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Effect of assessment for learning method on students' academic achievement in carpentry and joinery in technical colleges

The problem of the study. The conventional assessment methods used in evaluating the academic achievement of students have been saddled with deficiencies.

Research methods. This study examined the effect of assessment for learning method on students' academic achievement in carpentry and joinery works in technical colleges in Edo and Delta States, Nigeria using quasi-experimental research design. The population for this study comprised of 430 students and the sample size was 68 vocational II carpentry and joinery students from two intact classes randomly drawn from the 12 technical colleges in Edo and Delta States. The instrument used for data collection was Carpentry and Joinery Works Achievement Test (CJWAT) developed by the researcher from NBTE curriculum. The instrument was tested by three experts. The reliability of CJWAT was calculated using Kuder Richardson formulae 21 (KR-21) and a reliability coefficient of .78 was achieved. Mean and standard deviation were used to address study questions whereas one-way and two-way Covariance Analysis (ANCOVA) were used to evaluate hypotheses at a .05 level of significance.

Results. The study's findings revealed that the learning method assessment (9.43) had a higher achievement score than the traditional method of assessment (5.25), indicating that the learning method assessment had a greater impact on student achievement in carpentry and carpentry than the traditional method of assessment. One-way ANCOVA result, $F(1,77) = 56.75$, $p = .000$ indicates a significant difference between the two assessment methods with regards to students' achievement in carpentry and joinery trade. Female students (9.34) find the Assessment for Learning Method to be marginally more effective than male students (9.30). On the other hand, the Two-way ANCOVA result, $F(1,75) = 1.83$, $p = .180$ shows no significant difference between the academic achievement scores in carpentry and joinery trade of the students' based on gender. It is therefore concluded that there is a significant difference between the mean achievement scores of students assessed with Assessment for Learning method and those assessed with the conventional assessment method in favour of assessment for learning method and no significant difference between the mean achievement scores of male and female students assessed with assessment for learning method at post-test.

Conclusion. It was proposed, among other items, that the government and all stakeholders organize and fund seminars, conferences and workshops for technical teachers on a regular basis to attend and learn how to adopt assessment for learning method in educational institutions through the application of rubrics and portfolios.

Keywords: carpentry and joinery works, assessment for learning method, rubric, portfolio, students' academic performance

For Reference:

Oviawe, J. I., Azman, M. N. A., Kiong, T. T., & Retnowati, E. (2021). Effect of assessment for learning method on students' academic achievement in carpentry and joinery in technical colleges. *Perspektivy nauki i obrazovania – Perspectives of Science and Education*, 52 (4), 121-131. doi: 10.32744/pse.2021.4.8

Introduction

Carpentry and joinery is a skill-oriented vocational trade offered in Nigerian technical colleges [6]. It is capable of providing its recipients with profitable skills for self-reliance and also paid employment. Carpentry and joinery programme deals with the acquisition of skills and techniques in designing, cutting, constructing, erecting and dismantling of various temporary and permanent carpentry and joinery structures. It is a trade curriculum with a wider description of specific behaviours expressed in modules of discrete practical tasks and related knowledge which the student is expected to demonstrate due to the educational process to achieve the objectives [27]. Its objectives include: (i) expose and acquaint the students to knowledge and skill in the design, construction, erection and dismantling of various temporary structures; (ii) acquaint the students with the knowledge and skill of the act of joinery production and set for the site; (iii) give and impart skills to students who shall be able to make: timbering to trenches and shore structures; construct formwork for concrete structures; erect and maintain: scaffolds, roofs, ceiling, wood partitions and screens, cladding to concrete and steel work; construct: wall panels, doors and windows, gates and garage doors, pre-fabricated timber building, stairs and furniture for domestic and public buildings; and (iv) expose students to the effective usage of the various hand tools used for carpentry and joinery [13]. Besides, the study of Carpentry and joinery trade enables students to develop skills such as analysis, experimentations, manipulation of variables and decisions which are fundamental in the ever-dynamic world of work. Considering the vital role that Carpentry and joinery works plays, students' academic achievement should be given priority.

Academic achievement is the cognitive, affective and psychomotor attainment of students in a given academic task or activity [25]. It is the outcome of what is learnt after teaching. To O. C. Nwana [19], it is the cognitive score. C. Nwagbo [17] claimed that the academic achievement of the teaching/learning process has to do with the achievement of the stated educational objectives. The rate at which Carpentry and joinery works students' perform in formative and summative assessment over the years have been on the decline. This is evident in reports of internal and external examinations in Nigeria. To this end, NABTEB Chief examiner's report over the years has revealed evidence of low academic achievement in Carpentry and joinery works and other technical trades [16]. For example, in 2014, only 117,800 candidates representing 15% of the 1,184,384 that sat for the examination obtained credits in five subjects including Carpentry and joinery works. The achievement of students in Carpentry and joinery works in National Technical Certificate (NTC) organized by NABTEB has not been encouraging, probably due to ineffective teaching and assessment of the trade [31].

Assessment of learners' academic abilities has been described as a significant variable linked to successful instruction preparation and positive learning outcomes [26]. B. K. Martens & J. C. Witts [14] concluded that, with the exception of an adequate evaluation of the academic skills of learners, instructional judgment is unlikely to promote academic competence. Assessment is a means whereby the teacher gets data about knowledge gains, skills acquired, behavioural modifications and other parts of the improvement of the students'. C. C. Egwim & C. E. Amaechi [5] defined the assessment as a process for identifying, choosing, developing, gathering, evaluating, interpreting and using information

to improve student learning and development [20]. It involves the teacher's intentional effort to appraise the consequence of the process of instruction and the general effect of educational learning on the behaviour of students'. Assessment can be either formative or summative. Formative assessment takes place as instruction progresses while summative assessment is takes place at the conclusion of a programme. According to R. J. Stiggins et al [30], there are two forms of evaluation during instruction: assessment of learning and assessment for learning. Assessment of learning is a frequent assessment, such as mid-terms and final tests, which are teacher-centered and judgmental in order to inform the final grade of the learner.

Over the years, the conventional assessment method (CAM) have been in use both as formative and summative, but not much attention has been given to new innovative methods of assessment. CAMs are assessment methods that emphasize assessing the students' learning outcome without incorporating how the students learn or arrive at a point. CAMs does not involve students in the assessment method and thus seen as one sided assessment which is termed, 'assessment of learning'. In this study, 'assessment for learning' method which is principally used in formative assessment is considered. Assessment for Learning according to Assessment Reform Group [3], The method of defining and assessing the knowledge to be used by the learners and their teachers to assess where the learners are interested in learning, where they need to go and how best to get there. It includes the use of homework assignments, quizzes and self-assessment proposals. It is learner-centred and gives the learner an opportunity to find information about areas of strengths and areas of further learning. Assessment for learning can benefit all students but is not something added to teaching, but is integral to it [4]. Its main features are that: it takes place during the learning process; it is collaborative, in the midst of teachers: aligning teaching, identifying the learning needs of students or classes, selecting and acclimatizing materials and tools, drawing up distinguished instructional strategies and learning perspectives to help learners advance their learning, and offering immediate input and guidance.

R. J. Stiggins et al [30] posed four main questions for teachers to answer whenever they prepare for correct evaluation and successful usage. This includes the purpose of the test, the learning objective, the assessment methods and the means of reporting the results. The Federal Ministry of Education, Science and Technology [9] explained how evaluation helps a teacher. Through the appraisal, the instructor will recognize the successes of the learners, the needs of the learners, the shortcomings and the strengths. The instructor may conduct the evaluation either formally or informally. Formal evaluation is timed, graded and supervised by outsiders, whereas informal assessment includes listening to the justification, demonstration or questioning of learners purposely. M. J. Allen [1] asserted that assessment for learning in the 21st century is made possible through the use of like rubrics, portfolios, performance-based assessment, self-assessment and peer-assessment. In this study, the researcher used rubrics and portfolios as assessment for learning methods to determine the effect on students' academic achievement in Carpentry and joinery works.

Rubrics are evaluation instruments that make it possible for teachers to measure and report on the learning academic achievement process. According to M. J. Allen [1], the heading is a grid-like contingent document that defines and articulates the requirements for a student's assignment by listing the parameters, or what counts, and by defining the quality levels from exceptional to poor. A. M. Quinlan [24] claimed that they are 'descriptive scoreboard schemes,' 'a set of scoreboard guidelines' which are of direct significance as a result of the focus on the use of built responses and on the achievement of program-based

tasks. M. Simon & R. Forgette-Giroux [29, p.18] added that the comprehensive feedback given by the headings is useful for the advancement of students at both the aggregate and individual student levels. It allows the teacher to assess definite skills and abilities that are not measurable through standardized testing systems that measure discrete knowledge at a particular time. Rubrics help in the promotion of learning, by providing the learners with quality feedback, and thereby promote student learning.

Portfolio is a determined series of student work that demonstrates the student and others contributions or accomplishments in one field or another [2]. The compilation must include the student's participation in the selection of material, the selection criteria, the deciding factors for the importance of the decision and the evidence of the student's self-reflection. The most significant aspect and value of the portfolio evaluation is that, rather than being a snapshot of student information at one point in time (like a single standardized test), it draws attention to student initiative, progress and success over a given period of time. According to D. Light & E. A. Pierson [12], Portfolios assess the student's ability to apply information rather than just rehearsing it. Since the portfolio allows data to be collected from a number of sources: parents of students, employers, teachers, and themselves, it enables teachers to provide accurate information about the student. They are important methods used to analyze the learning products and processes of students. V. Klenowski [10] and F. Ersoy [7] proposed that the portfolio should be used as tools for learning and assessment. The portfolio therefore has a capacity that enables learners to learn by assessment and to be assessed during learning (assessing for learning and evaluating learning).

Assessment for learning seeks at improving learning while Assessment of Learning seeks at ensuring the school and teacher accountability. Assessment for learning searches for the prospective for learning and shows the next move to be taken with the aim of promoting learning and hubs upon the dynamics of instruction and learning; but Assessment of Learning indicates what has been accomplished already, memorized and immersed and offers a picture of the present situation [8]. One of the key distinct features here is that assessment for learning encourages feedback and uses some important assessment methods/tools, while assessment of learning does not necessarily consider such. According to R. Agus & S.M. Samuri [11], assessment for Learning is primarily aimed at ensuring immediate improvement of instruction through assessment rather than improvement of learning after teaching and learning. This implies that it emphasizes improvement of learning as the teaching and learning is ongoing rather than at the conclusion of the instruction.

In this study, Assessment for Learning incorporates assessment into the teaching process by helping students understand precisely what they need to learn, what is required of them and offering input and guidance on how to enhance their work through the use of certain enhanced assessment methods [26]. Assessment for Learning is concerned with the act of collecting evidence about learning that encourages feedback through some assessment methods like rubrics, portfolios, achievement -based assessment, self-assessment and peer-assessment, which are aimed at adapting to teaching and plan next steps in learning [13]. This makes the students to improve their interest and attitude towards learning and assessment, thereby encouraging students' involvement irrespective of their gender [15].

Gender is the social construction of male and female based on socio-cultural norms and power. To I. F. Okoro [21], gender is the differences in mental and emotional characteristics between male and female as prescribed by the society. It is the social traits and prospects linked with being male or female and the associations between women and men, boys and girls, in addition to the relations among women and those linking men. C. Nwagbo & U. Chukelu

[18]; O. I. Oludipe [22]; and J. I. Oviawe [23] confirmed that there is no substantial gap in the academic performance of both male and female students. Other researchers [12; 17; 28] indicated a significant gap between male and female students academic achievement and interest. This discrepancy in literature over the achievement of male and female students makes this study necessary in terms of their academic achievement.

The poor academic achievements of students in examinations have not been encouraging to educationists and stakeholders. This is evident in poor achievements recorded and reported annually by NABTEB chief examiner. Several factors have been linked on students' poor achievement [5; 22; 21]; and [20] linked it to poor teaching methods; while D. Light & E. A. Pierson [12] attributed it to poor assessment methods. With the new trends in learning and assessment, one begins to wonder how effective the new methods of assessment (assessment for learning) could be in the improvement of learning. This study therefore sought to answer the following questions: could assessment for learning method be effective in the improvement of students' academic achievement in carpentry and joinery works in Edo and Delta States, Nigeria? What is the effect of assessment for learning on students' academic achievement in carpentry and joinery works in technical colleges in Edo and Delta States, Nigeria? These questions are the problem this study sought to answer.

Purpose of the study

The purpose of the study was to investigate the effect of assessment for learning method on students' academic achievement in carpentry and joinery trade in technical colleges in Edo and Delta States, Nigeria. Specifically, this study sought to:

- Compare the mean achievement scores of students assessed with assessment for learning method (AFLM) and those assessed with the conventional assessment method (CAM) at pre-test and post-test;
- Determine the mean achievement scores of male and female students' assessed with AFLM at post-test.

Research methods

Design of the Study

The study used quasi-experimental research design. Specifically, it is the non-randomized, control group, pre-test, post-test design. This design was employed because the students used for the study were in their intact classes and randomization would distort the academic activities in the school.

Study participants

The study population consisted of 230 students from the 12 technical colleges in Edo and Delta States, Nigeria. The sample size was 70 vocational II carpentry and joinery students from four intact classes randomly drawn from the 12 technical colleges. Vocational II students were used for the study because they were neither facing the problem of being freshly introduced to Carpentry and joinery works (as is the case with vocational I) nor preparing for any end of programme examination (as is the case with vocational III). Two intact classes were randomly selected from each of the State. Two technical colleges were then assigned to experimental group and the other two control group. The experimental group was AFLM while the control group was the CAM.

Instrument for data collection

The instrument used for data collection was Carpentry and Joinery Works Achievement Test (CJWAT) developed by the researcher from NBTE curriculum. CJWAT was made up of 40 multiple choice items with ABCD alternatives (options). The 40 items was compiled by the researcher. CJWAT was used to assess the learning outcome (achievement) of the vocational II students before and at the conclusion of the instructional treatment (pre-test and post-test). The 40 items were selected by the researcher based on the contents in the vocational II carpentry and joinery works topics: Safety Practice, Tools, Machines and Maintenance, Uses of Materials, Construction principles and techniques, and Finishes and Finishing. The four intact classes were made to cover the same learning contents.

Lesson plans were produced for both the experimental and control groups. The experiment lasted six weeks. The regular carpentry and joinery trade teachers used in the study were derived from sampled technical colleges. The reason for the choice of using the regular teachers for the experiment was that if a new teacher other than the regular teachers comes in to teach the students, the students may think that something (experiment) is going on and that may affect their achievement. The regular teachers were properly trained using the AFLM and CAM. The essence of training the teachers was to ensure uniform instruction and assessment towards the validity of the experiment for easy generalization. However, before treatment, both group (experimental and control) were given pre-test. The experimental groups were subjected to treatment of AFLM, while the control group was assessed using CAM. The assessment was conducted by their regular carpentry and joinery teachers with the guidance by the researcher. At the conclusion of the experiment, the post-test was administered to both the experimental and control groups and data used for data analysis.

The research questions were answered using Mean and standard deviation while one way and two-way Analysis of Covariance (ANCOVA) were used for testing the hypotheses at .05 level of significance.

Findings

Research Question 1: What are the mean achievement scores of carpentry and joinery students assessed with assessment for learning method and those assessed with conventional assessment method at pre-test and post-test levels?

Table 1

Mean achievement scores of carpentry and joinery students' assessed with assessment for learning method and those assessed with the conventional assessment method

Group	N	Pre-test		Post-test		$\bar{X}_{\text{Gain}}$	$\bar{X}_{\text{Difference}}$
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD		
Assessment For Learning Method	38	17.77	2.25	27.20	2.61	9.43	.63
Conventional Assessment Method	32	17.15	2.34	22.40	3.14	5.25	4.80

Result in Table 1 shows that the mean achievement scores for carpentry and carpentry students evaluated with the learning method evaluation and the traditional assessment method was 17.77 and 17.15, with a standard deviation of 2.25 and 2.34, respectively, and

a mean difference of .63 at the pre-test. This indicated that the two groups were relatively at the same cognitive level prior to treatment. However the post-test achievement mean evaluation scores for the learning method and the conventional assessment method were 27.20 and 22.40, respectively, with a standard deviation of 2.61 for the learning method and 3.14 for the conventional assessment method, and a mean difference of 4.80 for the conventional assessment method. The score of achievement in the evaluation of the learning method was 9.43 over that of the traditional assessment method 5.25. The higher achievement score of the learning method assessment (9.43) over the traditional method of assessment (5.25) showed that the learning method assessment had a relative impact on student achievement in carpentry and carpentry more than the conventional method of assessment. It is therefore concluded that assessment for learning method was effective in enhancing students' academic achievement in carpentry and joinery trade in technical colleges.

Research Question 2: What is the influence of gender on the mean achievement scores of carpentry and joinery students assessed with assessment for learning method?

Table 2

Mean achievement scores of carpentry and joinery male and female students' assessed with assessment for learning method

Group	N	Pre-test		Post-test		$\bar{X}_{\text{Gain}}$
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD	
Assessment For Learning Method Male	33	18.38	2.23	27.68	2.75	9.30
Female	5	17.27	2.18	26.61	2.37	9.34

Table 2 shows that the average score for the Assessment for Learning Method for male and female students was 18.38 and 17.27 with standard deviations of 2.23 and 2.18, respectively; indicates that female and male students both assessed with the Assessment for Learning Method were at the same level prior to treatment. On the other hand, the mean score for the Assessment for Learning Method category of males was 27.68 and females 26.61 with standard deviations of 2.75 and 2.37, respectively, with mean benefit scores of 9.30 for males and 9.34 for female students, respectively indicating that Assessment For Learning Method slightly enhances female students' achievement in carpentry and joinery trade more than the male students. With the result of Table 2, it is concluded that Assessment for Learning Method is slightly more effective among females students than the male students.

Hypothesis 1: There is no significant difference between the mean achievement scores of students assessed with Assessment for Learning Method and those assessed with the conventional Assessment Method at post-test.

Table 3 reveals that the F-calculated value for post-test effect as 56.75 with significance probability value of .000 which is less than .05 alpha level ($P < .05$). This indicates a significant difference between the two assessment methods with regards to students' achievement in carpentry and joinery trade. Thus, the null hypothesis was rejected. It is therefore concluded that there is a significant difference between the mean achievement scores of students assessed with Assessment for Learning method

and those assessed with the conventional assessment method at post-test in favour of assessment for learning method.

Table 3

One-way ANCOVA for the significant difference between the mean achievement scores of students' assessed with Assessment for Learning method and those assessed with the conventional assessment method at post-test

Source	Type III sum of Squares	df	Mean Square	F	Sig.
Corrected model	472.73	2	236.14	8.38	.000
Intercept	472.73	1	1736.66	208.77	.000
Pre-test	11.47	1	11.47	1.38	.240
Method	472.09	1	472.09	56.75	.000
Error	640.52	77			
Total	18636.00	80			
Corrected Total	1112.80	79			

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students assessed with Assessment for Learning Method and those assessed with the conventional Assessment Method at post-test.

Table 4

Two-Way ANCOVA for the significant difference between the mean achievement scores of students' assessed with Assessment for Learning method and those assessed with the conventional assessment method at post-test

Source	Type III sum of Squares	df	Mean Square	F	Sig.
Corrected model	487.58	4	121.89	14.62	.000
Intercept	1552.06	1	1552.06	186.18	.000
Pre-test	5.43	1	5.43	.65	.420
Method	452.871	1	452.87	56.75	.000
Gender	15.28	1	15.28	1.83	.180
Method*Gender	.02	1	.02	.00	.960
Error	625.22	75	8.34		
Total	18636.00	80			
Corrected Total	1112.80	79			

Table 4 reveals that the F-calculated value for post-test gender effect as 1.83 with significance probability value of .180 which is greater than .05 alpha level ($P > .05$). This indicates no significant difference between the academic achievement scores in carpentry and joinery trade of the students' based on gender. Thus, the null hypothesis was retained. It is therefore concluded that there is no significant difference between the mean achievement scores of male and female students assessed with assessment for learning method at post-test.

Discussion

The results of this study have shown that the approach of learning evaluation is more efficient in enhancing student academic achievement than the conventional assessment method in carpentry and joinery trade. This indicates that assessment for learning method was effective in the improvement of students' academic achievement in carpentry and joinery trade. The finding of this study also revealed that there was significant difference between the mean achievement scores of students assessed with assessment for learning method and those assessed with the conventional assessment method at post-test. This finding is in line with that of M. Simon & R. Forgette-Giroux [29, p.18] indicated that the comprehensive feedback given by the headings is useful for the improvement of students at both the aggregate and individual student levels. Similarly, D. Light & E. A. Pierson [12] argued that portfolios assess the student's ability to apply expertise before merely rehearsing it. The authors added that they are fundamental apparatus for students' learning assessment of products and process supports the finding of this study. As a result, the categories and portfolios included in the learning evaluation package have the potential to allow students to learn all through assessment and to be assessed during learning assessment for learning and assessment of learning).

The finding of this study indicated that assessment for learning method is slightly more effective among female students than male students. This resulted in a finding in Table 4 that did not indicate any major difference in the mean achievement scores of male and female students as calculated by the post-test learning assessment. The finding of this study showed that gender as a moderating variable had no significant influence on the academic achievement of students in carpentry and joinery trade in technical colleges. These findings corroborates earlier findings reported by C. Nwagbo & U. Chukelu [18]; O. I. Oludipe [22]; and J. I. Oviawe [23] that there is no substantial difference in the results of both male and female students in the academic performance test.

Conclusion and recommendations

Based on the findings of this study, it is concluded that assessment for learning method was effective in the improvement of students' academic achievement in carpentry and joinery trade in technical colleges. The assessment package is slightly more effective among the female students' than the male students'. The implication of this is that gender is not a significant variable in the academic achievement of students in carpentry and joinery trade in technical colleges with particular reference to assessment for learning method. Based on the findings of this study, it was recommended that:

- carpentry and joinery trade teachers should adopt and employ assessment for learning method in technical colleges to facilitate students' academic achievement in carpentry and joinery trade.
- the Government through its ministry of education and Board for Technical Vocational Education and Training should organize and expose carpentry and joinery trade teachers who do not possess the requisite skills and competence to implement assessment for learning method (in the use of rubrics and portfolios) in technical colleges to compulsory conferences, seminars and

workshops regularly to learn how apply them towards improving students' academic achievement.

- curriculum planners and policy makers should incorporate innovative assessment methods in carpentry and joinery textbooks.

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