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Promoting Students' Academic Performances and Interests in Blocklaying and Concreting Works using a Futures-Wheel Instructional Strategy versus Problem Solving: Implications for Sustainable Development

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Abstract: The need to identify effective measures to minimize continuous poor academic performance of students in blocklaying and concreting works and other technical subjects/trades led to this study which sought the effectiveness of Future-wheel as compared to the problem solving approach in the instruction in technical colleges. The study adopted the non-equivalent control group quasi experimental research design. Six research questions and six null hypotheses guided the study. The study was conducted in Edo State, Nigeria. The population for the study consisted of all 604 vocational II blocklaying and concreting works students in the six technical colleges in Edo State as at 2017/2018 academic session. A sample size of 80 vocational II students was drawn using random sampling technique and used for the study. Findings from the study revealed among others that there was significant mean effect of Futures-Wheel instructional strategy on students Mean performance score and interest in blocklaying and concreting works; there was no significant mean effect of gender on students' Mean performance score in Basic Technology. In line with the findings of the study, the educational implication of the findings were highlighted and it was recommended among others that blocklaying and concreting works teachers should be trained in the use of innovative instructional strategies such as Futures-Wheel to facilitate students' academic performance in the subject.

Keywords: Blocklaying and concreting works, futures-wheel, problem-solving, achievement, interest, gender, location

1. Introduction

Vocational education is the form of education obtainable at technical colleges designed to provide a springboard for the acquisition of technical skills (Azid et al., 2019). It is designed to give training and impart the necessary skills leading

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to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant. To the Federal Republic of Nigeria (FRN), (2014) vocational education is aimed at preparing individuals to acquire practical skills, basic and scientific knowledge and attitude required as craftsmen and technicians at sub- professional level. The objectives of vocational education as stated by FRN (1998) are: (i) to provide trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technical level; (ii) to provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development; (iii) to give training and impart necessary skills to individuals who shall be self-reliant economically. The economic development and the development of a citizen who will be self-reliant is the driving force of vocational education (blocklaying and concreting works inclusive).

Studies have revealed that most teachers prefer using the conventional teaching method in their bid to deliver subject content to students (Nandi et al., 2000; Azhar et al., 2015). This trend has invariably led to students' poor performance and interest in school subjects. It also applies to blocklaying and concreting works as the numbers continue to decline in student performance and interest. Similarly, there have been recommendations by researchers on the need for the use of constructivists instructional strategies in technical subjects among others (Agarwal, 2018). These claims seem to suggest that they are effective in arousing students' interest and performance in school subjects. The problem of this study was therefore predicated on the need to adopt innovative instructional strategies to see if it could enhance students' performance and interest in technical college blocklaying and concreting works (Riyati & Suparman, 2019). The study, therefore, sought to compare the extent Futures-Wheel and problem statement instructional strategy improved students' performance and interest in technical college blocklaying and concreting works.

Blocklaying and concreting work is an aspect of a vocational education programme taught at the technical colleges designed to produce students as technicians with the acquisition of skills and techniques in block-moulding, blocklaying and concreting works/occupations to enable recipients to earn a living (Oviawe, & Anetekhai, 2020). According to Farul et al. (2017), the operations in blocklaying and concreting works involves the skills required in accomplishing given tasks in mixing of mortars by hand, moulding of blocks, laying of blocks, rendering of walls, wall and floor tiling, pointing to walls, creating openings in walls (lintel and arches). It also involves slump test (workability test on concrete), placing concrete in positions, application of admixture to concrete, compaction, curing of blocks and concrete and fixing of concrete joint materials. Blocklaying and concreting works graduates are trained to meet the requirements of man in the ever-changing technological society. Skills are acquired to enable the recipient to take the best of his/her physical, community and political, environment It is predicated upon the teaching of skills and also demanding the expert/professional use of hands (Mohamad et al., 2019). It is geared towards the production of educated men and women who can effectively work with their brains and hands. The disciplinary philosophy and contents of blocklaying and concreting are based on the fundamental needs of equipping students with the basic knowledge and requisite skills to adequately prepare them for the challenges of the world of work (Edokpolor & Ile, 2020).

In the course of exposure to vocational education, blocklaying and concreting works students' are expected to study the content of its curriculum which afford them the opportunity to expand their knowledge, skills, values and attitudes. This exposure enables them to confront today's technological issues and realities and even that of the future. Hence, teachers are expected to guide students in developing those skills and competencies necessary for providing solutions to the problems of the environment (Okeagu, 2013); by employing scientific approaches in teaching to enhance students' understanding and acquisition of knowledge and skills.

Learning approaches are ways or strategies both teachers and students adopt towards presenting/delivering and understanding classroom instructions. No learning approach is all-encompassing on its own; an effective learning approach/strategy combines elements of other approaches (Ellis, 2005). An effective learning approach should be able to arouse students' curiosity and interest to learn, develop students' critical thinking ability (Azid et al., 2020) and enhance learning. Therefore, a Futures-Wheels instructional strategy is considered necessary in this study, because it possesses features that are essentially scientific and analytical to assist students adequately understand the nature of blocklaying and concreting works.

Based on the innovative idea of Glenn (1994), the Futures-Wheel is an instructional strategy that makes for effective teaching and learning and considers the consequences of behaviour, event(s), trends, decisions, concepts, topics, policies, issues, subject matter and strategies on the future within the scope and context of past and present situations. These impacts show the multi-dimensional network of inter-relationships of actions and problems (The Futures Academy, 2008; Emergent Futures, 2009). It is Futures-Wheel was developed to identify the future potential consequences of actions or phenomena basically as a result of Glenn's (1994) research as a learner in Antioch University, New England. Variations of the Futures-Wheel are known as Implementation Wheel, Impact Wheel, Mind Mapping, and Webbing (The Futures Academy, 2008).

Futures-Wheel is a way of organizing thinking and questioning about the future, based on the knowledge of the past and present scenario. It is a structured brainstorming that helps teachers and students in exploring ideas through interaction (Glenn, 1994). Mezieobi, Fubara & Mezieobi (2008) described the Futures-Wheel as a structured brainstorming method used to organize thinking about future events, issues, trends and strategy. Futures-Wheel is also seen as an instructional technique that allows the student to explore the consequences of past and present behaviours on future situations. The practical steps in utilizing Futures-Wheel are:

- *Write the change (concept or topic) you want to teach or consider at the centre of a piece of paper, or on a flipchart and circle it* –It could be an event, problem, action, task, policy, situation or a possible solution to problems. Examples here include design of residential buildings, safety, site investigation and preparation, carry out accurate work measurements, etc.
- *Identify the direct-first-order consequences of the topic or change.* Teacher brainstorms with students on the possible direct effects of that change or topic –The teacher is expected to write each change in a circle and connect it from the central idea (major or main topic) with an arrow.
- *Identify the indirect-second-order consequences* – Here, the teacher brainstorms with students on all the possible-second-order effects of the first-order (direct consequences). These are added to the diagram and also connected with an arrow in the same way. Thereafter, this process is repeated by identifying the third-order consequences, and so on,
- *Analyze the implications* - Once the teacher has completed all the levels of the Futures-Wheel, one can have a clear or better picture, graph or idea of the possible direct or indirect consequences of an action, concept, task, policy, topic or change.
- *Now, if or where those possible consequences that the teacher has identified are negative, the teacher should think of how to manage them in order to really capture what the idea or topic intends to achieve.* However, where the consequences are positive, the teacher should also think of what to do in order to take full advantage of the topic's objectives. Once this is done properly, the teacher will have a clear visual map that lays out or depicts or shows all the cause-effects (implications) of the problem, action, or topic; and even allowing for better management of the situation (that is, making appropriate provision for possible solutions).

In the context of this study, the use of Futures-Wheel involves logical thinking (that is, questioning) and analysis of issues, concepts, topics, tasks and situations or ideas that will assist in solving technological and global issues. Futures-Wheel in this study is compared to problem-solving strategy to determine its effectiveness.

Problem-solving is one of the learning approaches that seem to enhance students' interest to learn (Mettas & Constantinou, 2008), and a student-based learning approach whose main attributes are related to real-world problems, student control, and group-based processes. Problem-solving strategies identify and provide solutions to issues arising from instructions. It adopts the scientific or systematic process of identifying, classifying, collecting of data, analysis and conclusion through drawing inferences (Nworgu, 2015). In this strategy, the teacher poses a problem to the students and guides them towards providing answers (Okeagu, 2013). It is logically based on the identification of persistent issues and problems and how best to tackle them. The problem-solving strategy seeks to provide solutions to problems, issues, concepts and tasks by way of research based on systematic and scientific inquiry (Tee et al., 2020). Futures-Wheel and problem-solving strategies are compared to determine their effects on students' academic performance and interest in blocklaying and concreting works in technical colleges in Nigeria.

Performance in this study connotes the extent or degree of learning of the technical college blocklaying and concreting works attained by students'. It was used to determine what students have learnt after being exposed to the specific skills of blocklaying and concreting works using Futures-Wheel and Problem-solving instructional strategies (Mohd Najid et al., 2019). Performance entails students' final accomplishment of worth after much effort must have been employed. Bitrus (2014) stated that the concept refers to a task, accomplished by way of demonstrating skills and practice to effect positive change in the behaviour of the learner. Accordingly, it can be used to measure students' performance in technical college blocklaying and concreting works. Similarly, interest has a strong impact on students learning.

Interest was another variable also considered in this study because if students have an interest in a given subject, they tend to do well in the subject. Interest is a feeling of curiosity or concern about something that makes the attention turn towards it (Hunter & Csikszentmihalyi, 2003). Renninger (2012) noted that interest includes stored knowledge, stored value, and feelings that influence both immediate and long-term engagement, questioning behaviour, and the activity of individuals or groups of individuals around a specific topic. In this study, interest is the eagerness, willingness, attention and intellectual curiosity shown by students towards learning Blocklaying and concreting works in technical colleges. Renninger asserted that students with little interest to learn have less capacity to attend, find meaning, and identify their own questions. With interest, students ask and seek answers to curious questions as they engage content. When students have more developed interest, they pose curiosity questions and are also more inclined to learn and/or to use systematic approaches to seek answers (Engle & Conant, 2002). Students who have an interest to learn are also likely to be motivated learners; they are more likely to seek out challenges and difficulties (Renninger, 2012).

There seems to be a decline in the academic performance and interest of students in technical colleges (Potvin & Hasni, 2014). The National Business and Technical Education Board (NABTEB) Chief Examiner's Reports (2008, 2009, 2010, 2011 & 2012) noted that students' performances in technical subjects (Blocklaying and concreting works inclusive) at the end of vocational education have not improved. NBTE asserted that the overall performance of students in technical drawing had been quite low with the highest mean score in technical drawing recorded as 30.21%, 34.67%, 38%, 40.43% and 27.78% respectively. The above results indicate that the percentage of students' failure will continue to increase in the future and this portends great danger. Some of the reasons for poor performance could be attributed to students; poor knowledge and interest in blocklaying and concreting works and other technical subjects, disobedience to the rubrics, misinterpretation of the questions, inability to properly draw and label diagrams, teacher's poor coverage of the syllabus, among others (Oteze, 2011; Ugwoke, 2012; Anne et al., 2013; Nwoke & Akukwe, 2015).

Another factor that may influence students' academic performance and interest in blocklaying and concreting works is gender. Gender is a socio-cultural construct that assigns character and roles to one's sexual identity of being either a boy or a girl (De Cecco & Shively, 1984). The prevalent effect of gender bias and stereotypes in Nigeria affects certain vocations and disciplines whereby certain vocations are considered for males and some for females (Oludipe, 2012). In Nigeria, there is a stereotyping bias that science and technology-based subjects and programmes are a males' enterprise while catering, nursing, typing, home management among other disciplines are females. This sex stereotyping of subjects is of great concern in the academic field and has resulted in controversial issues and conflicting reports among educators, scholars and researchers. While some researchers reported that there exists no significant difference in the performance of male and female students in school subjects (Nwagbo & Chukelu, 2011; Oludipe, 2012), other scholars reported that there is a difference in the performance of male and female students (Nasr & Agar, 2011; Okoro, 2011; Larbi & Okyere, 2014; Nwoke & Akukwe, 2015; Asaf & Zahoo, 2017; Ogundola, 2017).

Some studies on students' performance and interest in school subjects have established that there are variances in students' academic achievement and interest in terms of gender and location (Lee & Burkam, 1996; Eugene & Ezeh, 2016). Some other studies found out that when exposed to the same instructional strategy, gender and location do not have significantly varied on students' academic performance and interest in the various school subjects (Rozendaal et al., 2003; Tayyaba, 2012). Indeed, the issue of the influence of gender and location on students' academic performance has not been settled. This study intends to make its contribution to the educational debate and to add to the existing literature on the effect Futures-Wheel and problem-solving instructional strategies with a focus on the interaction effect of gender and location on students' performance and interest in blocklaying and concreting works in technical colleges.

2. Research Methods

2.1 Research Design

The study adopted a pre-test, post-test non-equivalent control group quasi-experimental research design in examining the effects of Futures-Wheel instructional strategy on blocklaying and concreting works students' performance in technical colleges in Edo State. The experiment group is the student college in Edo State using the Future-Wheel while the control group using the problem-solving in the instructional strategy on blocklaying and concreting works. The design was specific with non-equivalent control groups and non-randomized groups because intact classes consisting of male and female students were used for the different groups.

2.2 Study Participants

The population for the study consisted of all the 604 Vocational II blocklaying and concreting works students from the six technical colleges in Edo State, Nigeria as at the 2017/2018 academic session. Vocational II students were used for the study because vocational I students were still new at the technical colleges and Vocational III were about to write their final examinations, thus the students do not need any distractions. The cluster sampling technique was used to select two technical colleges out of six technical colleges in Edo State for the study. The sample for the study comprised of 80 Vocational II students drawn from two intact classes where the experimental class consist of 32 males and 8 females while the control class had 35 males and 5 females.

2.3 The Instrument for Data Collection

Blocklaying and concreting works performance test (BLCWPT) and blocklaying and concreting works students' interest inventory scale (BLCWSIIS) were the instrument used for data collection. The BLCWPT covered measurement on the workshop and site safety, building team, blocklaying and concreting tools and equipment; site and workshop organization, site preparation and setting-out, concreting materials; excavation of trenches, foundation; manufacture, application and properties of block/brick; walls and types of bonds; types of floors; fenestration in buildings; methods of proportioning mixing and testing concrete; and use of formwork in construction. While the BLCWSIIS consist the indictor of I have interest in blocklaying and concreting works; what interests me in BLCW is its importance to man and the society; I study BLCW because I like to take a career in building construction; I would not like to do anything connected to building construction; I would like to study building construction in the university; I do not see any importance of BLCW to me; what interest me in BLCW is it's relevance to life; among others.

BLCWPT consists of 30-items multiple-choice items with five options (ABCDE) and five essay questions based on the themes and topics from the NBTE (2008) Blocklaying and concreting works curriculum. The items offered students the opportunity to fully express their cognitive ability on the contents of blocklaying and concreting works both before and at the end of the instructional treatment (pre-test and post-test). BLCWSIIS had two sections: A and B. Section A contained information on the personal data of the respondents while section B had items that addressed students' interest developed by the researcher from the literature reviewed. The items of BLCWSIIS were rated on a five-point Likert type scale; viz: Strongly Agree (SA) -5, Agree (A) – 4, Undecided (U) – 3, Disagreed (D) – 2, Strongly Disagreed (SD) – 1.

The interest inventory scores were non-dichotomous (that is, polychotomously) and positively scored. Both BLCWPT and BLCWSIIS were used for the pre-test and post-test. The BLCWPT item numbers were reshuffled before it was later used for post-test. After the administration of BLCWPT and BLCWSIIS pre-tests to the students within the first week of the study, the trained regular blocklaying and concreting works teachers from the sampled technical colleges gave no feedback to the students about the test instruments given. Rather, their respective scores were recorded and kept. However, at the end of the whole experiment, post-tests on BLCWPT and BLCWSIIS were also administered to the two groups. The BLCWPT scripts were marked and scored between the minimum of 0 and a maximum of 100%, while the BLCWSIIS was rated between a maximum of 5 and a minimum of 1 respectively. Hence, a benchmark of 3.00 was set for decision making on the items of the BLCWSIIS.

2.4 Instrument Validity and Reliability

BLCWPT and BLCWSIIS were validated by five Technical teacher educators, two blocklaying and concreting works and an expert in Measurement and Evaluation. The reliability co-efficient of the BLCWPT was obtained using Kuder Richardson's formula 21 (K_{R-21}), which yielded a reliability index of .87. Kuder Richardson's formula 21 (K_{R-21}) was used because part A of the test instrument consists of multiple-choice (objective) questions that were scored dichotomously, while the Cronbach Alpha reliability test was employed in the instrument, because of the polychotomously score (nature) of the part B (essay) test items of the instrument, which had a reliability of .67. The reliability of BLCWSIIS items was estimated by using the Cronbach Alpha formula, which gave a reliability index of .97. The Cronbach Alpha reliability test was adopted for the instrument because the BLCWSIIS involved a rating scale that has non-dichotomous scores.

2.5 Experimental Procedure

In order to compare the effects of Futures-Wheel instructional strategy on students' academic performance in blocklaying and concreting works, a factorial design within a pre-test-post-test experimental design (non-equivalent groups) was used. The experimental conditions that were controlled include: planned control of extraneous variables, school ethos, teacher variable, duration of the experiment, instructional situation variable, and effect of pre-test – post-test.

The researcher sought permission from the Principals and cooperation of the blocklaying and concreting works teachers in each of the technical colleges used for the study to enable the conduct of the study in the technical colleges. The researcher explained the purpose of the research to them and requested their assistance in experimenting. The regular teachers were coached on the lesson plan and notes prepared for the experiments two weeks before the commencement of the study. The reason for the choice of using the permanent teachers of blocklaying and concreting works for the experiment was that if a new teacher other than the regular teachers comes in to teach the students using any instructional strategy, the students may think that something (experiment) is going on and that may affect their performance and interest in blocklaying and concreting works. The permanent teachers were properly trained using the Futures-Wheel instructional strategy lesson plans and the problem-solving lesson plans during the training session. The essence of training the teachers was to ensure uniform instruction towards the validity (Md Yunos et al., 2017) of the experiment for easy generalization. However, before treatment, both groups (experiment and control) were given a pre-test. After the experiment for four and the control group taught the same learning units for four weeks using the problem-solving method lesson plans, the post-test was administered on both the experimental and control groups of the intact classes. The scores of the experimental group in both pre-test and post-test were recorded and compared with the scores gotten by the control group in both pre-test and post-test. The experiment lasted for six weeks (that is, the first week for pre-test, week two to five for class activities, and week six for post-test). The experiment came to an end with the post-test. Adequate control measures were taken to eliminate all the extraneous variables that would have otherwise threatened the validity of this study.

The following precautions were taken in the course of the experiment: (i) attendance was taken at the beginning of every class session so that scores of students who would have missed any of the sessions was not used during data analysis; (ii) the three groups were given an equal number of treatment; (iii) to prevent the subjects from being familiar with the questions of the pre-test and post-test, the items were re-arranged; and (iv) the time allowed for the pre-test and post-test was the same.

2.6 Method of Data Analysis

Mean and Standard Deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at .05 level of significance. The pre-test scores were used as the covariates to their post-test scores. The ANCOVA served as a means of controlling the extraneous variables from dependent variables thereby dealing with the threats of initial differences across the groups, and increasing the precision of the experimental results. Acceptance and rejection of the null hypotheses depended on this alpha level and the degree of freedom in relation to the calculated F-value. The acceptance mean of achievement score was 50 per cent in this study.

3. Results

Research Question 1: What is the Mean performance scores of technical college blocklaying and concreting works students taught with Futures-Wheel instructional strategy and those taught with problem-solving strategy?

Table 1 - Mean performance scores of technical college blocklaying and concreting works students taught with Futures-Wheel instructional strategy and those taught with problem-solving strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain
	$\bar{X}_1$	SD1	$\bar{X}_2$	SD2	
Futures-Wheel (Experiment)	12.81	5.21	41.67	3.59	28.86
Problem-solving (Control)	12.08	4.45	18.00	3.52	5.98

Table 1 shows that the pre-test Mean performance scores of the students in the experimental group (Futures-Wheel) performed better (12.81) and standard deviation of (5.21) than the control group (12.08) with a standard deviation of (4.45). However, the post-test Mean performance score showed that students taught with Futures-Wheel had higher post-treatment Mean performance scores of 41.67 with a standard deviation of 3.59; while students in the control group taught with problem-solving had a Mean performance score of 18.00 and a standard deviation of 3.52. The result shows that the Mean performance gain of students taught Blocklaying and Concreting works using Futures-Wheel is 28.86 while that of students taught Blocklaying and Concreting works with problem-solving is 5.98 The implication is that the treatment (Futures-Wheel) had positive effects on students Mean performance scores in Blocklaying and Concreting works.

Hypothesis 1: There is no significant difference in mean performance scores of students taught Blocklaying and Concreting works using Futures-Wheel and those taught using the problem-solving method.

Table 2 - ANCOVA of the significant difference in mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel and those taught using problem-solving

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-115.40	-	-155.40	-18.5504	
Explained (R)	33.7021	2	16.85105	2.7088	2.021
Residual (E)	267.4979	78	6.2209		
Total	301.2000	78	6.6933		

Significant at P<.05

Table 2 shows the general result of performance scores using ANCOVA. There is a significant difference in mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel and those taught using problem-solving, $F(2,78) = 2.7088$, $p=2.021$. This implies that the Mean performance scores of students taught with Futures-Wheel was significantly different and higher than those of the students taught with Problem-solving instructional strategy, in favour of the experimental group. Therefore, the null hypothesis is rejected. This indicates that there is a significant difference in Mean performance scores of students taught blocklaying and concreting works using Futures-Wheel and those taught with problem-solving instructional strategies.

Research Question 2: What is the difference in the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel and those taught using problem-solving instructional strategies?

Table 3 - Mean interest scores of technical college blocklaying and concreting works students taught with Futures-Wheel instructional strategy and those taught with problem-solving strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain
	$\bar{X}_1$	SD1	$\bar{X}_2$	SD2	
Futures-Wheel (Experiment)	13.39	4.91	33.06	3.44	19.67
Problem-solving (Control)	13.63	5.11	20.63	3.34	7.00

The result in Table 3 reveals that the pre-test Mean interest scores of the students taught blocklaying and concreting works using Futures-Wheel is 13.39 with a standard deviation of 4.91 while that of students taught with problem-solving instructional strategy was 13.63 with a standard deviation of 5.11. The result further reveals that the post-test Mean interest score of students' taught with Futures-Wheel is 33.06 with a standard deviation of 3.44 while that of students taught without Futures-Wheel is 20.63 with a standard deviation of 3.34. The result shows that the Mean interest gain of students taught Blocklaying and Concreting works using Futures-Wheel is 19.67 while that of students taught Blocklaying and Concreting works with problem-solving is 7.00. The implication is that the treatment (Futures-Wheel) had greater effects on students Mean interest scores in Blocklaying and Concreting works.

Table 4 - ANCOVA of the significant difference in mean interest scores of students taught Blocklaying and Concreting works using Future-Wheel and those taught using problem-solving

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-66.000	-	-66.000	-7.5812	
Explained (R)	24.4719	2	12.2360	2.7088	.686
Residual (E)	191.5281	78	8.7058		
Total	216	78	9		

Significant at P<.05

The result in Table 4 shows that there is a significant difference of mean interest scores of students taught Blocklaying and Concreting works using Future-Wheel and those taught using problem-solving, $F(2,78) = 2.7088$, $p=0.686$. Since F-calculated value (2.7088) is more than the F-table value of .686, therefore the null hypothesis is rejected. This implies that there is a significant difference in Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel and those taught with problem-solving instructional strategies.

Research Question 3: What is the effect of gender on the Mean performance scores of students taught blocklaying and concreting works using Futures-Wheel?

Table 5 - Mean Performance scores of Male and Female Students taught blocklaying and concreting works using Futures-Wheel instructional strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain
	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	
Male	15.81	5.47	23.54	4.04	7.73
Female	15.79	5.45	23.51	4.03	7.72

The result in Table 5 reveals that the pre-test Mean performance scores of male students taught blocklaying and concreting works using Futures-Wheel is 15.81 with a standard deviation of 5.47 while that of their female counterparts was 15.79 with standard deviation of 5.45. The result further reveals that the post-test Mean performance score of male students taught with Futures-Wheel is 23.54 with a standard deviation of 4.04 while that of their female counterparts was 23.51 with standard deviation of 4.03. The result shows that the Mean performance gain of male students taught Blocklaying and Concreting works using Futures-Wheel is 7.73 while that of the female students is 7.72. The result reveals that the differences between the Mean performance scores of male and female students in Blocklaying and concreting works was not significant to suggest differences in performance due to gender. The hypothesis 3 was tested at .05 level of significance as seen in Table 6.

Table 6 - ANCOVA analysis of significant difference of gender on Mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-111.200	-	-111.200	-12.2212	
Explained (R)	31.6180	2	15.4531	1.4413	1.972
Residual (E)	281.4312	78	7.1351		
Total	313.0592	78	7.0411		

Significant at P<.05

The result in Table 6 shows that there is no significant difference of gender on Mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel, $F(2,78) = 1.4413$, $p=1.972$. Since the F-calculated value of 1.4413 is less than the F-table value of 1.972, therefore the null hypothesis is retained. This implies that gender has no significant effect on the Mean performance scores of students taught blocklaying and concreting works using Futures-Wheel.

Research Question 4: What is the effect of gender on the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel?

Table 7 - Mean interest scores of Male and Female Students taught blocklaying and concreting works using Futures-Wheel instructional strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain	Diff in $\bar{X}$ gain
	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2		
Male	14.81	4.33	22.97	3.11	8.16	
Female	14.82	4.33	23.10	3.12	8.28	

The result in Table 7 reveals that the pre-test Mean interest scores of male students taught blocklaying and concreting works using Futures-Wheel is 14.81 with a standard deviation of 4.33 while that of their female counterparts was 14.82 with a standard deviation of 4.33. The result further reveals that the post-test Mean performance score of male students taught with Futures-Wheel is 22.97 with a standard deviation of 3.11 while that of their female counterparts was 23.10 with a standard deviation of 3.12. The result shows that the Mean interest gain of male students taught blocklaying and concreting works using Futures-Wheel is 8.16 while that of the female students is 8.28. Hypothesis 4 was tested at .05 level of significance as seen in Table 8.

Table 8 - ANCOVA analysis of significant difference of the effect of gender on mean interest scores of students' taught blocklaying and concreting works using future-wheel

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-110.900	-	-110.900	-12.5504	
Explained (R)	32.7033	2	17.85105	1.021	1.1088
Residual (E)	271.4119	78	8.2209		
Total	304.1442	78	8.6933		

Significant at P<.05

The result in Table 8 shows that there is no significant difference of significant difference of the effect of gender on Mean interest scores of students' taught Blocklaying and Concreting works using Future-Wheel, $F(2,78) = 1.021$, $p=1.1088$. Since the F-calculated value of 1.021 is less than the F-table value of 1.1088, therefore the null hypothesis is retained. This indicates that gender has no significant effect on the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel.

Research Question 5: What is the effect of location of school on the Mean performance scores of students taught blocklaying and concreting works using Futures-Wheel?

Table 9 - Effect of location on mean performance scores of students taught blocklaying and concreting works using futures-wheel instructional strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain	Diff in $\bar{X}$ gain
	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2		
Urban	15.72	5.25	26.17	4.15	10.45	
Rural	13.11	4.15	20.10	3.12	6.99	

The result in Table 9 reveals that the pre-test Mean performance scores of urban students taught blocklaying and concreting works using Futures-Wheel is 15.72 with a standard deviation of 5.25 while that of rural students was 13.11 with standard deviation of 4.15. The result further reveals that the post-test Mean performance score of urbane students' taught with Futures-Wheel is 26.17 with a standard deviation of 4.15 while that of their rural counterparts was 20.10 with standard deviation of 3.12. The result shows that the Mean performance gain of urban students taught Blocklaying and Concreting works using Futures-Wheel is 10.45 while that of the rural students is 6.99. The hypothesis 5 was tested at .05 level of significance as seen in Table 10.

Table 10 - ANCOVA analysis of significant difference of the effect of location on Mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-118.600	-	-118.600	-19.5504	
Explained (R)	43.1133	2	17.22311	2.9721	2.122
Residual (E)	284. 2521	78	7.5521		
Total	301.3554	78	7.7673		

Significant at P<.05

The result in Table 10 shows that there is a significant effect of significant difference of the effect of location on Mean performance scores of students taught Blocklaying and Concreting works using Future-Wheel, F(2,78) = 2.9721, p=2.122. Since the F-calculated value of 2.9721 is more than the F-table value of 2.122, therefore the null hypothesis is rejected. This implies that location has a significant effect on the Mean performance scores of students taught blocklaying and concreting works using Futures-Wheel.

Research Question 6: What is the effect of location on the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel?

Table 11 - Effect of location on the mean interest scores of students taught blocklaying and concreting works using futures-wheel instructional strategy

Strategy	Pre-test		Post-test		$\bar{X}$ Gain	Diff in $\bar{X}$ gain
	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2		
Urban	13.67	4.22	26.55	5.23	12.88	
Rural	11.22	3.23	19.12	3.41	7.90	

The result in Table 11 shows that the pre-test Mean interest scores of urban students taught blocklaying and concreting works using Futures-Wheel is 13.67 with a standard deviation of 4.22 while that of their rural counterparts was 11.22 with standard deviation of 3.23. The result further reveals that the post-test Mean performance score of male students taught with Futures-Wheel is 26.55 with a standard deviation of 5.23 while that of their rural counterparts was 19.12 with standard deviation of 3.41. The result shows that the Mean interest gain of urban students taught Blocklaying and Concreting works using Futures-Wheel is 12.88 while that of the rural students is 7.90. The hypothesis 6 was tested at .05 level of significance as seen in Table 12.

Table 12 - ANCOVA analysis of significant difference of the effect of location on mean interest scores of students taught blocklaying and concreting works using future-wheel

Sources of Variations	Sum of Squares	DF	Mean Square	F cal-value	Sig.
Covariates	-112.200	-	-112.200	-15.4411	
Explained (R)	32.3266	2	14.71216	2.8411	2.121
Residual (E)	282. 1234	78	5.2312		
Total	314.4500	78	6.1021		

Table 12 - Continue

Significant at P<.05

The result in Table 12 shows that there is a significant effect of significant difference of the effect of location on Mean interest scores of students taught Blocklaying and Concreting works using Future-Wheel, F(2,78) = 2.8411, p=2.121, therefore the null hypothesis is rejected. This implies that location has a significant effect on the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel.

4. Summary of Findings

The summary of the findings of this study shows that there is a significant difference in the mean and interest performance scores of students taught blocklaying and concreting works using Futures-Wheel and those taught with problem-solving instructional strategies. On the other hand, gender has no significant effect on the mean and interest performance scores of students when taught blocklaying and concreting works using Futures-Wheel. In addition, the location has a significant effect on the mean and interest performance scores of students when taught blocklaying and concreting works using Futures-Wheel.

4.1 Discussion of Findings

The findings of this study are discussed in line with the research questions and hypotheses that guided the study. Findings from research question 1 and hypothesis 1 revealed that there is a significant gain in academic performance of students in blocklaying and concreting works taught with Futures-Wheel instructional strategy more than those taught with problem-solving strategy. The significant gain in knowledge and improvement in students' performance could be attributed to the activity-laden nature and logical as well as problem-solving procedures inherent in the strategy. These activities and other instructional incentives would have allowed students not only to participate actively in classroom interactions but also spurred them to initiate, negotiate and acquire requisite knowledge and skills very fundamental to understanding and solving problems and issues in blocklaying and concreting works. This finding seems to be in line with that of Mandor (2007) who reported that students performed better when exposed to learner-centred instructional approaches than teacher-centred strategies. However, the findings of this study is in contrast with that of Bitrus (2014) who reported that there is no significant difference in students' mean achievement scores or gains as a result of exposure to instructional strategies.

Findings with respect to research question 2 and hypothesis 2 revealed that there is a significant difference in the Mean interest scores of students taught blocklaying and concreting works using Futures-Wheel and those taught using problem-solving strategy. Naturally, an instructional strategy such as Futures-Wheel which has in-built learner-centred and problem-solving pedestal nature could have helped students in becoming more interested in blocklaying and concreting works (Alao, Onah & Alao, 2020). This was evident because students' interest (post-test) scores were higher than their pre-test interest scores. This finding indicates that when students are given the opportunity to participate actively in the instructional process, their interest in learning activities increases. This finding is in line with that of Obi (2006) on the same subject matter which indicated that instructional strategies could improve both performance and interest of students. Furthermore, this finding corroborates the earlier findings of John (2007) who found that innovative instructional strategies improve students' interest in learning. Thus, the instructional strategy via the Futures-Wheel can be proposed to be part of the curriculum improvement for the blocklaying and concreting works course in order to train and produce students as technicians with the acquisition of skills and techniques in block-moulding, blocklaying and concreting works to enable them for sustainability survival.

The finding of the study with respect to research question 3 and hypothesis 3 indicates that there is no significant difference in the effect of gender on the Mean performance scores of students' when taught blocklaying and concreting works using Futures-Wheel. The non-significant difference in the effect of gender on students' performance in blocklaying and concreting works as observed in this study may be attributed to the effectiveness of Futures-Wheel. In line with the finding of this study, Chen (2021) stated that being male or female does not influence students' academic performance when taught using the same teaching method. This finding supports the earlier research findings that found and reported no significant difference in the Mean scores of male and female students when taught using innovative strategies (Oludipe, 2012; Ndinika & Ubani, 2017) Need to put in alphabetical order. However, the finding of this study contradicts the earlier findings of Ezeugwu (2007) who found out that gender has a significant influence on students' academic performance when taught using the same innovative teaching strategy. To this end, Larbi & Okyere (2014); Nwoke & Akukwe (2015) reported that when girls and boys are instructed through the same instructional method, girls benefit most, which enable them to perform at an almost equal level as their male counterparts is not in support of the findings of this study. Asaf & Zahoo (2017) found that girls performed better than boys in their study did not support the findings of this study. Also contradicting the findings of this study is that of Ogundola (2017) who found that gender had effects on students' achievement in technical drawing in favour of girls. Barbican (2008); Okoro (2011) asserted that irrespective of the method used in teaching concepts, boys usually achieved significantly better than girls is in contrast to the findings of this study. The findings of this study disagree with that of Nnamani et al. (2018) who reported that gender had an effect on students' achievement in favour of the girls.

Findings in respect to research question 4 and hypothesis 4 reveal that there is no significant difference in the effect of gender on the Mean interest scores of students' when taught blocklaying and concreting works using Futures-Wheel. This finding corroborates the earlier findings of Nwagbo (2013) who reported that gender had no significant effect on students' interest in learning when taught using the same teaching method.

The findings of the study with respect to research question 5 and hypothesis 5 revealed that there is a significant difference in the effect of location on the Mean performance scores of students when taught blocklaying and concreting works using Futures-Wheel. This finding is in line with that of Esa et al., (2017), Adebisi (2008) and Chukwu (2009) who reported that location has a significant effect on students' academic performance when taught using the same teaching method. However, the findings of Onuwa (2004) and Kalu (2004) that location has no significant effect on students' academic performance when taught using the same teaching method disagrees with the finding of this study.

The finding of this study with respect to research question 6 and hypothesis 6 shows that there is a significant difference in the effect of location on the Mean interest scores of students' when taught blocklaying and concreting works using Futures-Wheel. This finding corroborates that of Chukwu (2009) and Adeji (2011) who earlier reported that the school location of students had a significant effect on their interest in learning when taught using the same teaching method. However, the finding of this study disagrees with that of Onuwa (2004) and Nze (2006) who found and reported that school location of students has no significant effect on students' academic interest when taught using the same teaching method. However, the gender and location will not affect the study which is insignificant results but there is a need for long term improvement for Nigeria education system by providing the training of technical teachers and infrastructural provision both in urban and rural educational institutions to enhance quality instructions via innovative instructional approaches for sustainable development.

4.2 Implications of the finding for Sustainable Development

The findings of this study have implications for education and sustainable development particularly in blocklaying and concreting works instructional delivery in technical collages (Osman & Kamis, 2019). The implications of this study border on the development of innovative instructional approaches that are learner-centred for instruction in blocklaying and concreting works. Interestingly, the finding of this study revealed that the use of Futures-Wheel instructional strategy could enhance students' performance and interest in content in blocklaying and concreting works curriculum. The implication is that for Nigeria to achieve sustainable development through blocklaying and concreting works curriculum that is designed to train and produce students as technicians with the acquisition of skills and techniques in block-moulding, blocklaying and concreting works/occupations to enable recipients earn a living; technical teachers have to use Futures-Wheel instructional strategy in teaching blocklaying and concreting works.

Furthermore, the findings of the study revealed that school location had effect on students' academic performance blocklaying and concreting works. The implication of this finding is that a country that aims to achieve sustainable development cannot afford to have disparity in terms of quality instructions in rural and urban educational institutions. Hence, there is a need for proper training of technical teachers and infrastructural provision both in urban and rural educational institutions to enhance quality instructions for sustainable development.

5. Conclusion and Recommendations

Emerging research opinions indicate that poor performance in blocklaying and concreting works and other technical subjects are becoming very worrisome to stakeholders in education. This study was conducted to determine the effect of Futures-Wheel instructional strategy on students' academic performance and interest in blocklaying and concreting works in technical colleges in Edo State, Nigeria. It is concluded based on the findings of this study that Futures-Wheel instructional strategy because of its innovative and problem-solving nature improved students' academic performance and interests in blocklaying and concreting works. Based on the findings of this study, the following recommendations were made:

- Governments, technical teacher education institutions and all other stakeholders who are responsible for the training of technical teachers to train them in the use of innovative instructional strategies such as Futures-Wheel. This can be done by engaging teachers in capacity-building conferences, seminars and workshops.
- Blocklaying and concreting works teachers should adopt Futures-Wheel strategy in teaching curriculum concepts. This strategy will help to enhance students' performance and interest in blocklaying and concreting works.
- Stakeholders should ensure that infrastructures should be provided in rural areas as it is in urban areas for quality education.

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