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Effectiveness Of Cooperative Learning Strategy On Students Academic Achievement In Technical Drawing In Tertiary Institutions In Delta State

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Abstract

Research reports indicate that performance of students in Technical Drawing in Tertiary Institutions deteriorates every session. Factors such as poor method of instructional technique and instructional treatments were attributed to these poor achievements. A need therefore arises for exploring more effective learning technique for teaching and learning Technical Drawing has not been ascertained. It was therefore imperative to investigate the effectiveness of cooperative learning strategy on student's achievement in Technical Drawing. A quasi-experiment research design was adopted for the study. Three research questions guided the study. A validated Technical Drawing Achievement Test (TDAT) was used for data collection. Mean and Standard Deviation were used for data analysis. The result shows that cooperative learning strategy (CLS) had a significant effect on students achievement in Technical Drawing. It was recommended that Technical Drawing teachers should use CLS to boost learning outcome.

INTRODUCTION

One essential component of effective teaching and learning is the use of appropriate instructional techniques. Imparting adequate knowledge, skills and values requires a good teaching method capable of facilitating effective learning.

Over the years, teaching and learning in the school system has been predominantly teacher-centred and teacher directed (Boyle, 2013). The teacher centred activities may not be effective in teaching and learning Vocational subjects like Technical Drawing because the students ought to practice, demonstrate and show a certain degree of proficiency in the knowledge and skills demonstrated by the teacher.

The new National Policy on Education (NPE,2014), stated that no educational system can rise above the quality of its teachers. Teaching is the process of guidance by which the learner is made to grasp ideas and facts and develop skills. It is the process of transmitting knowledge and skills (Nweke, 2017). This implies that teaching is the process of developing the cognitive, affective and psychomotor abilities of the learner through giving the learner knowledge of facts about subject matter, reinforcing or developing positive attitude in learner and also developing in the learner certain physical or manipulative skills (Edozie, 2006). It is a series of activities designed and performed to produce desirable change in students' behaviour. According to Davis (2015), teaching takes place when information (or some skills) is communicated from teacher to pupils. If there is no communication, there is no teaching, if what is taught is not communicated; the attempt at teaching is unsuccessful.

Teaching and learning are like two sides of a coin. Okoh 92016) defined learning as a relatively lasting change in behaviour that is induced directly by practice or relevant experience. This definition implies that for learning to take place there must be;

i. A direct inducement
ii. This inducement is by direct experience
iii. There must be a relatively permanent change in behaviour.

This change in behaviour could be cognitive, affective and psychomotor related. When this happens, learning becomes holistic. According to Owen (2017), learning is the process of acquiring new or modifying and reinforcing existing knowledge, behaviour, skills, values, or preferences which may lead to a potential change in

synthesizing information, depth of the knowledge, attitude or behaviour relative to the type and range of experience.

According to the National Policy on education, the following are the aims and objectives of teaching and learning:

i. The inculcation of national consciousness and national unity.
ii. The inculcation of the right types of values and attitude for survival of the individual and the Nigeria society.
iii. The acquisition of appropriate skills, abilities and competencies both mental and physical as equipment for the individual to live in and contribute to the development of his society.

There are different types of teaching and learning methods which includes the following;

i. Lecture method
ii. Demonstration method
iii. Dramatic method
iv. Discovery or development method
v. Project method
vi. Socratic or questioning method
vii. Comparative method
viii. Story telling method etc

Iloh (2010) divided teaching methods into four broad categories namely;

i. Cooperative teaching method
ii. Competitive teaching method
iii. Cooperative-competitive teaching method
iv. Individualistic teaching method

Regarding cooperative learning strategy (CLS), students of different levels of ability work together in small groups (5-10) to achieve a common purpose (Akinbola, 2016). It involves the use of a variety of learning activities to improve their understanding of a subject. Slavin (2013) explained that student in a group interacts with each other, share ideas and information and make decisions about

their findings to the entire class. Holubeck (2010) presented the essential element of cooperative learning as positive inter-social skill and face to face interaction.

Olisa (2010) stated that cooperative learning strategy (CLS) could be used as an effective technique for enhancing students' achievement in Vocational subjects like Technical Drawing could be enhanced by using cooperative learning method. Studies have shown that cooperative learning methods has improved students' attitude towards learning, self-esteem and intergroup relationship. CLM also enhances integrated process and product assessment mechanism needed for evaluation in psychomotor domain. The teacher in using this method blends the learning situations by grouping the students and subjecting them to competitive testing while evaluating their psychomotor domain

CLM may take different forms. Good cooperative learning in the classroom requires that time is spent on team-building skills, helping students become listeners, giving students practice on how to make contributions to group effort. Cooperative learning improves intrinsic motivation, encourages students' interdependence and promotes deep understanding. It reduces social distance among students and improves self- worth and productivity more so, it develops general mutual concern and interpersonal trust among students and increases propensity for pro-social behaviour.

Research findings further show that compared with other methods, cooperative learning produces greater academic learning, better inter-group relations among different races, enhanced self-esteem and improved relationship between mainstreamed academically handicapped students and normal progress students. It promotes group spirit (spirit de corps). Cooperative learning is also referred to as collaborative learning.

The integration of cooperative learning style may assist the technical drawing students in the tertiary institutions to benefit from a shift from teacher

centred to student centred for better acquisition of problem solving skills and thinking United Nations Education and Scientific Cultural Organization (UNESCO,2002), had often times stressed the need to seek for appropriate learning style and instructional technique that is student centred. There is no doubt that students academic achievement is positively affected by the method of teaching adopted by the teacher. There is need for development and implantation of new educational practice to make classroom more interesting and interactive even in a conventional format.

Cooperative learning method could be an effective motivating method and can be applied in Technical Drawing. Most literature opined that the use of cooperative learning as a method of teaching could enhance deeper learning by the students. Upon this background, it becomes pertinent to investigate the effectiveness of cooperative learning strategy on academic achievement of students in Technical Drawing.

Technical Drawing involves composing plans that visually communicate how something functions or is to be constructed. The aims of Technical Drawing include the following:

i. To use acquired knowledge for solving day –to-day engineering problems.
ii. To read and interpret working drawing.
iii. To develop the basic skills of drawing.

Overtime, there has been continued debate on the most effective pedagogical technique to be used in teaching and learning of Technical Drawing. Some argued for (teacher) imposing knowledge on students, while other suggested that although structure are known within disciplines, it makes sense for students to discover them (Lawtey and Ornstein, 2000). In recent times, there seems to be a move towards allowing students to be more directly involved in the teaching learning process. Even within the formal classroom setting, teachers can move away from the

conventional teaching method of in which one deliver a speech and students just passively listen and take notes and allows more active engagement of students.

Cooperative learning strategy could be one way to improve the intellectual ability and performance of students in Technical Drawing. Cooperative learning is an instructional technique in which students work together as a team to achieve a specific target or objective. There have been many studies that have been conducted that have outlined the value of cooperative learning style. One of such was conducted by Felder (1994), who found that students became so accustomed to working in groups that their work translated into high academic achievements. It was noted that in the conventional classroom students typically gained average of 50% while the group that was involved in the study of cooperative learning strategy gained average of 72%. Following recent outery over students poor performance in Technical Drawing, teachers have been called upon to evolve ways of enhancing students performance in the subject. A seemingly fruitful approach could be that of employing the cooperative learning strategy (CLS).

Statement of Problem

Research studies indicate that achievement of students in Technical Drawing in literary institutions deteriorates every session. Factors like poor method of teaching and instructional treatments were attributable to these poor achievements. A need therefore arises for exploring some effective learning techniques for Technical Drawing concepts. The effectiveness of cooperative learning strategy on the teaching and learning of Technical Drawing is yet to be ascertained. The question then is “would cooperative learning strategy increase performance of students in Technical Drawing”?

This research project would investigate the performance of Technical Education students in tertiary institutions in Technical Drawing concepts when they are taught with the cooperative learning strategy in order to find out whether such teaching and learning methods could be exploited. It is no longer debatable

that the performance of Home Economics students in Public examinations has rose-dived. This could be as a result of unprofitable and inappropriate teaching method adopted by the teachers. If this trend should continue unabated, resourceful, skilled and knowledgeable technical education practitioners will be lacking for the economic growth and well being of the nation. It is therefore imperative to investigate the effectiveness of cooperative learning strategy on students academic achievement in Technical Drawing.

Purpose of the Study

The major purpose of the study is to determine the effectiveness of cooperative learning strategy (CLS) on students academic achievement in technical drawing, specifically the study would;

1. Determine the significant difference that exist in the use of cooperative learning strategy (CLS) and conventional teaching method (CTM) in teaching and learning of Technical Drawing.
2. Find out what group of students performed better in Technical drawing achievement Test (TLDAT).
3. Find out what group of students performed better in the Technical Drawing retention test (TDRT)

Research Questions

The following research questions will be answered in the course of this study;

1. What significant difference exist in the use of cooperative learning strategy (CLS) and conventional teaching method (CTM) in the teaching and learning of Technical Drawing.
2. What group of students performed better in Technical Drawing Achievement Test (TDAT)?
3. What group of students performed better in Technical Drawing retention Test (TDRT)?

Significance of the Study

Benefits that shall accrue from this research work are many, specifically, curriculum planners, technical drawing teachers and students will benefit from the result of this study. More so, this study will contribute to the knowledge base on technical education by highlighting the benefits of cooperative learning strategy (CLS). Poor achievement of students in Technical Drawing will be emborated. The findings of this study will hopefully enlighten the technical college teachers on how to improve their instructional delivery by using cooperative style for teaching. It is also hoped that the findings of this study will unfold the teaching style and learning conditions that may be employed not only to reduce the declining performance of students in Technical Drawing but also to stimulate students' interest and retention.

Finally, the study will be highly beneficial to curriculum planners and educational administrators as the findings will afford them the opportunity to know those pedagogical practices that are in tone with contemporary technological changes in teaching. The findings from this study will help the policy makers in making necessary review and further contributions in the policy formulation process.

Delimitation of the Study

The research is restricted to Technical Drawing students in Tertiary Institutions in Delta State and to Mechanical Engineering Drawing aspect of Technical Drawing. Building Drawing was not covered.

Limitation of the Study

The study covered only the Mechanical Engineering aspect of Technical Drawing. Other areas of the subject will not be covered.

Operational Definition of Terms

1. Cooperative learning strategy is an instructional method in which students work together as a team to achieve a specific target or objective.
2. Conventional teaching method is the form of instruction that is teacher oriented or centred approach that occurs when educators mainly teachers give students information instead of facilitating learning. (Guiding students on information).
3. Technical Drawing is the act and discipline of composing plans that visually communicate how something functions or is to be constructed. It is essential for communicating ideas in industry and engineering.

Review of Related Literature

The literature for this study will be reviewed and organized under the following subheading:

1. Conceptual frame work of methods of teaching and learning of technical drawing in tertiary institutions.

2. Cooperative method of teaching and learning technical drawing in tertiary institutions.
3. Conventional method of teaching and learning technical drawing in tertiary institutions.
4. Problems of teaching and learning technical drawing in tertiary institution.

Conceptual Framework of Teaching and Learning of Technical Drawing in Tertiary Institutions

Teaching and learning is an art and the equality of teaching and learning depends on the love, dedication and devotion of the teacher and students towards the subject of the knowledge. The quality of any teaching and learning program cannot rise above the quality of teachers and students, teaching and learning is a highly individualized activity and the student-teacher interaction is an intense human relationship that encompassed a broad range of personalities and behaviours (Okolie, 2001).

There is no best or most effective teaching style, which will work well for all teachers. Those teaching method include: (i) Lecture method (ii) project method (iii) field trip method (iv) peer learning method (v) Inquiry method

(vi) Demonstration method (vii) discussion method (viii) discovery method (ix) cooperative method and (x) conventional teaching method e.t.c.

According to Collins (2000), teaching is any interpersonal influence aimed at changing the way in which other persons can or will behave. Teaching here is

defined in terms of socialization which makes it everybody's business, since several agencies are involved in the socialization of its citizen. Similarly, Kerby (2007) defined teaching as a system of action intended to induce learning. This is in agreement to an earlier definition of teaching. In essence, the notion of teaching seems to be totally dependent on learning.

Teaching therefore entails filling in the mind of the learner skill, knowledge, facts and information needed for immediate or future use. It is a process of interaction between the teacher and students in which the students are guided and directed to learn.

There are two basic concepts that play pertinent roles in. teaching and learning

(i) Constructivism

(ii) Motivation (Keritha McLeish, 2009)

The term constructivism refers to the idea that learner construct knowledge for themselves... each learner individually (and socially) constructs meaning... as he or she learn (Hein 1991). Hein (1991), further notes that if we accept the constructivist position. We are inevitable require to following a pedagogy which argues that we must provide learners with the opportunity to: a) Interact with sensory data, and b) construct their own world. These are two (2) basic viewpoints that can be isolated within the context of constructivism.

According to Igba (2004), some academic subscribe to empiricism which is the belief that knowledge is anchored in the external environment and exist independent of the learners cognitive ability, and so they tend to speak about helping learners construct accurate concepts. Others academics are more radical and subscribe to the view that knowledge resides in the constructs of learning as cited in Lasley and Ornstein (2004) p. 20.

Cooperative Method of Teaching and Learning Technical Drawing in Tertiary Institutions.

Ransdell and Moberly (2003) opine that cooperative learning is a viable but under-used teaching-learning tool. They contend that educator can best utilize this teaching strategy in their classrooms more effectively if they themselves were active participant in their teacher education training programme.

There are other educators who have conducted studies within their own classrooms.

One such is Meng (2005), examines the application of cooperative learning style in the Chinese. He found that the nature of the Chinese culture which is marked by collectivism enable this learning style to be more successful. Collectivism places emphasis on a more extended self which is understood in a wider context that is in relation to a physical and social environment which one seeks to harmonize (Hui & Vilareal, 198ft as cited in Meng 2005). Meng (2005) outlines an experiment conducted by Tang (1996) in Hong Kong in which he tested

Chinese students' habitual learning approaches, tendency to collaboration and their distribution of test and assignment.

Based on the finding Chinese student tended to be in cooperative learning groups which were at time spontaneous student centre and based on group effort individual reward structure. This cultural phenomenon of collectivism is opposite to the western idea of individualism, Meng (2005) in concluding indicate that cooperative learning style is an effective motivating style and can be applied to many instructional fields.

He however noted that students characteristic and cultural background must be considered as such it should be flexible and change depending on the situation.

There have been surveys conducted in third world cities such as Nigeria to assess student view of cooperative learning strategies. One such as conducted by Akinbobola (2009) to discover the attitude of student toward the use of cooperative, competitive and individualistic learning strategies in Nigerian Secondary school physic. The research design for this study was quasi-experimental. There was a total of one hundred and forty (140) student taking part in the study who were selected by a random sampling technique. A structured questionnaire titled students attitude towards physics questionnaire (SATPQ) on 4 point scale was used to collect the data. Poor student performance can be attributed to poor teaching methods, unqualified and inexperienced teachers: poor student attitude toward physic, poor learning environment and gender effect (Ivowi, 1997 as cited in Akinbobola, 2009).

Conventional Method of Teaching and Learning Technical Drawing in Tertiary Institutions.

Although most of the literature is pointing toward the use of cooperative learning as a method for enhanced and deeper learning. Peek et al (1995) state that cooperative learning style is not applicable to all subject matter in all disciplines.

They identify the conventional teaching method as a better technique than cooperative learning when:

(a) A large quantity of information is to be disseminated;
(b) The teacher wants to establish a class culture that his/her delivery style;
(c) Students meant to take notes for examination preparations;
(d) Students can use information other than what is presented;
(e) The learners are auditory.

The conventional teaching method classroom can also enhance learning once there is appropriate context and design of teaching/learning when context is difficult to relate to student, the teacher want to develop critical thinking skill in conventional teaching strategies.

Cardodo, Cristiano and Arent (2009) recommended the need for development and implementation of new educational practice to make classroom more interesting and interactive even in a conventional format.

Miller (2003) compares students' outcome following the use of problem based learning versus conventional teaching method for teaching in a theoretical

graduate pharmacology course ever a semester. She found that while the lecture delivery was a more effective way of teaching particular material, the final course average produced a normal distribution in both group of students; those exposed to problem-base learning and those exposed to the conventional teaching method. The finding infers that there is virtually no difference with respect to student performance.

Learning outcomes such as profession-specific skills, knowledge are bases for teaching using more social constructivist techniques in undergraduate programmes. The finding of Hanson and Sinclair (2008) suggest that lecturers may perceive a positive association between the use of social constructivist teaching methods and the superior development of students' profession-specific skills and knowledge-creation capacity, but not with the superior development of their theoretical knowledge. Seemingly, conventional teaching method value the development of theoretical knowledge over profession-specific skills. The researches further report that there is continuing divergence between method used.

However, technology has changed so many things as well as the manner we digest information. Digital tools, such as computers, audio and visual tools are slowly replacing conventional teaching methods. Conventional teaching as most of us have experienced, is classroom-based and consist of lectures and direct instructions conducted by the teacher. This teacher-centered method emphasized learning through the teacher's guidance at all times students are expected to listen to lectures and learn from them.

Students and teachers will benefit more if both conventional and modern methods are fuse together in order to create a more effective, fun and interactive learning experience.

Problems of Teaching and Learning Technical Drawing in Tertiary Institution

It has been observed that Nigeria is facing a serious problem of how to finance her educational programmes Ayodele (2009) reports among several reasons that government is unwilling to allocate an increase share of its expenditure to education. Supporting this view, Ibukun (2009) declares that "education in Nigeria is inadequately funded due to the rising cost of resources for learning, skyrocketing enrolment of students and the grouping inflation within the country.

Other factors which need prompt attention raised by Nigerian Education Research and Development Council (NERDC) (1980) before good qualities can be attained during expansion include the creating of adequate physical facilities such as good books and teaching aids, the education and training of the necessary cadres of teachers with adequate knowledge of what to teach and of the methodology, the enrichment of learners home and school environment through the provision of adequately equipped libraries.

Other factors still include; the promotion of extra-curriculum and co-curricular activities; the quality control of education through supervision, inspection, continuous assessment, the fiscal resources and allocated measure taken by the government toward revitalizing the educational system.

The unavailability of resources to teach the students are likely to lead to poor learning outcome and also affects the lecturers output. Ayeni, (2005) identifies some factors that are responsible for the poor learning outcome of students in Technical drawing. These include inappropriate planning of educational programmes, insufficiency of qualified Technical drawing educators in the field, insufficient material resource for training, lack of recognition and encouragement of technical drawing graduates, inadequate funding and lack of technical drawing guidance and counseling.

There is no doubt that the inadequate funding of technical drawing may lead to insufficient or non availability of material resource for training. A situation where skilled personnel are available but no material resource to work with will be discouraging. In some technical college, the few resources that are available are old and not properly installed due to lack of fund.

There are instances where some resources are available but the lecturer are not able to utilize them in teaching and learning process as a result of lack of skills.

Also in some of these technical colleges, some modern equipment such as sophisticated Set Square, computer machine, drawing table/board and other are not used by lecturers because of their inability to use them.

Overstretched of available physical space and facilities due to over enrolment as noted by Famad (2007) are there too. All these have great consequences on the outcome of the technical drawing.

The review shows that very few research studies have investigated the effect of cooperative learning style and conventional teaching method on students achievement in technical drawing. A strong relationship between cooperative learning style and higher achievement as well as greater long-term achievement show in the literature. It is a common finding in western research (e.g. Johnson & Johnson, 2009, Slavin 2011) that cooperative learning style provide greater achievement than conventional, competitive or individualistic learning.

Summary of the Literature Review

The review shows that very few research studies have investigated the effect of cooperative learning style and conventional teaching method on students achievement in technical drawing. A strong relationship between cooperative learning style and higher achievement as well as greater long-term achievement show in the literature. It is a common finding in western research that cooperative learning style provide greater achievement than conventional, competitive or individualistic learning.

The benefit of cooperative learning style have been show in numerous studies in the western context, which in Nigeria (including technical drawing), some studies show it is no better than, or worse than the conventional teaching method in its effect on students' learning.

Cooperative learning has theoretical grounding in various theories of psychology. The idea is that man is social being as such various form of social

interaction are essential for human society survival. Within the classroom the concept of cooperation can be prompted since individuals will be learning to work together for the overall benefit of the group. The studies indicate that cooperative learning is a very useful and beneficial strategy. However, can cooperative learning flourish in a conventional society? In spite of the previous studies on effective instructional techniques for teaching and learning Technical Drawing, the effectiveness of CLS on the subject has not been ascertained.

Research Methodology

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February 2021

This chapter presented the procedure used in carrying out this study under the following sub-headings: design of the study; area of the study, population for the study, sample and sampling technique; instrument for data collection; validity of the instrument, reliability of the instrument, method of data collection and method of data analysis.

Design of the study

The design of this study was quasi-experimental, utilizing a non-equivalent control type as intact classes. Two subject groups were involved and treatment was given to one group only.

According to Gall, Gall and Borg (2007), quasi-experimental design can be used when it is not possible for the researcher to randomly sample the subject and assign them to treatment groups without disrupting the academic programmes of the schools involved in the study. This design was considered suitable for this study because intact classes non-randomized groups were used.

Area of the Study

The study will be carried out in Delta State. Precisely

- Delta State University Abraka.
- Federal College of Education (Technical) Asaba.
- Delta State Polytechnic Ogwashi-Uku, Ozoro, Ughara.

Population for the Study

The population for the study comprised all the students of Technical Education who were in their second final year of study. The population figure will

be 563. These students were deemed suitable for the study because they were assumed to have been most adequately exposed to technical drawing courses.

Sample and Sampling Technique

Because of the small number of the population, no sampling was made.

Instrument for Data Collection

The Technical Drawing Achievement Test (TDAT) instrument was developed for the study.

Validation of the Instrument

The instrument used for data collection was face validated by four experts in school of technical education, Federal College of Education (Technical) Asaba. The experts were requested to review and revise the instrument items in terms of relevance, clarity and appropriateness to the students' standard. Their recommendations were incorporated in the final version of the TDAT which had 50 items.

Reliability of the Instrument

The TDAT was trial-tested on thirty technical education students in Federal college of education (Technical) Umunze, Anambra State and the results were used to determine the reliability of the TDAT. A reliability index of 0.88, using Ginbech Alpha formula was obtained. The value indicated that the TDAT was reliable and therefore, adequate for the study.

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Volume 08 Issue 02

February 2021

Method of Data Collection/Procedure

Prior to the beginning of the second semester two intact technical education classes at Federal College of Education (Technical) in Asaba, precisely NCE (Tech) Year II and III were randomly assigned to treatment condition. One class was randomly chosen and taught Technical Drawing using the conventional teaching method and acted as the control group, and the other class was taught the same subject using the cooperative learning strategy and acted as the experimental group. The two groups were taught for four weeks. A pre-test on technical drawing was administered to both groups before the treatment. The technical drawing course comprised of three units and each unit taught within 60 minutes in one week. The same researcher taught both groups. In the control group, the researcher instructed student to learn the technical drawing contents using conventional teaching method.

In the treatment group, the researcher guided students to learn the technical drawing contents using cooperative learning strategy. In this group the researcher supplied the following three steps:

(1) The researcher organized the learning materials and identified the objectives of the subject matter

(2) Students help each other to learn their learning materials and

(3) The researcher assessed students' understanding through their presentation in front of the whole class.

This process was repeated three (3) time, once for each unit of work .

Throughout the experiment both groups could not meet at the same time as they were taught by the same researcher. The treatment group was taught on Wednesdays, while the control group was on Fridays. Both groups covered the same technical drawing contents and received technical drawing instruction for the same amount of time precisely for 12 weeks. After the treatment, both groups took post-test (TDAT) to measure students' achievement. Fourteen days later, a retention test was administered to both groups. Scores thus obtained provided the required data for analysis.

Method of Data Analysis

To determine the effectiveness of TDAT on the groups, the mean scores and standard deviation of the experiment and control groups were compared on the measures.

Result of the Study

Table 1: Mean score and standard deviations for experimental and control group in ATAT.

Groups	NS	X	SD
Experimental (CLM)	26	40.69	3.48
Control (CTM)	26	29.57	4.08

Data on table 1 shows the mean achievement score and standard deviation of the experimental and control groups.

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Volume 08 Issue 02

February 2021

The experimental group has a mean score of 40.69 and a standard deviation of 3.48, while the mean score and standards deviation for the control group were 29.57 and 4.08 respectively. The experimental groups recorded higher mean score. The implication is that CLM proved more efficacious than the CTM technique as an instructional technique for teaching and learning Technical Drawing.

Table 2: Mean and standard deviation for experimental and control groups in Technical Drawing Achievement Test

S/N	Group	Year of study	Pre-text NS	Xa	SDa	Post text NS	Xb	SDb
1	Experimental (CLM)	NTC 3(A)	13	43.76	4.73	13	45.15	3.51
		NTC 3(B)	13	40.61	3.40	13	45.76	4.14
2	Control (CTM)	NTC 3(A)	13	32.52	4.41	13	39.30	6.41

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Volume 08 Issue 02

February 2021

		NTC 3(B)	13	29.25	3.40	13	30.23	6.01

Table 2 shows the mean achievement score and standard deviation of the experimental and control groups by year of study with different sub-groups. The experimental group has a high mean achievement score in both the pre-text and post-text. The experimental group in NTC3 Group A and group B performed better than the control group in NTC3 A and B in Technical Drawing Achievement Text (TDAT). The implication again is that CLM proved more effective than the CTM technique as an instructional technique for teaching and learning Technical Drawing.

Table 3: Mean and standard deviation for experimental and control groups in Technical Drawing Retention Test (TDRT).

S/N	Group	Post-text			Retention Text		
		NS	Xb	SD	NS	Xc	SD
1	Experimental (CLM)	26	42.1	2.37	26	49.65	8.12

2	Control (CTM)	26	29.79	6.23	26	30.26	3.76

Table 3 shows the mean achievement score and standard deviation of the experimental and control group in the retention text. The experimental group has a higher mean achievement score in both the pre-text and retention text.

This indicates that the experimental group performed better than the control group in the Technical Drawing Retention Text. The implication is that CLM proved more efficacious than the CTM technique as an instructional technique for Teaching and Learning Technical Drawing Courses.

Discussion

Research question one result shows that the experimental group had a mean score of 40.69 and standard deviation of 2.48 while the mean score and standard deviation for the control group were 29.57 and 4.08 respectively. There was significant difference between the mean achievement of the experimental and control group in the Technical Drawing Achievement Test (TDAT). This difference can be attributed to the cooperative learning method which fosters student-student relationship as supported by Okebukola (2015). Adebayo (2016) also supported that CLM motivates students understanding of Technical Drawing. Evidence from this study therefore indicates that the CLM has a significant effect on the students' Achievement in Technical Drawing. Teachers should therefore explore and use CLM to boost learning outcome in Technical Drawing.

Regarding Research Question Two, the experimental group has high mean Achievement score in both the pre-text and the post-text. The experimental group in NTC3 Group A and B performed better than the control group in NTC3 A and B in TDAT. Results indicate that the experimental group for NTC 3 performed better than the control group for the NTC 3 students. This finding is consistent with that of Okebukola (2015), Adebayo (2016), Ezeanyike (2016) who in their separate studies found that CLS motivates students understanding of Technical Drawing.

Regarding Research Question three, the experimental group had high Achievement score in both the post-test and Retention test. The experimental group performed better than the control group in Technical Drawing Retention Text. This finding is consistent with that of Okebukola (2015) who found that CLM enhances student academic achievement in science, technology and mathematics (STM).

Summary

Technical Drawing is the art and discipline of composing plan that visually communicates how something functions or is to be constructed. Technical Drawing is essential for communication, Idea in industry and engineering. There had been continued debate a bout the most effective pedagogical technique to be used in teaching Technical Drawing. Some argued for teacher imposing knowledge on student, while others suggest that student should be exposed to self learning through discovery. In recent times, there seems to be move towards allowing students to be more directly involved in teaching-learning process. Within the formal classroom setting, teachers can move away from the conventional teaching

method of teaching in which one effectively deliver a speech and students just passively listen and take notes, and allow more active engagement of students.

Cooperative learning strategy could be one way to improve the intellectual ability of students in Technical Drawing. Cooperative learning is an instructional method in which students work together as a team to achieve a specific target or objective. There have been many studies that have been conducted that have outlined the values of cooperative learning styles; one of such was conducted by Felder (2014). Ransoell and Moberly (2013) opined that cooperative learning is a viable but under used teaching-learning tool. They contend that educators can best utilize this teaching strategy in their class room more effectively if they themselves were active participant in their teacher education training programme. Most of literature is pointing towards the use of cooperative learning. Peek etal (2015) stated that cooperative learning style is not applicable to all subject no matter in all disciplines. They identify the conventional teaching method as a better technique than cooperative learning when:

- A large quantity of information is to be disseminated
- The teachers wants to establish a class culture that his/her delivery style
- Students have to take note for examination preparations
- Students can use information other than what is presented
- The learners are auditory.

The conventional teaching method in classroom can also enhance learning once there is appropriate context and design of teaching/learning when context is

difficult to relate with students, the teachers wants to develop critical thinking skills in a conventional teaching strategies.

Conclusion

The study concludes that CLS enhances students' achievement. The teachers of Technical Drawing should promote cooperative learning strategy CLS to boost students performance in the teaching and learning of Technical Drawing at the tertiary level of education.

Recommendation

1. Technical Drawing teachers should be encouraged to avail themselves of the opportunities offered by CLS to enhance students' academic achievement in Technical Drawing.
2. Seminars and workshops should be organized by stakeholders in educations for Technical Drawing teachers on effective use of CLS in teaching and learning

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APPENDIX

Pre-test/post-test

1. If a client of yours is having difficulty visualizing a design what type of drawing would be the easiest to understand?
   A axonometric B. three view orthographic C. one-view orthographic D. biometric
2. Which of the following is not a pictorial drawing?
   A. isometric B. multiview C. perspective D. axonometric
3. A circle will appear as an isometric drawing as an _____ A. Ellipse. B. Cycloid C. Circle D. Parabola
4. An axonometric drawing which has axes divided by equal angle is?
   A. Diametric B. Trimetric C. Orthographic D. Isometric
5. An axonometric drawing which has all three axes divided by equal angle is
   A. diametric B. trimetric C. orthographic D. isometric
6. In an oblique drawing, the projection rays are drawn_____ to each other and _____ to the plane projection.

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A. Oblique ……. Oblique B. oblique ……. Parallel

C. Parallel ……. Oblique D. parallel…….. parallel

7. In an axonometric drawing, the projection rays are drawn _____ to each other and _____ to the plan of projection.

A. Oblique …….. oblique B. oblique …… parallel

C. parallel …… oblique D. parallel ……. Parallel

8. All of the following are process (as opposed to input and output) in a manufacturing business except

A. Material B. planning C. documenting D. designing

9. Following operations can make use of the CAD database, except?

A. Designing B. marketing C. producing D. none of the above

10. Which of the following is the responsibility of the production manager?

A. people B. plants C. processes D. all of the above

11. Which of the following projection method does not need projectors Perpendicular to the projection plane?

A. Isometric B. orthographic C. oblique D. axonometric

12. In a trimetric drawing, the relationship of the angle between axes to each other is: A. Three are equals B. two are equal

C. three are unequal D. none of the above.

13. In an isometric stretch of a cube: A. the frontal face appears in it true shape B. the receding area are at 45 degrees to the horizontal C. all face are equally distorted D. only the depth distances must be reduced.

14. In isometric drawings:

A. Two axes are perpendicular B. true measurements can be made only along C. all faces are unequally distorted D. none of the above

15. One method of drawing an eclipse that represents an isometric pictorial Circle is known as:

A. The box construction method B. the coordinate construction method C. the four center approximation method D. none of the above

16. Non- isometric lines are located and sketched how?

A. they draw parallel to the isometric axis B. they are measured using the angle from the multivie C. they are measured using non-isometric template D. they are located by determining the end points of the non-isometric line

17. In an oblique stretch of a cube:

A. the frontal face appears in it true shape B. the receding areas are at 30 degrees to the horizontal C. all face are equally distorted D. the depth distances must be reduced.

18. In an oblique drawing, all the following angles are commonly used for drawing the depth axis except:

A. 30^{o} B. 45^{o} C. 60^{o} D. 90^{o}

19. Which of the following will be a typical use for product data management?

A. tracking potential clients by marketing B. generating variations of a preliminary design C. searching for how any design used a particular fastener D. evaluating the strength of the rib support on a cast piece

20. Which design process involves responding to the emotional needs of the

consumer?

A. Aesthetic design B. functional design C. systems design D. e-business

21. Which network system gives outside vendors access to a company's internal network?

A. Intranet B. extranet C. internet D. outer net

22. All of the following are part of a typical team, except:

A. vendors B. quality control specialists C. manufacturing engineers D. Accountants.

23. Which of the following input devices doers not translate hand movements into instructions for the computer?

A. Scanner B. mouse C. keyboard D. 3D mouse

24. Which type of output device creates image which look and feel like photographs?

A. Electrostatic plotter B. laser printer C. dye-sublimation printer D. inkjet plotter

25. Hoch tool can be used to draw a 90 degree angle?

A. 30/60 triangle B. protractor C. drafting macjine D. all of the above

26. Which set of lead grade has a grade out of sequence?

A. H, HB, B, 3B B. 7B, H, F, 3H C. 6B, B, H,4H D. 9H, HB, B, 2B

27. Which type of line is part of a dimension?

A. break lines B. phantom lines C. extension lines D. cutting plane lines

28. Which type of line is particular to section drawings?

A. break lines B. phantom lines C. extension lines D. cutting plane lines

29. Which angle cannot be made with either a 45 or 30/60 triangle or a

combination of the two?

A. 90 B. 70 C. 30 D. 15

30. A drawing instrument set usually contains all of the following, except:

A. bow compass B. scale C. dividers D. extra leads

31. Which of the following operating systems is used with CAD system?

A. dos B. Unix C. Linux D. all of the above

32. Which line type is thin and light?

A. visible lines B. center lines C. construction lines D. all of the above

33. Which line type is thick and black?

A. visible lines B. center lines C. construction lines D. all of the above

34. What type of sketches are typically used in the refinement stage of the design process?

A. Isometric B. document C. oblique D. Ideation

35. What type of sketch incorporate convergence?

A. isometric B. perspective C. oblique D. multiview

36. What type of sketch show the front in true shape?

A. isometric B. perspective C. oblique D. axonometric

37. What type of sketch uses a milter line?

A. a two-view multiview B. an isometric pictorial C. a three point perspective pictorial D. a three view multiview

38. Which type of line has precedence over all other types of lines?

A. a hidden line B. a center line C. a visible line D. none of the above

39. Which statement(s) is true about the precedence of lines?

A. a hidden line has precedence over a center line B. a center line has

precedence over a visible line C. a visible line has precedence over a miter line D. all of the above

40. Where do the projection line converge in a perspective sketch?

A. the vanishing point B. the ground line C. the horizon line D. the eye point

41. When you want to make the letters of a line of text narrower, you would set its:

A. Aspect B. scale C. alignment D. font

42. When you want to make sure that all of the text stay to the right of a given Point on the drawing, you would set its:

A. Aspect B. scale C. alignment D. font

43. Which of the following is typically represented in a drawing but does not have a true physical counterpart on the object?

A. Edge of plane surface B. edge of a circular face C. corner of rectangular D. limiting element of a curve surface

44. A cutting plane normal to a face of a cube has to be _____ in order to cut an oblique face

A. Rotated about one axis B. rotated about one axis and translated C. rotated about two axes D. rotated about two axes and translated

45. All of the following are variables involved in the use of image planes, Except;

A. The object being viewed B. the size of the object C. the eyes of the viewer D. the image plane.

46. In a VR system, all of the following statements about immersiveness are

true, except:

A. Response time is an important factor B. both display resolution and display size can affect it C. the visual sense is the only sense to affect D. tracking body movement is an important factors

47. Imagine a "L" shape face extruded into three dimension. How many faces does it contain?

A. Seven B. eight C. ten D. six

48. Which type of variable is the following list: Texas, Utah, California, Delaware?

A. nominal B. ordinal C. scalar D. vector

49. Which type o variable is the following list: Thinnest, Thin, Medium, fat, fattest?

A. Nominal B. ordinal C. scalar D. vector

50. What is the major difference(s) between perspective and parallel projection?

A. parallel projection can only be used with object containing parallel edges.

B. perspective projection gives a more realistic representation of an object.

C. parallel projection is equivalent to a perspective projection where the Viewer is standing infinitely far away D. B and C