

Effect of cognitive behavioral active engagement training on test item construction skills among primary school teachers in Nigeria

Implication for educational policy makers

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Abstract

Background: Most classroom teachers are weak in constructing test items for assessment of students. This study examined the effects of cognitive behavioral active engagement training on test items construction skills among primary school teachers in Nigeria.

Methods: We adopted a randomized pretest–posttest control group design. A total of 148 participants served as the study sample. One instrument was used for data collection. The participants were administered the instrument at 4 different times. Test construction guide was employed to implement the training. Data analysis was completed using analysis of covariance.

Results The researchers found that cognitive behavioral active engagement training had a significant effect on participants' test items construction scores as measured by test construction skills inventory at posttest, first and second follow-up stages.

Conclusion The researchers concluded that cognitive behavioral active engagement training is efficacious in the improvement of test items construction skills among primary school teachers in Nigeria.

Abbreviations: ANCOVA = analysis of covariance, CBAET = cognitive behavioral active engagement training, CBT = cognitive behavioral therapy, CG = control group, TCG = test construction guide, TCSI = test construction skills inventory, TOS = table of specification.

Keywords: active engagement, cognitive behavioral active engagement training, cognitive behavioral therapy, educational policy makers, primary school teachers, test construction

1. Introduction

Test is one out of many educational tools used to for measuring behavioral or learning outcomes. It is a set of questions (items) with appropriate responses and constitutes the major building blocks of

learning outcomes and instruction. Test is seen as a standard procedure for estimating a sample of behavior from a specified domain.^[1] A structured situation comprising a set of tasks or questions to which an individual is expected to respond is test.^[2]

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Recommendations

Thus, it was recommended that.

Teachers should use the skills acquired during CBAET intervention to construct their classroom test item continuous assessment and en-of-term examination.

CBAET intervention should be integrated into teacher education programmes for better test item construction and academic achievements of students.

Teachers with more years of practice and skills in test development should guide those with lesser years of practice during the construction of their classroom tests.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Good test items have the capability and tendency to assess students' cognitive abilities as well as psychomotor and effective abilities. The construction of good test items is one of the responsibilities of teachers.^[3] This means that, the knowledge and skills essential for effective construction of a good test items are required of every teacher. Sadly, there have been consistent reports by scholars that teachers' test construction skills are weak.^[4-7] The issue of poor test construction skills was found to be more predominant among non-professional teachers.^[8,9] The test items most teachers construct are poor and do not actually function as it was supposed to.^[10] The results^[3] revealed that the teachers have limited skills in the construction of end-of-term examination. It was also found that some teachers have negative attitude towards test construction and see test construction as a burden.^[11] Because of these negative attitude and weak test items construction skills possessed by teachers, some depend on the use of past or already existing questions to assess students.^[10] It can be deduced from these reports that, the use of past or already existing questions may contain items that were not taught. The poor test items constructed by teachers may not provide precise information about student learning outcomes. These inadequacies of teachers in test item construction require urgent attention if objective and accurate information are to be obtained from teacher records of students' academic achievement in school.

To achieve this, teachers need to be sufficiently exposed to the nitty-gritty of test item construction skills. Skill according to^[12] is the knowledge, abilities, and experience needed to perform a job. Alison added that the skills required to solve problems are known as analytical skills. Analytical skills refer to the ability to collect and analyze information, solve problems, and make decisions.^[13] Test construction skills include the competencies needed for developing quality tests based on stipulated principles of test construction.^[14] Some of the competencies are: objectivity, communicative, item validation skills, and skills for applying appropriate strategies for ascertaining the validity and reliability of test instruments.^[15] Skill in test construction enables a teacher to create tests with precision, appropriateness of language-use, objectivity, and good grading scales.^[16] Test construction skills are of great essence to the teachers because it helps them to: formulate items to elicit clear and concise answers from students; create tests items that are proper for learners of different personal characteristics among others.^[14] Teachers' incompetency to construct valid and reliable test items may result in false assessment of students' achievements. It is a major problem that requires urgent attention in Nigerian schools.

The construction of a good test requires sound knowledge of the content and basic competence. This is why it was emphasized that subject matter knowledge positively influence the basic competence of teacher in the subject.^[17] It makes sense to say that teacher's competence in test construction determine the quality of the tests items. In determining primary school teachers competence in evaluating students' cognitive and psychomotor achievement,^[18] found that teachers' years of experience and qualifications did not significantly influence their competence in assessing their students but sex has a significant influence. In assessing the relationship between commerce teachers' proficiency in test construction and test quality, it was found that, there is a significant relationship between teacher's competence and content validity of their tests.^[7] Using test construction skills inventory (TCSI) to determine the test construction skills of teachers,^[6] found that there was no significant difference in the mean ratings of male and female teachers and a significant

difference in the mean ratings of more experienced and less experienced teachers. The result confirmed^[19] remark that more experienced teachers understand and appreciate the importance of test construction skills better. In a study on Knowledge of test construction procedures among lecturers in Nigeria,^[20] revealed high knowledge of test construction procedures by the lecturers.

All the tests used for assessment in the classroom are expected to be constructed based on standard procedures. These standard procedures include content analysis, review of instructional objectives, development of test blue print or table of specification, writing of items, test items review/validation, among others. Classroom teachers are expected to possess and apply requisite skills in the construction of good items^[6] Deficiency in test construction skills by teachers might result in the use of poor test items which in turn snowball into malpractice in external examinations.^[21,22,6]

Test item construction according to^[23] is often regarded as an art and science of developing items that will focus on a piece of knowledge (or skill, ability, trait) and differentiate between examinees with high and low levels of knowledge. Test construction starts with content analysis which deals with selecting topics in accordance with those content areas taught by the teacher. This is followed with reviewing those instructional objectives representing different levels of intellectual functioning which the test measures. The content is related to the instructional objectives using a table of specification (TOS) which guide the writing of items.

The test blue print or table of specification is a two-way grid table that shows the relationship between the cognitive levels and the topics (contents) of instruction which is fundamental in test item construction.^[3,24-26] It helps teachers align objectives, instruction, and assessment.^[27] TOS helps teachers to write items that improve the content validity of the tests constructed for classroom use.^[28]

In test item writing, the number of items to be written should be guided by the table of specification. As student teachers, we were advised to write twice the number of items required so that when inappropriate items are discarded during the item review, we can still have the number specified in the test blue-print. Student teachers are expected to be creative in order to write items that can differentiate examinees levels of knowledge. This is in line with^[29] assertion that test item construction is a task that requires imagination and creativity.^[30] Believes that test item construction is the "development of items which ensure that exams appropriately measure the skills, knowledge, and abilities of test-takers to determine their qualification for certification and continuing competency." Researchers' experiential evidence shows that most teachers and student teachers are not competent in constructing good, valid, and reliable test in their various subject areas. Efforts by other researchers in Nigeria were solely on reporting inadequacies or incompetence of teacher/student teachers in test item construction. It is therefore pertinent to use cognitive behavioral active engagement training (CBAET) to regularly and practically expose teachers to test constructions kills or steps like; how to ensure content coverage, appropriate use of language in writing items, item organization, test guidance among others. This will help in minimizing the negative consequence arising from teachers' deficiencies in the construction of good test items.

Cognitive behavioral therapy (CBT) was developed by^[31] and theorized that human cognitive, behavioral, and emotional reactions largely depend on how the person interprets and

processes events. If the interpretation of the event reflects reality accurately, the beliefs, responses, and feelings of the person will be adaptive, but if the individual processes the event inaccurately, such person is likely to develop dysfunctional thoughts. The development of dysfunctional thoughts brings about maladaptive and unrealistic behaviors. CBT changes the unrealistic and dysfunctional behaviors^[32] and feelings to a functional ways by enhancing adaptive prosocial skills.^[33] CBAET is an extension of CBT conceived by the researchers.

CBAET is guided by the tenets of CBT. In addition to the principles of CBT, CBAET assumes that active participation enhances cognitive ability of an individual. This new paradigm of CBT, which is CBAET, holds that if a person is actively involved in a task he/she is likely to improve in cognitive skills, critical thinking skills, and adaptive-behavioral skills. This suggests that such individual would be motivated, which in turn is attributed to cognitive active participation in a given task like test items construction. Without active participation, it will be difficult to activate the cognitive, critical thinking, and adaptive-behavioral skills of teachers in test items construction. As such, it may be quite challenging to create good, valid, and reliable tests in education. It also involves curiosity and passionate effort of the learner to achieve competence in any area of study. Thus, engagement in the training of teachers also involves behaviors (like persistence, effort, attention) and attitudes (such as enthusiasm, positive learning of values) as well as motivation and interest.

Cognitive is concerned with the level of active interest and investment in their education process. Cognitive engagement refers to the cognitive strategies that students adopt and employ during the learning process.^[34] Examples of cognitive engagement include: being thoughtful and purposeful in their approach to education, and willingness to exert necessary effort.^[35] For a learner to be effective across the continuum of learning styles, it was suggested that active engagement strategies should be adopted.^[36–38] Active engagement strategy is any techniques adopted in teaching and learning processes that enable the students to be actively involved in learning activities. Active learning is any instructional technique that substantially engages the students in course content through active listening, talking, writing, reading, and reflecting. It gives the students opportunities to do things by themselves and thinking about what they are doing.^[39]

The engaged learners demonstrate the behaviors of concentration, investment, enthusiasm, and effort.^[40,41] It has been found that women have higher self-efficacy than men when exposed to active engagement.^[42–45] It appears women are more attentive, accurate, and organized than men when exposed to active engagement. Probably, they were more sensitive to instruction, paid attention to details, and did not to skip anything taught.^[46] Research has shown that students from ethnic minority backgrounds may respond better, in terms of emotional and behavioral engagement.^[47,48] Students' related factors like ethnic identity beliefs, experiences with discrimination, and bicultural efficacy, can affect students' engagement in learning.^[49,50]

Increased teachers' support and engagement directly leads to increase student engagement.^[51] Research findings indicate that students' engagement in school activities, influences their psychological and academic outcome in an encouraging manner.^[52] It was also found through research that, students are more likely to engage in school activities if their teachers are busy with them and the materials being taught.^[53] Research findings equally show that principals who facilitate collaboration within the school increase teacher engagement, as well as,

increase in student engagement.^[54] It was also discovered that teachers who are engaged, provide academic support for students, show enthusiasm, and are concerned with students' success.^[53] Students' engagement is a strong predictor of students' learning, achievement, and academic progress.^[55,56] It can be deduced from previous findings that, the relationships established by teachers with their students have a way of directly or indirectly affecting student engagement, learning outcome, and academic progress. The use of CBAET in engaging teachers on test construction would likely create needed individual's interest and enthusiasm for school activities which will in turn result in overall school progress.

Since active engagement of students makes the more curious and passionate about learning, it is pertinent to use it in teaching teachers. This may intrinsically motivate teachers' curiosity, interest, and intellectual competence in test construction. The objective of the study is to determine the effect of active engagement strategy on teachers' test item construction skills. The researchers hypothesized that active engagement will significantly improve teachers' test item construction skills.

2. Methods and materials

2.1. Ethical considerations of participants

The research Ethics Committee of Science Education Department at the University of Nigeria granted the researchers authorization to conduct the research. The researchers adhered to established Ethical Principles and Code of Conduct of American Psychological Association and also complied with the Declaration of Helsinki. The participants completed writing informed consent form designed by the researchers. The participants were assured of their confidentiality with regards to any information given either in filling the demographic section or responding all the items in TCSI. The following inclusion criteria were used: practicing teachers in Nigeria, teachers who are practicing with license, willingness to participate in the experiment, within the age range of 25 to 65 years, teachers possess school scheme of work for the subject(s) they are teaching. The following exclusion criteria were used: teachers who are not on regular salaries, already participating in another study, on medication due to health challenge, those who did not meet the inclusion criterion. The participants for the study were 121 teachers South-south in Nigeria. The justification for using this sample size is anchored on Gpower software statistical analysis conducted and the result showed that the sample size was adequate for the study.^[57]

2.2. Design

The study employed a randomized pretest–posttest control group design. This is an experimental design which uses 1 independent variable with 2 levels in a single experiment and the effect of each the level of the independent variable is measured using different group of participants. The researchers manipulated one levels of an independent variable of the study (CBAET) whereas the control group (CG) was not manipulated. Subjects were randomized into experimental and control groups.

2.3. Measure

TCSI^[6] is a 25-item inventory structured on a 4-point scale with the following options: strongly agree (SA) = 4, agree (A) = 3, disagree (D) = 2, and strongly disagree (SD) = 1. Samples items

from TCSI include the following: “Outline the content covered for the term before setting test from them”; “Prepare a test blueprint as a guide in the test construction”; “Consult standard text books in the subject for guide”; “Give clear instructions to guide the test takers”; “Write test so that both high and low achievers can understand”; “Ensure that the items are measuring the determined objectives” among others. The internal consistency estimate of TCSI was reported as 0.73.^[6] TCSI was found to stable across sex but sensitive to years of experience, as such, it could be used to assess the test construction skills of both male and female teachers.^[6] TCSI was adapted for this study because it deals with the basic constituents of test construction skills. In this study, the internal consistency of TCSI was estimated at 0.71. TCSI was considered valid and reliable instruments used in Nigeria culture to determine test construction skills of teachers. The instrument was therefore suitable and adopted by the researchers for this study.

2.4. Training guide

Test construction guide (TCG) for CBAET, developed by the researchers was used to enable the trainers to assist the participants construct good test items. TCG direct both the research assistants/trainers and participants on how to construct good test items. It indicates the basic principles, steps, and skills involved in test items construction. The training lasted for 16 sessions (8 weeks of 2 sessions per week with a time frame of 2 hours for each session). Supportive materials for test construction for educational measurement and evaluation were provided. The trainers adhered to the directives of the researchers.

2.5. Research assistants

Four research assistants/trainers administered this intervention. The 4 research assistants were two men and two women with age range of 35 to 60 years and a minimum of 5 years of practice. The research assistants/trainers are experts in educational measurement and evaluation. They hold a doctor of philosophy degrees in educational research, measurement, and evaluation and are licensed teachers. The skills to construct good item had been acquired by them already and are currently teaching courses related to the field at various levels of higher education.

The researchers conducted a 4-session briefing for the research assistants. Each session lasted for 2 hours per day and the briefing lasted for 4 days. Session 1: Research assistants established rapport with colleagues. They were briefed on the intention of the study and use of active engagement to implement it. The research assistants were told to mention 3 active engagement techniques they have been using to involve students in teaching/learning process that would also be used for teachers. Brainstorming, Jigsaw, Hand-on-activities, and Think-pair-shared active engagement techniques were emphasized by research assistants. All the research assistants agreed to Jigsaw, and Hand-on-activities active engagement technique for implementation of the study for the following reasons: all the research assistants can effectively and efficiently employ the technique. The technique requires the trainers to form teams, know how to make members from each team in a class to meet as a group to learn a task together, when the team had understood the task, they return to their whole class and teach what they have learned.

Session 2: The researchers reviewed principles of test construction with the research assistants. Specifically, standard

procedures for test construction were considered and its include content analysis, review of instructional objectives, development of test blue print or table of specification, writing of items, test items review/validation, among others. Session 3: Research assistants were given the TCG and they carefully studied the steps in test items construction as arranged in the guide. Session 4: All the research assistants and the researcher met for rehearsal on implementation of the experiment using TCG by research assistants. The reason for organizing the briefing sessions was to control the errors which may arise because of research assistants’ differences that were used for the study. The briefing helped to establish a common instructional standard among the trainers and the researcher monitored the research assistants to ensure that they adhere strictly to the specifications of the guide.

2.6. Procedure

The researchers visited the schools in January 2018 in order to become accustomed with teachers. Prior to the commencement of the treatment, TCSI was administered as pretests (Time 1) to the teachers in their groups by the researchers. The aim was to determine the baseline test construction skill scores of the teachers (N=148). Of all the 148 teachers, 121 teachers who met our inclusion criterion were recruited as participants in this study whereas 27 teachers were excluded. The recruited participants were assigned to CBAET group (n=60) and waitlisted control group (n=61). Simple random allocation software^[58] facilitated participants’ allocation by the researchers. The process adopted during the distribution was use of a box containing slips of papers tagged “CBAET” and “CG.” Participant who picked “CBAET” slip was assigned to Cognitive Behavioral active engagement training group whereas those who picked “CG” were assigned to waitlisted control group by the researchers. The participants were blinded during screening exercise. The recruitment exercise lasted for 7 weeks. Participants in CBAET group were exposed to Cognitive Behavioral active engagement training for test construction. However, those in the comparison group (control group) were attended to 2 weeks after completion of intervention with CBAET group (Fig. 1).

Table 1 shows that the CBAET group comprised 35 men (58.3%) and 25 (41.1%) women; the control group comprised 33 men (54.1%) and 28 (45.9%) women. From the analyses of results, no significant sex difference was observed among the study participants ($\chi^2=0.220$, $P<.639$). Regarding ethnicity, in the intervention (CBAET) group, 22 participants (36.7%) were from Igbo, 4 (6.7%) were from Hausa, 6 (10.0%) were from Yoruba, and 28 (46.6%) were from other ethnic background. In the control group, 19 participants (31.1%) were from Igbo, 8 (13.1%) were from Hausa, 9 (14.8%) were from Yoruba, and 25 (41.0%) were from other ethnic background. No significant ethnicity difference was observed among the study participants ($\chi^2=1.704$, $P<.636$). In the CBAET group, 8 participants (13.3%) had 5 years and below years of practice, 14 (23.3%) had 6 to 10 years of practice, 17 (28.3%) had 11 to 15 years of practice, and 21 (35.0%) had 16 and above years of practice. In the control group, 8 participants (13.3%) had 5 years and below years of practice, 15 (24.6%) had 6 to 10 years of practice, 21 (34.4%) had 11 to 15 years of practice, and 17 (27.9%) had 16 and above years of practice. No significant years of practice difference was observed among the participants ($\chi^2=0.868$, $P<.833$). Regarding age, in the CBAET group, 10 participants (16.7%) were within the age of 30 years and below, 28 (46.7%)

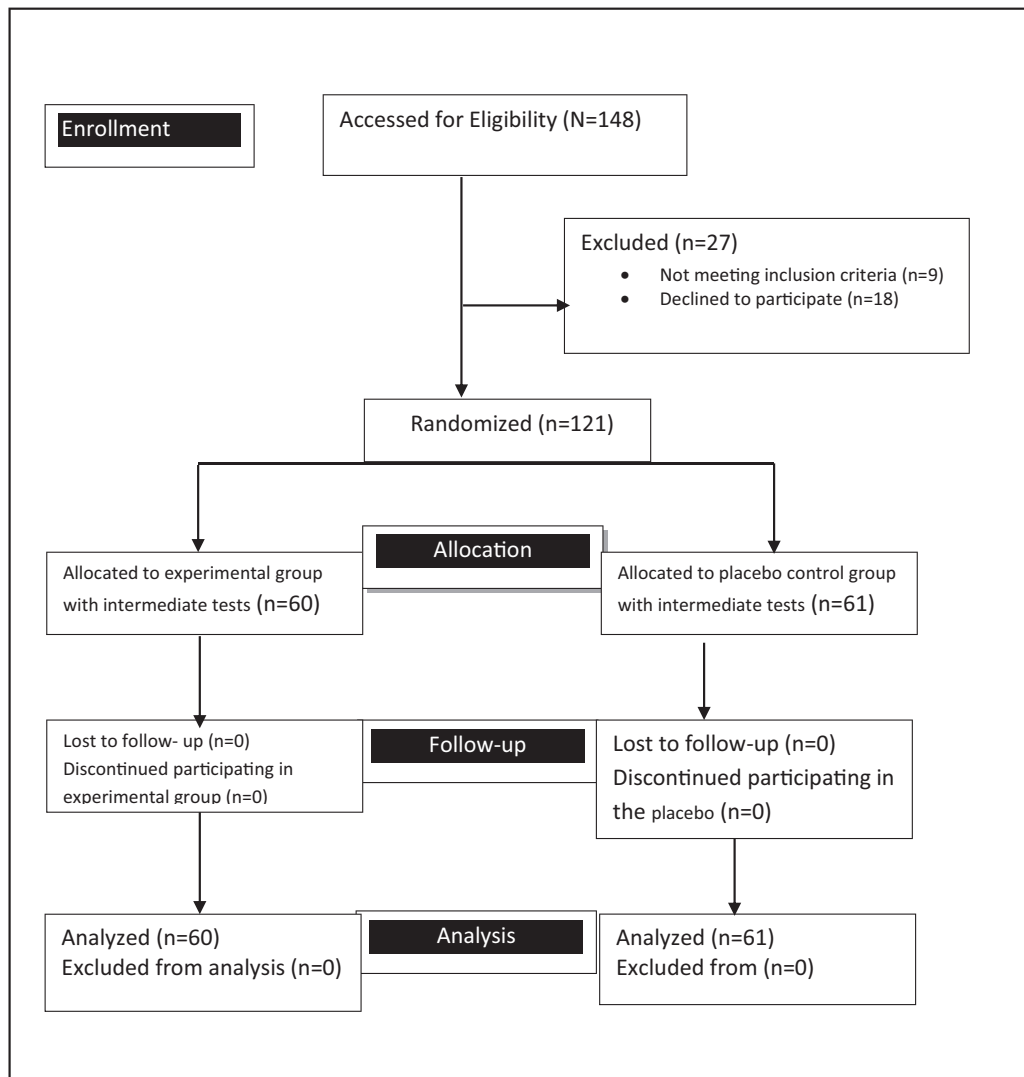


Figure 1. Flow diagram for participants allocation.

were within the age of 31 to 40 years, 9 (15.0%) were within the age of 41 to 50 years, and 13 (21.7%) were within the age of 51 years and above. In the control group, 15 participants (24.6%) were within the age of 30 years and below, 24 (39.3%) were within the age of 31 to 40 years, 14 (23.0%) were within the age of 41 to 50 years, and 8 (13.1%) were within the age of 51 years and above. No significant age difference was observed among the participants ($\chi^2=3577$, $P<.311$). Concerning state, in the CBAET group, 11 participants (18.3%) were from Cross River state, 18 (30.0%) were from Rivers state, 18 (30.0%) were from Delta state, and 13 (21.7%) were from other states. In the control group, 15 participants (24.6%) were from Cross River state, 19 (39.3%) were from Rivers state, 20 (32.8%) were from Delta state, and 7 (11.5%) were from other states. No significant state difference was observed among the participants ($\chi^2=2.540$, $P<.468$). Demographic characteristics of participants are presented in Table 1.

The intervention was a 16-sessions training that lasted for 8 weeks. The training was implemented by 4 research assistants. The CBAET group was partitioned into 12 subgroups. Each subgroup was made up of about 5 participants and handled by 2

trainers. Each subgroup of 5 participants sat round a table and all the 12 subgroups were trained in a single large hall. The control group participants received training on test construction using lecture method. The control group participants were not partitioned into subgroup. All participants in this group sat in a single hall and were handled by 2 trainers. The participants were teachers who are currently teaching different subjects in Nigeria schools. They were chosen for this study because they appear to show limited skills in test construction.^[7,3]

At week one, the first session commenced and it focused on introduction of participants and research assistants, as well as the rules and regulations that guided the process. The time and limits of confidentiality were established. In the 2nd session, the research assistant introduced the participants to: meaning of tests, test construction principles, and test formats.

The 3rd session was used to expose participants to task that deals with stating purposes of test, content description and analysis. The 4th session was used to make participants extract instructional objectives from school scheme of work or national curriculum and individual were engaged in identification of instructional objectives. In the 5th and 6th sessions, participants

Table 1
Demographic characteristics of the participants.

Characteristics	CBAET group n (%)	Waitlist control group n (%)	Statistic	Sig (P)
			χ^2	
Gender				
Male	35 (58.3)	33 (54.1)	0.220	.639
Female	25 (41.7)	28 (45.9)		
Ethnicity				
Igbo	22 (36.7)	19 (31.1)	1.704	.636
Hausa	4 (6.7)	8 (13.1)		
Yoruba	6 (10.0)	9 (14.8)		
Others	28 (46.6)	25 (41.0)		
Year of practices				
≤5 yr	8 (13.3)	8 (13.1)	0.868	.833
6–10 yr	14 (23.3)	15 (24.6)		
11–15 yr	17 (28.3)	21 (34.4)		
≥16	21 (53.0)	17 (27.9)		
Age				
≤30 yr	10 (16.7)	15 (24.6)	3.577	.311
31–40 yr	28 (46.7)	24 (34.4)		
41–50 yr	9 (15.0)	14 (23.0)		
≥51 yr	13 (21.7)	8 (13.1)		
State				
Cross River	11 (18.3)	15 (24.6)	2.540	.468
Rivers	18 (30.0)	19 (31.1)		
Delta	18 (30.0)	20 (32.8)		
Others	13 (21.7)	7 (11.5)		

% = percentage, χ^2 = chi-square, CBAET = active engagement group, n = number of participant, sig = associated probability.

were exposed to test blue-print or TOS and were engaged on how to develop it as well as item writing in groups. The 7th and 8th sessions were used for further training of participants on test items writing using TOS. Participants were exposed to types of validity.

At sessions 9 and 10, participants were trained on types of reliability estimate. Participants practice how to determine estimate of temporal stability, estimate of scorer or rater reliability, estimate of internal consistency, and estimate of equivalence in groups and did group presentations. In the 11th and 12th sessions, participants were trained on test administration, item analysis, selection, and serialization. The 13th and 14th sessions were used by individual participant to construct between 20 and 50 items in a primary school subject area as to engaged them in practice exercises. This was done to avoid relapses. Participants were engaged in sub-group discussion and criticism of individual work. Week 8 was for 15th and 16th sessions and the training was terminated. Oral evaluation of knowledge gained and skills acquired in test items construction was determined.

There was no risk arising from the experiment rather it was anticipated that teachers' test items construction skills improved due to the use of test items construction skills guide for CBAET. Monetary compensation was not paid to participants and schools used for the study. The researchers blinded the participants in both groups and data analyst. This is to ensure possible bias was eliminated and concealment is maintained in the study.

The participants in CBAET-intervention group were told to come back in next 3 months after the intervention for follow-up session. At the follow-up stage, the participants in CBAET groups were assessed at Time 3 to ascertain their reduction in test anxiety capacity. After the follow-up assessment period, the participants

in control group were reminded to come back in 2 weeks time for their own session using the participants' emails and phone numbers. Control group received any intervention. Working with the CG lasted for 6 weeks. The CG group was equally assessed at Time1, Time2, and Time3.

To ensure high level of compliance from the participants in CBAET, CG, and research assistants, the researchers provided snacks and transportation fare (10 dollars) per participants. Summary of TCG is presented in Table 2.

2.7. Data analysis

The data of the pretest, posttest, and follow-up were subjected to statistical analysis using SPSS version 20 (IBM Corp., Armonk, NY). Specifically, analysis of covariance (ANCOVA) was used as method of data analysis. ANCOVA was used to determine the main effect due to treatment as well as control for factors or characteristics like participants' years of practice and sex which cannot be randomized. Frequency, percentage, and Chi-square (χ^2) were used to analyze the demographic characteristics of the participants. In ANCOVA, it is expected that the researcher(s) determined main effect due to experimental conditions (WC and CBEAT), and main influence due to moderator variable(s). In determining main influence due to moderator variable(s) only, emphasis is on the levels of the moderator variable irrespective of the experimental conditions hence the pool. It is therefore inappropriate to partition the result of main influence of moderator variable (years of practice) into experimental conditions (WC and CBEAT). Based on this premise, the researchers used Table 3 to report main effect due to experimental conditions (WC and CBEAT), and Table 4 for main influence due to moderator variable (years of practice).

Table 2**Summary of test construction guide (TCG).**

Time (h)	Session	Week	Activities	Strategies employed
4 h (2 h per session)	1 and 2	1	The participants get acquainted with each other and trainer, rules and regulations, durations were explained. Formation of groups. Introduction to principles of tests construction, cognitive tests. Participants meet at team level and conceptualize principles of tests construction. This is setting the stage in active engagement. Participants were given home activities	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	3 and 4	2	Home activities were reviewed and contributions made. Members from each team in a class to meet as a group to learn a task together. Task on content analysis, and review of instructional objectives for participants. This stage involves explaining to teachers what to do with respect to content. Participants were given home activities.	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	5 and 6	3	Home activities were reviewed and contributions made. Members from each team in a class to meet as a group to learn a task together. Task on preparation of table of specification (TOS) using empirical procedure. Task on using table of specification to write 20 multiple choice test items for a particular subject. This session involved modeling for students what to do, and guided/group practices. Participants were given home activities.	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	7 and 8	4	Home activities were reviewed and contributions made. More practice on test item writing and assemblage. Emphasis in this session was placed on types of validation (content, criterion-related, construct and face validity). This session involved modeling for students what to do, and guided/group practices. Participants were given home activities	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	9 and 10	5	Home activities were reviewed and contributions made. In this session, participants were trained on types of reliability estimate (estimate of temporal stability, estimate of scorer or rater reliability, estimate of internal consistency and estimate of equivalence). This session involved modeling for students what to do, and guided/group practices participants were given home activities	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	11 and 12	6	Home activities were reviewed and contributions made. In this session, participants were trained on test administration, item analysis, selection and serialization. This session involved independent practices. Participants were given home activities	Jigsaw, Hand-on-activity active engagement
4 h (2 h per session)	13 and 14	7	Home activities were reviewed and contributions made. Individual participant constructed between 20 and 50 items in a secondary school subject area. This session involved independent practices. Participants were prepared for the conclusion of the training.	Hand-on-activity active engagement
4 h (2 h per session)	15 and 16	8	Terminating treatment. Oral evaluation of treatment gains in test items construction and skills acquired. This session involved closure/assessment.	Question and answer
Three months after intervention	First follow-up			
Three months after first follow-up	Second follow-up			

TCG=test construction guide, TOS=table of specification.

3. Results

Table 3 reveals the study outcomes for the participants in the CBAET group compared with the control group (CG) over the 4 periods. Before the treatment, the result in Table 3 shows that there was no significant difference between the intervention and control groups at initial test item construction skills of participants in Nigerian as measured by TCSI, $F(1,120)=0.0145$, $P<.905$, $\eta_p^2=0.000$, $\Delta R^2=0.001$. After post-training, CBAET had a significant effect on participants' test construction skills scores as measured by TCSI, $F(1,120)=1947.352$, $P<.001$, $\eta_p^2=0.323$, $\Delta R^2=0.497$. After the post-treatment, the first follow-up result still shows that CBAET had a significant effect on participants' test construction skills scores as measured by TCSI, $F(1,120)=2019.294$, $P<.001$, $\eta_p^2=0.377$, $\Delta R^2=0.518$. The second follow-up result equally shows that CBAET had a significant effect on participants' test construction skills scores as measured by TCSI, $F(1,120)=2697.688$, $P<.001$, $\eta_p^2=0.417$, $\Delta R^2=0.552$. The η_p^2 (partial eta squared) values of 0.323, 0.377, and 0.417 indicate that CBTA accounted for 32.3%,

37.7%, and 41.7% increase in test construction skills scores of participants in Nigeria as measured by TCSI at post-treatment, first and second follow-up stages respectively. The mean difference is an indication that the new method introduced by the researchers is more effective compared with the conventional method. Therefore, the outcome suggests that CBAET is more promising in helping primary school teachers to learn how to construct test items.

Table 4 reveals the study outcomes for the participants in terms of years of practice (≤ 5 years, 6–10 years, 11–15 years, and ≥ 16 years) over the 4 periods. Before the treatment, the result in Table 4 shows that there was no significant influence of years of practice among participants at initial test item construction skills of in Nigeria as measured by TCSI, $F(1,120)=12.45$, $P<.296$, $\eta_p^2=0.032$. After post-training, years of practice had a significant influence on participants' test construction skills scores as measured by TCSI, $F(1,120)=19.266$, $P<.001$, $\eta_p^2=0.338$. After the post-treatment, the first follow-up result still shows that years of practice had a significant influence on participants' test

Table 3
Analysis of covariance showing the effect of CBAET on test construction skill as measured by TCSI.

Time	Measures	Group	Mean (SD)	F	P	η_p^2	ΔR^2	95% CI
Pretest	TCSI	CBAET	42.20 (3.32)	0.014	.905	0.001	0.001	41.71–42.92
		WC	42.20 (3.02)					
Posttest	TCSI	CBAET	75.08 (7.12)	1947.352	.001	0.323	0.497	68.27–70.58
		WC	66.10 (7.20)					
Follow-up 1	TCSI	CBAET	78.10 (6.40)	2019.294	.001	0.377	0.518	71.54–73.63
		WC	68.82 (6.23)					
Follow-up 2	TCSI	CBAET	81.67 (6.88)	2697.688	.001	0.417	0.552	74.16–76.38
		WC	70.70 (6.44)					

η_p^2 = effect size, ΔR^2 = adjusted R^2 , C = control, CBAET = cognitive behavioral active engagement training, mean (SD) = mean (standard deviation), P = probability value, TCSI = test construction skills inventory.

construction skills scores as measured by TCSI, $F(1,120) = 15.160$, $P < .001$, $\eta_p^2 = 0.287$. The second follow-up result equally shows that years of practice had a significant influence on participants' test construction skills scores as measured by TCSI, $F(1,120) = 13.417$, $P < .001$, $\eta_p^2 = 0.263$. The η_p^2 (partial eta squared) values of 0.333, 0.287, and 0.263 indicate that years of practice accounted for 33.8%, 28.7%, and 26.3% increase in test construction skills scores of participants in Nigeria as measured by TCSI at post-treatment, first and second follow-up stages respectively. This result is presented in Table 4

4. Discussion

The findings of the study revealed that at the post-treatment and follow-up measures, the efficacy of cognitive behavior active engagement training on the improvement of test construction skills among teachers was significant. This finding has shown the superiority nature of the CBAET over the conventional lecture

approach in the improvement of among teachers with limited skills in test construction skills. The teachers who were trained using CBAET were optimally motivated during the intervention sessions and that led to the radical increase in their test construction skills after the intervention and even at the first and second follow-up measure. Although this finding was based on teachers, it is inline with that of^[52] who found that students' engagement in school activities influences their psychological and academic outcome in an encouraging manner. In this study, teachers were trained like students in the classroom using CBAET. The outcome of this training improved teachers' test construction skills scores. The result was clear evidence that CBAET was able to reduce the limitation teachers encountered in test items construction.

As one of the problems faced by the teachers in their official duties especially during students' assessment, CBAET is a sure remedy for enhancing teachers' test items construction skills. CBAET can be use in addressing teachers' test construction skills

Table 4
Analysis of covariance showing the influence of years of practice on teachers' test construction skill as measured by TCSI.

Time	Measure	N	Groups	Mean (SD)	F	P	η_p^2
Pretest	TCSI	16	≤5 y	41.87 (3.24)	12.45	.296	0.032
		29	6–10 y	43.00 (3.37)			
		38	11–15 y	42.62 (3.21)			
		38	≥16 y	41.66 (2.80)			
Posttest	TCSI	16	≤5 y	63.50 (9.13)	19.266	.001	0.338
		29	6–10 y	67.79 (17.69)			
		38	11–15 y	69.82 (7.13)			
		38	≥16 y	76.37 (6.41)			
1st follow-up	TCSI	16	≤5 y	68.00 (7.76)	15.160	.001	0.287
		29	6–10 y	71.31 (7.34)			
		38	11–15 y	72.42 (7.31)			
		38	≥16 y	76.32 (6.16)			
2nd follow-up	TCSI	16	≤5 y	70.13 (7.63)	13.417	.001	0.263
		29	6–10 y	74.22 (8.41)			
		38	11–15 y	75.39 (8.91)			
		38	≥16 y	80.87 (6.51)			

η_p^2 = effect size, CBAET = cognitive behavioral active engagement training, mean (SD) = mean (standard deviation); N = number of participants within years of practice bracket; P = probability value, TCSI = test construction skills inventory, WC = waitlist control.

which was reported to be weak.^[4–7] Before the training commenced, teachers cognitive structure for handling test items construction skills were actually limited, as such some teachers had to depend on the use of past or already existing questions to assess students.^[3,10] It was noticed the teachers had challenges in content analysis, developing table of specification, writing good items, item assemblage, among others. After the training, the post-training outcome indicated that the pre-training challenges in the construction of good, valid, and reliable test by teachers were surmounted. The result in Table 3 shows a significant change in teachers' test items construction skills due to the professional development they had. CBAET received by teachers now enable them construct test items that provide precise information about student learning outcomes as well as obtain objective and accurate information about students' academic achievement in school from teacher records. This finding affirmed^[51] assertion that, increased teachers' support and engagement directly leads to increase student engagement.

This result corroborated the research findings which indicated that students' engagement in school activities, influences their psychological and academic outcome in an encouraging manner.^[52] Just like the students, teachers' engagement in test items construction activities, influences their skills a cognitively delightful manner. In cognitive behavioral active engagement training, teachers were instructed and given opportunities to carry out a lot of activities during the experiment and it resulted in increase in the test items construction skills of teachers. The first and second follow-up measurement indicated that there was consistent improvement in the test items construction skills of teachers. This finding is in consonance with the research result that, students' engagement is a strong predictor of their learning, achievement, and academic progress.^[55,56] CBAET intrinsically motivated teachers' curiosity, and enhanced their intellectual competence in test construction. The snowball effect of this finding include; reinforce students' engagement, as CBAET could also be used by teacher to teach their students, students will be assessed using valid and reliable instruments developed by the teacher, minimize examination malpractices as internal test items will be similar to that of external tests, among others. These findings validated the efficacy of the CBAET intervention in treating test items construction limitations or problem among teachers in Nigeria schools.

It was also revealed that years of practice had a significant influence on participants' test construction skills at post-treatment, first and second follow-up measures. This finding buttressed that of^[19] who reported that more experienced teachers understand and appreciate the importance of test construction skills better. The finding equally supports that of^[6] that used TCSI to determine the test construction skills of teachers and found a significant difference in the mean ratings of more experienced and less experienced teachers. However, the finding negates that of^[18] who found teachers' years of experience and qualifications did not significantly influence their competence in assessing their students. It also disagrees with that of^[20] who found that lecturers' knowledge of test construction procedures did not differ significantly based on years of experience. Teachers' active engagement in school activities over time influences their competence in constructing test item in an encouraging manner. At post-treatment, first and second follow-up stages, participants' test construction mean scores based on years of practice were higher for ≥ 16 years, followed by 11 to 15 years, 6 to 10 years, and ≤ 5 years being the least among the 4 groups under

consideration. The result of this study is probably since teachers who have spent more years in the practice of teaching and learning may have gained experiences developing a lot of classroom test. Although all the teachers' test construction mean scores improved, the use of CBAET favored teachers with more years of practice. The current finding agreed with previous studies that documented the significant roles of cognitive-behavioral strategies in challenging distorted thoughts and unrealistic assumptions of Nigerian employees.^[58–60] In addition, similar findings were reported by empirical-based literature that CBT is a strong non-clinical intervention that could help people irrespective of their class, backgrounds, affiliation, and sex.^[61–64] This study also supported Iremeka et al,^[65] Ede et al,^[66] Ede et al,^[67] and Agah et al^[68] on the efficacy of cognitive-behavioral and rational-emotive approaches in altering irrational behaviors.

4.1. Strength of the study

This study explored an area which addresses the contemporary problems among teachers in Nigerian schools. The intervention has improved test items construction skills among teachers, which in turn will decrease the negative impact of limited skills. The intervention is considered timely, given the potential impacts of teachers' weak skills in test item construction on students' learning outcomes and decisions in Nigeria. The intervention successfully validated the effectiveness of CBAET in improving test item construction skills among teachers using randomized pretest-posttest control group design.

4.2. Implication for practitioners and educational policy makers

Given the cost effect of CBAET in improving test items construction skills among teachers it is appropriate that practitioner in relevant fields especially teachers of primary schools should employ the skills and procedures as noted in CBAET in the courses of their professional practices. It was noted that the participants engaged in CBAET progressively improved in their test construction scores. Therefore, practitioners should incorporate CBAET in their teaching and learning process. The researchers found that the participants post-intervention, first and second follow-up measures indicated consistent improvement. This means they retained most of the materials taught which indicate mastery learning and acquisition of skills. Based on these findings, if teachers are not properly trained, teachers' test item construction skills will continue to be poor. This in turn may result in other education problems like poor achievement or unduly high scores arising from use of poorly constructed test items.

For those in educational authorities in Nigeria who initiate the policy process should make it possible that every primary school teacher in primary schools and beyond to be exposed to how to construct test items. We argue that if teachers understand how development process of test items it will enhance quality teaching delivery and educational decisions. Practice implication for policy makers in education sectors is that if the policy or decision about teaching and learning is made without adequate consideration of quality of school assessment, may affect pupils/students. School management, educational administrators, and policymakers need to make decision that will guide teaching and learning process based on information gathered from the classroom experiences and assessment. Nitko^[69] stated that government uses assessment decisions making that helps curriculum planning and implemen-

tation. Supporting this view, our finding suggests that CBAET is an effective method that can help teachers improve in their test item construction skills. Regrettably, past studies have reported that teachers had been described to be key source of anxiety affecting test item construction because they lack the prerequisite skills.^[4,8] Since teachers in schools lack affection for test item construction,^[5,7] it implies that they make wrong decision about the students' performance and achievement. To that end the educational policy that emerged from such decision will also be affected. Therefore, we recommend that State and Federal Policy Makers should adopt philosophies of CBAET to train recruited primary school teachers on the need for construction of test items. With the outcome of this study, we recommend for CBAET professional development workshops that incorporate school management teams comprising principals, teachers, local government educational supervisors, state legislative offices, and parents. Organizing this workshop, the quality of test items in Nigerian primary schools will certainly improve.

4.3. Limitations

Like other empirical-based studies, this present study has some limiting factors. The instrument used for data collection had been used in Nigeria only. This appears to localize the result of the study. More therapists could be use when the numbers of participants are large. It was only moderating influence of years of practice that was determined among several demographic variables. The moderating effects of demographic variables like sex, age, ethnicity, and state of origin were not determined. Thus, the demographic variables moderating the effectiveness of CBAET on the improvement of test item construction skills among teachers should be determined in subsequent study. The participants proficiency in test construction was not determined, therefore, further study should be carry out using any tool that measures proficiency in test item construction. This is necessary because the researchers did not access proficiency scale in test item construction and appears not available for now. Hence, subsequent study should focus on the development of proficiency scale for measuring test item construction. The use of teachers with different years of practice may have created a state of inequality among participants. Teachers who have spent more years practicing may have been engaged in writing several classroom tests. This may have given them undue advantage over their colleagues during the experiment. We noted the inability to present the influence of age and sex as parts of limitation of this study. Given these limitations, we encourage future studies to consider age and sex as possible moderators. Further study with CBAET should consider teachers within the same years of practice bracket. With these limitations, the generalization of these findings should be done with caution.

5. Conclusion

Based on the findings of the study, the researchers concluded that CBAET is efficacious in the improvement of test item construction skills among teachers in Nigeria. Teachers' years of practice had a significant influence on participants' test construction skills and the influence is in favor of teachers with more years of practice.

Thus, it was recommended that:

1. Teachers should use the skills acquired during CBAET intervention to construct their classroom test item continuous assessment and en-of-term examination.

2. CBAET intervention should be integrated into teacher education programmes for better test item construction and academic achievements of students.
3. Teachers with more years of practice and skills in test development should guide those with lesser years of practice during the construction of their classroom tests.

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