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DEVELOPING A COMPUTER-BASED TESTING (CBT) METHOD FOR EFFECTIVE ASSESSMENT IN ISLAMIC EDUCATION: A CASE STUDY

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ABSTRAK

Latar Belakang: Inovasi dalam sistem evaluasi pembelajaran diperlukan karena transformasi digital dalam dunia pendidikan. Ini termasuk mata pelajaran Pendidikan Agama Islam (PAI), yang secara strategis bertanggung jawab untuk membentuk karakter religius peserta didik. Namun, penggunaan asesmen berbasis komputer (CBT) di institusi pendidikan berbasis Islam masih belum optimal. **Tujuan:** Tujuan dari penelitian ini adalah untuk menjelaskan seberapa efektif CBT dan menganalisis bagaimana persepsi siswa terhadap CBT berhubungan dengan prestasi pembelajaran PAI di SMP Islam Sawahan Turen. **Metode:** Studi ini menggunakan pendekatan kuantitatif dengan desain deskriptif-korelasional. Angket tertutup dan tes objektif digunakan untuk mengukur persepsi siswa dan mendapatkan data primer. Metode stratified random sampling digunakan untuk memilih sampel sembilan puluh siswa. Seluruh perangkat memenuhi kriteria statistik, menurut hasil uji validitas dan reliabilitas. Analisis data menunjukkan bahwa persepsi siswa terhadap CBT berada pada kategori tinggi, dengan nilai rata-rata untuk semua item di atas 4,00. Siswa juga menunjukkan capaian kognitif yang baik dengan nilai PAI rata-rata 78,44. Ada hubungan positif dan signifikan antara persepsi terhadap CBT dan hasil belajar, menurut uji korelasi Pearson ($r = 0,531$; $p < 0,05$). **Hasil:** Hasil ini menunjukkan bahwa CBT baik untuk evaluasi dan meningkatkan prestasi akademik siswa. **Kesimpulan:** Penelitian ini mendukung pengembangan asesmen digital yang berkaitan dengan nilai-nilai PAI dan mendorong penggunaan teknologi dalam pendidikan berbasis karakter.

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Keywords:		ABSTRACTS
CBT;	Islamic	Background: Innovation in learning evaluation systems is essential in response to the digital transformation within the field of education. This necessity also applies to Islamic Religious Education (PAI), which plays a strategic role in shaping students' religious character. However, the implementation of Computer-Based Testing (CBT) in Islamic-based educational institutions remains suboptimal. Purpose: This study aims to evaluate the effectiveness of CBT and analyze how students' perceptions of CBT correlate with their academic achievement in PAI at SMP Islam Sawahan Turen. Method: A quantitative approach with a descriptive-correlational design was employed. Closed-ended questionnaires and objective tests were used to measure students' perceptions and obtain primary data. A stratified random sampling method was applied to select a sample of ninety students. All research instruments met statistical requirements based on validity and reliability tests. Data analysis revealed that students' perceptions of CBT fell into the high category, with average scores across all items exceeding 4.00. Students also demonstrated strong cognitive performance, with an average PAI score of 78.44. Pearson correlation analysis indicated a positive and significant relationship between students' perceptions of CBT and their academic achievement ($r = 0.531$; $p < 0.05$). Result: These findings suggest that CBT is an effective tool for evaluation and contributes to improved academic outcomes. Conclusion: This study supports the development of digital assessments aligned with PAI values and encourages the integration of technology in character-based education.
Education;	Digital	
Assesment		

A. INTRODUCTION

In the era of digital transformation, Islamic Religious Education (PAI) must adapt to technological advancements in the evaluation of learning outcomes. Computer-Based Testing (CBT) has emerged as a contemporary assessment approach increasingly adopted in educational institutions. It is considered to enhance efficiency, objectivity, and transparency in measuring students' learning achievements, with its adoption accelerating worldwide—particularly following the COVID-19 pandemic, which compelled schools to transition to digital systems.

Moreover, In Indonesia, the Ministry of Education has expanded the National Computer-Based Assessment Program (*Asesmen Nasional Berbasis Komputer*—ANBK). However, its application in Islamic Religious Education remains limited, especially in Islamic-based junior high schools (Arifin, 2022). Accurate assessment of PAI learning outcomes is crucial for fostering students' religious character, as articulated in the *Profil Pelajar Pancasila*. While the integration of CBT in school-based assessment offers numerous advantages, it also presents challenges that require careful consideration. With comprehensive planning and preparation, CBT can serve as an effective instrument for improving the quality of both assessment and learning in junior high schools.

According to 2023 data from the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), only 34% of junior high schools in Indonesia have fully implemented computer-based assessments for religious education subjects. Previous research indicates that developing CBT for PAI subjects can improve assessment quality in terms of both validity and practicality (Fahmi, 2024). However, most studies have concentrated on technical design or general implementation, with relatively few quantitatively evaluating the relationship between the effectiveness of CBT and learning achievement in PAI. Findings from Ghufroon et al. (2023) reveal that smartphone-based testing in Qur'an and Hadith instruction not only enhances the accessibility of examinations but also significantly improves students' learning autonomy and spiritual motivation. The study further notes that students exhibit greater enthusiasm and focus when undertaking CBT compared to conventional tests. Nevertheless, such research remains largely confined to technical design or application development, with minimal empirical investigation into the quantitative relationship between perceived CBT effectiveness and learning outcomes—particularly in the cognitive and affective domains of PAI. This gap highlights the need for further empirical research to examine the direct and measurable effects of CBT implementation on learning achievement.

The present study aims to address this gap by employing a quantitative methodology to evaluate the effectiveness of CBT at Sawahan Islamic Junior High School, Turen. Specifically, the research focuses on: (1) the extent to which CBT effectively measures learning achievement in PAI, and (2) the role of CBT in enhancing the quality of both formative and summative assessments. This investigation is not only theoretically relevant to the framework of digital constructivism in education but also carries practical implications for policymaking in technology-based assessment within Islamic schools and *madrasah*.

Computer-Based Testing (CBT): Conceptual Framework

CBT is an assessment method that employs computer technology as the primary medium for administering examinations and evaluating learning outcomes. Its conceptual foundation lies in leveraging information technology to improve the efficiency, objectivity, and accuracy of the assessment process. Unlike traditional paper-based tests, CBT enables more dynamic question formats, including interactive, randomized, and multimedia-based items. Furthermore, CBT systems can provide instantaneous, automated feedback to students, thus aligning with the principles of responsive and data-driven evaluation.

In the context of Islamic Religious Education, CBT serves a strategic role by integrating religious values with technological innovation, thereby addressing the demands of 21st-century educational digitalization. Hajri (2023) asserts that CBT not only expedites assessment but also enhances student engagement in autonomous and reflective evaluation processes. However, its successful implementation depends on several factors, including the readiness of infrastructure, teachers' competence in designing digital assessments, and students' digital literacy (Ghufron et al., 2023; Kunaifi & Wahyudi, 2024). Consequently, a thorough conceptual understanding of CBT as a technology-based evaluation tool is essential—not only from a technical standpoint but also from pedagogical and philosophical perspectives, especially in value-based education such as PAI.

Meanwhile, CBT replaces traditional paper-based tests with a computerized system. Hajri (2023) highlights its advantages, including time efficiency, automated result processing, and the capacity to present more varied and adaptive test items. CBT also facilitates more accurate data-driven evaluations. Within PAI learning, the use of CBT can enhance the validity of assessment instruments while reducing teacher subjectivity bias.

Assessment in Islamic Religious Education (PAI)

PAI assessment serves two primary purposes: first, to evaluate students' cognitive mastery of the taught material; and second, to assess the development of their religious attitudes and values. This requires an assessment system that is both effective and reliable in comprehensively measuring learning progress. According to Miftahudin et al. (2025), the integration of digital assessment into religious education is essential to ensure that Islamic values remain relevant in the contemporary era.

In addition, assessment in Islamic Religious Education (PAI) occupies a dual function that distinguishes it from general subject evaluations. Beyond measuring cognitive mastery of content—such as Qur'anic literacy, Hadith comprehension, Islamic jurisprudence, and history—PAI assessment must also capture the affective and behavioral dimensions of learning. According to Bloom's revised taxonomy, educational objectives span the cognitive, affective, and psychomotor domains; however, PAI prioritizes the integration of knowledge (*'ilm*), attitudes (*akhlak*), and practice (*amal*). This aligns with the Islamic pedagogical philosophy that education should nurture holistic human development (*insan kamil*), as reflected in the *ta'dib* (disciplining of the mind, soul, and body) framework proposed by Al-Attas (1993). Consequently, PAI assessment cannot be restricted to content recall but must also evaluate the extent to which students internalize Islamic values and demonstrate them in their behavior.

From a theoretical standpoint, authentic assessment theory provides a strong basis for evaluating PAI learning outcomes. Authentic assessment emphasizes the measurement of students' abilities in real-world contexts, requiring tasks that mirror meaningful applications of knowledge and values. In PAI, this could include observing participation in congregational prayers, involvement in community service, or the ability to resolve ethical dilemmas using Islamic principles. Such an approach resonates with the *amal shalih* (righteous deeds) concept in Islamic tradition, where learning is validated through practical application. The *Assessment for Learning* (AfL) model also complements this perspective, as it promotes continuous feedback, reflection, and self-regulation—skills that are essential in developing lifelong religious commitment rather than mere examination performance.

Additionally, the constructivist learning theory—particularly digital constructivism—offers insights into how PAI assessment can adapt to 21st-century educational contexts. Constructivism posits that learners actively construct meaning through interaction with content, peers, and the environment. Digital constructivism extends this by integrating technology as a medium for interaction, enabling assessments that are interactive, adaptive, and multimedia-based. In the context of CBT for PAI, this could mean integrating audio recitation evaluation, interactive case studies on Islamic ethics, or scenario-based problem-solving in jurisprudence. This approach aligns with the *maqasid al-shari'ah* (objectives of Islamic law) framework, ensuring that assessment supports the preservation of faith, intellect, and moral integrity while leveraging modern technology.

Further, the measurement of affective outcomes in PAI can be grounded in Krathwohl's affective domain taxonomy, which categorizes the internalization of values from mere awareness to full adoption and habitual practice. This theoretical lens is particularly relevant in assessing religious attitudes, as it allows educators to gauge not only students' declarative knowledge but also the depth of their emotional and ethical engagement. Combining Krathwohl's model with contemporary educational measurement theories—such as Item Response Theory (IRT) in CBT environments—can provide more precise, bias-reduced evaluations. This integration of Islamic educational philosophy with modern assessment theory ensures that PAI evaluation is both faithful to its spiritual objectives and responsive to the demands of contemporary education systems.

Measuring Learning Achievement

Learning achievement measurement refers to the extent to which educational objectives have been attained by students following a given instructional process. According to the *Instructional Objective Model*, learning should be evaluated across cognitive, affective, and psychomotor domains. Wahyudi et al. (2025) argue that while CBT can objectively measure cognitive learning outcomes, further innovation is needed to integrate assessment of the affective and psychomotor dimensions.

Moreover, measuring learning achievement in Islamic Religious Education (PAI) requires a multidimensional approach that goes beyond cognitive recall of religious knowledge. Drawing from Bloom's revised taxonomy, learning outcomes in PAI must be assessed across three domains: cognitive (understanding Qur'an, Hadith, jurisprudence, and Islamic history), affective (internalization of Islamic values, attitudes, and moral reasoning), and psychomotor (ritual performance and religious

practices). This holistic approach reflects the Islamic concept of *tarbiyah*, which emphasizes balanced development of intellect (*'aql*), faith (*iman*), and righteous action (*amal*). In this view, achievement is not merely the ability to answer questions correctly but the demonstration of integrated knowledge, ethics, and practice in daily life.

The *Instructional Objectives Model* provides a useful theoretical basis for operationalizing PAI learning goals into measurable indicators. Within this model, objectives are explicitly linked to observable and assessable behaviors. For instance, a cognitive objective might involve interpreting Qur'anic verses relevant to ethical decision-making, an affective objective could focus on showing empathy in social interactions, and a psychomotor objective might measure the correct performance of ablution or prayer. By aligning assessment items—whether in conventional or CBT formats—with these objectives, educators ensure that the measurement process is valid, reliable, and representative of the full scope of Islamic education aims. This alignment also allows for both formative assessment (monitoring ongoing progress) and summative assessment (evaluating mastery at the end of instruction).

Based on the measurement theory perspective, the adoption of modern assessment models such as Item Response Theory (IRT) and Performance-Based Assessment (PBA) can significantly enhance the accuracy of measuring PAI learning achievement. IRT allows for more precise estimation of student ability by accounting for the difficulty and discrimination levels of each test item, while PBA enables the evaluation of complex competencies such as moral reasoning or application of Islamic jurisprudence in real-life scenarios. When combined with technology-enhanced assessment tools—such as Computer-Based Testing (CBT)—these approaches facilitate data-driven analysis, immediate feedback, and adaptive testing tailored to individual student levels. This integration ensures that the measurement of PAI learning achievement is not only empirically sound but also aligned with the pedagogical goal of producing knowledgeable, ethical, and practicing Muslims.

B. METHOD

This study employed a quantitative approach with a descriptive–correlational design. The purpose of this design was twofold: (1) to determine whether the implementation of Computer-Based Testing (CBT) was successful at *SMP Islam Sawahan*, and (2) to examine the relationship between CBT usage and learning outcomes in Islamic Religious Education (PAI). Primary data were collected through two instruments: a closed-ended questionnaire and an objective test. The questionnaire was designed to measure students' perceptions of CBT effectiveness, while the test quantitatively assessed PAI learning achievement.

The study involved ninety Grade VIII students from *SMP Islam Sawahan Turen* during the 2024/2025 academic year, all of whom participated in PAI classes and completed assessments via the CBT system. To ensure adequate representation from each class, proportional stratified random sampling was applied. The sample was proportionally drawn from three different classes, with the number of respondents in each class determined according to its student population size.

In the context of this research, the dependent variable refers to the variable whose changes are influenced by another variable—in this case, PAI learning

achievement. The independent variable is the factor presumed to influence changes in the dependent variable—in this study, the application of Computer-Based Testing (CBT). These variables were measured to determine whether variations in CBT implementation correlated with differences in PAI achievement levels.

Quantitative descriptive analysis was used to process data from field trials, small group trials, and expert evaluations. Data sources included validators (subject-matter experts and media experts) who provided expert judgments, as well as teacher responses to the use of web-based assessment tools, collected through questionnaires based on the study's formulated research questions. Questionnaire responses were analyzed and interpreted using predetermined success criteria outlined in interpretation guidelines. The results were subsequently compared to these benchmarks to determine the extent to which CBT met effectiveness standards. Data analysis employed the following formula:

1. Validity Testing

The validity test was conducted to determine the extent to which an instrument can accurately measure the development of basic computer testing skills in evaluating Islamic Religious Education (PAI) learning achievement. In this study, validity testing was performed on a sample of ninety respondents with a significance level (α) of 5% or 0.05.

Meanwhile, to obtain the r-table value, the degrees of freedom were calculated as $df = N - 2 = 90 - 2 = 88$, resulting in an r-table value of 0.207. An item is considered valid if the calculated r value (r-count) exceeds the r-table value ($r\text{-count} > r\text{-table}$) and the p-value (significance) is less than 0.05.

The statistical instrument used for this test was the Pearson Product-Moment Correlation formula, implemented using IBM SPSS Statistics version 25. This method was chosen due to its suitability for determining the strength and direction of the linear relationship between each test item score and the total score, thus ensuring the construct validity of the assessment too.

Table 1. All Variable Validity Testing

No.	Items	R. Counting	R. Table	Description
1.	P1	0.584	0.207	Valid
2	P2	0.570	0.207	Valid
3	P3	0.614	0.207	Valid
4	P4	0.565	0.207	Valid
5	P5	0.493	0.207	Valid
6	P6	0.558	0.207	Valid
7	P7	0.626	0.207	Valid
8	P8	0.613	0.207	Valid
9	P9	0.597	0.207	Valid
10	P10	0.681	0.207	Valid

Source: IBM SPSS Statistics version 25

Based on the table above regarding the use of the computer-based testing method in the assessment of Islamic Religious Education to effectively measure learning achievement, all items were found to be significant, as the obtained correlation

coefficients exceeded the r-table value of 0.207. Therefore, there was no need to modify or remove any of the statements.

2. Reliability Testing

The reliability test was conducted to determine the consistency of the measuring instrument when applied repeatedly to the same object. In other words, reliability testing aims to indicate the extent to which measurement results remain consistent when the assessment is administered two or more times. A reliability coefficient below 0.6 is generally considered poor, a value of 0.7 is acceptable, and a value above 0.8 is regarded as good.

Based on the calculation of Cronbach's Alpha using SPSS version 25, the reliability coefficient obtained in this study was as follows:

Table 2. All Variable Reliability Testing

Reliability Statistics	
Cronbach's Alpha	N of Items
.793	10

The table above indicates that each statement variable has a value that can be categorized as significant or acceptable, as all values exceed the Cronbach's Alpha threshold of 0.6.

C. RESULT AND DISCUSSION

This study examined the implementation of Computer-Based Testing (CBT) and analyzed the relationship between its application and learning achievement in Islamic Religious Education (PAI) at SMP Islam Sawahan Turen. The research findings were obtained through two primary instruments: a student perception questionnaire and a PAI learning achievement test. Data were analyzed using both descriptive and correlational quantitative approaches.

1. Description of Students' Perceptions of CBT Effectiveness

The questionnaire consisted of 10 closed-ended statements designed to measure students' perceptions of the effectiveness of CBT. Each item was scored using a Likert scale ranging from 1 to 5. The results of the data analysis indicated that the average student perception of CBT effectiveness fell within the high category.

Table 3. Average Student Perception Score on the Effectiveness of CBT

No.	Items	Average Score	Description
1.	P1	4.26	High
2	P2	4.18	High
3	P3	4.32	High
4	P4	4.12	High
5	P5	4.05	High
6	P6	4.22	High
7	P7	4.34	High
8	P8	4.29	High
9	P9	4.19	High

As shown in Table 1, all items obtained an average score above 4.00. The highest-scoring item was P10 (4.38), while the lowest was P5 (4.05). These results indicate that students generally responded positively to the implementation of CBT in the assessment of Islamic Religious Education (PAI).

2. Description of Islamic Religious Education (PAI) Learning Achievement Test Results

The learning achievement test consisted of 25 objective items designed to assess students' cognitive abilities in Islamic Religious Education (PAI) material. The individual scores were aggregated on a scale ranging from 0 to 100. The following presents the statistical summary of students' test results.

Table 4. Descriptive Statistics of PAI Learning Achievement Test Scores

No.	Statistics	Score
1.	N (Number of Students)	90
2	Maximal Score	92
3	Minimum Score	63
4	Average	78.44
5	Standard Deviation	6.89

From the 90 students who took the test, the mean score was 78.44. The highest score achieved was 92, while the lowest was 63. The standard deviation of 6.89 indicates a variation in learning outcomes among students that remains within the normal range.

3. The link between CBT Effectiveness and Learning Achievement

To address the second research question, namely the correlation between perceived CBT effectiveness and PAI learning achievement, a Pearson Product-Moment correlation test was conducted. The results of the correlation analysis are presented in the following table:

Table 5.

No.	Variable	r. counting	Sig. (2-tailed)
1.	Persepsi Efektivitas CBT	0.531	0.000
2	Capaian Pembelajaran PAI		

The analysis results show a correlation coefficient (r) of 0.531 with a significance value of 0.000 ($p < 0.05$). This indicates a strong positive relationship between students' perceptions of effective CBT and their learning achievement in PAI. Further analysis and interpretation of these findings will be discussed in the discussion section.

The findings of this study indicate that the implementation of the Computer-Based Testing (CBT) system in the assessment of Islamic Religious Education (PAI) at SMP Islam Sawahan Turen has been largely successful in terms of effectiveness, both from the perspective of students' perceptions and their cognitive achievement scores. These results reinforce the theoretical argument within the framework of digital constructivism, which posits that educational technology serves not merely as a tool but as a medium for cultivating meaningful learning experiences (Jonassen, 1999).

The high average score of students' perceptions toward the effectiveness of CBT reflects a positive response to the digitalization of evaluation within the Ministry of Education context, even when applied to religious education. This finding aligns with Hajri (2023), who argued that CBT enhances active and reflective student engagement, while also enabling more personalized and immediate assessment. The strengths of CBT—such as adaptive testing, automated scoring, and rapid feedback—contribute to deeper student involvement compared to conventional paper-based testing methods.

The relatively high average learning achievement score (78.44) further demonstrates that CBT can effectively accommodate the measurement of cognitive learning objectives. This outcome supports the findings of Wahyudi et al. (2025), who concluded that CBT improves the accuracy and efficiency of learning evaluations, particularly in the cognitive domain. However, it is important to note that while CBT performs well in capturing cognitive outcomes, it faces challenges in measuring the more complex affective and psychomotor domains. This limitation is consistent with Ghufon et al. (2023), who emphasized that developing CBT systems for religious education requires innovation to more comprehensively capture spiritual and attitudinal dimensions.

The Pearson correlation analysis revealed a statistically significant positive relationship between students' perceptions of CBT effectiveness and their PAI learning achievement ($r = 0.531$, $p < 0.05$). This finding has important implications, as it supports the hypothesis that a positive perception of assessment technology can directly contribute to academic achievement. The result resonates with the Technology Acceptance Model (Davis, 1989), which asserts that perceived usefulness and ease of use influence users' intention to adopt technology, thereby affecting learning performance.

In the context of PAI, this connection signifies the successful integration of religious values with digital media—two domains often perceived as opposing forces. Miftahudin et al. (2025) previously underscored the importance of digitalizing religious education to maintain its relevance in a rapidly evolving era. The present study extends this understanding by demonstrating not only enhanced relevance but also measurable improvements in learning achievement.

When compared to Kunaifi and Wahyudi (2024), the findings reveal a shared consensus regarding user readiness and positive perceptions of CBT. However, the present study contributes further by employing a quantitative correlational approach that empirically tests the relationship between perception and achievement. Previous studies have tended to focus more on technical design or user satisfaction with the CBT interface. Thus, the theoretical contribution of this study lies in reinforcing CBT's status

not only as an effective technical development but also as a pedagogically influential tool that impacts student learning outcomes in the context of Islamic education.

Therefore, these findings also highlight the need for a hybrid approach in PAI assessment, particularly for the affective domain, which cannot be fully captured through objective digital testing alone. This is critical because religious education aims not only to develop cognitive skills but also to nurture good character and moral integrity. Future CBT development for PAI should therefore incorporate supplementary instruments such as observation checklists, digital reflective journals, or value-based e-portfolios to create a more comprehensive assessment system.

CONCLUSION

The results of this study demonstrate that the implementation of Computer-Based Testing (CBT) in the assessment of Islamic Religious Education (PAI) at SMP Islam Sawahan Turen is both effective and positively received by students. The high average perception score, coupled with strong cognitive achievement outcomes, confirms that CBT can serve as a reliable and efficient evaluation tool in a religious education context. The positive correlation between students' perceptions of CBT effectiveness and their learning achievement further reinforces the argument that well-designed digital assessment systems can enhance learning outcomes by increasing engagement, providing timely feedback, and facilitating adaptive evaluation.

Despite these encouraging findings, the study also acknowledges the limitations of CBT in assessing the more complex affective and psychomotor domains inherent in PAI. As such, a hybrid assessment approach is recommended, integrating objective digital tests with complementary methods such as observational assessment, reflective journals, and value-based e-portfolios. This combined strategy would ensure that the holistic objectives of Islamic education—encompassing cognitive mastery, moral character, and spiritual values—are more comprehensively measured and supported.

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