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Learning Styles and Gender Effects on Secondary School Students' Learning Outcomes in Ijebu-Ode Community, Ogun State, Nigeria

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Abstract. Students' learning styles can help to enhance effective teaching and learning. Making students aware of their learning styles and showing them their individual strengths and weaknesses can help students to understand why learning is sometimes difficult for them and is for developing their weaknesses. The study adopted a pre-test, post-test, control group switching replication quasi-experimental design. Switching replication quasi-experimental design was used in order to increase the internal validity of the study and to establish the efficacy of the treatment. Two Local Government (Ijebu North & Ijebu Ode) Areas in Ogun State were purposively selected. The main instrument used for the study was Learning Styles Self-Assessment Test (LSSAT). LSSAT was an adaptation of the Learning Style Scale developed by Clark (2011), designed to help identify how students prefer to learn. The result of the main effect of learning style on the students' achievement scores in the first phase and after the second phase (i.e. after switching replication) show non-significant main effect of learning style on the students' achievement scores. It was recommended that teachers should evaluate their students' lesson plans to identify which learning modality - visual, auditory or kinesthetic- is best suited for each particular lesson.

Keywords: Learning styles, Learning outcomes, Gender, Teaching-learning, Civics, Biology

1. Background to the Study

The learner is seen as the person who does not yet have the required knowledge and the teacher as the one who has the knowledge, and whose function is to convey them to the learner. By this, the relationship between the teacher and the learner is determined. From the nature of this relationship, a number of things follow: the systematic transmission of knowledge from teacher to learner needs to proceed smoothly: carefully designed syllabuses and prescribed curriculum contents have to be put in place as well as conducive/supportive learning environment and resources to enhance motivation for learning (Udo & Uko, 2014).

A learning style is a student's consistent way of responding to and using stimuli in the context of learning. Keefe (1979) defines learning style as the composite of characteristic cognitive, affective and physiological factors that serve as relative stable indicators of how a learner perceives, interacts with and responds to the learning environment. Stewart & Felicetti (1992) also define learning style as those educational conditions under which a student is most likely to learn. Thus, learning styles are not really concerned with what learners learn but how learners prefer to learn. Many learning style models exist in literature, such as the learning style model by (Clark, 2011). While there are

still many open issues with respect to learning styles, the learning style models agree that learners have different ways in which they prefer to learn.

Civics, as one of the emerging trends in social studies curriculum occupies a prominent position in solving the problem of incivility and political ignorance in the society (Lee, 2010). Citizenship Foundation (2014) avers that Civics increases learners' knowledge and skills to understand challenge and engage with the pillars of democracy: politics, economy and law. In its own submission, the American Sociological Association (2009) describes Civics as the teaching of knowledge, skills and dispositions needed to become a responsible and effective citizen of a country. Kerr (2009) explains that Civics increases students' knowledge, skills and values. To Akinlaye (2003), civics also prepares students to take appropriate civic actions as individuals or as members of groups devoted to civic improvement. Merrifield and Mutebi (1991) further reveal that Civics enables students to understand, appreciate, and apply knowledge, processes, and attitudes from academic disciplines. Civics is one subject, according to VanSledright (2011) that is specifically designed in content and function, to produce healthy, good and active citizens, wherein a good citizen is seen as patriotic, responsible, disciplined and conscientious, morally sound with love for his/her country.

Biology is a very important subject in the field of science and also one of the science subjects at the senior secondary school (Federal Republic of Nigeria, 2014). Biology is the science of life that studies living matter, structure, function and behaviours of organism. It is concerned with evolution, distribution and taxonomy of life (Bilesanmi-Awoderu, Afuwape & Jolaosho, 2017a). Biology is the corner stone that cannot be over emphasized in terms of nation's technology and industrial development (Bilesanmi-Awoderu, Afuwape & Jolaosho, 2017b). The Biology curriculum is planned such that the teacher is compelled to use activity oriented, learner-centred approach to meet the needs of the learners. Effective teaching of Biology cannot be achieved without positive and meaningful interaction between the teacher, students and the learning materials. It is established that the problem of poor performance in Biology sometimes is not limited to the students' factors alone but also to teachers' pedagogical strategies (Ayuba, 2016).

Furthermore, many educational theorists and researchers consider learning styles as an important factor in the learning process and agree that incorporating them in education has potential to facilitate students learning. Knowing students' learning styles can help enhance learning and teaching. First, teachers can benefit by getting information about how students learn best, and this provides a deeper understanding that could help explanation or preparation of learning material. Furthermore, making students aware of their learning styles and showing them their individual strengths and weaknesses can help students to understand why learning is sometimes difficult for them and is for developing their weaknesses. In addition, students can be supported by matching the teaching style with their learning style. Providing students with learning material and activities that fit their preferred ways of learning in other to make learning easier for them (Graf & Kinshuk, 2007).

The Visual, Auditory and Kinesthetic Learning Styles (VAK) use the three main sensory receivers: Visual, Auditory and Kinesthetic (movement) to determine the dominant learning style. VAK seems to be about the most popular model nowadays due to its simplicity (Clark, 2011). According to the VAK theorists, information should be presented using all the three styles. This allows learners the opportunity to become involved, no matter what their preferred style may be. Several studies confirmed this (Dawn, 2009). Adedapo (2013) reported that there was no significant effect of learning style on students' cognitive achievement in microteaching and also no significant interactive effect of microteaching modes and learning style on students' cognitive achievement in microteaching. Olurinola (2015) found that there was no significant main effect of learning style on the attitude of students' to Visual Arts. However, Hattie (2011) reported

that there was significant effect of learning style on students' cognitive achievement in learning concepts. There is therefore a need to look at how instructional strategy can interact with learning style in enhancing learning outcomes.

2. Statement of Research Problem

In situations where students are ill-informed, bewildered or disenfranchised from productively participating in socio-political activities, it is certain that such country would be retrogressive or backward among the comity of nations (National Council for Social Studies, 2007). This situation could be said of the present political dispensation in Nigeria. Interaction with students reveals a growing sense of disenchantment with all levels of government and distrust in government's policies and programmes. Meanwhile, students' performance in Biology, in both internal and external examinations, has consistently been reportedly low, over the years in Nigeria. The problem of decline performance is not limited to students' factors alone but also to teachers' pedagogical strategies. The effective teaching of Biology cannot be achieved without positive and meaningful interaction between the teacher, students and the environmental resources.

The problem of decline performance is not limited to students' factors alone but also to teachers' pedagogical strategies. The effective teaching cannot be achieved without positive and meaningful interaction between the teacher, students and the environmental resources. Instruction given by the teacher has to be effective for learning to take place. The essence of instruction is to prepare, present and evaluate lessons given to learners. Many teachers teach without students learning, which later results to poor academic achievement. There is therefore a need to look at how learning style and gender enhance learning outcomes.

3. Research Hypotheses

$H_0$1 There is no significant main effect of learning styles on:

- Students' achievement in Civics and Biology
- Attitude of students to Civics and Biology

$H_0$2: There is no significant interaction effect of gender and learning styles on:

- Students' achievement in Civics and Biology
- Attitude of students to Civics and Biology

4. Theoretical Background: Cognitive Constructivism Learning Theory

The constructivist theory was proposed by Bruner (1960) to describe the active nature of learning. Constructivism is an epistemology used to explain how people acquire knowledge. The basic idea is that problem solving is at the heart of learning, thinking, and development. As people solve problems and discover the consequences of their actions through reflecting on past and immediate experiences, they construct their own understanding. Learning is thus an active process that requires a change in the learner. This is achieved through the activities the learner engaged in, including the consequences of those activities, and through reflection.

Constructivists believe that prior knowledge impacts the learning process. In trying to solve novel problems, perceptual or conceptual similarities between existing knowledge and a new problem can remind people of what they already know. This is often one's first approach towards solving novel problems. Information not connected with a learner's prior experiences will be quickly forgotten. In short, the learner must actively construct new information into his or her existing mental framework for meaningful learning to occur. According to the theory, students build new knowledge based on their prior knowledge. Prior knowledge provides an anchor to assimilate new knowledge into cognitive structure (schemata).

Taber (2001) developed a typology to analyze the learning impediments in terms of prior knowledge. He opined that, if students do not have appropriate prior knowledge, intended learning cannot take place. This kind of learning impediments was labeled a 'null learning

impediments'. This 'null' means that students do not have or at least do not seem to have prior knowledge that is assumed to be what they have learnt from the prior instructions and where they start to build new knowledge. In order to teach any subject successfully in the classroom, teachers should be aware of what students' prior knowledge is, how it affects teaching and learning. The role of prior knowledge in teaching and learning can be considered as both foundation for learning and barrier to understanding (Fisher, 2004).

Bruner (1960) believed that prior knowledge is the foundation for subsequent learning, thus a curriculum should be organized in a spiral manner so that the students continually build upon what they have already learned. He argued that the spiral curriculum helps the students to master knowledge by revisiting the same basic ideas of the knowledge repeatedly in different ways of learning, depending on his/her readiness for learning. In our educational settings, current curriculum reflects those ideas. As a result, the curriculum is organized in a simple-to-complex, general-to-detailed, concrete-to-abstract manner so that students repeatedly learn the key concepts in any subject as they move up from the lower grades to higher grades in schools. This helps students master certain prerequisite knowledge and skills. This prerequisite sequencing provides linkages between each lesson as student spirals upwards in a course of a study. As new knowledge and skills are introduced in subsequent lessons, they reinforce what is already learnt and become related to previously learned information. What the student gradually achieves is a rich breadth and depth of information that is not normally developed in curricula where each topic is discrete and disconnected from each other.

According to Erinosho (2008), learning becomes " meaningful" only after the new materials are well connected with existing related knowledge or schemata individual can only learn if her/his conceptual schema provides the framework upon which to fit new knowledge. The more the information a learner acquires, the more the schema changes in terms of scope and structure of the network. On the contrary, learning conflict occurs if there is a contradiction between the existing schema and new ideas, forcing the learner to consider whether to reject the new idea or discard the old. For effective learning therefore, it is important to draw upon relevant previous experiences of learner in teaching new materials.

In this sense, prior knowledge can be defined as the pre-instructional knowledge that students have learned from previous lessons. That is, prior knowledge is the foundation for subsequent learning that should be mastered before new information is to be taught. The teaching sequence should be designed on the basis of a detailed conceptual analysis of the any subject to be taught and students' typical pre-instructional knowledge. Through this analysis, curricular goals can be identified and teaching activities designed and evaluated (Leach & Scott, 2003).

Therefore, a paramount factor in any meaningful learning is what has previously been learned. In order for meaningful learning to take place, it is necessary both for the learner to hold some relevant prior knowledge, and for the teacher to 'make the connection' to help the learner recognize its relevance. If either of these conditions is not met, then rote learning instead of meaningful learning will take place (Taber, 2001). Likewise, many cognitive learning theorists emphasize the positive links between what has been learnt and what is to be learnt. They argued that because knowledge has logical and psychological links, the possibility of sequential and vertical transfer of learning would be enhanced by suitable arrangements and presentations (Fensham, 2002). This means that without prior knowledge learning cannot occur. In short, prior knowledge determines what we learn from experience. Many studies have been carried out to investigate the effect of prior knowledge on students' achievements and attitude, mostly in the tertiary institutions. Some of the studies found positive relationship between prior knowledge and achievement (Ajogbeje, 2012; Melin & Amelia, 2014) while others found no significant effect (Bamiro, 2011 & Agoro, 2014). Robert (2003) reported that students with high prior knowledge in the content area had higher content knowledge gain at the end of instruction while Myers & Dyers

(2006) on the other hand observed that students with less prior knowledge had higher content knowledge gain at the end of their study.

5. Literature Review

The integration of system approach into the curriculum has opened up the classroom to date more flexible teaching methods that result not only in more engaged student processes, but also in the changing roles of the teacher and student. Most of the instruction in schools, tends to be auditory (lectures), abstract (intuitive), passive (little opportunity for student feedback) and sequential. Bransford, Brophy and Williams (2000) indicated that the content itself, and the content-specific style of teaching, prevalent in the old paradigm of education, can have a filtering effect on students.

Educational technology research should be undertaken with understanding of how people learn and teach. Most educators use selected theories of intelligence or learning styles to influence their teaching. This is based on the idea that students have different strengths and learning preferences, thus teachers must adjust their instruction according to the students' learning styles (Brian, 2011). The process by which people perceive and process information is as unique as the individual.

Since individuals respond differently to certain situations, the preferred learning style of a learner may not always be the same for different learning tasks. The learner may prefer one style of learning for one task and a combination of others styles for a different task. Dick and Carey Instructional Model allow all learners the opportunity to become involved no matter what their preferred style may be. It also offers asignificant opportunity to improve the students' performance and most effectively support students with different learning styles (Mayer, 2003). In support for effective learning, Clark (2011) is of the opinion that the most effective teaching methods involve a combination of all three sensory components.

A shift from traditional to a system approach model in instruction has led to an increased interest in learners' individual differences. Consequently, learning styles tend to be distributed differently in different field of study. Learning styles can be seen as "a description of the attitudes and behaviours which an individual's preferred way of learning" (Clark, 2011). An individual's learning style indicates how he or she best retrieves and retains information. Different people prefer different methods of learning. The VAK learning style encompasses three methods of sensory learning: Visual (sight), Auditory (sound) and Kinesthetic (touch or motion). The most effective teaching methods involve a combination of all three sensory components. Though individuals may prefer to use a particular learning method, it is important to understand that learning styles are situational, and no single style is dominant in every circumstance (Dawn, 2009).

The VAK learning style uses the three main sensory receivers: Visual, Auditory, and Kinesthetic to determine the dominant learning style. It is sometimes known as VAKT (Visual, Auditory, Kinesthetic and Tactile). It is based on modalities channels by which human expression can take place and is composed of a combination of perception and memory. VAK is derived from the accelerated learning world and seems to be the most popular model due to its simplicity (Clark, 2011). VAK Learners use all three modalities to receive and learn new information and experiences. However, according to the VAK or modality theory, one or two of these receiving styles is normally dominant. This dominant style defines the best way for a person to learn new information by filtering what is to be learned. This style may not always be the same for some tasks. The learner may prefer one style of learning for one task, and a combination of others for a different task.

Visual: Visual learning style is the learning style which focuses on watching to learn. The individual with visual learning style learn best through visual stimulation. The visual learners are able to read and understand and they study best when reading a text and using highlighters as visual stimulation that assist in remembrance. These students benefit when diagrams, videos or similar visuals are used to teacher them. People

who prefer to learn visually can be categorized into two groups: linguistic or spatial. Visual-linguistic learners benefit most by reading and writing tasks. They can quickly understand and retain information that is in written form, so materials such as meeting handouts, notes in class and textbook assignments work well for these learners. Visual-spatial learners do not enjoy reading or writing tasks but instead learn most effectively when graphs, illustrations, colour coding and other visual aids are used to present information People who prefer to learn in this manner tend to associate new information with mental imagery. Learners who are visual-linguistic like to learn through written language, such as reading and writing tasks. They remember what has been written down, even if they do not read it more than once.

They like to write down directions and pay better attention to lectures if they watch them. Learners who are visual-spatial usually have difficulty with the written language and do better with charts, demonstrations, videos, and other visual materials. They easily visualize faces and places by using their imagination and seldom get lost in new surroundings. To integrate this style into the learning environment: the use of graphs, charts, illustrations, or other visual aids are important. Include outlines, concept maps, agendas, handouts, etc. for reading and taking notes. Include plenty of content in handouts to reread after the learning session. Leave white space in handouts for note-taking. Invite questions to help them stay alert in auditory environments. Post flip charts to show what will come and what has been presented. Emphasize key points to cue when to takes notes. Eliminate potential distractions. Supplement textual information with illustrations whenever possible. Have them draw pictures in the margins. Have the learners envision the topic or have them act out the subject matter (Graf, Kinshuk & Liu, 2009 & Clark, 2011).

Auditory: Auditory learning style is the style of learning through listening. Students who use this learning style hear lectures, participate in a discussion from which it is easy for them to understand the information better. For individuals who are auditory learners, written works are often difficult for learners in that category; information should therefore be sufficiently loud to be heard such that tone, pitch and sounds will aid comprehension. Auditory learners like to receive new information and instructions through listening and speaking. An auditory learner can best absorb information by having a conversation with someone, listening to an audiotape, sitting in a classroom lecture or participating in a presentation. People with this learning preference may enjoy activities that involve brainstorming, debate and other vocal exchanges that take place between people. Auditory learners often talk to themselves. They also may move their lips and read out loud. They may have difficulty with reading and writing tasks. They often do better talking to a colleague or a tape recorder and hearing what was said. To integrate this style into the learning environment:

Begin new material with a brief explanation of what is coming. Conclude with a summary of what has been covered. This is the old adage of tell them what they are going to learn, teach them and tell them what they have learned. Use the Socratic method of lecturing by questioning learners to draw as much information from them as possible and then fill in the gaps with you own expertise. Include auditory activities, such as brainstorming, or buzz groups. Leave plenty of time to debrief activities. This allows them to make connections of what they learned and how it applies to their situation. Have the learners verbalize the questions. Develop an internal dia1ogue between yourself and the learners (Clark, 2011).

Kinesthetic: Kinesthetic learning style refers to tactile learning, which is learning by doing something. The individual learns only by touching, putting something together or take something apart using his hands. These learners are exploratory learners and need to move to understand the world around them (Dunn & Dunn, 2002). Kinesthetic learners can be classified as dependent on touch or motion. A kinesthetic learner may appear to be easily distracted by exhibiting excess movement, doodling on notes in class or falling asleep during a long presentation. These learners

perform best when encouraged to be active. Teaching techniques that benefit kinesthetic learners involve taking stretch breaks during long presentations, performing activities that involve movement, providing opportunity for notes to be written or highlighted and playing music when appropriate.

Kinsthetic learners do best while touching and moving. It also has two sub-channels: kinesthetic movement) and tactile (touch). They tend to lose concentration if there is little or no external stimulation or movement. When listening to lectures they may want to take notes for the sake of moving their hands. When reading, they like to scan the material first, and then focus in on the details (get the big picture first). They typically use color high lighters and take notes by drawing pictures, diagrams, or doodling. To integrate this style into the learning environment: Use activities that get the learners up and moving. Play music, when appropriate, during activities. Use coloured markers to emphasize key points on flip charts or white boards. Give frequent stretch breaks (brain breaks). Provide toys Play-Dough to give them something to do with their hands. Provide high lighters, colored pens and/or pencils. Guide learners through a visualization of complex tasks. Have them transfer information from the text to another medium such as a keyboard or a tablet.

Since individual respond differently to certain situations, the preferred learning style of a learner may not always be the same for different learning tasks. The learner may prefer one style of learning for one task, and a combination of others styles for a different task. However according to the VAK modality theory, one or two of the receiving styles is normally dominant. It is the dominant styles that define the best way for a person to learn new information which occurs by filtering what is to be learned. According to the VAK theorist, we need to present information using all three styles. This allows all learners the opportunity to become involved, no matter what their preferred style may be.) In support of effective learning, Clark (2011) is of the opinion that the most effective teaching methods involve a combination of all three sensory components.

6. **Methodology**

The study adopted a pre-test, post-test, control group switching replication quasi-experimental design. Switching replication quasi-experimental design was used in order to increase the internal validity of the study and to establish the efficacy of the treatment. Two Local Government (Ijebu North & Ijebu Ode) out of twenty Local Government Areas in Ogun State were purposively selected. Purposive sampling technique was also used to select two public senior secondary schools from a total of nineteen (19) public secondary schools in Ijebu North Local Government Area and from a total of thirty four (34) public secondary schools in Ijebu-Ode Local Government Area, Ogun State. The main instrument used for the study is Learning Styles Self-Assessment Test in Civics and Biology (LSSAT-CB).

LSSAT-CB was an adaptation of the Learning Style Scale developed by Clark (2011), designed to help identify how students prefer to learn. The instrument was used to categorize students into of the three groups identified in the study (Visual, Auditory and Kinesthetic). The inventory contains 30 items whose answers provide students with an indication of what their personal learning preference may tend to be. The students were asked to respond to the thirty items to detect their learning style. Ten items each, representing the three categories, Visual, Auditory and Kinesthetic was developed, however the items were shuffled to control against respondents' fixation on any of the categories. The statements require respondent to indicate how each applies to them. Specifically *1* means Not Like Me, *2* means A Little Like Me, *3* means Like Me, *4* means A Lot Like Me. Scores were totaled to determine students' learning style preference. The instrument was validated, and a Cronbach alpha coefficient of 0.70 was obtained. The hypotheses formulated were tested using the univariate analysis of covariance (ANCOVA) test with pre-test scores serving as covariates. The analysis was done at two levels (before and

after switching replication) and at 0.05 level of significance. Multiple classification analysis (MCA) was used to show and explain the magnitudes of the mean post-test achievement and attitude scores across the different levels of instructional model, gender and learning style.

7. Results

$H_0$1 There is no significant main effect of learning styles on:

- Students' achievement in Civics and Biology
- Attitude of students to Civics and Biology

$H_0$2: There is no significant interaction effect of gender and learning styles on:

- Students' achievement in Civics and Biology
- Attitude of students to Civics and Biology

Table 1: Students' Pre & Post-test Achievement Scores according to Learning Style before and after Switching Replication (SR)

Learning Style		N	Mean	S.D.	Mean Gain	Min.	Max.
Visual	Pre-test before SR	70	7.89	1.64	4.12	4	11
	Post-test before SR		12.01	2.87		7	17
	Pre-test after SR		6.57	1.40	4.67	4	10
	Post-test after SR		11.24	2.85		7	17
Auditory	Pre-test before SR	21	8.05	1.24	3.09	6	10
	Post-test before SR		11.14	2.61		8	16
	Pre-test after SR		6.19	1.67	4.10	4	10
	Post-test after SR		10.29	2.85		6	16
Kinesthetic	Pre-test before SR	9	7.33	1.41	3.34	5	10
	Post-test before SR		10.67	3.24		7	16
	Pre-test after SR		7.00	1.41	3.67	5	9
	Post-test after SR		10.67	3.39		8	17
Total	Pre-test before SR	**100**	**7.87**	**1.54**	**3.84**	**4**	**11**
	Post-test before SR		**11.71**	**2.87**		**7**	**7**
	Pre-test after SR		**6.53**	**1.46**	**4.46**	**4**	**10**
	Post-test after SR		**10.99**	**2.89**		**6**	**17**

The result in table1 shows the participants' mean and standard deviation scores in achievement according to learning style classification before(i.e. pre-test) and after (i.e. post-test in the first phase as well as post-test in the second phase). At the end of the interaction period, the visual learners, n = 70, recorded mean pre-test score of 7.89 (S.D. = 1.64) and mean post-test score of 12.01 (S.D. = 2.87) giving a positive mean gain of 4.12 in the first phase of the study. After switching replication, the same participants recorded mean pre-test score of 6.57 (S.D. = 1.40) and post-test score of 11.24 (S.D. = 2.85) also giving a positive mean gain of 4.67 in the second phase of the study. The auditory learners, n = 21, recorded mean pre-test score of 8.05 (S.D. = 1.24) and mean post-test score of 11.14 (S.D. = 2.61) giving a positive mean gain of 3.09 in the first phase of the experiment, while the same participants, after switching replication, recorded mean pre-test score of 6.19 (S.D. = 1.67) and post-test score of 10.29 (S.D. = 2.85) also giving a positive mean gain of 4.10 in the second phase of the study. The kinesthetic learners, n = 9, recorded mean pre-test score of 7.33 (S.D. = 1.41) and mean post-test score of 10.67 (S.D. = 3.24) giving a positive mean gain of 3.34 in the first phase of the study, while the same participants, after switching replication, recorded mean pre-test score of 7.00 (S..D. = 1.41) and post-test score of 10.69 (S.D. = 3.39) also giving a positive mean gain of 3.67 in the second phase of the study. This result shows consistent mean-gains in achievement scores across the levels of the students' learning style in both the first phase and second phase of treatment.

Table 2: Students' Pre & Post-test Attitude Scores according to Learning Style before and after Switching Replication (SR)

Learning Style		N	Mean	S.D.	Mean Gain	Min.	Max.
Visual	Pre-test before SR	70	68.14	10.95	**12.92**	50	90
	Post-test before SR		81.06	14.60		57	112
	Post-test after SR		76.06	14.10	7.92	50	103
Auditory	Pre-test before SR	21	65.00	7.67	**10.95**	50	80
	Post-test before SR		75.95	13.36		60	103
	Post-test after SR		73.95	14.20	8.95	57	110
Kinesthetic	Pre-test before SR	9	66.56	7.49	**8.00**	60	78
	Post-test before SR		74.56	11.83		67	100
	Post-test after SR		69.89	8.48	3.33	60	82
Total	Pre-test before SR	**100**	**67.34**	**10.10**	**12.06**	**50**	**90**
	Post-test before SR		**79.40**	**14.20**		**57**	**112**
	Post-test after SR		**75.06**	**13.73**	**7.72**	**50**	**110**

The result in table 2 shows the participants' mean and standard deviation scores in attitude according to learning style classification before (i.e. pre-test) and after (i.e. post-test in the first phase as well as post-test in the second phase). At the end of the interaction period, the 70 visual learners recorded mean pre-test attitude score of 68.14 (S.D. = 10.85) and mean post-test attitude score of 81.06 (S.D. = 14.60) giving a positive mean gain of 12.92 in the first phase of the study. After switching replication, the same participants recorded mean post-test attitude score of 76.06 (S.D. = 14.10) also giving a positive mean gain of 7.92 in the second phase of the study. The 21 auditory learners recorded mean pre-test attitude score of 65.00 (S.D. = 7.67) and mean post-test attitude score of 75.95 (S.D. = 13.36) giving a positive mean gain of 10.95 in the first phase of the study, while the same participants, after switching replication, recorded mean post-test attitude score of 73.95 (S.D. = 14.20) also giving a positive mean gain of 8.95 in the second phase of the study. The 9 kinesthetic learners recorded mean pre-test attitude score of 66.56 (S.D. = 7.49) and mean post-test attitude score of 74.56 (S.D. = 11.83) giving a positive mean gain of 8.00 in the first phase of the study, while the same participants, after switching replication, recorded mean post-test attitude score of 69.89 (S.D. = 8.46) also giving a positive mean gain of 3.33 in the second phase of the study. This result shows improved and consistent mean-gains in attitude scores of the visual, auditory and kinesthetic participants in both the first phase and second phase of treatment.

$H_0$1a: There is no significant main effect of learning style on the students' achievement scores in Civics and Biology

The result of the main effect of learning style in tables 1 and 2 show non-significant main effect of learning style on the students' achievement scores ($F_{(1, 88)} = 2.685$, $P > 0.05$) in the first phase and ($F_{(1, 88)} = 1.583$, $P > 0.05$) after the second phase (i.e. after switching replication). This outcome implied that there is no significant difference in the scores obtained by the visual, auditory and kinesthetic participants in achievement scores, i.e. there is no significant main effect of learning style on achievement. As a result, the null hypothesis five is retained. The non-significant outcome obtained after switching replication for the main effect of learning style further confirms the finding that there is no significant main effect of learning style on the students' achievement scores.

However, the result of the multiple classification analysis (MCA) on learning style (the first phase of the experiment) showed that with a grand mean of 11.565, the kinesthetic learners with adjusted mean post-test achievement score of 11.905 (i.e. 11.565 + 0.340) recorded the highest mean achievement score, followed by the visual learners with adjusted mean post-test achievement score of 11.567 (i.e. 11.565 + 0.002) while the auditory learners with adjusted mean post-test achievement score of 11.412 (i.e. 11.565 - 0.153) recorded the lowest mean achievement score. This outcome shows that the kinesthetic learners recorded the highest achievement scores than the other students with

visual and auditory learning styles in the first phase of the experiment, although the obtained difference is not statistically significant.

The result of the multiple classification analysis (MCA) on learning style (the second phase of the experiment) showed that with a grand mean of 10.922, the kinesthetic learners with adjusted mean post-test achievement score of 11.904 (i.e. 10.922 + 0.982) recorded the highest mean achievement score, followed by the visual learners with adjusted mean post-test achievement score of 10.912 (i.e. 10.922 - 0.010) while the auditory learners with adjusted mean post-test achievement score of 10.536 (i.e. 10.922 - 0.386) recorded the lowest mean achievement score. This outcome shows that the kinesthetic learners recorded the highest achievement scores than the other students with visual and auditory learning styles in the second phase of the experiment (i.e. after switching replication), although the obtained difference is not statistically significant. The result further shows that learning style as a variable accounted for 6.5% of the variance in the students' achievement scores in the first phase of the experiment and by table 2, another 6.5% of the variance in the dependent variable (after switching replication).

$H_0$1b: There is no significant main effect of learning style on the students' attitude to Civics and Biology

The result of the main effect of learning style show non-significant main effect of learning style on the students' scores in attitude ($F_{(1, 88)}$ = .115, P > 0.05) in the first phase and ($F_{(1, 88)}$ = 1.495, P > 0.05) after the second phase (i.e. after switching replication). This outcome implied that there is no significant difference in the attitude scores obtained by the visual, auditory and kinesthetic participants, i.e. there is no significant main effect of learning style on attitude. As a result, the null hypothesis six is retained. The non-significant outcome obtained after switching replication for the main effect of learning style further confirms the finding that there is no significant main effect of learning style on the students' attitude.

However, the result of the multiple classification analysis (MCA) on learning style (the first phase of the experiment) showed that with a grand mean of 78.852, the kinesthetic learners with adjusted mean post-test attitude score of 80.151 (i.e. 78.852 + 1.299) recorded the highest mean achievement score, followed by the visual learners with adjusted mean post-test attitude score of 79.195 (i.e. 78.852 + 0.343) while the auditory learners with adjusted mean post-test attitude score of 77.153 (i.e. 78.852 - 1.699) recorded the lowest mean attitude score. This outcome shows that the kinesthetic learners recorded the highest attitude scores than the other students with visual and auditory learning styles in the first phase of the experiment, although the obtained difference is not statistically significant. The result of the multiple classification analysis (MCA) on learning style (the second phase of the experiment) showed that with a grand mean of 73.430, the kinesthetic learners with adjusted mean post-test attitude score of 73.838 (i.e.73.430 + 0.408) recorded the highest mean achievement score, followed by the visual learners with adjusted mean post-test attitude score of 73.522 (i.e. 73.430 + 0.092) while the auditory learners with adjusted mean post-test attitude score of 73.350 (i.e. 73.430 - 0.080) recorded the lowest mean attitude score. This outcome shows that the kinesthetic learners recorded the highest attitude scores than the other students with visual and auditory learning styles in the second phase of the experiment (i.e. after switching replication), although the obtained difference is not statistically significant.

The result further shows that learning style as a variable accounted for 9.0% of the variance in the students' attitude scores in the first phase of the experiment, just 4.7% of the variance in the dependent variable (after switching replication).

$H_0$2a & b: There is no significant interaction effect of gender and learning style on the students' attitude to Civics and Biology.

The results of the 2-way interaction effect of gender and learning style show no significant interaction effect of gender and learning style on the students' scores in attitude ($F_{(2, 88)}$ = .158, P > 0.05) in the first phase of the experiment and

($F_{(2, 88)} = .405$, $P > 0.05$) after switching replication (i.e. in the second phase of the experiment). This outcome implied that the mean post-test attitude scores of the male and female participants do not vary significantly with the mean post-test attitude scores of the visual, auditory and kinesthetic participants. That is, the effect of the students' gender (male or female) on their mean post-test attitude scores is not sensitive to the levels of their learning styles (visual, auditory or kinesthetic). Hence, the null hypothesis twelve is retained.

8. Discussion of Findings

8.1 Effect of learning style on the students' achievement in Civics and Biology

The result of the main effect of learning style on the students' achievement scores in the first phase and after the second phase (i.e. after switching replication) show non-significant main effect of learning style on the students' achievement scores. However, the results of the Multiple Classification Analysis (MCA) on learning style (the first phase of the experiment) and (the second phase of the experiment) show that the kinesthetic learners obtained the highest achievement scores than the other students with visual and auditory learning styles in both phases of the experiment, although the obtained difference was not statistically significant.

It was revealed that learning style accounted for 6.5% of the variance in the students' achievement scores in the first phase of the experiment and 6.5% of the variance in the dependent variable (after switching replication). The finding of significance or no significance supports what is documented in literature that Dick & Carey Instructional Model is more effective in reaching all type of students and reducing differences in academic performance among different learning styles (Mangal & Mangal, 2013).

The finding is in consonance with the work of Olurinola (2015) who reported that there was no significant main effect of learning style on students' achievement in Visual Arts. Similarly, Adedapo (2013) reported that there was no significant effect of learning style on students' cognitive achievement in microteaching and also no significant interactive effect of microteaching modes and learning style on students' cognitive achievement in microteaching. The result however contradicts the findings of Hattie (2011) who reported that there was significant effect of learning style on students' cognitive achievement in learning concepts in Physics while Ogundokun (2011) revealed that learning styles, school environment and test anxiety jointly predicts the learning outcomes.

8.2 Effect of learning style on the students' attitude to Civics and Biology

The results of the main effect of learning style on the students' scores in attitude in the first phase and after the second phase (i.e. after switching replication) show non-significant main effect of learning style on the students' scores in attitude. This implies that there is no significant main effect of learning style on attitude. However, the result of the Multiple Classification Analysis (MCA) on learning style (the first phase of the experiment) and (the second phase of the experiment) show that the kinesthetic learners obtained the highest attitude scores than the other students with visual and auditory learning styles, although the obtained difference was not statistically significant. It was revealed that learning style accounted for 9.0% of the variance in the students' attitude scores in the first phase of the experiment and just 4.7% of the variance in the dependent variable (after switching replication).

The finding is in consonance with the work of Olurinola (2015) who reported that there was no significant main effect of learning style on students' attitude towards Visual Arts. Similarly, Adedapo (2013) reported that there was no significant effect of learning style on students' attitude to microteaching. The result however contradicts the finding of Hattie (2011) who reported that there was significant effect of learning style on students' attitude to learning concepts in Physics.

8.3 Interaction effect of gender and learning style on the students' achievement in Civics and Biology

The results of the 2-way interaction effect of gender and learning style show no significant interaction effect of gender and learning style on the students' achievement scores in the first phase of the experiment and after switching replication (i.e. in the second phase of the experiment). This implies that the effect of the students' gender (male or female) on their mean post-test achievement scores is not sensitive to the levels of their learning styles (visual, auditory or kinesthetic). The finding agrees with the findings of Olurinola (2015) who discovered no significant interaction effect of gender and learning style on students' achievement in Visual Arts. However, it contradicts the findings of Hattie (2011) who reported that there was significant interaction effect of gender and learning style on students' cognitive achievement in learning concepts in Physics.

8.4 Interaction effect of gender and learning style on the students' attitude to Civics and Biology

The results of the 2-way interaction effect of gender and learning style show no significant interaction effect of gender and learning style on the students' scores in attitude. This implies that the post-test attitude scores of the male and female participants do not vary significantly with the post-test attitude scores of the visual, auditory and kinesthetic participants. That is, the effect of the students' gender (male or female) on their mean post-test attitude scores is not sensitive to their learning styles (visual, auditory or kinesthetic). Kolb and Kolb (2005) believe that learning styles are not fixed personality traits but relatively stable patterns of behavior that are based on their background and experiences. The finding agrees with the findings of Olurinola (2015) who discovered no significant interaction effect of gender and learning style on students' attitude towards Visual Arts. However, it contradicts the findings of Hattie (2011) who reported that there was significant interaction effect of gender and learning style on students' attitude to learning concepts in Physics.

9. Conclusion

Irrespective of students with different learning styles, the students exposed to the instructional model have positive mean gains in achievement scores in and attitude across the levels of learning styles. Gender and learning style on the students' achievement in, and attitude. The mean post-test achievement and attitude scores of both male and female students are not sensitive to their learning styles (visual, auditory or kinesthetic). Moreover, learning style is still a factor in students' academic achievement. Findings revealed that with the use of the instructional model, students' achievement at all levels of learning styles can be enhanced since they all have positive mean gains across the levels of learning style.

10. Recommendations

Based on the findings of this study, and to enhance learning outcomes of the students, the following recommendations are made:

(i) Evaluate your lesson plans to identify which learning modality - visual, auditory or kinesthetic- is best suited for each particular lesson. For instance, in a lesson about basic pattern making the teacher may be able to integrate all three modalities by explaining the concept, drawing examples on the chalkboard and asking the children to make different patterns in their sketchbooks. Assign a target modality for each lesson plan and attempt to vary styles throughout the day.

(ii) Offer students who excel through visual learning methods a seat near the front of the classroom, where they can clearly see the chalk board and remain visually engaged in lessons without the distraction of other children ahead of them. Incorporate visual teaching by drawing charts, graphs or other visual representations that help explain a concept on the chalkboard. Include illustrations with assignment worksheets, when feasible, to help visual learners better understand tasks.

(iii) Incorporate auditory learning by offering lecture-style presentations, reading instructions for assignments aloud and presenting opportunities to give oral reports. Students who best retain information through spoken words

are more likely to remain engaged when they are required to both absorb and share information verbally. Pay attention to the tone of your voice, inflection and body language when presenting a lesson, as auditory learners will feed off of the teacher's delivery.

(iv) Provide opportunities for kinesthetic learning by incorporating movement and interaction into as many lesson plans as possible. Give children a chance to practice math by using objects to physically complete addition and subtraction equations. Provide opportunities for children to reenact historical events through skits and look for ways to explain concepts by involving students in physical actions and the creation of projects. The information about students' learning styles can be used for providing teachers with more information about their students, showing them that their students have different preferences and ways in which they learn. Furthermore, the information about students' learning styles can help teachers in understanding why and when students may have difficulties in learning. In addition, the information can be used for making students themselves aware of their own learning styles, helping them to better understand their strengths and weaknesses in the learning process. The arts not only reach more students with differing learning styles and

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