

Chapter 28

COMPUTER-ADMINISTERED TESTING PRACTICE IN HIGHER EDUCATION IN ERA OF SEVERE ACUTE RESPIRATORY SYNDROME-RELATED DISEASES OUTBREAKS

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Introduction

Tests remains one of the most widely used assessment tools in determining the extent to which students have achieved their short- and long-term objectives in a course. In time past and present, many educational tests in higher education and beyond, are written in the paper-pencil test (PPT) format (Owan, Duruamaku-dim & Eneje, 2019). Increasing developments and innovations in information and communication technology have ushered in a test administration strategy known as the Computer Administered Testing (CAT). Other common names associated with this new model include Computer Based Test (CBT), Computer Based Assessment (CBA), Electronic Test (e-Test), Computer Assisted Test and many others. Whatever the name, one of the central characteristics of a computer-based test is the delivery of test items to respondents using electronic means, especially through the support of the internet. The advent of CAT gained widespread adoption, as many institutions and examination regulatory bodies switched swiftly to it, to maximise their supposed numerous benefits.

For instance, in 2013, the body responsible for regulating enrollment into higher education in Nigeria (The Joint Admission and Matriculation Board, JAMB) quickly adopted the CAT (Bassey, Ubi, Anagbougu & Owan, 2020). Along these lines, JAMB now uses the computer-administered testing approach in conducting all assessments

in the Unified Tertiary Matriculation Examination (UTME). The focal point of this chapter is to discuss the concept of computer regulated testing and its implications in an era of Severe Acute Respiratory Syndrome (SARS) related infection pandemics. This is especially significant because during the outbreak of most SARS-related diseases (like the COVID-19), social and physical distancing is advocated by the government of different nations. SARS-related diseases are caused by a virus known as the coronavirus which affects the respiration of infected persons or animals. These diseases can be spread through air if droplets from an infected get to a non-tainted individual.

The Center for Disease Control and Prevention (2020) revealed that there are seven kinds of SARS-related maladies brought about by the human coronavirus. They include 229E (alpha coronavirus), NL63 (alpha coronavirus), OC43 (beta coronavirus), HKU1 (beta coronavirus), MERS-CoV (the beta coronavirus that causes Middle East Respiratory Syndrome, or MERS), SARS-CoV (the beta coronavirus that causes the extreme intense respiratory condition, or SARS) and the SARS-CoV-2 (the novel coronavirus that causes coronavirus illness 2019, or COVID-19). These diseases are fatal and have killed numerous people at the time of their outbreaks. For example, in the year 2020, global political, educational, religious and economic activities were suspended for almost seven months due to the pandemic of the novel coronavirus (COVID-19). Many tainted individuals of the infection can encounter mellow to direct respiratory sickness and recuperate without requiring extraordinary treatment (World Health Organization, WHO, 2020). In any case, individuals liable to develop genuine sickness are more seasoned individuals and people with feeble resistance (weak immunities) and fundamental clinical issues, for example, cardiovascular sickness, diabetes, ceaseless respiratory illness and cancer (WHO, 2020).

To forestall the spread, people must be all around educated about the causes and spread of coronavirus. The infection spreads through droplets of salivation or release from the nose when contaminated individual coughs or sneezes (WHO, 2020). In this manner, individuals must practice social distancing, essential hygiene and respiratory etiquette (such as, coughing into a flexed elbow). This pandemic,

whose origin is discernible to Wuhan city in China, has displaced world activities in practically all areas including sports, business, education, entertainment and so on. Since there is a requirement for social distancing (as a method for abridging its spread), schools, at all levels, in almost every nation of the world (including Nigeria) were shut. This implies that academic exercises at all levels of education have been put to a stop. Thinking about the significance of education from one viewpoint, and the unpredictable end of the infection on the other, there is a need for teaching and learning to proceed. There is also a need for approaches to be developed that can help the perseverance of schools in such difficult occasions. Furthermore, it is pertinent to think about Computer Administered Testing as an evaluation practice that would flourish during health pandemics (when there are compelling reasons to adopt an e-learning framework).

Concept of Computer-Administered Testing

Computer-administered testing (CAT) refers to tests that are designed by teachers/assessors and delivered to students/respondents using electronic means with the support of the internet and computers. In this kind of assessment practice, questions are designed, responses and scoring are all done electronically. Test administrators, under this system, can schedule a time when respondents should be up to take their surveys, test, quizzes or exams just as in a normal classroom. However, in the case of CATs, administrators and respondents can play their roles from the comfort of their homes. Electronic testing practice such as the CAT can be designed within an institution to a targeted set of users (standalone) or can be made to be a part of a virtual learning environment which can be assessed globally through the World Wide Web. There are many other terms used by different writers to mean the same thing as CAT. These terms include Computer-Based Assessment (CBA), Computer-Based Testing (CBT), e-assessment, computerized testing, Computer-Assisted/Mediated, Online assessment, Computer-Aided Assessment (CAA) and so on.

Approaches to Computer-Administered Testing

Approaches to computer-administered testing include the following

1. Traditional Testing

The least difficult utilization of computers in test conveyance is the administration of traditional tests where all examinees get similar test questions in the same order, normally a question at a time. Even though this appears to be a trifling development over paper-and-pencil tests, it has various points of interest. In the first place, all guidelines are introduced by the computer, preceding the examinee getting the test questions, regularly alongside some training questions. This guarantees that every examinee has perused and comprehended the guidelines. Second, scores can be made accessible to the examinee or test administrator upon completion of the test. Moreover, all examinee responses are recorded electronically, dispensing the need to optically scan test answer sheets. The measure of time it takes the examinee to react to each question can be recorded. This data can help to assess the examinee's speed, attention levels and processing time which may be valuable for assessing their performance. There is no need for paper in this testing approach, decreasing the cost of reproducing the test materials and documenting paper records. At long last, the testing procedure can be upgraded with sound, video, and shading, making it conceivable to gauge characteristics not effectively measured in paper-and-pencil test administration

2. Branched or Response-Contingent Testing

Branched or response-contingent testing helps to assess factors that can be measured through a problem-solving situation or series of steps. In this methodology, a difficult circumstance is introduced to the examinee with various other options. Every option "branches" to an alternate second stage in the problem-solving process. Ensuing branches for each resulting question keep on prompting various changes in the circumstance introduced to the examinee. As a result, every examinee can follow a different pathway in the problem-solving process, some of which lead to a proper answer for the issue while others don't. These "situational" tests are commonly scored as far as the ampleness and productivity with which an examinee arrives (or doesn't arrive) at an answer for the presenting problem.

3. Partially Versatile Testing

Versatile tests are intended to adjust to every examinee as the testing procedure is executed. Response-contingent tests are versatile in that sense, however partially and completely versatile tests take this procedure further. Partially versatile tests work from a bank of questions that is organized by item difficulty. The easiest of these tests comprise of subsets of items gathered into short tests or testlets, containing questions of varying average difficulty levels. A testlet of medium difficulty is administered, each question in turn, and promptly scored. Examinees who score high on the testlet then get a progressively difficult testlet. The individuals who score low are then offered a simpler testlet. If solitary two testlets are given to an individual, the test is a two-phase test. A multistage test includes the administration of at least three testlets, with the difficulty of each ensuing testlet dependent on the examinee's score on the past testlet. In the testlet approach, expanding depends on the examinee's score on each testlet. One variety of this methodology includes branching after each question is administered. This permits examinees to move all the more rapidly toward questions that are reliable with their capacity level.

4. Completely Versatile Testing

Completely versatile testing, in light of a group of scientific models called item response theory (IRT), is as of now the most utilized way to deal with versatile testing. A completely versatile electronic versatile test (EVT) has the five after prerequisites and qualities:

- a. It utilizes an inquiry bank in which all the questions have been aligned by a proper IRT model. The IRT family incorporates models for questions that are scored in two classes, for example, various decision scored as right or erroneous, valid or invalid, true or false, yes or no and rating scale addresses that are scored as numerous classifications.
- b. Pre-existing data about every examinee, for example, their school grade, can be utilized as a beginning stage for choosing questions.
- c. Questions are administered each in turn and the examinee's score is assessed after each question is replied.
- d. After each question is administered, the whole question bank is looked and the question that will give the most exact measurement

of that examinee (given the examinee's score by then in the test) is chosen for administration.

- e. This procedure of choosing and administering a question and rescore is repeated until a reasonable end basis is reached. Completely versatile CATs can be ended when the examinee's score arrives at a prespecified level of exactness, when there are not any more valuable questions in the bank for measuring a given examinee, or when the examinee has been dependably grouped as for at least one cutting scores.

Completely versatile CATs dependent on IRT are drastically shorter than regular tests, and they lessen the time required for test organization by half to 90%. They can gauge people at a lot more significant levels of accuracy than ordinary tests of a similar length. Besides, for tests with questions scored in one of two classifications (e.g., right or inaccurate), most examinees will reply about half of the items effectively paying little heed to how high or low their score is. Low-capacity examinees are probably going to encounter the test as "simpler" than comparable tests that they have taken because the CAT will have adjusted to their capacity level by giving them simpler items. Then again, high-capacity examinees will encounter the test as more troublesome than numerous they have taken. As an outcome, the "mental condition" of the test is better likened for all examinees, bringing about a fittingly testing condition. Completely versatile CAT has been actualized in various significant testing programs.

5. Successive Testing

Many have alluded to successive tests as CATs, however, they are a distinguishable arrangement of techniques. Successive tests are normally used to settle on an order of choice (e.g., to recruit or not to employ, to graduate or not to graduate) utilizing at least one prespecified cut-off scores. Regularly, the items in the test are arranged by how much accuracy they add to settling on the characterization choice. At that point, the questions are controlled in order of rank until a classification can be made. Rather than completely versatile CAT, questions are not chosen dependent on the examinee's quality or intelligence level. Without a doubt, successive tests, by and large, are not intended to gauge constant qualities. Since test end is

individualized in successive testing, be that as it may, successive tests may contrast long among examinees.

6. Scrambled Testing

In this approach, the examiners design the test in such a way that questions in a bank are not administered in an order of difficulty. Test items are served differently to different students so that students do not respond to the same question at the same time. It is adopted by test administrators seeking to reduce examination malpractice by misleading students who copy answers (multiple-choice items) from their colleagues. This approach has been flexibly implemented with CAT than the “paper-type” approach associated with paper-pencil testing (PPT). Although it has been discredited for compromising test difficulty, validity, reliability and known measurement theories (Bassey et al., 2020), it still serve a very useful purpose in curbing examination malpractice. In Nigeria, the Joint Admission and Matriculation Board are using this approach in the Unified Tertiary Matriculation Examinations (UTME).

Advantages of Computer-Administered Tests

There are several benefits that computer-administered testing offers to institutions, programs, instructors and learners. These benefits are summarized in terms of increased delivery, grading efficiency, administration, consistency and reliability, timing, scope and purpose. Other benefits outlined by Asuni (2008) includes improved test security resulting from electronic transmission and encryption, unbiased test administration and scoring, less reaction and acknowledgement blunders, fewer cognizance mistakes brought about by the testing procedure, improved interpretation and restriction with widespread accessibility of substance, new progress and adaptable thing types, expanded applicant acknowledgement and fulfilment and a developmental advance toward future testing systems. These benefits are discussed below.

1. **Multiple testing:** In the computer-administered testing approach, different tests can be administered to respondents at the same time. Different subjects can be written simultaneously at the convenience of respondents and test administrators. For, in UTME

examinations, students seeking admission into different academic disciplines can be assessed at the same time.

2. **Flexible and Individualized Assessments (FIA):** This allows students' test to be personalized to different individuals either based on their level of intelligence or for a specific purpose that is of interest to the examiners. The level of difficulty of each question can be balanced relying upon the student's previous responses. In terms of flexibility, CAT can be designed to suit individuals of different age categories and can be used in schools, firms and other organisations for recruitment purposes.
3. **Quick scoring and grade determination:** Unlike the classical paper-pencil testing approach, CATs designed in formats where students are to select responses (e.g., multiple-choice or true/false), can be scored immediately without the respondents waiting for days, weeks or months. Therefore, respondents can instantly see their grades immediately after an assessment exercise, making it possible for instructors to make decisions and provide immediate feedback if s/he wishes to.
4. **Vertical and horizontal assessments:** Tests can be vertically aligned to assess the same core knowledge at increasing levels of difficulty. Through CATs, it is also very easy to compare students' performance in an institution to a national, regional, state or other criterion as may be determined by the test administrators (criterion-based testing). They can be horizontally aligned if they are scored in such a way that learners can be compared against one another at the same level (norm-referenced), which is critical for sorting and choosing students for promotion, awards, scholarships and so forth.
5. **Large-scale assessment:** The use of CATs enables teachers, institutions and organisations to administer tests to a large number of respondents at the same time. This can be achieved through the internet or other forms of computer networks. The numbers of respondents needed to reach a threshold are indefinite because a computer-administered test (especially those powered by the internet) are limitless.

6. **Grading efficiency:** Through the use of CATs there is increased reliability in the grading of students' performance as there is a high level of fairness. Computers are not humans; thus, grading is done based on the response(s) provided. With CATs, there is no addition nor subtraction of scores for any reason, since, in the first place, there was no error. Computers have no feelings and do not care if the respondents they are grading is their owner or not. The high speed and immediate provision of immediate feedback also make CATs highly reliable and dependable.
7. **Easy administration:** It is very easy to administer tests using electronic means as the need for test administrators and respondents to travel to a physical venue may not be necessary. Students can sit comfortably at homes and take a test on the scheduled time. The stress of supervisors and invigilators moving around halls to serve test questions/answer booklets and monitor the entire test-taking process is not needed in remote testing.
8. **Consistency in timing:** In computer testing, all respondents can start a test and end at the same time, except variation occurs based on the speed and intelligence of different respondents. If a test is scheduled to last for an hour, in CATs all respondents must stop on or before the time elapses. In the paper-pencil approach, if the duration of a test elapses, scripts are usually collected based on sitting arrangements where students in the front row would have to submit first while those in the middle and back rows would continue writing until invigilators get to them.

Disadvantages of Computer-Administered Tests

Very little can be said about the detriments of online evaluations, since the favourable circumstances exceed them by a wide margin. Below are highlights of a few demerits of computer-administered tests.

1. It requires that both the test administrators and respondents be ICT literates.
2. It is very expensive to buy gadgets (such as computers, assessment software, internet data bundle, routers, switches and other networking tools) needed for successful electronic testing. For large-scale assessment, it very expensive to procure computers that will be commensurate to the number of respondents. Thus, many

institutions schedule respondents into groups to meet up, compromising its advantages of large-scale assessment and timeliness.

3. Technology is generally not dependable, there may be connection or web-related issues, power failures and different things like that.
4. It is difficult to monitor and supervise respondents taking tests from remote locations (such as homes) potentially leading to a high rate of examination malpractice. Furthermore, when people take tests online without supervision, it is difficult to realize who is taking the test, what materials they were using while taking the test and who was helping them during testing.
5. Various programs utilize various settings for textual styles, hues, and other presentation qualities to convey Web-based tests. These possibly render a given question diversely to various examinees. Moreover, contrasts in screen size and resolution decrease the equality of CATs
6. At the point when tests are administered in an uncontrolled environment, as may happen with CATs, environmental factors present during test-taking can influence the performance of respondents. An essential guideline of standard testing practice is that paper-and-pencil tests are to be administered in a tranquil and comfortable condition. When tests are administered through the Web, a wide assortment of unessential variables may be available that meddle with—and possibly negate—the subsequent scores of students.

Computer-Administered Testing in the era of SARS-related infections: A necessity?

SARS-related pandemics are very deadly and can affect the stability of different nations. For example, the COVID-19 caught the entire globe unprepared with a high rate of deaths accounting for its fatality. Schools and other public gatherings were discouraged as one of the social distancing policy to mitigate its spread. However, there is a need to think beyond the era of COVID-19 because anticipated future SARS-related disease outbreaks are still likely to occur. In times of such disease outbreaks, there is a need for teaching, learning and assessment to continue in higher education, given the research roles tertiary institutions play (which may help in the discovery of a

solution). Consequently, many scholars are advocating for a switch to e-learning or online education (Harris, 2020; Strauss, 2020; UNICEF, 2020). We can say, probably, that a change to e-learning is the best procedure to use since it offers educators and learners the opportunity to teach and learn from the comfort of their homes. If e-learning is the answer for viable instructional delivery during serious health pandemics, then the utilization of CATs for assessment is a necessity. CATs are particularly useful as they can be taken at the comfort of respondents' homes through the support of the internet.

Although, while many countries have access to computers, mobile devices and e-learning facilities (Bebell & O'Dwyer, 2010; Fleischer, 2012; Zucker & Light, 2009), to a point that every elementary and middle school student, as well as teachers, have their own mobile devices (Sung, Chang & Liu, 2016), the situation in Nigeria seems to be different. Schools at all levels in Nigeria appears to have the same problem of poor e-learning setup for group use not to discuss individualisation. For effective teaching, learning and assessment to thrive in Nigeria at a time when traditional face-to-face classrooms are not plausible, more efforts must be made to provide functional and adequate ICT resources and services needed for CATs. Regardless of whether the whole globe embraces a standard e-learning practice, educational assessors must consider CAT in the evaluation of students' learning during SARS-related health pandemics. This is exceptionally significant to reason, considering the need for social distancing, which may serve a crucial purpose in mitigating the spread of respiratory infections.

Conclusion

SARS-related health pandemics like the SARS-COV2 (COVID-19) pose a great economic, social, and educational challenge to affected countries. Schools and other public places were suspended to promote social and physical distancing. The lessons gained from the experience of the COVID-19 are so devastating that it has become necessary for individuals of different works of life, as well as, the government to prepare themselves against future outbreaks of SARS-related infections. Educational stakeholders particularly, need to think of innovations that can be used to ensure that academic and co-curricular

activities are not affected should any outbreak (requiring social distancing and school closure) surfaces in the future. Many scholars have advocated for a switch towards e-learning in such a difficult moment. One crucial academic activity that must be given serious consideration is the assessment of students learning. Therefore, the use of CATs is of immense importance, as an evaluation practice, for quality educational appraisal and performance feedback.

Suggestions for improvement

There are varieties of viewpoints that should have been considered when CAT is deployed, for example, program quality, security, dependable system (if Internet-based), capacities, support, maintenance, programming costs for improvement, test delivery and licenses. For effective computer-administered testing, the following specific suggestions were made for improvement:

1. The government at all levels, donor agencies and philanthropists should ensure that they support educational institutions with quality ICT and e-learning facilities to raise a formidable e-learning infrastructure in higher institutions of learning.
2. During pandemics requiring the closure of schools, educators and learners should utilize e-learning platforms for instructional delivery and adopt CAT for students' assessments.
3. When using the computer-administered test, teachers should make sure that higher-order test items are used to reduce or eliminate the rate of students' examination malpractice tendencies in higher education.
4. For effectiveness in the use of CAT, students' assessment should be done through real-time video-presentation using online platforms (such as ZOOM, google meet, and skype), to enable teachers to monitor the testing process remotely.
5. For large-scale CAT, test administrators should make use of web-based tools rather than computer programs. This would give access to all students across distant locations, without the need to split respondents into groups (as in traditional CAT).
6. Parents should ensure that their children and/or wards in higher education are provided with electronic devices such as personal computers, smartphones, tablets, and so on, to enable every student switch to e-learning as the need arises.

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