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Effects of Teacher-Fabricated Electric Furnace on Students' Academic Achievement and Interest in Mechanical Engineering Craft Practice in Technical Colleges in Osun State

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Abstract

The study was carried out to determine the effects of teacher-fabricated electric furnace on academic achievement and interest of students in mechanical engineering craft practice in technical colleges in Osun state. The study adopted a quasi-experimental and Research & Development (R & D) design. The population for the study was 100 students. The instruments for data collection were the Mechanical Engineering Craft Practice achievement test (MECPAT) and the Mechanical Engineering Craft Practice Interest Inventory (MECPIT). The reliability coefficient of the instrument was .76 using Cronbach Alpha technique and the internal consistency of the MECPAT interest inventory. The data collected were analyzed using Mean and Standard Deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the three hypotheses formulated. The study found that students taught with teacher-fabricated electric furnace had a higher mean achievement score than those students taught using the discussion method in the achievement test, it was also found that male and female respondents taught with teacher-fabricated electric furnace and those taught using discussion method in the interest inventory items have interest in the usage of teacher-fabricated electric furnace in learning mechanical engineering craft practice. There were significant difference between the mean achievement scores of students taught with teacher-fabricated electric furnace and those taught with discussion method in mechanical engineering craft practice. It was recommended that mechanical engineering craft practice teachers in technical colleges should adopt the use of the teacher-fabricated electric furnace to teach mechanical engineering craft practice students for effective teaching and learning. It was further recommended that facilities that could encourage the use of the teacher-fabricated electric furnace should be improvised to mechanical engineering craft practice teachers in technical colleges for effective teaching and learning.

Keywords: Teacher-Fabricated Electric Furnace, Academic Achievement, Interest, Mechanical Engineering Craft Practice, Technical Colleges

Introduction

Sociologically, education is a process of acculturation through which people are guided and trained to develop their potentials, talents and skills necessary for their overall development and that of their societies. It is indeed a major indicator of knowledge and skills development, and thus has the potential for

transforming and equipping man with the cognitive and innovative abilities which position him to contribute meaningfully to the overall development of his society (OECD, 2023). In particular, industrial technology education equips man with the creative, technological, and innovative skills needed to catalyze industrial transformation (Zishiri & Mataruka, 2024)). Thus, the quality of technology education in the school system is not unconnected with the scientific and technological development and the extent of economic sustainability needed in Nigeria (Okoli et al, 2013). In support for advocacy on science and technology at all levels of education, the Federal Republic of Nigeria in the National Policy on Education (2013) stipulated technology as a tool for national development. This enhances the teaching and learning of technology at all level of education including technical colleges.

Technical colleges are post primary institutions that furnish students with both specialized technical skills and broader competencies to enhance employability in the industrial and service sectors (Vincent & Ariyo, 2024). Furthermore, Vincent &Ariyo (2024) opined that Technical colleges are established for training of students to acquire practical skills, knowledge and attitude, necessary for promotion of industrial development in the area of maintenance, production of goods and general technical services. These colleges offer programme that are more hands-on and practical compared to traditional academic institutions, students typically learn skills related to a particular industry or profession, such as automotive technology, welding, computer programming, healthcare, or culinary arts, Mechanical Engineering craft and so many other craft related subjects that prepare students for a specific career path.

Mechanical Engineering craft is a general name used in describing trades that have direct bearing with metal, welding/forming or servicing/repairs of machines or machine related equipment and appliances (Obed & Tom, 2020).The trades in this group include agricultural implement and equipment, mechanic works, auto body repair and spray painting, auto electrical work, auto body mechanic works, auto mechanic works, auto building, auto parts merchandising, air-conditioning and refrigeration mechanic works, welding and fabrication engineering craft practice, foundry craft practice, instruments mechanic works, marine engineering craft and mechanical engineering craft practice (Obed & Tom, 2020). Mechanical Engineering craft practice is a trade that provides a post primary technical education and practical proficiency in fitting, turning and machining to the level of good craftsman (Nnodim & Quintus,2023). The subject matter of mechanical engineering craft practice is specifically designed to provide the skills and knowledge to fulfill the needs of the modern industry.

Furthermore, Nnodim & Quintus (2023) found that MECP programs in Nigerian technical colleges, especially in Rivers State, impart practical skills such as grinding, drilling, and fitting. These competencies are closely tied to students' ability to become self-reliant and enter industrial and service sector roles after graduation. MECP students are usually awarded the National Technical Certificate (NTC) by National Business and Technical Examination Board (NABTEB) after successfully passing all the relevant modules of the course, which includes entrepreneurship skills training (Nnodim & Quintus, 2023)). The study of mechanical engineering craft practice requires proficiency in the usage of several machines among them is the electric furnace.

A metallurgical furnace is characterized as an enclosed structure designed for intense heating by fire or electrical means, typically used for roasting, smelting, heat treatment, melting, or calcination of metals and materials. Examples of furnace are blast furnace, electric furnace, basic oxygen furnace, open hearth furnace and besmear converter furnace (Xinxin, 2024). Their heating sources could be coal, charcoal, gas or electricity.

Teacher-Fabricated Electric Furnace refers to an electric heating device constructed by a teacher, usually in a vocational or technical education setting, for demonstration, instructional, or practical training purposes. It is designed and built using locally available materials and components to help students understand the principles of electric heating, metalworking, fabrication, and safety procedures in a hands-on, cost-effective way.

Features of a Teacher-Fabricated Electric Furnace:

i. Electric Heating System: Uses electrical energy (typically through resistive heating elements like nichrome wire) to produce heat.
ii. Insulated Chamber: Built using firebricks, ceramic wool, or other heat-resistant materials to maintain high internal temperatures.
iii. Temperature Control: May include a thermostat, thermocouple, or digital controller to monitor and adjust temperature.
iv. Safety Components: Designed with safety switches, grounding, fuses, and insulation to protect users from electrical or heat-related hazards.
v. Customized for Training: Built to meet specific learning goals in subjects like electrical installation, metalwork, mechanical engineering, or physics.

Purpose of Teacher-Fabricated Electric Furnace:

i. Demonstration Tool: Helps explain concepts like resistance heating, thermal conductivity, and circuit design.
ii. Skill Development: Allows students to gain hands-on experience in wiring, metal fabrication, and maintenance.
iii. Innovation & Creativity: Encourages both teachers and students to apply engineering knowledge to solve real-world problems using available resources.
iv. Cost-Effective: More affordable than commercial furnaces, especially in schools with limited budgets.

Applications in Education

Melting and shaping metals (aluminum, lead, copper), Heat treatment of metal parts, demonstrating electrical and thermal systems and Preparing students for careers in manufacturing, maintenance, or engineering trades (Riaz et al., 2023). It therefore follows that without a functional furnace, it will be difficult for the teacher to develop the student's skill in metal related work. The furnace is used for moulding operation, casting operation etc.

Moulding is a manufacturing process that involves shaping molten metal into a desired form. The process typically begins with melting metal in a furnace and then pouring or injecting it into a mold cavity. Casting is a manufacturing process that involves pouring molten metal into a mold cavity to create a desired shape upon solidification. This versatile technique is widely used in industries to produce a variety of metal parts and components. It is necessary that Mechanical Engineering Craft Student to be very grounded in the operation of the furnace in order to ascertain this, proper training and assessment must be put in place in order to boast their academic achievement.

Achievement is defined as attained success in any act while Mwihia (2020) viewed it as the ability of an individual to reach a set goal through effort, skill or courage. Hongyu (2024) defines academic achievement as the degree to which students, classes, or schools meet expected educational goals. It notes that it is commonly measured using grades, standardized test scores, and other performance indicators

Academic achievement is commonly measured by continuous assessment and examinations. It is noted that academic achievement is always denoted by a score, which represent the amount of learning acquired, knowledge gained or skills and competencies developed in the school subject. Academic achievement depends on a wide range of factors including instructional approaches, teacher competence, student intelligence and motivation, curriculum organization, teaching aids and materials, the learner's interest, home background, and broader environmental contexts (Authors 2023).

Interest is defined as the attention with a sense of concern; lively sympathy or curiosity; and the power to excite or hold such attention (in something) (Typhoon International Corp, 2004). "Interest plays an important role in the field of psychology as a number of researches have showed that it is related to

personality, motivation, cognition, development, emotion, vocations, aesthetics, behavior, hobbies, reasoning, and information processing. Interest is a key determinant of reading comprehension and effective text processing. When readers encounter texts that align with their interests or are allowed to choose content they experience greater motivation, attention, and persistence, resulting in higher comprehension and reduced mind wandering (van der Sande et al., 2023). Though there is evidence that seductive details of interest have detrimental effect as it impairs comprehension; interest promotes comprehension and memory for several reasons: interest increases attention to a text; interest makes people process a text more deeply; and interest promotes good metacognitive strategies.

Statement of Problem

Mechanical engineering craft practice is one of the trades offered by technical college students in Nigeria. Students of this trade are expected to graduate with the necessary skills which include metal moulding, casting, forging, and heat treatment operations that will make them either to secure jobs in industry or to be self-employed. Thus, the students who take public examinations in this course from the technical colleges have been presenting poor results as shown by National Business and Technical Examination Board Chief Examiners' Report by NABTEB (2014, 2016, 2017 & 2018). It is thus necessary to find more effective methods of teaching mechanical engineering craft practice in technical colleges preferably student-centered teaching methods such as the teacher-fabricated electric furnace, which could as well improve students' overall achievement. In support of the chief examiner report, Olakotan (2022) stated many studies have identified the teaching problem principally the teachers' method of teaching as the major factor contributing to poor academic achievement. He explained further that the lecture method and demonstration method are the main teaching methods employed by the technical teachers for implementing the curriculum. This necessitated the researcher to investigate and determine the effectiveness of teacher-fabricated electric furnace on academic achievement and interest of students in MECP in technical colleges in Osun.

Hypotheses:

The following null hypotheses will be tested at 0.05 level of significance.

Ho_1. There is significant difference between academic achievement mean score of students taught moulding operation using teacher-fabricated electric furnace and those taught moulding operation with discussion method in technical colleges in Osun State.

Ho_2. There is significant difference between academic achievement mean score of students taught casting operation using teacher-fabricated electric furnace and those taught casting operation with discussion method in technical colleges in Osun State

Ho_3. There is significant difference in the interest of male and female students when taught mechanical engineering craft practice using teacher-fabricated electric in technical colleges in Osun State.

Theoretical Framework

The theoretical framework upon which this study is based on are: Conscious competence theory of learning and constructivism theory of learning.

Conscious Competence Theory of Learning (Propounded by Broadwell in 1969). The theory was propounded by Broadwell in the year 1969. The theory posits that skills that are relevant today may become obsolete tomorrow due to change and dynamism caused by innovations. Hence, there is need for individual learner and teacher to be conscious of constant improvement by acquiring new competencies for effective teaching and learning. The theory is relevant to this study because it will help Mechanical Engineering Craft Practice students in their career opportunities by making conscious efforts to acquire technical skills through active learning that can help them to solve difficult tasks and expand their scope of knowledge in the subject.

Constructivism theory of learning propounded by *Jean Piaget* in 1972. Constructivism theory posits that learners must consciously think about deriving meaning when listening or watching the instructor who is

facilitating their learning environments, and with this observation, learners construct their own knowledge. The theory is relevant to this study because it will help Mechanical Engineering Craft Practice students in their career opportunities by making select and transform information, construct hypothesis and make decision

Methodology

Design of the Study

This study adopted Research and Development (R and D) and incorporated quasi- experimental design. Quasi- experimental design involved the use of pre-test and post-test design with experimental and control groups.

Area of the Study

The study was carried out in Osun State, Nigeria. The population of the study comprised 100 of year two students of the two Technical Colleges offering mechanical engineering craft practice. Year two students was used here because foundry technology is in their scheme of work.

Sample and Sampling Technique

The study employed purposive sampling techniques. This is because the entire years two students for mechanical engineering craft practice were manageable in size. This number of students was shared into the control group and experimental group for the purpose of treatment.

Instrument for Data Collection

The instrument for data collection in this study was Mechanical Engineering Craft Practice Achievement Test (MECPAT) and Mechanical Engineering Craft Practice Interest Inventory (MECPII) developed by the researcher. The Mechanical Engineering Craft Practice Achievement Test (MECPAT) consisted of 30 multiple choice items. These questions were used for the pre-test, later it was restructured for the post-test (Instrument for treatment of Experimental and Control groups). The MECPII was used to test students' interest in Mechanical Engineering Craft Practice. The items of the interest inventory were based on four-point Likert scale of Strongly Agreed (SA), Agreed (A), Disagree (D) and Strongly Disagree (SD).

Data Collection Procedures

The researcher with the aid of regular subject teachers was subjected the eight purposively sampled intact groups to pre-testing exercise with the MECPAT, to test the intelligence status. Thereafter, the experimental group was subjected to the treatment after which the post-test was administered to the experimental group. The scores of the experimental group in both pre-test and post-test was recorded and compared with the scores obtained by the control group in both tests.

Methods of Data Analysis

The data collected from the pretest, posttest, and interest were analyzed using mean to answer the research questions. The pretest- posttest mean gains of each of the experimental groups were compared to determine the group that achieved better. The hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance. This was because ANCOVA is a statistical technique which removes the initial differences between groups, so that the selected or pre-tested groups can be correctly considered as equated or equivalent by removing score difference in the pre-test performance across groups and reducing the between-group source variation. In testing the hypotheses, if p-value was less than the level of significance (0.05), the null hypothesis was rejected but if the p-value was greater than or equal to the level of significance at (0.05), the null hypothesis was accepted. All the data analysis were done using the Statistical Package of the Social Science (SPSS) version 27. In research question three, any questionnaire item with a mean limit ranging from 3.50-5.00 indicated strongly agree, 2.50-3.49 indicated agree, 1.50-2.49 indicated disagree, and 0.50-1.49 indicated strongly disagree. A t-test statistics analysis was used to test the null

hypotheses at 0.05 probability level of significance. The null hypotheses were not rejected if the t-calculated value is less than the table value while they were rejected if t-calculated value is greater than the table value.

Results

Research Question 1: What are the effects of teacher-fabricated electric furnace on student's academic achievement in moulding operation in technical colleges in Osun State?

Table 1: Mean and Standard Deviation of Pre - test and Post - test Scores of Experimental and Control Groups in the Achievement Test in moulding operation

Group	N	pretest		Posttest		Mean difference
		X	SD	X	SD	
Experimental	50	3.88	1.47	7.16	1.70	3.28
Control	50	3.74	1.44	3.86	1.77	0.12

The data in Table 1 revealed that the experimental group had a mean of 3.88 and a standard deviation of 1.47 in the pretest, and a mean score of 7.16 and a standard deviation of 1.70 in the post test making a pretest posttest gain of 3.28. The control group had a mean score of 3.74 and a standard deviation of 1.44 in the pretest and a mean score of 3.86 and a standard deviation of 1.77 in the post test with a pretest gain of 0.12. The result showed that the experimental group performed better than the control group with the pretest-posttest gain of 3.16

Research Questions 2: What are the effects of teacher-fabricated electric furnace on student's academic achievement in casting operation in technical colleges in Osun State?

Table 2: Mean and Standard Deviation of Pre - test and Post - test Scores of Experimental and Control Groups in the Achievement Test in casting operation

Group	N	pretest		Posttest		Mean difference
		X	SD	X	SD	
Experimental	50	4.18	1.49	6.76	2.00	2.58
Control	50	4.28	1.46	4.64	1.65	0.36

The data in Table 2 revealed that the experimental group had a mean of 4.18 and a standard deviation of 1.49 in the pretest, and a mean score of 6.76 and a standard deviation of 2.00 in the posttest making a pretest posttest gain of 2.58. The control group had a mean score of 4.28 and a standard deviation of 1.46 in the pretest and a mean score of 4.64 and a standard deviation of 1.65 in the post test with a pretest posttest gain of 0.36. The result showed that the experimental group performed better than the control group with the pretest-posttest gain of 2.22.

Research Questions 3: What are the effects of teacher-fabricated electric furnace on male and female student's interest in technical colleges in Osun State?

Table 3: Mean and Standard Deviation Analysis on the effects of teacher-fabricated electric furnace on male and female student's interest in technical colleges in Osun State.

S/N	Items	X_1	SD_1	X_2	SD_2	$\bar{X}_C$	SD_C	RMK
1.	Casting and moulding is simple to understand	3.20	.42	2.60	.84	2.90	.63	A
2.	Casting operation on metal requires considerable skills and patience	4.00	.00	3.60	.52	3.80	.26	A
3.	Moulding and producing correct size job are very interesting.	3.20	.42	2.80	1.03	3.00	.73	A
4.	I frequently ensure that tong for carried molten metal are in good condition	3.20	1.23	3.20	.79	3.20	1.01	A
5.	If the mechanical engineering craft practice teacher/instructor fails to come to the class on time, I can go to their office to call any of them whose period is one.	3.40	.52	3.20	.79	3.30	.66	A
6.	I know that rivet is made of both hot and cold forging methods	3.00	.94	2.00	.94	2.50	.94	A
7.	I know that water cooling system is a vital component in various industrial processes and power plants, where excess heat needs to be dissipated to maintain equipment and machinery at safe operating temperatures	3.40	.84	2.00	.67	2.70	.76	A
8.	I encourage my friends to develop interest in mechanical engineering craft practice	3.40	.52	3.00	.94	3.20	.73	A
9	I know, that auxiliary system operation is the system that provide essential support, control, and safety measures to ensure the furnace's effective functioning and the quality of the metalworking processes carried out inside it	3.60	.52	3.00	.67	3.30	0.60	A
10.	I like to work in an accident free workshop	3.20	1.23	3.60	.52	3.40	0.87	A

Keys: Keys: *X_1 = Male Students, X_2= Female, $\bar{X}_C$ = Combine Mean, SD_C = Combine Standard Deviations, SA = Strongly Agreed, A = Agreed, D = Disagreed, SD = Strongly Disagreed.*

The data in Table 3 revealed that the male students had a mean of 3.36 and a standard deviation of .66 while the female students had a mean of 2.90 and a standard deviation of .77 in student's interest. The mean indicates that the respondents agreed that they have interest in the usage of teacher-fabricated electric furnace in learning mechanical engineering craft practice in Technical Colleges in Osun State.

Hypothesis 1

Ho_1. There is significant difference between academic achievement score of technical college students taught moulding operation using teacher-fabricated electric furnace and those taught moulding operation with discussion method

Table 4: Analysis of Covariance on Students' (Experimental and Control) on Academic Achievement of Students using Teacher-Fabricated Electric Furnace and Discussion Method in moulding operation

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	231.240[a]	2	115.620	35.491	.000
Intercept	357.782	1	357.782	109.826	.000
pretest	.200	1	.200	.061	.805
Group	230.817	1	230.817	70.852	.000
Error	316.000 3314.000	97	3.258		
Total	547.240	100			
Corrected Total		99			

P< 0.05

Decision: The result on Table 4 showed that calculated F. ratio for the group treatment on the students' academic achievement in Teacher-Fabricated Electric Furnace is 70.852 with .000 level of significance thus, the null hypothesis of significant difference between mean achievement score of students taught using Teacher-Fabricated Electric Furnace and Discussion method in moulding operation was not rejected at 0.05 level of significance. This means that the f-cal was statistically significantly at $p<0.05$ level. Thus, indicating that Teacher-Fabricated Electric Furnace was significantly more effective than the Discussion method.

Hypothesis 2.

Ho_2. There is significant difference between academic achievement score of technical college students taught casting operation using Teacher-Fabricated Electric Furnace and those taught casting operation with Discussion Method.

Table 5: Analysis of Covariance on Students' (Experimental and Control) on Academic Achievement of Students using Teacher-Fabricated Electric Furnace and discussion method in casting operation

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	115.725[a]	2	57.862	17.255	.000
Intercept	413.825	1	413.825	123.406	.000
pretest	3.365	1	3.365	1.003	.319
Group	110.903	1	110.903	33.072	.000
Error	325.275 1233.000	97	3.353		
Total	104.242	100			
Corrected Total		99			

P< 0 .05

Decision: The result on Table 5 showed that calculated F. ratio for the group treatment on the students' academic achievement in Teacher-Fabricated Electric Furnace is 33.072 with .000 level of significance thus, the null hypothesis of significant difference between mean achievement score of students taught using Teacher-Fabricated Electric Furnace and Discussion method in casting operation was accepted at 0.05 level of significance. This means that the f-cal was statistically significantly at p<0.05 level. Thus, indicating that Teacher-Fabricated Electric Furnace was significantly more effective than the Discussion method

Hypothesis 3

Ho_3. There is significant difference between male and female students of technical college students interest taught using teacher-fabricated electric furnace and those taught with discussion method

Table 6: T-test Analysis on male and female students of technical college students interest taught using teacher-fabricated electric furnace and those taught with discussion method

Respondents	N	X	SD	t-cal	t-tab	RMK
Male	90	3.36	.66	1.82	1.96	NS
Female	10	2.90	.77			

Keys: *N* = Number of Respondents, X_1 = Mean, SD = Standard Deviations, t-cal = t-test Calculated Value, t-tab = t-test Table Value, RMK = NS (Not Significant).

The summary of the t-test analysis in Table 6 shows that the calculated value of 1.82 is less than the table value of 1.96 at 0.05 significance levels and 98 degrees of freedom. Therefore, the null hypothesis of significant difference in the mean responses of male and female students of technical college students' interest when taught mechanical engineering craft practice using teacher-fabricated electric furnace and those taught with discussion method was rejected

Discussion of Findings

The data presented in Table 1 provided the answer to research question one. The finding reveals that students taught moulding operation with teacher-fabricated electric furnace had a higher mean achievement score than those students taught using the discussion method in the achievement test. In the same vein, analysis of covariance was used to test the first hypothesis, Table, at the calculated F-value (70.852), significance of P (.000), and confidence level of .05 there was a statistically significant difference between the mean scores of the group taught with teacher-fabricated electric furnace and those students taught using the discussion methods in the achievement test. The implication of this finding therefore is that teacher-fabricated electric furnace is more effective than discussion methods in enhancing student's achievement in moulding operation. The findings of the study is in harmony with Obodo et al. (2020) who agreed students taught using improvised teaching-learning materials performed better than students taught without improvised teaching-learning materials. The students' improvised instructional materials were more effective because these materials are locally made and captured student's interest during teaching process which leads to maximizing comprehension of the subject matter.

The findings of the study is in consonance with Kabir, et al. (2020) whose findings also showed that improvised injection molding model is effective in improving students' psychomotor performance in metalwork, but the impact of improvised injection molding in improving students' psychomotor performance in fabrication and welding craft is higher than lecture method. The higher performance scores recorded by the experimental groups is due to the fact that when dependable instructional technique in learning is utilized with adequate teaching aids properly utilized, the students engage with higher order thinking tasks such as analysis, synthesis and evaluation hence increasing students' academic performance.

The data presented in Table 2 provided the answer to research question two. The finding reveals that students taught casting operation with teacher-fabricated electric furnace had a higher mean achievement score than those students taught using the discussion method in the achievement test. In the same vein, analysis of covariance was used to test the second hypothesis, Table, at the calculated F-value (33.072), significance of P (.000), and confidence level of .05 there was a statistically significant difference between the mean scores of the group taught with teacher-fabricated electric furnace and those students taught using the discussion methods in the achievement test. The implication of this finding therefore is that teacher-fabricated electric furnace is more effective than discussion methods in enhancing students‟ achievement in casting operation. The findings of the study is in harmony with the assertion of Medugu & Wada (2022)

A study on electrical installation training in technical colleges of Adamawa State reports that using illustrative and actual materials (machinery, tools, hardware) makes lessons more interesting, improves attention, and enhances conceptual clarity and performance develops students' ability in some cognitive skills in mechanical engineering craft practice and systematically assist in the understanding of the practical project, knowledge, skills or abilities are developed in production and casting of metal projects through instructional materials and teaching aids such as the teacher-fabricated electric furnace, facilitates the decision of a person toward taking the right action in the production of engine parts.

In principle there is a relationship with the work of Chen (2024) on Cognitive and Constructivist Strategies for Teaching about Language and for Providing Reading and Writing Instruction. The study uncovered that Cognitive and constructivist strategies were found to be interactive and thus more powerful than the traditional discussion method of teaching college students, yet too often the traditional method prevails. Four interactive strategies used successfully were cooperative learning, semantic feature analysis, nonsense story analysis, and fictitious writing systems. Surveys, exams, and informal discussions with Students following the use of these strategies indicate that students found these strategies to be very effective. In another study by Kwan (2020) on effects of the constructivist learning environment on students‟ critical thinking ability, the duo reported that both cognitive strategies and goal orientations fully mediated the relationships between the constructivist learning environment and critical thinking ability. The finalized model showed an acceptable fit to the data and that 22% of the variance in critical thinking ability was explained, suggesting the usefulness of the model in predicting critical thinking ability. In another study conducted by (Osei, 2019) on the impact of constructivist-based teaching method on secondary school learners‟ errors in algebra revealed that the study found that participants in experimental school significantly reduced their errors in algebra than those in control school. The study showed that CBTM was a more effective pedagogy that improved the errors Grade 11 learners commit in algebra than the TTM. Conclusively, the findings of this study are unanimous with these literatures.

The data presented in Table 3 provided the answer to research question three. The finding reveals that the respondents agreed that they have interest in the usage of teacher-fabricated electric furnace in learning mechanical engineering craft practice in Technical Colleges in Osun State. In the same vein, t-test analysis was used to test the three hypotheses, Table, at the calculated value of 1.82 is less than the table value of 1.96 at 0.05 significance levels and 98 degrees of freedom. The finding that there is no significant difference in male and female students' interest in learning mechanical engineering craft practice. This finding is similar to findings of several other studies that have been conducted on effects of gender on achievement of male and female students in sciences and other fields. For instance, Putri, et al (2023) who discovered that there was no significant gender difference in the performance of students taught with a problem-based learning technique in a physics achievement test. Similarly, Goreth & Vollmer (2022) also found that gender is not significant in the academic achievement between females and males. Hence, these findings confirmed that when males and females are exposed to academic activities in subjects like Foundry and Forging Technology, under the same environmental conditions, and taught by the same teacher using the same methodology, their performance level would be the same.

Conclusion

Mechanical engineering craft practice is a trade found in technical colleges to equip students with knowledge, skills and attitudes for self-reliance. However, the performance of graduates and learning outcomes of the students in mechanical engineering craft practice over the years are not encouraging. This problem is tied to the kinds of teaching strategies and methods for implementing the trade. In order to proffer everlasting solution to the identified problem, a study was set up to investigate the effect of teacher-fabricated electric furnace on the academic achievement and interest of Mechanical engineering craft practice students in technical colleges. The investigation therefore reveals that teaching mechanical engineering craft practice to students using teacher-fabricated electric furnace is better than employing other conventional teaching methods of teaching.

Recommendations

Based on the findings, the following recommendations were made:

1. Mechanical engineering craft practice teachers in technical colleges should adopt the use of teacher-fabricated electric furnace to teach Mechanical engineering craft practice trades to students.
2. Facilities that could encourage the use of teacher-fabricated electric furnace be provided to Mechanical engineering craft practice teachers in technical colleges.
3. Workshop and seminar should be organized for mechanical engineering craft practice teachers on the effective use of teacher-fabricated electric furnace
4. Curriculum planners and developers should incorporate the use of teacher-fabricated electric furnace into programme of technical colleges across the country.

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