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Resources for Social Studies: Info-Graphics Illustrations and Jigsaw Effects on Students' Achievement

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Abstract

The Pedagogical shift to learner-centered instructions entails that teachers need to have pre-requisite skills which will enable them to navigate the teaching and learning process efficiently by enabling them to serve as facilitators of curriculum content in Social Studies. This study examined Resources for Social Studies: info graphics illustrations and their effects on students' achievement. The research design for this study was quasi-experimental. The population of the students consisted of all Social Studies school pupils within Jos-South Local Government Area of Plateau State through random sampling technique 34 (n = 17) students were sampled for the study within the experimental and control groups, Data was collected using the instrument titled "Social Studies Students Achievement Test" (SSSAT) that was content and faced validated to determine its internal consistency while for reliability the test- and retest using alpha conbrach 0.66 and 0.70 was attained respectively. The treatment group was taught using info graphics and Jigsaw stimulated games whereas the control class group was taught using the conventional teaching methods. The research null hypotheses were tested using parametric t-test statistics at the confidence level of 0.05%. The findings of the study showed that there is a significant difference between the experimental and control group with the Tstat 3.30 >Tcrit 2.05 indicating a strong significant difference between the sampled groups, there is no significant difference in the post-test mean scores of male and female students in the experimental group with the Tstat 1.53 < Tcrit 2.14 indicating poor significant difference, there is no significant difference between the mean scores of studies who identified as visual learners and those who are not with the Tstat 0.29 < Tcrit 2.44 indicating a low significant difference between the sampled groups. The study recommended that; specialize in digital content creation by teachers, school administrators encouragement for improvisation of instructional resources, autonomy for teaching in selecting resource materials, considerable budgetary allocation to schools by Federal Government to equip their resource rooms.

Keywords
Resources; effect; info graphics; illustration; achievement

I. Introduction

An ideal classroom should be embedded with learning resources that are materials used by the classroom teacher to supplement instruction or stimulate the interest of the learner, this takes the form of tools and devices that stimulates the interest and perception of learners towards learning contents, when learning resources are brought into the classroom the learners uses a mix of more than one senses especially when they can view, feel and touch it. , resources can take the form of digital and non-digital these learning resources can be categorized into many forms such as; reading and non-reading materials, audio-visual resources, community resources, human resources, online databases, costumed android

applications, webinars, conferences, journals, books, bulletin, podcasts, newsletters, films, documentaries, models, timelines, Google arts and culture, chalkboard, models, graphs, charts, maps, pictures, diagrams, cartoons, filmstrips, infographics, radio, television, manuals, periodicals, magazines, audio-tape records, relia and diorama. Olayinka (2016) asserts that resource materials in the Social Studies classroom need to be improvised to aid students' achievement in Social Studies, according to the Olayinka, Social Studies resources are textbooks, chalkboards, and library materials: books, journals, periodicals, pamphlet, flyers and magazines etcetera.

Olumorin, Yusuf, Ajidagba and Jekayinfa (2010) perceived that instructional material resources support and facilitate effective teachers teaching to all categories of learners in the classroom as they can teach effectively without communication barriers, they emphasized that using instructional resource materials such as visual materials appeal to all sense organs and thus facilitate worthwhile learning within the cognitive, affective and psychomotor domains of learning. Similarly, Kochhar (2012) maintained that instructional resource materials are very significant to learning and teaching tools. He submitted that teachers ought to use available instructional resource materials to supplement textbooks and rote learning of Social Studies contents among learners in the classroom to boost interest in Social Studies curriculum activity and achievement of students Enekwe et.al (2021) maintained that instructional materials are generally classified into two main groups which are the visual, audio and audio-visual resource materials that are available to the teachers and learning facilitators to use. Scholarly viewpoints and findings from different literature continue to emphasize the use of learners-centred approaches and resource material to provide an enabling environment for positive interest, attitude, perception and achievement of Social Studies curriculum contents within and outside the classroom environment.

Academic achievements are the degree and current level of students learning and understanding that is measured by laid down standards and awarded on merit, this encompasses students' ability and performance, it is multidimensional; it is intricately related to human growth and cognitive, emotional, social, and physical development. Furthermore, Academic achievement is commonly measured through examinations or continuous assessment but there is no general agreement on how it is best evaluated or which aspects are most important. Academic achievement can be evaluated in several ways such as oral tests, homework, participation in classroom activities, quizzes, and examinations.

Infographics can refer to a set of data visualizations that present complex information quickly and clearly which includes signs, photos, maps, graphics and charts. Infographics are visual representations that integrate information derived from data and graphics to convey a message. These visualizations are frequently used to aid in data interpretation. infographics which are Statistical infographics, Informational infographics, Timeline infographics, Process infographics, Geographic infographics, Comparison infographics, Hierarchical infographics, List infographics, Resume infographics and, picture infographics. Matrix and Hodson (2014) view infographics as data visualizations that present complex information quickly and clearly which includes signs, photos, maps, graphics and charts. Infographics are visual representations that integrate information derived from data and graphics to convey a message. These visualizations are frequently used to aid in data interpretation. Currently, design guidelines for infographics exist broadly under the umbrella of several disciplines that include semiotics and graphic design.

Kankaew and Suksudthi (2021) defined infographics as a collection of imagery, charts, and minimal text that gives an easy-to-understand overview of a topic. Sabry (2021) describes info-graphic as a visual representation of any kind of information or data it can be in form of static and animated images which are used for educational, marketing and scientific purposes. From the following author's input on the concept of the infographic, it is safe to say that info-graphics is a visual graphical design that is used to interpret data and information into simple bits for easier cognition by learners or available audiences. Ibrahem and Alamro (2021) identified 10 types of infographics which are Statistical infographics, Informational infographics, Timeline infographics, Process infographics, Geographic infographics, Comparison infographics, and Hierarchical infographics, List infographics, Resume infographics and, picture infographics. However, in the course of this study, the researcher will utilize the picture static infographics.

Jigsaw puzzles in the context of this study are regarded as tiling puzzle that requires the assembly of often oddly shaped interlocking and mosaic pieces, each of which typically has a portion of a picture; when assembled, they produce a complete picture. Mohamadlou et.al (2021) stress in their study that Jigsaw puzzles are effective for learning and provide a sense of connectedness between the learner and learning contents. Also in the same vein, Tabiolo and Rogayan (2019) with the study of Chukwu and Dike (2019) the study also showed positive results that Jigsaw-Puzzle and Graphic Organizer are effective instructional strategies for enhancement of students' academic performance in growth as a concept in various school subjects. Thus, Jigsaw puzzle captivates students' attention and interest which can therefore boost their academic achievement, especially in Social Studies curriculum contents.

II. Review of Literature

2.1 Picture of illustrated info graphics

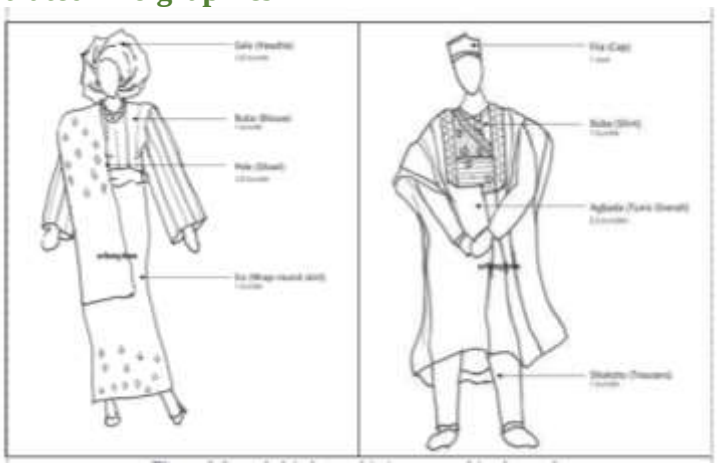


Figure 1. *Sampled infographic image used in the study*

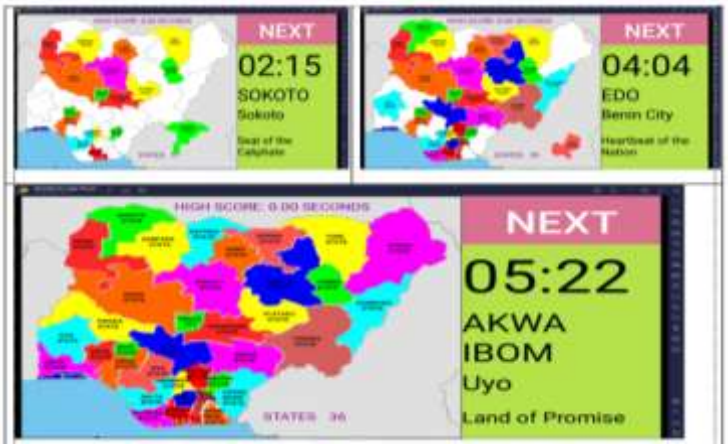


Figure 2. *Mobile app Jigsaw puzzle used for the study*

2.2 Problem Statement

The Pedagogical shift to learner-centred instructions entails that teachers need to have pre-requisite skills which will enable them to navigate the teaching and learning process efficiently by enabling them to serve as facilitators of curriculum content in Social Studies which is a core curriculum subject offered at all levels of education in Nigeria school system. The various resources and instructional materials available in Social Studies needs technical and problem-solving skills to sort out and make meaning of the data and resources available to the classroom, to facilitate inclusivity of all category of learners it is pertinent to utilize resources that are engaging to classroom learners and will equip them with necessary values, attitude skills and knowledge deemed fit for solving societal issues and problems emanating from their societies.

Social Studies has been challenged with myriad issues from non-professionals teaching the subjects to its neglect and competition among various school subjects like civic education and improper teaching resources and aids to facilitate effective teaching and learning of Social Studies in the classroom. This study hopes to unravel the various types of resources available to Social Studies teachers in the classroom, and how graphical resources like infographics can aid the teaching and learning processes in the classroom. This study hopes to find out convenient ways and methods for creating graphical infographics that can serve as effective resources in teaching Social Studies content and also the effects of illustrated infographics on student achievement.

2.3 Purpose of the Study

The main aim of the study is to investigate the resources for Social Studies using infographics illustrations and their effects on student's achievement the specific objectives are to;

1. Find out the initial mean score difference of the experimental and control classes before the administration of the treatment intervention
2. Find out the mean score difference between the experimental and control classes after the administration of treatment intervention
3. Determine if there is a gender factor between the mean score of students in the experimental and control groups
4. Determine if learner style is a predictor and precursor for student's achievement

2.4 Hypotheses

1. There is no significant difference in the pre-test mean score of the experimental and control classes.
2. There is no significant difference in the post-test score of the experimental and control classes.
3. There is no significant difference in the post-test mean score of male and female students in the experimental class.
4. There is no significant difference between the mean scores of students who identified as visual learners and those who are not.

III. Research Method

This study employed a quasi-experimental design, which will comprise a pre-test and post-test for both the experimental and control group classes of primary school pupils the targeted population of this study consist of all primary school pupils in Jos-South Local Government Area of Plateau State. There are 139 public primary schools in Jos South of Plateau State and 34,903 Primary three pupils. 16,905 make up the male gender while 17,998 make up the female gender (Plateau State Universal Basic Education Board (SUBEB, 2019). The sampling technique involved purposive sampling and random sampling of which the purposive sampling technique will be adopted to select 2 out of 139 primary schools (a,b) from the study area while a simple random technique will be used to select pupils from an intact arm of primary schools from primary 5 and 6 the sample size of 34 will be split into half (n = 17).

For data analysis the parametric independent t-test was utilized in the course of this study, the rationale for using a t-test is because it permits realizing the research objectives which aims to determine the relationship between the dependent and independent variables 'x and y' infographics illustrations and effects of students achievement, the choice for adopting t-test is because it helps the researcher determine if the results of the mean difference between the two groups (control and experimental) could have happened by chance and make inferences concerning the relationship between the research variables.

In course of developing and deploying the research instrument the researcher taught Social Studies pupils two (2) elementary topics such as "states and capital, culture and identity" using a detailed comprehensive lesson plan which was validated by 3 experts in the field of Social Studies, the infographics illustrations and stimulate jigsaw game functioned as the research instrument which was used for the treatment group and conventional teaching strategies was adopted for the control class, before the administration and development of research instruments the two topics were weighted using a Table of Specifications (TOS) to issue specific levels of test items from lower to higher faculty of thinking this was centered on the Benjamin Bloom learning faculties within the Cognitive domain of learning thus, the 6 faculties of thinking within the cognitive domain; remembering, understanding, applying, analyzing, evaluating and creating; were allocated portioned test items.

The validity and reliability of the instruments were determined through the face and content validity for acquiring the internal consistency of the research instrument and a pilot school was utilized to determine the test and re-test using alpha conbrach formulae the pre-test was 0.66 alpha while the re-test obtain the conbrach alpha value of 0.70 which is deemed acceptable, the researcher explored various available options in the creation of visually illustrated infographics and effective and engaging learner content through an online internet source

The researcher utilized 3 computer applications and software programmes that were classified as online and offline based application the three major software used to create the infographics was 'Canva and Adobe Studios: Illustrator and a mobile application titled "Map Out Nigeria" respectively. Canva is an online graphic design tool that works to simplify the process of digital design and aid users through costumed templates and layouts for creating a presentation, posters, infographics, and social media posts. Canva offered a myriad library of icons, transparency tool elements, graphics text, also with the ability to add frames and vignettes to imagery, users using Canva have no legal issues with the image copyright issues as stipulated in the term and conditions, while the cons are that Canva does not have local file storage, overuse of designs, no source file, requires payment for exclusive good features, the mobile app has fewer features compared to the web and online version.

Adobe Illustrator a graphic design application used to create vector graphics this vector images and graphics are made of points, lines, shapes, and curves based on mathematical formulas rather than a set amount of pixels, and therefore can be scaled up or down while maintaining image quality. It is used for creating create logos, icons, charts, infographics, posters, ads, books, magazines, and brochures. Pros of using adobe illustrator (Ai) are that is an extremely versatile vector-based design software with endless file exporting options and offers large discounts from the Creative Cloud which is a parent platform for different variety of Adobe software programs though, it takes up large disc space and requires lots of software training.

"Map out Nigeria" is an android based application that works only on mobile devices that were available for downloaded from the Google Play Store, nevertheless the researcher was able to use an android emulator software titled "Blue-Stacks" to imitate the mobile features via 2 Personal Computer (PCs) through this PCs the researcher was able to utilize the gaming software for puzzle jigsaw games that the experimental group adopted in the course of treatment. The researcher with constant exposure and online tutorial resources was able to circumvent technical challenges by developing the skill sets for creating and using openly licensed software for creating vectors, and illustrations that constituted to development of the infographics and jigsaw game used in the study.

IV. Results and Discussion

Table 1. Hypotheses one

The pre-test mean sore of the experimental and control class		
Group	**Expr**	**Ctrl**
Type of Test	**Pre-test**	**Pre-test**
Mean	51.3529412	41.1176471
Variance	198.367647	216.235294
Observations	17	17
Hypothesized Mean Difference	0	
Df	32	
t Stat	**2.07256709**	
P(T<=t) one-tail	0.02317453	
t Critical one-tail	1.69388875	
P(T<=t) two-tail	**0.04634907**	
t Critical two-tail	**2.03693334**	

Table 2. Summary for Research Hypotheses one

Group	Type of Test	N	X	SD	Df	P-value	T_{stat}	T_{crit}	Decision
Experimental	Pre-test	17	51.35	14.08	32	0.04	2.07	2.03	Rejected
Control	Pre-test	17	41.12	14.70					

Tables 1 and 2 illustrate the summary for research hypothesis one "There is no significant difference in the pre-test mean score of the experimental and control class" the respondents were purposively selected and proportionally distributed into equal sizes for both the experimental and control class, and the mean score in the pre-test for the experimental group was 51.35 and that of the control class was 41.12 however the standard deviation of the two groups in the pre-test was 14.08 for the experimental class and 14.70 for the control group, the P-value was 0.04 against α of 0.05, Tstat was 2.07 while Tcrit 20.3 was recorded as the rule of thumb guiding the decision for rejecting null hypotheses in t-test postulates that if the t-value (Tstat >¬Tcrit) the null hypotheses will be rejected. Thus (2.07 > 2.03) implies that there is a difference between the mean score of the experimental and control classes in favour of the experimental group before the administration of the research intervention. This is a normal phenomenon where any particular group can surpass the other group in the pre-test before the research intervention, other factors such as teachers teaching strategies student's understanding and prior knowledge could be possible factors why the experimental group had a greater mean score compared to the control group counterpart though the differences in the mean scores were not sturdily significant.

Table 3. Hypotheses two

The post-test mean score of the experimental and control classes		
Group	**Expr**	**Ctrl**
Type of Test	**Post test**	**Post test**
Mean	61.1176471	45.5882353
Variance	126.485294	251.007353
Observations	17	17
Hypothesized Mean Difference	0	
Df	29	
t Stat	**3.29552961**	
P(T<=t) one-tail	0.00129835	
t Critical one-tail	1.69912703	
P(T<=t) two-tail	**0.0025967**	
t Critical two-tail	**2.04522964**	

Table 4. Summary for Research Hypotheses two

Group	Type of Test	N	X	SD	Df	P-value	T_{stat}	T_{crit}	Decision
Experimental	Post-test	17	61.11	11.24	29	0.003	3.30	2.05	Rejected
Control	Post-test	17	45.58	15.84					

Table 3 and 4 data shows the results input for research hypothesis two after being tested with the t-test inferential statistics it was observed that the experimental group obtained a mean score of 61.11 while the control group's mean score was 45.58 with a standard deviation of 11.24 for the experimental class and 15.84 for control class respectively, the mean score for pre-test is in accord to the post-test mean scores of the two groups, before the administration of the treatment, the experimental mean score surpassed that of their control class counterparts though it was not a strong significant difference however, after the administration of the research instruments it was observed that the P-value in the post-test was 0.003 against α 0.05. The Tstat was 3.30 > than Tcrit 2.05 this shows a strong significant difference between the two groups ensuing to the post-test this could be as a result of the overlooked prominence of the research instruments and intervention.

Table 5. Hypotheses three

The post-test mean scores of female and male students in experimental group		
Group	**Expr**	**Expr**
Type of Test	**Post test**	**Post test**
Category	**Female**	**Male**
Mean	65.8571429	57.8
Variance	103.809524	125.955556
Observations	7	10
Hypothesized Mean Difference	0	
Df	14	
t Stat	**1.53852262**	
P(T<=t) one-tail	0.07310608	
t Critical one-tail	1.76131014	
P(T<=t) two-tail	**0.14621216**	
t Critical two-tail	**2.14478669**	

Table 6. Summary for Research Hypotheses three

Group	**Category**	**Type of Test**	**N**	**X**	**SD**	**Df**	**P-value**	**T_{stat}**	**T_{crit}**	**Decision**
Experimental	Female	Post-test	7	51.35	10.18	14	0.14	1.53	2.14	Accept
Experimental	Male	Post-test	10	41.12	11.22					

Tables 5 and 6 show the results of the student's responses to research question three “There is no significant difference in the post-test mean score of male and female students in the experimental class” from the data, the female respondents were 7 while the male respondents were 10 in total making the total number of 17 respondents in the experimental class. The mean score of the female respondents was 51.35 while that of the female respondents was 41.12, with the Standard Deviation of 10.18 and 11.22 from the female and male respondents respectively, the P-value was 0.14 against the α of 0.05, the Tstat was 1.53 < than Tcrit of 2.14. Sequel to these null hypotheses was rejected. This could be related to factors such as the nature of the instrument which engaged the learners with various types of their senses such as seeing and touching, this occurrence is not restricted to a particular gender.

Table 7. Hypotheses four

The mean scores of students who identified as visual learners and those who are not		
Group	**Expr**	**Expr**
Type of Test	**Post test**	**Post test**
Category	**Non-visual**	**Visual**
Mean	61.75	59.6
Variance	103.2954545	217.8
Observations	12	5
Hypothesized Mean Difference	0	
Df	6	
t Stat	**0.29767102**	
P(T<=t) one-tail	0.387996066	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	**0.775992132**	
t Critical two-tail	**2.446911851**	

Table 8. Summary for Research Hypotheses four

Group	**Category**	**Type of Test**	**N**	**X**	**SD**	**Df**	**P-value**	**T_{stat}**	**T_{crit}**	**Decision**
Experimental	Non-visual	Post-test	12	61.75	10.16	12	0.38	0.29	2.44	Accept
Experimental	Visual	Post-test	5	59.60	14.74					

Tables 7 and 8 depict the respondent's responses to research hypothesis four "There is no significant difference between the mean scores of students who identified as visual learners and those who are not", to test these hypotheses the researcher had to categories each of the learners into their previewed learning type which is auditory, visual, verbal, kinetics and logical learners. However tables 7 and 8 portray the aggregate of the visual and non-visual learners in the experimental group, the total number of non-visual learners was 12 and visual learners in the experimental group were 5, with mean scores of 61.75 and 59.60 the Standard Deviation was 10.16 and 14.74 for Non-visual and Visual learners respectively with the degree of freedom at 12 the P-value was 0.38 against the α of 0.05 the Tstat was 0.29 < than Tcrit 2.44 this entails that the null hypotheses was accepted however to avoid type 1 error the researcher compared visual learners to the other 4 categories of learners recognized in this study.

Table 9. visual learners difference with verbal, auditory, logical and kinetic learners

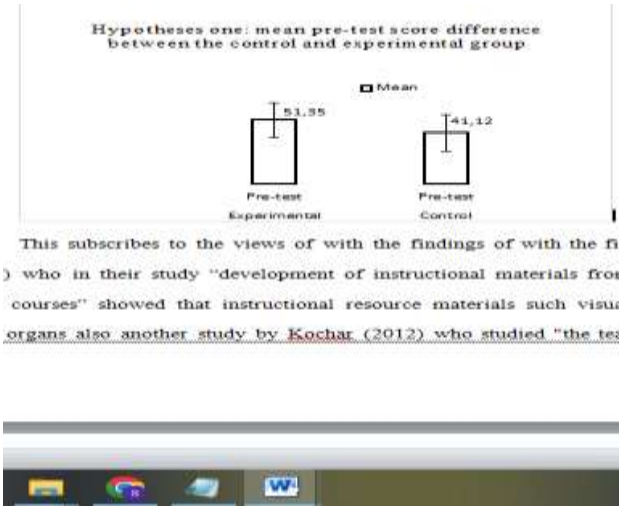
S/n	**Group**	**Category**	**Type of Test**	**N**	**X**	**SD**	**Df**	**P-value**	**T_{stat}**	**T_{crit}**	**Remark**
1	Experimental	Verbal/Visual	Post-test	4	58.25	4.57	5	0.85	0.19	2.57	Accept
	Experimental		Post-test	5	59.60	14.76		(α/4) 0.21			
2	Experimental	Auditory/Visual	Post-test	4	58.25	12.61	7	0.88	-0.14	2.36	Accept
	Experimental		Post-test	5	59.60	14.76		(α/4)			

								0.22			
3	Experimental	Logical/Visual	Post-test	2	67.50	16.26	2	0.30	0.59	4.30	Accept
	Experimental		Post-test	5	59.60	14.76		(α/4)			
								0.07			
4	Experimental	Kinetic/Visual	Post-test	2	70.00	5.66	5	0.23	1.34	2.57	Accept
	Experimental		Post-test	5	59.60	14.76		(α/4)			
								0.05			

The total number of visual learners in the experimental group was 5 while that of verbal was 4, auditory 4, logical 2 and kinetic 2 learners respectively. The Mean score difference between verbal and visual was 1.35, auditory and visual learner's mean difference was 1.35 also, logical and visual learners' mean difference was 7.9 while that of kinetic and visual learner's mean difference is 10.4. the Standard deviation of visual learners was 14.76 while verbal was 4.57, auditory was 58.25, logical was 67.50 while kinetic was 70.00 t-test testing of the research hypotheses showed that there is no significant difference between visual learners and other learners in the verbal, auditory, logical and kinetic category.

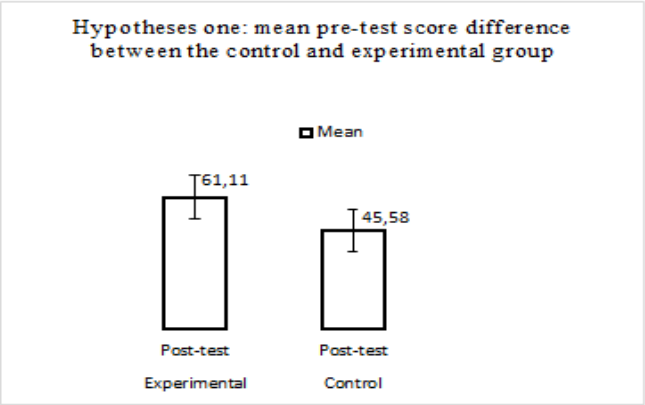
Discussion

After testing the research hypotheses, the results showed that in research hypotheses H0 ≠ 0 was rejected which implied that there is a significant difference in the pre-test mean score of the experimental and control groups with Tstat > Tcrit although the difference between the two sample group was weak which entails a very low significant difference was observed. The standard error for hypotheses one in the pre-test was 1.93 in the experimental and 2.01 in the control group



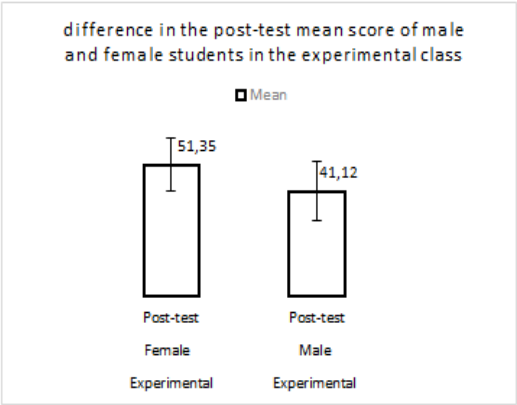
This subscribes to the views of with the findings of Olumorin et.al (2010) who in their study “development of instructional materials from local resources for art based courses” showed that instructional resource materials such visual materials appeal to all sense organs also another study by Kochar (2012) who studied "the teaching of Social Studies" findings asserted that there is a direct significant effects between instructional resource materials use and the achievement of students and Enekwe et.al (2021) who studied the challenges and solution in utilizing audio visual materials in teaching Social Studies, thier findings showed that audio-visual materials have significant effect on students achievement

Research hypotheses two results showed a rejection of the null hypotheses s H0 ≠ 0 which also denotes that there is a significant difference between the experimental and control group with the Tstat 3.30 >Tcrit 2.05 indicating a strong significant difference between the sampled groups, the standard error for hypotheses two in the post-test for the experimental group was 2.73 and 3.84 for the control group



These findings collate this agrees with the study of Zubairu, Soretire and Patrick who investigated the "Effect of Game-Based Interactive Power Point on Students' Learning Outcomes in Civic Education their study results showed that there is a significant difference in the attitudes and academic performance of students in the experimental and control classes in favour of Game-based Interactive PowerPoint which was the treatment group. Also as observed in the Study of Zubairu et.al students within the treatment group who used Jigsaw and infographics resource materials in learning had an average of 36% increase in their post-test achievement score compared to their control group counterparts.

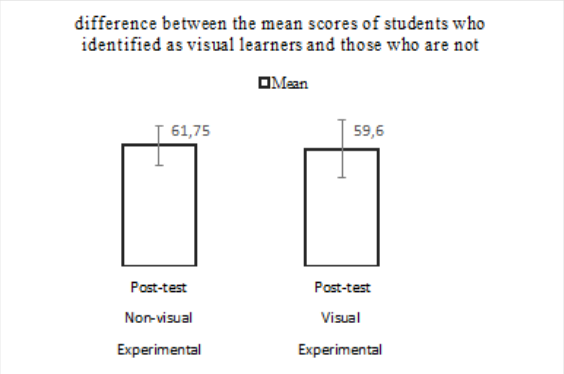
Research hypotheses three results showed the null hypotheses was accepted H0 = 0 this entails that there is no significant difference in the post-test mean scores of male and female students in the experimental group with the Tstat 1.53 and Tcrit 2.14 indicating poor significant difference, thus the null hypotheses was rejected. The standard error for research hypotheses three in the post test for female students was at 3.85 and male standard error score was 11.22



This agrees with the studies of and Olayinka (2016) study of the Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria which showed that gender effect was not statistically significant in social

studies Ibrahem and Alamro (2021) who studied the effects of Infographics on Developing Computer Knowledge, Skills and Achievement Motivation their findings showed that though no gender factor associated with the level of achievement male students had more interest on animated infographics than female students who preferred the static infographics.

Research hypotheses four results showed that the null hypotheses was accepted H0 = 0 this infers that there is no significant difference between the mean scores of studies who identified as visual learners and those who are not in the experimental group. The standard error for research hypotheses four in the post-test for non-visual learners was at 2.93 while that of visual learners was at 6.59.



This result collates with the findings of Sener and Çokçaliskan (2018) who Investigated between Multiple Intelligences and Learning Styles the results of their findings showed that most of the intelligence types and learning styles had a moderate positive correlation.

V. Conclusion

Resource materials have continually been part and parcel of an ideal teaching and learning environment, through the findings of this study it can therefore be asserted empirically those resource materials such as illustrated info graphics and Jigsaw puzzle games have a positive effect on student achievement. It is hoped that the findings of this study will convince various stakeholders such as school administrators and teachers on the proper resource materials available to teach social studies. However, the teachers should be aware of the endless possibilities available in using resource materials as it can facilitate worthwhile learning within and outside the classroom environment

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