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Effect Of Multiple Intelligence Instructional Strategies On Upper Basic II Students' Achievement And Attitude Towards Basic Science

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Abstract: ***This study investigated the effect of MI instructional strategies on upper basic II students' achievement and attitude towards Basic Science in Nasarawa State. It adopted a non-randomized, pretest-posttest, control group quasi-experimental research design. This non-equivalent control group design was considered appropriate for this study because participants were not randomly assigned to the two groups rather treatment was randomly assigned to intact classes which were already organized. The population of the study comprised 1,467 students made up of 837 males and 530 females from public coeducational schools in Keffi Education Zone. The sample for this study consists of 72 (38 males and 34 females) upper basic II students drawn from two public coeducational schools in the Zone. In each of the schools selected, one intact class each was randomly sample. A flip coin was used to select the experimental and control groups (35 students for the experimental group (Multiple Intelligence) and 37 students for the control group (Expository Method)). The head of the coin was assigned as the experimental group while the tail became the control group. Two instruments namely; Basic Science Achievement Test (BSAT) and Attitudes Towards Basic Science Questionnaire (ATBASQ) were used for data collection. The reliability of ATBASQ was determined using Cronbach Alpha and the coefficient obtained was 0.79 while BSAT was determined using K-R_{21} formula and the reliability coefficient obtained was 0.80. Descriptive statistics of means and Standard Deviations were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. The findings of this study revealed that Multiple Intelligence instructional strategy had significant effect on upper basic II students' achievement and attitude towards Basic Science concepts taught. Based on the findings of this study, it was recommended that; Basic Science teachers should adopt the Multiple Intelligence instructional strategies which will enable them cater for the diverse learning styles of students in order to improve their cognitive achievement and attitude towards Basic Science concepts. Students should be encouraged to work collaboratively and cooperatively which will help trigger their achievement and attitude towards Basic Science.***

Keywords: Achievement, Attitude, Basic Science, Multiple Intelligence and Instructional Strategy.

I. INTRODUCTION

Science education is a veritable instrument for social change which brings about socio-economic development and empowerment all the world. The application of scientific knowledge to real life problems is the most powerful instrument for enabling society to face global challenges and innovations in education. It is at the centre of empowerment of students toward self-reliant and industrial skills that are needed for survival especially in this era of global economic crisis (Eze, 2010).

Basic Science education can do much to provide a sound foundation for later learning, as well as help students become comfortable with using science and scientific thinking in their daily lives, whether in a career or as consumers and citizens (Osokoya, 2013; Bukunola & Idowu, 2012; Oludipe, 2012). It

has been discovered through research that Basic Science is the pivot upon which all other sciences and technology are built. Basic Science is often called 'the bedrock of Science' because it is the foundation on which all other sciences such as Biology, Physics, Chemistry, Astronomy, Geology and applied Sciences such as Medicine and Physiology are built upon (Kabutu, Oloyede & Bandele, 2015; Osokoya, 2013).

It is in realization of the importance of science education and Basic Science in particular as a bedrock for sustainable development in any nation that educators and researchers are highly challenged to discover more authentic pedagogical strategies that will enhance the teaching and learning of Basic Science and develop students' overall potentials, assess and report students' achievement more appropriately (Bukunola & Idowu, 2012; Oludipe, 2012). There are many active learning methods that have been used in the Basic Science classroom that are student centred such as; experimentation, demonstration, discovery, concept-mapping and so on. Despite the utilization of these methods, Basic Science students to a large extent still show sign of low skill acquisition and low concepts understanding (Kabutu, Oloyede & Bandele, 2015). This indicates that there are latent-potentials in students which these methods sometimes are not able to develop. There are many educational theories that guide teachers to improve their performance in order to increase students' achievements; among these theories, multiple intelligence (MI) theory shows promise in this context and has been adopted in many settings (Ali, Soosan & Hamze, 2013).

MI serves as a framework that helps teachers design instruction and provide varied learning experiences tailored for each learner. In other words, it helps teachers foster students' preferences to improve their performance. It challenges students to understand the world around them and create connections between their lives and their interests (Al-Nakhbi & Barza, 2016; Yalmanci & Gozum, 2013). Implementing Ml learning theory may also help to ensure effective implementation of inclusive instructional models because of how it involves integrating different strategies according to students' different learning styles and abilities (Ali, Soosan & Hamze, 2013).

Teachers' ability to meet all students' needs is an important factor to achieve high standards in education (Konstantinou-Katzi, Tsolaki, Meletiou-Mavrotheris & Koutselini, 2012). In order to meet the varying needs of all students and help them to meet the established standards, teachers must differentiate their instructions by adapting materials, instructional procedures, and means of assessment. Teachers can modify the curriculum and maximize the learning opportunity for each student in the classroom (Hillier, 2011). In addition, giving students some choice can be a great motivator for students to participate and learn because it allows them to work in their own comfort zone.

II. MULTIPLE INTELLIGENCE THEORY

MI theory presents an alternative to the definition of intelligence as a single entity. Gardner (2006[a]) argues that the intelligence quotient (IQ), measures a narrow range of verbal/linguistic and logical/mathematical abilities and argues that the human cognitive architecture is not so limited. He holds that human intelligence can be divided into eight categories and that every person has a different level of development in each type of intelligence (Armstrong, 2009).

The eight intelligences are:

Verbal/linguistic intelligence: The ability to use word effectively.

Logical/mathematical intelligence: The ability to use numbers effectively.

Visual/spatial intelligence: The ability to recognize visual works accurately.

Bodily/kinesthetic: The ability to use the body to express the ideas and feelings.

Musical Intelligence: The ability to recognize rhythm and express musical.

Interpersonal Intelligence: The ability to understand others feeling, motivations and intentions and reply effectively.

Intrapersonal Intelligence: The self-knowledge and the ability to adapt the actions depending on this knowledge.

Naturalist Intelligence: The ability to recognize the different species in the environment (Gardner, 1993).

Gardner's MI theory is based on the premise that everyone has specific and distinct intelligences (Gangi, 2011). Each element of intelligence is separate, and can combine with others to provide solutions to problems. Thus, for a teacher to employ the MI Theory, they first have to identify the intelligences of their students (Gardner, 2006[a]). For example, a student with a powerful intrapersonal intelligence level will learn better alone and in a quiet environment, while s student with a strong interpersonal element will learn better in groups. So, students learn in different ways. The learning method that works best for one student may not work for another. Therefore, teachers should accommodate students' learning needs by incorporating varied teaching methods based on an assessment of students' MI.

Identifying a student's intelligence is one important step in order to achieve a larger goal. When the teachers recognize the student's intelligence, they will be able to tailor their teaching strategies to take those strengths into account (Armstrong, 2009). Science teachers may benefit from using MI strategies in such a way that each student would receive, understand, and interact with new information through his or her own capability. Scientific concepts become more meaningful to the student when teachers provide a variety of activities that tap into students' learning potential (Bas, 2008). Gangi (2011) suggests that MI method helps teachers to provide appropriate teaching strategies in diverse classrooms and support every learner by giving them the opportunity to learn and demonstrate their understanding by using their strengths. Moreover, MI learning theory helps parents and teachers to understand education holistically. MI persuades parents and teachers to consider various teaching approaches and examine their own ideas of achievement (Ali, Soosan & Hamze, 2013).

MI instructional strategy recognizes that each student possesses these intelligences, but they are not always developed well or effectively. This technique asks the question, in what ways are students smart, rather than, are they smart. Teachers can activate the less-pronounced intelligences

in students by carefully diversifying the strategies. Child centred teaching, open-ended projects, cross-curricular activities, independent study, learning centre activities, multi model work, group projects, discovery learning are some of the techniques that embrace Gardner's theory of multiple intelligence teaching Al-Nakhbi & Barza, 2016; Ali, Soosan & Hamze, 2013).

III. MI AND STUDENTS' ACHIEVEMENTS

Researchers (Al-Nakhbi & Barza, 2016; Okoli, Akuezuilo & Okoli, 2015; Emendu & Udogu, 2013; Ali, Soosan & Hamze, 2013; Yalmanci & Gozum, 2013) concluded that implementing MI strategies assisted teachers in creating more innovative lesson plans and in meeting student needs, which in turn led to higher academic achievement as well as improvements in emotional well-being and that students taught using MI methods have better acquisition and retention of knowledge. Golthan (2010) found significant differences in achievement levels in learning foreign language between students who studied using the traditional method as compared with students where Ml theory was applied. They conclude that student levels of motivation and engagement increase when the environment is rightly adapted. Moreover, students taught using MI and project-based methods demonstrated increased creative thinking, problem solving, and academic risk taking.

IV. MI AND ATTITUDES TOWARDS LEARNING

Several studies examined the effects of using MI strategies on students' attitudes towards learning foreign language, science, and reading. Al-Nakhbi and Barza, (2016) found that the students taught using MI based strategies had better attitudes towards learning science than those taught with traditional methods. Hasanah (2013) also reported positive results with MI strategies for 8th grade students' motivation for learning reading comprehension. Students' had a better learning experience with more active learning engagement, less boredom, and followed instructions better. Moreover, students taught using MI and project-based methods demonstrated increased creative thinking, problem solving, and academic risk taking. Student interaction and enthusiasm for learning was higher than the control group, as echoed by the findings of another study with 7th grade science students (Esra, Baig & Muhammet, 2006). Nevertheless, there are no a studies that investigate the effect of MI strategies on upper basic science students' achievement and attitude in Nasarawa State.

STATEMENT OF THE PROBLEM

Despite efforts through research into the strategies that could improve achievement and attitude of students towards Basic Science, it teaching and learning has received a continual criticism from the society as a result students' underachievement in external examinations. This weakness in students' achievement is attributed to some factors such as; students' weakness in comprehending Basic Science concepts, instructional approaches utilized by teachers, lack of manipulative skills by students, students' readiness and so on. There is therefore need to try new approaches in Basic Science teaching that will enhance students' achievement profile and promote cognitive acceleration that will guarantee productivity and face global challenges. The problem of this study therefore is; what is the effect of MI instructional strategies on upper basic II students' achievement and attitude towards Basic Science in Nasarawa State?

The purpose of this study was to determine the effect of MI instructional strategies on upper basic II students' achievement and attitude towards Basic Science in Nasarawa State. Specifically, the study sought to find out;

- ✓ the effect of MI instructional strategies on upper basic II students' achievement in Basic Science.
- ✓ the effect of MI instructional strategies on upper basic II students' attitude towards Basic Science.

RESEARCH QUESTIONS

The following research questions guided the study;

- ✓ What is the effect of MI instructional strategies on mean achievement scores of upper basic II students in Basic Science?
- ✓ What is the effect of MI instructional strategies on mean attitude rates upper basic II students towards Basic Science?

HYPOTHESES

H_{O1}: There is no significant difference between the mean achievement scores of upper basic

II Basic Science students exposed to MI instructional strategies.

H_{O1}: There is no significant difference between the mean attitude rates of upper basic II

students towards Basic Science as exposed to MI instructional strategies.

V. METHODOLOGY

This study investigated the effect of MI instructional strategies on upper basic II students' achievement and attitude towards Basic Science in Nasarawa State. It adopted a non-randomized, pretest-posttest, control group quasi-experimental research design. This non-equivalent control group design was considered appropriate for this study because participants were not randomly assigned to the two groups rather treatment was randomly assigned to intact classes which were already organized. The population of the study comprised 1,467 students made up of 837 males and 530 females from public coeducational schools in Keffi Education Zone. The sample for this study consists of 72 (38 males and 34 females) upper basic II students drawn from two public coeducational schools in the Zone. In each of the schools selected, one intact class each was randomly sample. A flip coin was used to select the experimental and control groups (35 students for the experimental group (Multiple Intelligence) and 37 students for

the control group (Expository Method)). The head of the coin was assigned as the experimental group while the tail became the control group. Two instruments namely; Basic Science Achievement Test (BSAT) and Attitudes Towards Basic Science Questionnaire (ATBASQ) were used for data collection. ATBAS contained 20 items designed to determine students' attitude towards Basic Science. ATBASQ was rated using a four-point rating scale. The options were; Strongly agreed (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagreed (SD) = 1 point. BSAT was a 20 itemed instrument with options A – D that tested the students' knowledge, comprehension, application of selected topics in Work, Energy and Power. The items were allotted 1mark each, culminating to the total score of 20marks. The test was validated by experts and was trial-tested. The reliability of ATBASQ was determined using Cronbach Alpha and the coefficient obtained was 0.79 while BSAT was determined using K-R_{21} formula and the reliability coefficient obtained was 0.80 implying that the instruments were reliable.

VI. EXPERIMENTAL PROCEDURE

Before the commencement of the experiment, a two-week intensive training programme was organized for the research assistants who were teachers from the sampled intact classes teaching Basic Science. The experimental group teacher was enlightened on the multiple intelligence theory, the multiple intelligence lesson plans on Work, Energy and Power; how to incorporate the multiple intelligence instructional strategy into the lessons and the general requirements of the research. The control group teacher was briefed on the requirements of the research and the use of expository method and the lesson plans on Work, Energy and Power. By the end of the training, the researcher organized a micro teaching session for the research assistants to ensure that they have mastery of instructions and materials.

A pretest test was administered one week prior to the experiment using BSAT and ATBASQ. The experimental group was taught using multiple intelligence instructional strategies, accompanied with multiple intelligence lesson plans. The lesson plans incorporated five multiple intelligence instructional strategies: active learning, project based learning, collaborative, authentic instruction and self-assessment of themselves. The instructional strategies addressed six multiple intelligences namely; verbal-linguistics, logical-mathematical, inter-personal, bodily-kinesthetic, visual-spatial and intra-personal intelligences. The experimental group was taught using real objects and charts. These visual aids that appeal to the sense of sight made the instruction authentic and addressed visual-spatial intelligence. The students were assigned different tasks which appeal to the sense of touch (bodily-kinesthetic). The students were grouped in 'fives' and different sub-topics were assigned to the in order to enhance critical thinking and skills. Finally, the students were allowed to evaluated themselves through self-assessment. The control group was taught using the expository method. The lessons lasted 80minutes each for four weeks. Data were collected and collated.

VII. DATA ANALYSIS

Descriptive statistics of means and Standard Deviations were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. The adoption of ANCOVA was to take care of error due to initial difference in ability among the participating students.

VIII. RESULT

RESEARCH QUESTION ONE

What is the effect of MI instructional strategies on mean achievement scores of upper basic II students in Basic Science?

Data to answer this research question is represented in Table 1.

Group	Type of test	No of students	X	SD	Mean Gain
Experimental (MI)	Pre-test	35	9.55	3.09	
	Post-test	35	17.43	2.98	7.88
Control (EM)	Pre-test	37	5.56	3.17	
	Post-test	37	10.38	2.21	4.82

Table 1: Means Achievement and Standard Deviations Scores of Students in the Experimental and Control Groups Using BSAT

Table 1 shows that the mean gain achievement score of the experimental group (MI) was higher (7.88) than the control group (4.82). This means that the group taught using Multiple Intelligence achieved better than those taught using the Expository Method. The standard deviation scores show that the groups' achievement scores were sparsely distributed around the mean.

RESEARCH QUESTION TWO

What is the effect of MI instructional strategies on mean attitude rates upper basic II students towards Basic Science?

Data to answer this research question is represented in Table 2.

Group	Type of test	No of students	X	SD	Mean Gain
Experimental (MI)	Pre-attitude	35	10.01	3.25	
	Post-attitude	35	18.12	3.01	8.11
Control (EM)	Pre-attitude	37	8.36	3.65	
	Post-attitude	37	13.71	3.65	5.35

Table 2: Means Attitude and Standard Deviations Scores of Students in the Experimental and Control Groups Using ATBASQ

Table 2 shows that the mean gain attitude score of the experimental group (MI) was higher (8.11) than the control group (5.35). This means that the group taught using Multiple Intelligence exhibited improved attitude towards Basic

Science than those taught using the Expository Method. The standard deviation scores show that the groups' achievement scores were sparsely distributed around the mean.

HYPOTHESIS ONE

There is no significant difference between the mean achievement scores of upper basic II Basic Science students exposed to MI instructional strategies.

Data to test this hypothesis is represented in Table 3.

Source	Type III Sum of squares	Df	Mean square	F	Sig.	Result
Corrected model	931.159	2	541.321	68.162	0.000	S
Intercept	127.356	1	127.356	20.226	0.001	S
Pretest	96.539	1	96.539	57.016	0.000	S
Group	54.306	1	54.306	83.352	0.000	S
Error	535.510	67				
Total	1744.87	72				

Significant at P<0.05

Table 3: Result of Analysis of Covariance on Students Achievement Using BSAT

Table 3 reveals significant difference in mean achievement scores of students exposed to Multiple Intelligence and Expository Method; F-calculated 83.352 P<0.05. This means that MI (treatment condition) was a significant factor that triggered the overall students' mean achievement scores in Basic Science concepts taught (Work, Energy and Power). Therefore, the null hypothesis of no significant difference was rejected.

HYPOTHESIS TWO

There is no significant difference between the mean attitude rates of upper basic II students towards Basic Science as exposed to MI instructional strategies.

Data to test this hypothesis is represented in Table 4.

Source	Type III Sum of squares	Df	Mean square	F	Sig.	Result
Corrected model	611.120	2	332.501	82.081	0.001	S
Intercept	201.006	1	201.006	51.421	0.001	S
Pretest-Attitude	109.316	1	109.316	64.321	0.001	S
Group	76.401	1	76.401	203.211	0.000	S
Error	305.421	67				
Total	1303.264	72				

Significant at P<0.05

Table 4: Result of Analysis of Covariance on Students Using ATBASQ

Table 4 reveals significant difference in mean attitude scores of students exposed to Multiple Intelligence and Expository Method; F-calculated 203.211 P<0.05. This means that MI (treatment condition) was a significant factor that triggered the overall students' mean attitude scores in Basic Science concepts taught (Work, Energy and Power). Therefore, the null hypothesis of no significant difference was rejected.

IX. DISCUSSION

Findings of the study revealed a significant difference between the achievement of upper basic II students taught Basic Science concepts using Multiple Intelligence instructional strategies and those taught using Expository Method. This is in agreement with the findings of (AL-Nakhbi & Barza, 2016; Yalmanci & Gozum, 2013; Emendu & Udogu, 2013; Ali, Soosan & Hamze, 2013; Okoli & Akuezuilo) who in their separate studies found that the adoption of the Multiple Intelligence instructional strategies greatly improves students' achievement. The reason for the improved achievement is because the teacher adopted various instructional approaches that appealed to the students' various intelligences, addressing their diverse learning styles and consequently increase their motivation to learn. Students were given opportunities to actively participate in the class by interacting freely with the teacher and their peers, learning in groups and assessing their performances themselves which improved their verbal-linguistic, logical-mathematical, interpersonal and intrapersonal intelligences, self-esteem, enthusiasm and their willingness to take ownership and responsibility for their learning. These in turn lead to a considerable improvement in their cognitive achievement.

Findings of this study also shows that a significant difference between the attitude of upper basic II students taught Basic Science concepts using Multiple Intelligence instructional strategies and those taught using Expository Method. This is in agreement with the findings of (AL-Nakhbi & Barza, 2016; Hasanah, 2013; Esra, Baig & Muhammet, 2006) who found out that students' attitudes increase positively towards science when exposed to Multiple Intelligence based learning strategy. The reason could be that students in the MI group were given far more choices than those in the Expository Method group. Students in MI had choices between types of activities to demonstrate their understanding of the Basic Science concepts. It is possible that these choices resulted in more active class participation and increased enthusiasm since greater autonomy for learners is associated with greater gains.

X. CONCLUSION

The findings of this study revealed that Multiple Intelligence instructional strategies had significant effect on upper basic II students' achievement and attitude towards Basic Science concepts taught. Implication of the findings as emanated from Gardner's theory of multiple intelligence include; different kinds of abilities exist in the learners. Teachers have the challenge to enrich their learners lives by identifying, developing and celebrating the diverse attributes of each learner.

XI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made;

- ✓ Basic Science teachers should adopt the Multiple Intelligence instructional strategies which will enable them cater for the diverse learning styles of students in order to improve their cognitive achievement and attitude towards Basic Science concepts.
- ✓ Students should be encouraged to work collaboratively and cooperatively which will help trigger their achievement and attitude towards Basic Science.

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