**Assessing the Impact of Lecturers’ Competencies in Computer Adaptive Testing on Entrepreneurial Students’ Academic Achievement: A Case Study of Faculty of Management Sciences, Ignatius Ajuru University of Education, Nigeria**

**ABSTRACT**

*This study assessed the competencies possessed by lecturers in computer adaptive testing on entrepreneurial students’ academic achievement in faculty of management sciences Ignatius Ajuru University of Education Rivers State.**Two research questions guided the study,**the study adopted descriptive research design. The target population of the study was 8 lecturers in the entrepreneurial department, 5 male and 3 female, total enumeration was studied. The instrument was titled: Assessing the Impact of Lecturers’ Competencies in Computer Adaptive Testing on Entrepreneurial students’ academic Achievement Questionnaire (AILCCATESAQ). The instrument was validated by three experts in measurement and evaluation in the department of educational foundation, Rivers State University. The reliability of the instrument was determined using Cronbach Alpha method and a reliability co-efficient of 0.79 was obtained. Mean and standard deviation were used in answering the research questions. The findings of the study showed that lecturers of entrepreneurial department have low competence in item selection; it also revealed that lecturers have high competence in item termination. Based on the findings of the study, the researchers recommend that lecturers should monitor students’ performance, analyze student results to identify areas where item selection may need adjustments.*

**Keywords:** Assessment, Competence, Computer Adaptive Testing.Entrepreneurial**.**

**INTRODUCTION**

In recent times, the educational sector has shifted from traditional content-based education towards a non-comprehensive and adaptive test of learning. With advancement in computer and network technologies new trends and methods for teaching and learning have emerged via computer Adaptive Testing (CAT). As defined in Wikipedia (2023), “computer Adaptive Testing (CAT) is a form of computer-based test that adapts to the examinee’s ability level. It is a form of computer administered test in which the next item or set of items selected to be administered depends on the correctness of the test takes responses to the most recent items administered. The fundamental thing about computer Adaptive Testing is that it allows tests to be adapted to the testee being assessed which has clear advantages significantly reducing testing time without losing accuracy”.

Test is the measuring tool, technology, or method that is intended to measure students, knowledge or time ability to complete a particular task or measure level of excellence, skin, mastery, competence, adaptive, attitude, interest and motivation. Furthermore, testing is used to determine the relative presence or absence of trait of learners or participants (Obilor, 2019). In this sense, testing can be considered as a form of assessment used in determining knowledge and abilities. As opined by Asuru (2015), “assessment is the process of organizing measurement data and fashioning them in an interpretable manner on the basis of which judgment (evaluation) could be made”. He further stated that assessment relates measurement data to identified standards and involves data comparison. “Assessment is the systematic basic for making inferences about the learning. Assessment is the process of gathering and discussing information from metaphor and diverse sources in order to develop a deep understanding of what student know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning” (Iwok, & Akpanuko, 2014)). Assessment is the systematic basic for making inferences about the learning. It involves a fact-finding activity and enables the assessor describe the prevailing status of the learner within the context of a given educational objectives. Assessment entails gathering data from diverse sources in order to have a cleaner understanding of the learners’ attributes as a result of the learning encounter. The focus of assessment is to organize measurement data into an interpretable manner. This is an important focus because entrepreneurship education has grown rapidity worldwide to the extent that “the Federal University of Education through the National Universities Commission (NUC), National Board for Technical Education (NBTE) and National Commission for Colleges of Education (NCCE) has made entrepreneurship education compulsory for every student in Nigeria tertiary institution with the hope that will stimulate graduate business startups” (Fenis, 2010).

“Entrepreneurs play a crucial role in modern economy owing to their ability to offset negative effects of socioeconomic development to take advantage of new opportunities and to generate new ideas for business growth” (Suarez, Pedrosa, Garcio & Muriz, 2020). There are many tools such as battery for assessment of the entrepreneur’s achievement and the measure of entrepreneurial technologies and abilities which is the strongest and most consistency predictor of entrepreneurial activity. However, despite the diversity of evaluation instrument in this context, there are more which evaluate the entrepreneur’s achievement adaptively, via computerized Adaptive Test (CAT). CAT have numerous advantages over conventional test due to their being based on Item Response Theory (IRT) and to their intrinsic characteristics. The development of a CAT will allow the quick and precise evaluation of entrepreneur’s achievement both in terms of assessment and of making quick decisions based on test score. This is particularly important in contexts where there are numerous evaluations, such as education.

Application of Computerized Adaptive Testing is a modern educational method that was created in order to provide a unique electronic test environment suited to the needs of each student (Seo, 2011). “Three applications of Computerized Adaptive Testing (CAT) to help solve problems encountered in educational settings are adaptive mastery testing for determining whether or not a student has material a particular content, adaptive grading for assigning grades to students and adaptive self-referenced testing for estimating change in a students’ achievement level.Adaptive mastering testing is designed to determine whether a students’ estimate achievement level (Ɵ) is determined by transforming a proportion-correct mastering criterion specified by the educator to the Item Response Theory (IRT) Ɵ metric through the use of the item pool characteristic curve, the mean of the item characteristic curves for all item in the pool. To begin the test, the question in the item pool that has the maximum level of item information at Ɵ is selected and administered. The students’ response is scored as corrected or incorrect, and the students’ achievement level is re-estimated. The result is the estimate of achievement whether or not Ɵm falls in the confidence interval. If it does another item is selected by identifying the item that provides maximum information at the updated estimate of achievement, Ɵ1. The item is administered and scored, resulting in a new estimate, Ɵ2, and a new confidence interval. This procedure continues until the confidence interval does not include Ɵm, at which point testing is terminated. If the lower limit of the confidence interval falls above the specified mastery level, Ɵm, the student is declared a master. If on the other hand, the upper limit of the confidence interval falls below Ɵm, the student is declared a non-master” (Seo, & Weiss, 2014).

“The application of a CAT would make it easier for lecturers to perform quick assessments of all the students in a school and spaced up the decision-making process regarding academic and professional orientation for whom interested or run their own idea or business. It would ease making better decision based on the scores of each participant, increasing their validity” (Seo, 2011). And possibly leading to fewer business failures and associated negative consequences. Accordingly, the development of a CAT would be a significant contribution to the field. Also, its validation in students would make it easier to make decision that would promote the growth of entrepreneurship, reduce the risk of failures, and guide potential entrepreneurs improving their training and opening up possibilities for their future professional success. However, the use of item selection as one of the objectives in CAT which is the process that selects the next question from the item bank considering factors like content balance, difficulty, and test taker’s previous responses, and use of test termination that determines when to end the test, such as when the test taker’s ability is accurately estimated or a maximum number of questions is reached. These objectives when used, work together to provide a personized and efficient assessment experience for entrepreneurial lecturers. However, the problem is that this mode of assessment has not been fully understood in assessing lecturers’ competencies specifically in the entrepreneurial department since it is a new department in the Faculty of management sciences in Ignatius Ajuru University of Education, Nigeria. Lack of research on the use of Computer Adaptive Testing (CAT) by the lecturers’ and students’ awareness of CAT as a testing methodology in their relevant qualifications especially in Faculty of management sciences, department of entrepreneurial in Ignatius Ajuru University of Education has not been reconnoitred. Lecturers or students may agree with the method and might want to use it, but they may not have academic competencies, capacities or cosiness with technology ensure successful engagement. Here lies the confidence to assess the impact of lecturers’ competencies in Computer Adaptive Testing on entrepreneurial students’ academic Achievement: A case study of the faculty of management sciences, Ignatius Ajuru University of Education, Nigeria.

**LITERATURE REVIEW**

Alvaro, Marcelino, Jose and Eduaredo (2020) developed and actively evaluated a computerized adaptive test to assess entrepreneurial personality. A bank of 120 items was created evaluating various aspect of entrepreneurial personality. The items were calibrated with the sametima graded Response Model using a Sample of 1170 participants (Mage = 42.34; Spage = 12.96). The result showed that the bank of items had an essentially unidimensional fit to the model. The CAT exhibited high accuracy for evaluating a wide range of Ɵ scores, using a mean of 16 items with a very low standard error (M= 10.157) Relative validity evidence for th e CAT was obtained with two additional tests of entrepreneurial personality (the Battery for the Assessment of the Enterprising personality and the measure of Entrepreneurial Tendencies and 657 respectively. It was concluded that the CAT developed has appropriate psychometric properties for the evaluation of entrepreneurial people.

Michael, & Wijesena (2018) investigated “a measure of Adaptive cognition for entrepreneurship research participants in this study included 432 undergraduate business students enrolled at a large western university. Administration of the instrument was done as part of a specially scheduled session outside of the normal class period. The mean age of the sample was 20.3 (standard deviation 1.28) and business major represented 64% of the sample (the remaining 36% were representative of psychology, economics, political science and undeclared majors who were enrolled at the time in a business course)”. In conclusion, the article showed that conceptualized cognition adaptability as the extent to which individuals are dynamic flexible, self-regulating and engaged in the process of generating multiple decision frameworks focused on sensory and processing variation in environments, then subsequently selecting among those multiple alternatives to effectively interpret, plan and implement a wide variety of person, social and organizational goals in the context of a changing reality. The result was that the factor structure was consistent with the theoretical dimensions via metacognitive knowledge, metacognitive experience, metacognitive monitoring and metacognitive control. MAC was highly correlated and opens up numerous opportunities for important empirical testing of cognitive acceptability in entrepreneurial contexts.

Rizki, Edi and Wipsar (2018) carried a study on “Computer Adaptive Test (CAT) as the appropriate model to assess physics achievement in 21st century. The study determined the superiority of computer Adaptive Test (CAT) compared to computer Based Test (CBT) and Paper and Pencil Test (PPT) by (a) comparing Item Response Theory (IRT) and Classical Test Theory (CTT) (b) comparing test media among Computer Adaptive Test (CAT), Computer Based Test (CBT) and Paper and Pencil Test (PPT) the next step was judgment towards the developed CAT to survey teachers and students from 10 senior schools in Yogyakarta that have been used for CAT application trial to assess students physics achievement. The respondents involved were 10 physics teachers and 155 students while the instruments used were reviewer sheet and questionnaire. The scoring model was a polytomus of 4 categories with a total score of 100. Based on the result there were some differences, among CAT, CBT and PPT. PPT analysis using CTT demonstrated guessing effect issue i.e. whether the answer is random or not. Classic methods of correcting assumptions do exist, but they are actually more biased than not applying correction at all. The utilization of CAT is also beneficial to process large-scale data”.

Analysis of large-scale data generates better result, and CAT makes such analysis easier to perform. Based on the analysis, several conclusions have been drawn up (1) CAT is superior for assessing achievement in physics compared to CBT and PPT according to the facts that: (a) IRT is more suitable to be employed compared to CTT and (b) CAT is more practical and appropriate for assessing physics achievement compared to CBT and PPT. (2) CAT is more feasible to measure physics achievement since the score of performance assessment from teachers and students were respectively 78.33% and 86.81%. Furthermore, the results of experts’ judgment was showed CAT is very appropriate to be implemental for assessing physics learning nowadays.

**PURPOSE OF THE STUDY**

The purpose of this study was to assess the impact of lecturers’ competencies in Computer Adaptive Testing on Entrepreneurial students’ academic Achievement: A case study of the faculty of management sciences, Ignatius Ajuru University of Education.Specifically, the study sought to:

1. Determine the extent lecturers’ competencies in item selection enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education.

2. Examine the extent lecturers’ competencies in test termination enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education.

**RESEARCH QUESTIONS**

1. To what extent do university lecturers’ competencies in item selection enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education?
2. To what extent do university lecturers’ competencies in test termination enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education?

**METHODOLOGY:**

The study adopted descriptive survey research design. The study was carried out in Ignatius Ajuru University of Education Rivers State, Nigeria., The study was limited to lecturers in the department of entrepreneurial, faculty of management sciences Ignatius Ajuru University of Education Port Harcourt. Based on the fact that the researcher was certain on the extent at which the lecturers’ competencies in the use CAT for administering test. The population was 8 lecturers in the entrepreneurial department, comprising of 5 male and 3 female lecturers in the department. The entire population was studied as total enumeration without sampling, this was because the population size was small; also, the researcher wants to achieve absolute accuracy, moreover the researchers’ questions require a comprehensive understanding of the entire population. A well-structured and designed questionnaire containing 20 items was used for data collection. The instrument was titled Assessing the Impact of Lecturers’ Competencies in Computer Adaptive Testing on Entrepreneurial students’ academic Achievement Questionnaire (AILCCATESAQ), the items of the questionnaire was structured on a 4-point rating scale of Very High competence (VHC), High Competence (HC), Low Competence (LC) and Very low Competence (VLC). The instrument was validated by expert judgment of three lecturers in measurement and evaluation in the department of guidance and counselling all in Ignatius Ajuru University of Education. Port Harcourt. The experts assessed the instrument in terms of content, suitability of language and appropriateness. Their corrections and modifications were incorporated before distribution of the instrument. The reliability of the instrument was established using Cronbach Alpha method, a reliability co-efficient of 0.79 was obtained which showed the instrument was reliable, 8 copies of the questionnaire were administered and were properly filled and returned and was used for analysis. Mean and standard deviation were used in answering the research questions.

**RESULTS**

**Research Question 1:** To what extent do university lecturers’ competencies in item selection enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education?

**Table 1: lecturers’ Competencies in item selection in entrepreneurial enhancing Students’ Academic Achievement (n = 8)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Responses** | | | | |
| **Male=5** | | **Female=3** | | |
|  | **SD** |  | **SD** | **Remark** |
| 1 | I use item selection techniques in choosing relevant topics when working on academic project | 2.08 | 0.33 | 2.18 | 0.39 | Low competence |
| 2 | I use item selection in prioritizing tasks when working on academic project | 2.24 | 0.37 | 2.05 | 0.38 | Low competence |
| 3 | Item selection improved your ability to manage your time effectively in academic settings | 1.98 | 0.28 | 2.01 | 0.31 | Low competence |
| 4 | Item selection influenced your ability to focus on key aspect of academic tasks | 2.05 | 0.31 | 1.99 | 0.29 | Low competence |
| 5 | Item selection has helped you develop a more entrepreneurial mindset in you academic pursuit | 1.73 | 0.22 | 1.70 | 0.21 | Low competence |
| 6 | Item selection enhance your skills to aid students in their academic performance | 1.91 | 0.26 | 2.00 | 0.31 | Low competence |
| 7 | I have confident in my ability to apply item selection techniques to future academic challenges | 1.68 | 0.19 | 1.70 | 0.21 | Low competence |
| 8 | I have improved in my applying item selection techniques, | 2.62 | 0.54 | 2.50 | 0.52 | High competence |
| 9 | I find it difficult to practice item selection in improving students’ academic performance | 2.74 | 0.59 | 2.81 | 0.61 | High competence |
| 10 | I can easily assess different topics in applying item selection techniques. | 1.83 | 0.23 | 1.60 | 0.20 | Low competence |
|  | **Grand Mean** | **2.09** | **0.32** | **2.05** | **0.34** | **Low competence** |

Criterion mean value = 2.50

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| --- |
| Data in Table 1 indicated that lecturers have low competence in item selection and this have affected students’ academic achievement in department of entrepreneurial, faculty of management science Ignatius Ajuru University of education in Table 1. showed that the lecturers (from department of entrepreneurial) have high competent in the use of item selection techniques in choosing relevant topics when working on academic project ( = 2.62 & 2.50) , yet they have low competence in the use of item selection techniques in choosing relevant topics when working on academic project when working on academic project ( = 2.08 & 2.18 for male and female lecturers respectively), they have low competence on how item selection influenced their abilities to focus on key aspect of academic tasks |

( = 2.24 & 2.05), they have low competence in improving their abilities to manage time effectively in academic setting ( = 1.98 and 2.01), Item selection influenced your ability to focus on key aspect of academic tasks ( = 2.05 &1.99), Item selection has helped you develop a more entrepreneurial mindset in you academic pursuit ( = 1.73 & 1.70), Item selection enhance their skills to aid students in their academic performance ( = 1.91 & 2.00) and have confident in their ability to apply item selection techniques to future academic challenges ( = 1.68 & 1.70). In addition, they have high extent in finding it difficult to practice item selection in improving students’ academic performance ( = 2.74 & 2.81) and have low competence in not finding it can easy to assess different topics in applying item selection techniques. ( = 1.83 & 1.60). The low competence of the lecturers in the item selection of various tests by the grand mean ( = 2.09 and 2.05) for male and female lecturers in the department of entrepreneurial). This result indicates that lecturers of entrepreneurial department posses’ low competence in item selection, thus affecting the academic achievement of students in the entrepreneurial department, faculty of management sciences Ignatius Ajuru University of education Port Harcourt Rivers State. The standard deviation reveals the extent of agreement of the lecturers on their competencies in test item selection, implementation of Computer Adaptive Testing and students’ academic Achievement in faculty of management sciences Ignatius Ajuru University of Education Port Harcourt Rivers State.

**Research Question 2:** To what extent do university lecturers’ competencies in item termination enhance entrepreneurial students’ academic achievement in Faculty of management sciences in Ignatius Ajuru University of Education?

**Table 2: lecturers’ Competencies in item termination in entrepreneurial enhancing Students’ Academic Achievement (n = 8)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Responses** | | | | |
| **Male N=5** | | **Female N=3** | | |
|  | **SD** |  | **SD** | **Remark** |
| 11 | Terminating poorly performance test items improves your assessment skills | 2.69 | 0.56 | 2.70 | 0.57 | High Competence |
| 12 | Terminating test items frequently increase my teaching method | 2.23 | 0.18 | 2.40 | 0.35 | Low Competence |
| 13 | Terminating test items do influence my teaching skills positively | 2.65 | 0.52 | 2.56 | 0.50 | High Competence |
| 14 | Terminating ambiguous test items enhances your ability to clarify complex concepts for students | 2.19 | 0.26 | 2.23 | 0.28 | Low Competence |
| 15 | Terminating confusing test items boost your ability to reduce students’ anxiety and improve performance | 2.32 | 0.34 | 2.36 | 0.30 | Low Competence |
| 16 | The process of terminating test items affects my understanding of students learning outcome | 2.16 | 0.55 | 2.30 | 0.42 | Low Competence |
| 17 | Recalling a specific instance when i terminate test items increase my lecture planning and delivering | 2.63 | 0.49 | 2.88 | 0.61 | High Competence |
| 18 | Eliminating of poorly performing test items impact students’ engagement and motivation | 2.61 | 0.46 | 2.59 | 0.5 0 | High Competence |
| 19 | Item termination helps to identify knowledge gaps and inform targeted instruction | 2.58 | 0.43 | 2.60 | 0.56 | High Competence |
| 20 | There is an improvement of students’ academic performance after terminating ineffective test items | 2.54 | 0.41 | 2.61 | 0.46 | High Competence |
|  | **Grand Mean** | **2.56** | **0.42** | **2.52** | **0.45** | **High Extent** |

Criterion mean value = 2.50

Data in Table 2 that lecturers have high extent in item termination and this have enhanced students’ academic achievement in department of entrepreneurial, faculty of management science Ignatius Ajuru University of education. Table 2 exposed that the lecturers (from department of entrepreneurial) have high competence in accepting that terminating poorly performance test items improves their assessment skills ( = 2.69 and 2.70 for male and female lecturers), they agree that terminating test items do influence their teaching skills positively ( = 2.65 and 2.56), recalling a specific instance when they terminate test items increase lecturers lecture planning and delivering ( = 2.63 and 2.88), eliminating of poorly performing test items impact students engagement and motivation (2.61 and 2.59), the lecturers also indicated that item termination helps to identify knowledge gaps and inform targeted instruction ( = 2.58 and 2.60) and there is an improvement of students’ academic performance after terminating ineffective test items ( = 2.54 and 2.61). On the other hand, data shown that terminating confusing test items boost lecturers ability to reduce students anxiety and improve performance ( = 2.23 and 2.40), terminating ambiguous test items enhances their ability to clarify complex concepts for students ( = 2.19 and 2.23), lecturers have low competence terminating confusing test items boost your ability to reduce students anxiety and improve performance ( = 2.32 and 2.36), the process of terminating test items affect my understanding of students learning outcome (2.16 and 2.30). Thus, the grand mean score ( = 2.56 and 2.52 for male and female lecturers) confirmed that the lecturers have high competence in item termination and this have enhanced the implementation of computer adaptive testing and students’ academic achievement. The standard deviation reveals the extent of understanding of the lecturers on their competencies in test item termination, implementation of Computer Adaptive Testing and students’ academic Achievement in faculty of management sciences Ignatius Ajuru University of Education Port Harcourt Rivers State.

**DISCUSSION OF FINDINGS**

The result in (Table 1) shows that lecturers of entrepreneurial department have low competence in item selection, thus affecting the academic achievement of students in the entrepreneurial department, faculty of management sciences Ignatius Ajuru University of education Port Harcourt Rivers State. This low competence is shown in their inability to define precise limits of a testee’s competence, inability to manage their time effectively in academic setting and to focus on key aspect of academic tasks. Also, some of the lecturers in the entrepreneurial department are unable to use item selection techniques in choosing relevant topic on academic project as well as having ability that enhances their skills to aid students in their academic performance. This finding is in agreement with Agu, Onyekuba and Anyichie (2013) that stated that most lecturers have poor knowledge skills and competencies in item selection techniques for use in computer Adaptive test practices. Also, Chikwe, (2017), stated that there is awful need for experts to select specific questions used to assess and evaluate the suitability of lecturers for a particular position or role that are valid and reliable academic performance tests in use for university students.

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| The findings of research question two (Table 2) revealed that lecturers have high competence in item termination and this have enhanced the implementation of computer adaptive testing and students’ academic achievement in the entrepreneurial department, faculty of management science Ignatius Ajuru University of education. This result shows that most of the lecturers in faculty of management sciences Ignatius Ajuru University of education have high competence in terminating poorly performance test items, this has improved their assessment skills and positively influence their teaching skills. Most the lecturers have high competence in eliminating poorly performance test items that impact students’ engagement and motivation, they also improved in identifying students’ knowledge gaps and inform target instruction and there is an improvement of students’ academic performance after terminating ineffective test items. This finding is in agreement with Asuk, (2016) and Baker, (2003), who opined that lecturers are consistent in determining when to end the test, and accurately estimate and maximum testee’s ability as regards to number of questions to give. However, to achieve a complete item termination, lecturers should clearly define learning objectives, ensure that the learning objectives are specific, measurable achievable and time bound. Lecturers should set assessment criteria that align with the learning objectives. |
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**CONCLUSION**

This study assessed the impact of lecturers’ competencies in Computer Adaptive Testing on Entrepreneurial students’ academic Achievement: A case study of Faculty of management sciences, Ignatius Ajuru University of Education, Nigeria. Based on the findings of the study, it was concluded that lecturers of entrepreneurial department have low competence in item selection, that there is appalling need for experts to select explicit questions used to assess and evaluate the suitability of lecturers for a precise position or role that are valid and reliable academic performance tests in use for university. The study also concluded that lecturers have high competence in item termination and this has enhanced the implementation of computer adaptive testing and students’ academic achievement. They have improved their assessment skills and positively influence their teaching skills, also enhanced in eliminating poorly performance test items that impact students’ engagement and motivation, developed in identifying students’ knowledge gaps and inform target instruction and there is an improvement of students’ academic performance after terminating ineffective test items. Nevertheless, documentation and justification of item termination is important, recording the rationale for terminating each item, including data and analysis in supporting the decision

**RECOMMENDATIONS**

From the result of findings obtained in this study, the following recommendations are made on lecturers’ competencies in Computer Adaptive Testing:

1. Lecturers should monitor student performance: Analyse students results to identify areas where item selection may need adjustment.
2. Lecturers should constantly communicate with students: Inform students about the termination criteria before starting a test; in order to manage their expectations and reduce anxiety.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

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