According to Akpan (1996), of particular concern is the apparent inability of many students to engage in complex problem - solving activities which results in poor performance.

In Biology, Okoli (2006) stated that available statistics from West African Examination Council and National Examinational Council on senior secondary school students' performance in Biology revealed that although biology had the highest enrolment relative to other science subjects, it recorded a very poor performance at Senior Secondary Certificate Examination, especially in the practical examinations which contribute significantly to overall performance. In addition, external examination results in Biology showed a high rate of failure, especially among senior secondary school students (WAEC, 2013). Orji (1995) pointed out that poor performance of students in science (biology inclusive) is due to the poor state in which science is taught in the schools. He noted that "chalk and talk" method has been the most widely used method in science teaching due to poor quality laboratory, large class size, and much workload on the teacher. Enaiyeju and Enaiyeju (1994) caution that if the situation is not addressed, the intended positive outcome derivable from science might be doomed. The authors were emphatic that many students perform poorly in Science Technology and Mathematics (STM). The problem of poor performance in STM could be as a result of poor methods of transmitting scientific knowledge. Orji (2010) opined that through proper implementation of well-articulated education programs using innovative method, science can bail nations out of economic and technological stagnation.

Researchers have shown that the number of graduate output has not been encouraging in secondary schools as indicated by interest and negative attitude exhibited by students. This could be due to the fact that most secondary school science teachers do not use result-oriented innovative strategies, rather they resort to the expository method of teaching which has been found to be non- productive. As a panacea to this problem, it has become necessary to try out such metacognitive strategies that empower learners and subsequently improve students' attitude towards science. One of such strategies is the Vee mapping instructional strategy.

Vee-map is an instructional strategy for assisting learners to acquire knowledge explicitly (meta-knowledge) (Gowin & Novak, 1984). Vee-mapping was invented and developed by Gowin & Novak (1984) to enable learners understand the structure of knowledge (e.g., rational networks, hierarchies, and combinations) and process of knowledge construction. Gowin's (1981) basically assumed that knowledge, is not absolute but dependent upon the concepts, theories and principles on which the world is viewed. Meaningful learning implies that individuals are able to relate new knowledge to relevant concepts and propositions that they already know. The Vee map aids students in the linking process by acting as a meta-cognitive tool that requires students to make explicit connections between previously learnt and newly acquired information. Literature attesting to its meta-cognitive potentials for students provides reason for its optimal use for tackling rote memorization of scientific concepts. The Vee map guides students in their quest for new knowledge and helps them interpret what they discover. Roth and Verechaka (1993) therefore likened Vee map to a road map showing a route from prior knowledge to new or further knowledge.

Meta-cognitive strategies (meta-knowledge and meta-learning) as pointed by Jegede, Alaiymola and Okebukola (1990) and Novak (1983) are strategies that empower a learner to take responsibility of his/her own learning in a highly meaningful fashion. Meta knowledge deals with the very nature of knowledge and knowing. Gowin and Novak (1984) as well as Biggs (1985) define meta learning as a process of being aware of, and taking control of one's own learning process which results to meaningful learning. According to Malone and Dekkers, (1984) meaningful learning means learners' ability to integrate new knowledge into their existing networks of concepts and prepositions in their cognitive structure. Once knowledge has been successfully integrated, it could affect one's attitude.

Attitude is a hypothetical construct that represents an individual's degree of like or dislike for something. Attitudes are generally positive or negative views of a person, place, thing or event. People can be ambivalent towards an object which means that one can simultaneously possess both positive and negative attitudes towards the item in question. Newbill (2005) observed that attitudes serve as functions including social expressions, value expression, utilitarian and defensive functions for people that hold them. It has been observed that instructional design can create instructional environment to effect attitudinal change. Newbill stated that attitudes are connected to social cognitive learning theory as one of the personal factors affecting learning.

Researchers like Petty and Cacioppo (1986) defined attitude as general evaluation which people hold in regard for themselves, other people, object and issues. According to Greenwald (1989), attitudes are pervasive, predict behaviours, a force in perception and memory, and they serve various psychological functions. Attitudes towards a subject determine success in that subject; favorable attitude results to good achievement in a subject. While continuous failure in a subject can make a student develop negative attitude while success will make a student to develop positive attitude towards learning the subject. Effective teaching can create a positive attitude in a student toward the school subject (Balogun & Akale, 1997; Olowojaiye, 2000). Besides attitude, there are other variables that can affect learning outcomes. One of such variables is gender.

According to Pramana (2018) the World Health Organization defines gender as the result of socially constructed ideas about the behavior, actions and roles a particular sex performs. Kelly (2006) observed that John Money coined the word gender role. The term gender role is used to signify all those things that a person says or does to identify himself or herself as having the status of boy or man, girl or woman, respectively. Indicators of such a role include clothing, speech patterns, movement, occupations, and other factors not limited to biological sex. The term gender also refers to the economic, social, political and cultural attributes and opportunities, associated with being male and female. Many researchers have been conducted that showed gender as having significant influence on students' learning outcomes. These studies include those of Olasehinde and Olatoye (2014); Zembar and Blume (2011); Okereke and Onwuke (2011); Ukozor (2011); and Jegede (2007) thereby making gender a salient variable that needs to be incorporated in the present study.

Based on this background therefore the present study is set to investigate the effects of Vee mapping instructional strategy on senior secondary school students' attitude towards Biology in Gwagwalada Area Council, Abuja.

Purpose of the Study
The purpose of this study is to investigate the effects of Vee mapping instructional strategy on secondary school students' attitude towards Biology. The specific objectives of this research were as follows:

(i)   to find out the effect of Vee-mapping instructional strategy on senior secondary school students' attitude towards biology;

(ii)   to investigate the influence of gender on attitude of senior secondary school students to biology when exposed to Vee-mapping instructional strategy.

Research Questions

The following research questions were raised to guide the study:

(i)   What is the effect of Vee mapping instructional strategy on senior secondary school students' attitude towards biology?

(ii)   What is the influence of gender on students' attitude towards senior secondary school biology when taught biology with vee-mapping instructional strategy?

Hypotheses

The following null hypotheses were formulated to guide the study:

Ho$_1$:   There is no significant difference in the mean attitude scores of students taught biology with Vee-mapping instructional strategy and those taught with conventional method.

Ho$_2$:   There is no significant difference in the mean attitude score of male and female students taught biology with Vee-mapping instructional strategy.

Methodology

The design of the study was quasi experimental using the pre-test and posttest control group approach. According Ali (1996), quasi experimental designs are designs of experiments which need good control and rigorousness. The instructional strategy was the independent variable while attitude towards biology was the dependent variable. As an experimental study, the participants for the study were grouped into two namely: the experimental group and the control group. The population of this study comprised all the SS2 students in all the senior secondary schools numbering one thousand six hundred and forty two (source: zonal education area Gwagwalada) that offered Biology in Gwagwalada Area Council of the Federal Capital Territory (FCT).

Due to its large size, it was difficult to involve the whole population. Two Senior Secondary Schools were purposively sampled. The total population of 100 students existing in the two sampled secondary schools constituted the sample size. Simple random sampling technique was used to select two secondary schools which were used as sample for the study.

The instrument that was used for data collection was the Biology Attitude Scale (BAS). This instrument was developed by the investigators. The BAS was a 15-item attitude-oriented opinion scale built on a modified four - point Likert scale of strongly agree (SA), agree (A), disagree (DA) and strongly disagree (SD). The BAS was a structured questionnaire made up of two sections, A & B. Section A contained bio-data of the respondents and section B consisted of structured statements on attitude of students towards Biology. The respondents were requested to indicate their responses to each statement by ticking (√) the most appropriate response category. For easy computation, the responses to positive statements were scored as follows: SA = 4, A = 3, D = 2, SD = 1 .On the other hand, responses to negative statements were reversed in the following order: SA = l, A = 2, D = 3, SD = 4. BAS was first vetted by the senior lecturers. The vetted questions were then given to experts in the field of science education for further validation for content and face validity. The reliability index of 0.72 was determined using the Cronbach Alpha statistics to determine the internal consistency.

The investigators used simple random sampling technique to assigned one of the sampled schools as the experimental group and the other as the control group. In experimental group, the researcher made use of Vee-mapping instructional strategy while in control group, conventional method was used. The same topics were taught to the control group using the conventional method of teaching. BAS was administered twice, first as pre-test to determine the initial level of the students' attitude towards biology, and second as post-test after the treatment to determine the students' attitude towards biology in both experimental and control groups. The treatment lasted for eight weeks

The data comprising the pre and post test scores of the Biology Attitude Scale (BAS) were analyzed using statistical techniques according to research questions of the study while t-test was used to test the hypotheses at 0.05 level of significance. The biology attitude scale was based on a modified four-point Likert scale with a bench markof 2.5. A score point of 2.5 and above was regarded as positive attitude while any point below 2.5 was regarded as negative attitude.

Equivalence of the Sample Students in the Groups
The equivalence of the sample participants in the two groups in respect of the learning outcome (attitude) was established through the analysis of their pre-test scores using t-test statistical technique as shown in Table 1.

Table 1: Two-tailed t-test result in respect of pre-test mean attitude scores of experimental and control groups

Groups	Mean	SD	N	df	t-value	Std. Error	p-value	Decision
Exptal.	2.24	1.40	50	98	1.21	0.1021	0.6551	NS
Control	2.00	1.42	50					

NS = Not significant

Results in table 1 showed that there was no significant difference between the mean attitude scores of students in the experimental and control group. Participants in experimental and control groups did not differ significantly, and hence were presumed to be equivalent in terms of attitude towards biology.

Research Questions
The answers to the research questions are here by presented using frequencies, means and standard deviation on Table 2.

Research Question One: What is the effect of Vee-mapping instructional strategy on senior secondary school students' attitude towards biology? To answer this research question, frequency count, standard deviations and means were used for the analysis reported in Table 2.

Table 2: Descriptive statistics showing groups' mean attitude scores in the Posttest

Groups	N	Mean	SD
Exptal.	50	2.79	1.10
Control	50	2.48	1.16

Results in Table 2 indicate that participants in the experimental group had a mean score of 2.79 with a standard deviation of 1.10, while those in the control group had mean score of 2.48 with a standard deviation of 1.16. In other words, the participants in the experimental group had a higher mean score of attitude than their counterparts in the control group.

Research Question Two: What are the differences between male and female students' post- test mean attitude scores in the experimental group? To answer this research question, frequency count, standard deviations and means were used for the analysis reported in Table 3.

Table 3: Descriptive statistics showing male and female students' mean attitude scores in the posttest

Gender	N	Mean	SD
Male	25	2.80	1.34
Female	25	2.78	1.12

Results on Table 3 indicate that male students had a mean score of 2.80 with a standard deviation of 1.34 while the female students had mean score of 2.78 with a standard deviation of 1.12. In other words, the male students had a slightly higher mean score of attitude than their female counterparts.

Testing of Hypothesis

Hypothesis One: There is no significant difference between the attitude of students exposed to Vee-mapping and the students exposed to conventional method. The hypothesis was tested using the t-test statistic. Results are presented in table 4.

Table 4: Two-tailed t-test result in respect of mean attitude score of groups exposed to Vee-mapping and those in the control group

Groups	Mean	SD	N	df	t-value	Std. Error	p-value	Decision
Exptal.	2.79	1.10	50	98	2.00	0.1110	0.0001	NS
Control	2.48	1.16	50					

Results in table 4 shows that there was significant difference between the mean attitude scores of the experimental group exposed to Vee-mapping strategy and their counterparts in the control group. As a result, the hypothesis was rejected. It then means that respondents in the experimental group did differ significantly from those in the control group in their post-test attitude score.

Hypothesis Two: There is no significant difference between the attitude of male and female students exposed to Vee-mapping strategy.

The hypothesis was tested using the t-test statistical technique. Results were presented in Table 5.

Table 5: Two-tailed t-test result in respect of mean attitude scores of male and female students exposed to vee-mapping strategy

Gender	Mean	SD	N	df	t-value	Std. Error	p-value	Decision
Male	2.80	1.34	25	48	0.11	0.1003	0.2211	NS
Female	2.78	1.12	25					

NS: Not Significant

Results in table 5: show that there was no significant difference between the mean attitude scores of male and female students in the experimental group exposed to Vee-mapping strategy. As a result, the hypothesis was accepted. In other words, respondents of both sexes in the experimental group did not differ significantly in their post-test attitude score.

Findings of the Study
(i)   Participants in the experimental group had a higher mean score of attitude towards biology than their counterparts in the control group.
(ii)   Male students had a slightly higher mean score of attitude than their female counterparts.
(iii)   There was significant difference between the mean attitude scores of the experimental group exposed to Vee-mapping strategy and their counterparts in the control group.
(iv)   There was no significant difference between the mean attitude scores of male and female students in the experimental group exposed to Vee-mapping strategy.

Discussion of Findings
The first hypothesis stated that there is no significant difference in the attitude of students exposed to Vee-mapping and those exposed to conventional method. The analysis of two tailed t-test shows that there was significant difference between the mean attitude scores of the experimental group and the control group. As a result the hypothesis was rejected. In other words the experimental group differs significantly from the control group in their post attitude score. The finding lend support to those of Katcha (2006), Andrew and Brain (2010), Oludepe (2012), Olasehinde and Olatoye (2014) who found significant difference in favor of the experimental group who differed significantly from the control group in their post attitude score. The reasons for this trend in results are abound. According to Gowin and Novak (1984), Vee mapping which is a meta-cognitive strategy helps students to construct new and more powerful meanings and to integrate thinking, feeling and acting; these could yield positive attitude. Meta-cognitive strategies empower learner to take responsibility of his/her own learning in a highly meaningful fashion (Jegede, Alaiyomola & Okebukola, 1990 & Novak, 1983). Vee mapping being a meta cognitive strategy could promote biology students attitude to biology. Newbill (2005) observed that instructional strategy can create instructional environment to facilitate attitude change. It could be that Vee-mapping instructional strategy may have led to the enhanced attitude of the students exposed to it.

On the other hand, this study found no significant difference between the mean attitude score of male and female students that were exposed to Vee-mapping instructional strategy. In other words, the result of the hypothesis which stated that there is no significant difference in the mean attitude of male and female students exposed to Vee-mapping instructional strategy, showed no significant difference. This finding buttresses those of Ezeudu and Obi (2013) who also found no significant sex related difference due to instructional strategy. The explanation could be based on the fact that Vee mapping facilitated the attitude of male and female students equally leading to no significant difference. Another reason could be that Vee-mapping has the potential to break every social and emotional barrier that could have caused the superiority of one gender over the other in terms of attitude. Thus the use of Vee mapping removes the abstract nature of the sciences making the female and male students to feel at ease which could have led not only to improved attitude but the non-significant difference in attitude recorded for both male and female students.

Conclusion
The study was informed by the need to improve the learning outcome of secondary school students in Biology which deteriorated over the years. The quest for improvement has led to the conception of this study, which experimented on the effect of Vee mapping as instructional strategy on students' attitude to Biology. Finding from the study revealed that the hypothesis that deal with the attitude of those exposed to Vee-mapping instructional

strategy and those students taught with conventional method was rejected since significant difference existed in mean attitude scores. On the other hand, the hypothesis on the attitude of male and female students exposed to Vee-mapping instructional strategy was accepted because there was no significant difference. It then means that Vee-mapping instructional strategy is a meta-cognitive teaching and learning tool that enhances attitude and is also gender friendly.

Recommendations
Following the findings, the following recommendations were made:
(i)   There is need to introduce Vee-mapping instructional strategy in pre-service science education programs in tertiary institutions.

(ii)   Regular workshops should be organized for science teachers to acquaint them with the knowledge of such innovative strategies as Vee-mapping instructional strategy.

(iii)   Science teachers should be encouraged to use Vee-mapping instructional strategies in the classroom through regular supervision and monitoring

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