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Challenges and solutions for the implementation of computer-based test learning evaluation at SMKN 2 Bandung

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ABSTRACT

This article explores the implementation of Computer-Based Testing (CBT) as a summative assessment method at SMK Negeri 2 Bandung, aiming for success and sustained benefits in the Indonesian education system. CBT includes diverse question formats, from multiple-choice to interactive simulations. The research objectives are: (1) describing CBT planning as a learning evaluation, (2) explaining CBT execution to enhance students' honesty in final exams at SMKN 2 Bandung, and (3) analyzing CBT results as a learning evaluation of students' honesty. This study delves into dimensions, context, and meanings related to the research subject using a qualitative approach with a descriptive method through interviews and surveys. Descriptive methods outline emerging characteristics and behaviors in the research context. This research enriches understanding of Information and Communication Technology's (ICT) role in educational transformation and proposes effective learning evaluation measures leveraging technology. The integration of CBT reflects a progressive step toward advancing education assessment methodologies.

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ABSTRAK

Artikel ini membahas penerapan Computer-Based Testing (CBT) sebagai metode penilaian sumatif di SMK Negeri 2 Bandung, dengan harapan keberhasilan dan manfaat berkelanjutan bagi sistem pendidikan Indonesia. CBT mencakup variasi pertanyaan, mulai dari pilihan ganda hingga simulasi interaktif. Tujuan penelitian ini adalah mendeskripsikan perencanaan dan pelaksanaan CBT untuk meningkatkan kejujuran peserta didik dalam ujian akhir semester di SMKN 2 Bandung, serta menganalisis hasil CBT sebagai evaluasi pembelajaran terhadap kejujuran peserta didik. Penelitian ini menggunakan pendekatan kualitatif dan metode deskriptif dengan wawancara dan survei. Pendekatan ini dipilih untuk mengeksplorasi dimensi, konteks, dan makna terkait subjek penelitian. Metode deskriptif digunakan untuk menguraikan karakteristik dan perilaku dalam konteks penelitian. Pentingnya penelitian ini terletak pada kontribusinya terhadap pemahaman peran Teknologi Informasi dan Komunikasi (TIK) dalam transformasi pendidikan, serta usulan langkah-langkah evaluasi pembelajaran yang efektif melalui teknologi. Integritas CBT mencerminkan langkah progresif menuju pengembangan metodologi penilaian pendidikan.

Kata Kunci: *Evaluasi; penilaian sumatif; tes berbasis komputer*

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INTRODUCTION

The use of Information and Communication Technology (ICT) in the Indonesian education sector has been regulated since 2007. The latest regulation governing this, namely Permendikbud Nomor 22 Tahun 2016 concerning Standards for Primary and Secondary Education Processes, explains that one of the principles applied in learning is to optimize the use of ICT to achieve learning effectiveness and efficiency. The integration of ICT in the Rencana Pelaksanaan Pembelajaran (RPP) is a critical component of this pedagogical approach. In addition to emphasizing the interests of students and the integration of fundamental competencies, the development of RPP must also take into account the implementation of ICT in integrated, systematic, and effective learning methods that are adapted to existing circumstances and conditions.

The rapid advancements in technology have also precipitated a shift in the demands of the global job market. Businesses that previously relied heavily on labor are now shifting toward greater reliance on capital through certain forms of automation. Consequently, SMK, which is predicated on the demands or needs of the job market, faces heightened challenges in preparing the competencies of its graduates. One such example is the Office Administration program, which has undergone significant changes due to the advancements in Information and Communication Technology (ICT). This program has since been renamed Office Automation and Management, a title reflecting its adaptation to changes in the workplace. This change indicates that education must adapt to shifting demands in the labor market by modifying its underlying principles and structures. Administrative activities that were previously paper-based have undergone a transition toward technology-related tasks. This modification has been identified and incorporated into the curriculum framework. Specifically, all Office Administration Competency Subjects have been progressively aligned with and contingent upon ICT (Utami & Purnama, 2023).

Weekly learning activities. The second summative evaluation is conducted after the activities have been completed within a semester (Mauliansyah *et al*., 2023). The present study elucidates pertinent information concerning the implementation of computer-based exams as a learning evaluation instrument within the context ofSekolah Menengah Kejuruan (SMK). The present article focuses on summative evaluation at SMKN 2 Bandung, with the author presenting several challenges faced in implementing computer-based exams. The evaluation of a learning activity is of paramount importance, as it serves as a gauge of the comprehension of the recipients of learning materials. In this context, evaluation is synonymous with assessment or measurement. Assessment is defined as a systematic and continuous process or activity that involves the collection of information regarding the learning process. This information is then used to make decisions that are based on specific criteria and considerations. The government has established Content Standards to achieve Graduate Competency Standards as the national education goal, based on the Peraturan Menteri Pendidikan dan Kebudayaan Nomor 21 Tahun 2016 concerning Content Standards for Primary and Secondary Education. Standard instructions serve as a reference for educators to understand what materials or equipment should be placed in the classroom. Furthermore, it is imperative to comprehend the level of proficiency necessary to ensure the successful cultivation of graduates who are equipped with the requisite competencies for their respective academic disciplines (Firdaus *et al*., 2022). Evaluation can be conducted in

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two forms: formative and summative. An evaluation of the formative nature is conducted at the conclusion of each phase.

Education is the fundamental element that enables individuals to prepare for a prosperous and secure future. In the contemporary digital era, information technology continues to play an instrumental role in enhancing the manner in which we acquire knowledge and develop our intellectual aptitudes. The present state of technological innovation in educational institutions is characterized by the exclusive utilization of computer-based testing, occasionally referred to as computer-based assessment (CBT). The integration of CBT within the teaching methodology has been demonstrated to yield a number of advantages for students, including enhanced efficiency in time management, increased accuracy in assessments, and a more interactive learning environment. However, the implementation of CBT also poses certain challenges, particularly in the context of summative learning evaluation at Sekolah Menengah Kejuruan Negeri 2 (SMKN 2) Bandung.

The implementation of Computer-Based Testing (CBT) signifies a progression towards a more efficient and inclusive future for education. However, to ensure the successful implementation of CBT in summative assessments at SMKN 2 Bandung, a meticulous plan must be formulated, extensive training must be administered, and innovative solutions must be devised to address the challenges that inevitably arise. The successful implementation of CBT, and the subsequent sustainable benefits it can provide for the education system, is contingent upon collaboration between the school, teachers, students, and other relevant parties. Summative assessment evaluations have the capacity to provide a comprehensive picture of student achievement (Ernawati *et al*., 2022). The employment of variations in this evaluation facilitates the attainment of a comprehensive understanding of students' learning, encompassing their knowledge, skills, and practical abilities. This multifaceted approach ensures that an accurate assessment of students' progress toward the established learning objectives is obtained.

A salient challenge pertains to the absence of adequate facilities and infrastructure conducive to computer-based examination administration. In this context, it is imperative for educational institutions to ensure that all students have equal access to computers and reliable internet connections. Furthermore, training is imperative for educators and school personnel to ensure proficiency in the management and implementation of computer-based exams. The article goes on to explore potential solutions to these challenges. One of the proposed solutions is to facilitate cooperation between schools and relevant parties, such as local governments and other educational institutions. This collaborative endeavor is anticipated to facilitate the acquisition of the necessary facilities and infrastructure to implement computer-based examinations.

LITERATURE REVIEW

Purpose of Learning Evaluation

In general, the purpose of evaluation in learning is divided into two parts (Mertasari, 2022), namely:

1. To collect information that will be used as a measure of the progress or advancement experienced by students after they have undergone a learning process for a certain period

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of time. In other words, the general purpose of evaluation in education is to obtain evidence that will serve as an indicator of the level of ability and success of students in achieving curricular objectives after they have undergone a learning process for a specified period of time.

2. The objective of this study is to determine the effectiveness of the teaching methods employed in the learning process over a specified period of time.

The objective of evaluation is to obtain precise data from students to ascertain their learning progress and the efficacy of the teaching methods employed in the teaching and learning process. The implementation of the evaluation function in the teaching and learning process is a matter that must be addressed with utmost urgency. The evaluation process constitutes an integral component of the educational paradigm within a madrasah, wherein the teaching and learning process represents the primary academic undertaking (Rindawan *et al*., 2023).

M. Athiyah Al-Abrasyi states that the fundamental purpose of evaluation is to ascertain the extent of students' comprehension of the subject matter. This evaluation process is intended to instill courage in students and to prompt them to recall the material that has been taught. Additionally, it serves to assess the extent of behavioral changes that have occurred. Furthermore, the evaluation program is implemented with the objective of identifying students who demonstrate high intelligence and those who require additional support, with the intention of providing targeted attention to the latter to facilitate their development (Muthoharoh, 2019).

Summative Evaluation

According to Dewi dan Dailami (2020) Summative evaluation is defined as an evaluation that is conducted at the conclusion of each unit of time, encompassing multiple subject matters, with the objective of ascertaining the extent to which students have demonstrated an ability to progress from one unit to the next. Summative evaluation is defined as the measurement of the final competence of the subject or the achievement of learning objectives. The evaluation results are utilized for the purpose of providing feedback to the users of the model or method, as well as for the development of evaluation measurement tools (Ličen et al., 2023). Revisions are made on the basis of evaluation results or unmet needs that cannot be addressed by the new model or method (Ismail *et al*., 2019). In certain instances, summative evaluation is not accorded sufficient attention within the curriculum. (Yildirim et al., 2023).

Summative evaluation, according to Mayasari (2021) can be divided into: 1) Outcome evaluations, defined as the process of assessing whether a program or technology exerts a quantifiable influence on predetermined target outcomes; 2) Impact evaluations, form of evaluation that is broader in scope and assesses the overall impact—both intended and unintended—of a program or technology as a whole; 3) Cost-effectiveness and cost-benefit analysis, instrumental in addressing inquiries pertaining to efficiency by means of standardizing outcomes in terms of costs and dollar value; 4) Secondary analysis, process of reexamining existing data to address novel inquiries or to employ methodologies that were not previously utilized; 5) Meta-analysis, methodological approach that involves the integration of outcome estimates from multiple case studies to formulate a comprehensive assessment or summary of the evaluation question. Salim dan Utama (2020) developed a

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summative evaluation design that incorporates the establishment of criteria for selecting the optimal learning media, encompassing the following aspects: compatibility with teaching materials, alignment with student profiles, congruence with student learning style preferences, and congruence with the availability of supporting facilities.

Computer-Based Test

Computer-based Test (CBT) is a test/evaluation conducted using a computer. The characteristics of this test are similar to conventional tests, which use one test device for several participants with the same test length (fixed test length) (Syayasna *et al*., 2020). Computer-based testing, also known as CBT, is a method of testing that utilizes computers connected to a network and the internet. As Bull and McKenna expound in their book, "A Blueprint for Computer-Assisted Assessment, the term", CBT is defined as the utilization of computers in the testing process and the assessment of student learning outcomes (Alek *et al*., 2020). Testing and assessment of student learning outcomes can follow the standards and classifications formulated by Sultan (2023): 1) Diagnostic assessment, which is a test used to assess students' initial understanding of a subject; 2) Individual tests, which provide feedback to monitor students' learning progress, including their skills and understanding of a particular subject. This type of test often relies on objective questions (Objective Test); 3) Summative tests, which are used to measure and evaluate the level of student learning success in a specific area or field of study. The use of CBT in these tests also often involves objective questions.

Consequently, CBT has emerged as a pivotal instrument within the domain of educational evaluation, particularly in the context of diagnostic, individual, and summative assessments. The integration of technological advancements, such as computers and the internet, has facilitated the delivery of more efficient and accurate assessments. The present article will examine the concepts of validity and reliability. In this case, the focus will be on the question of how well computer-based tests measure the knowledge, skills, or specific characteristics that are intended to be measured. For instance, if a computer-based test is designed to assess mathematical problem-solving ability, its validity is contingent upon its ability to measure this specific cognitive skill, rather than other abilities.

Reliability is defined as the degree to which a measurement instrument provides consistent and stable results when utilized repeatedly on the same subject or sample. Reliability is defined as the precision and consistency of the results obtained from the instrument. For instance, if a computer-based test demonstrates consistent scores when retested on the same test takers, even if the test is administered at different times, then the test is considered to have high reliability. Achieving both validity and reliability in the design and implementation of computer-based tests is imperative.

The utilization of CBT is regarded as being highly appropriate, effective, and meaningful in the assessment of students due to its accuracy, well-designed content, style, and navigation, and usability. The acceptability rating, which measures the ability to accept or respond, is highly satisfactory. A considerable number of developments employing CBT have led to enhanced efficiency in the process of learning evaluation (Aquino, 2018).

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METHODS

The present study employs a qualitative methodology, adopting a descriptive approach that integrates interview and survey techniques to facilitate a more profound comprehension of the phenomenon under investigation. Qualitative methods were selected because they enable researchers to explore various dimensions, contexts, and meanings related to the research subject. The descriptive approach was utilized to meticulously delineate the characteristics, behaviors, and patterns that emerged in the context under investigation. To this end, interview techniques were employed to obtain firsthand insights from a sample of five teachers and students. Concurrently, surveys were disseminated to collect a more extensive set of data, thereby validating the findings derived from the interviews. The amalgamation of these methodologies is anticipated to yield a comprehensive understanding of the research topic under investigation. The research process entailed conducting interviews with a selected teacher from SMKN 2 Bandung. Furthermore, the interviews conducted for this study were carried out in two distinct methods. Initially, unplanned interviews were conducted, which entailed informal and spontaneous conversations with the informant. Secondly, scheduled interviews were conducted, with questions meticulously formulated in advance.

RESULTS AND DISCUSSION

Summative evaluation is a systematic process to determine whether learning objectives have been achieved (Fuadiy, 2021). The dissemination of valuable information through the evaluation of educational programs serves to enhance pedagogical practices, refine curricular content, and augment student engagement. Summative evaluation is a method of assessing the effectiveness of learning media by evaluating its alignment with learning content. This evaluation process emphasizes the practicality and efficacy of the media, as well as its ability to meet learning objectives. The efficacy of media is determined by its ability to assist students in achieving the anticipated learning outcomes. Furthermore, usability requirements encompass functionality, acceptability, and ease of use. Functionality is defined as the ability of a medium to perform its intended functions effectively. Acceptability, on the other hand, refers to the degree to which users find the medium agreeable (Mertasari, 2022).

Teachers frequently employ summative assessments to evaluate student learning achievement and progress. Summative assessment can also be defined as the administration of final exams at a designated time, encompassing some or all of the courses undertaken during a semester, even subsequent to graduation. Summative assessment is defined as an evaluation that utilizes scores or grades to ascertain students' academic performance. This evaluation is conducted subsequent to the completion of all preliminary knowledge and concepts. Summative assessment is a method of evaluating the final grades of a class or activity. Summative assessment is designed to record students' overall achievements in a specific way. Summative evaluations are typically administered at the conclusion of a given subject, midway through the semester, or at the end of the semester in conjunction with grade promotion decisions (Arzfi *et al*., 2022). In this study, summative evaluation will be conducted in the form of a final semester assessment (FSA).

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Summative assessment is defined as the process of synthesizing student achievement and is intended to provide a comprehensive report at the conclusion of a study program. Summative assessments do not directly impact learning; however, they can influence decisions that may have consequences for students' learning. The functions of summative assessment are manifold. They include the measurement of students' abilities and understanding, the provision of feedback to academic staff as a measure of learning success, accountability, and standards for monitoring academic staff, and the motivation of students (Magdalena *et al*., 2021). To increase student motivation, teachers must also improve their skills in developing evaluation methods, including summative evaluation (Labak & Blazetic, 2023).

In implementing summative evaluation, SMKN 2 Bandung is among the schools that have adopted a computer-based evaluation system, also referred to as CBT. CBT is a test that utilizes computers with internet access to automatically assess the user. CBT is a test that utilizes computers connected to a network and the internet. According to McKenna and Bull in their book titled, "A Blueprint for Computer-Assisted Assessment," computer-based testing (CBT) is defined as the use of computers in the administration of tests and the assessment of students' learning outcomes. The testing and assessment of students' learning outcomes are based on the following standards and classifications: (1) diagnostic assessment, a test conducted to determine students' prior knowledge of a subject, (2) individual testing, an assessment that provides feedback to monitor students' learning progress, skills, and understanding of a subject. The use of CBT in this type of test generally takes the form of questions (Putri & Rahayu, 2018).

In principle, the implementation of CBT is similar to the process of learning using a computer. CBT can be conducted in a computer lab connected to a network and system. There are several aspects that must be considered in the implementation of CBT, including the validity of exam participants, the question bank, and the CBT system itself. The advantages of CBT include allowing test takers to take the test at a time convenient for them, reducing the time required to grade tests and prepare written reports, eliminating logistical tasks such as the distribution and storage of paper-based tests, and enabling test takers to immediately know their results (Tarmidi *et al.*, 2023).

The Forms of CBT

The forms of CBT based on Mastuti (2016) consist of: 1) Open Mode. Individuals have the option of undertaking tests without the necessity of prior registration or supervision. These tests can be accessed directly via the internet and are typically presented in the form of games. 2) Controlled Mode. This test is similar to the open test and is unsupervised. However, this test is taken by registered participants. Each participant is allotted their own username and password, which grants them access to the test page. 3) Supervised Mode. There is a supervisor in this CBT format. The supervisor is responsible for identifying participants. The administrator provides assistance to participants in the process of logging in, thereby facilitating their participation in the test and ensuring its successful completion. 4) Managed Mode. The Managed Mode CBT format is administered centrally. The party responsible for organizing the test manages the test and trains staff to control the test process.

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At SMKN 2 Bandung, computer-based summative evaluation is utilized in a managed mode. Prior to the administration of the summative evaluation, examinees at SMKN 2 Bandung are provided with a username and password, which they are then instructed to utilize during the examination. Furthermore, examinees engage in a simulation of the examination process. At SMKN 2 Bandung, the computer-based summative assessment is administered via the examinees' smartphones, with the assessment being managed through an LMS (Learning Management System). An LMS (learning management system) is a software application designed for e-learning activities that can be accessed via the Internet (Jingga et al., 2021).

Learning Management Systems (LMS) are often used to meet educational needs as a form of innovation (Kim & Park, 2023). In recent years, educational institutions have increasingly adopted LMS as a medium for learning and interaction between educators and students. The utilization of LMS is hypothesized to augment students' interest in learning and familiarize them with technology. Furthermore, LMS has the potential to alleviate teachers' workload, including the administration of homework and quizzes. LMS can also assist teachers in evaluating students' assignments and quizzes. The implementation of LMS has even been initiated at the elementary school level, with the objective of familiarizing children with technology as a beneficial instrument. Interactions within the LMS have been shown to capture children's attention, thereby indirectly increasing their interest in the material presented through the LMS (Porto *et al.*, 2023).

Challenges in Applying the CBT Model to Students at SMKN 2 Bandung

The findings of observational studies conducted on educators at SMKN 2 Bandung indicate that the implementation of CBT in summative assessments continues to encounter difficulties. The initial challenge pertains to issues concerning network connectivity. The utilization of LMS software necessitates an internet connection for access, thereby rendering it inextricable from issues of connectivity. Problems with connectivity during the implementation of computer-based assessments can result in sudden interruptions to the exam page. These interruptions can cause feelings of panic and anxiety among exam participants. Another challenge associated with the implementation of CBT pertains to the honesty of exam participants in responding to questions. It has been observed that a significant number of test takers frequently access new browser tabs in order to seek answers to the questions they are presented with via the Google search engine. In subject exams that necessitate calculations, test takers also frequently employ calculators on their mobile phones. This practice is regarded as ethically questionable due to the infringement of the established guidelines by test takers, who engage in activities such as opening additional applications or utilizing calculators for computations.

The implementation of summative evaluation using CBT at SMKN 2 Bandung requires examinees to prepare their own devices to take the exam. This requirement can be a challenge for examinees who do not have their own devices. However, the staff at SMKN 2 Bandung have also provided a solution to this challenge. SMKN 2 Bandung provides computers that can be used by examinees who do not have their own devices.

A subsequent evaluation of the exam's implementation was conducted by teachers and staff at SMKN 2 Bandung following the implementation of computer-based summative evaluation.

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This evaluation was based on observations and interviews with teachers. This evaluation was conducted to address issues that emerged during the implementation of the CBT. Consequently, the challenges encountered during the implementation of computer-based summative evaluation can be addressed and prevented from recurring in future exams. In addressing the challenges related to internet connectivity, the existing internet network system at SMKN 2 Bandung was updated, according to the results of interviews with teachers and staff. These updates entailed the implementation of a dedicated internet network, thereby ensuring that exam participants were constrained to accessing the examination page and precluding access to any external, non-examination related web content. Consequently, these issues can be mitigated in subsequent CBT implementations.

In addressing the challenge of exam participants' honesty in answering questions, according to interviews with teachers and staff at SMKN 2 Bandung, teachers and staff conducted evaluations to reduce cheating in future exams. A potential solution to the issue of exam cheating was proposed as a means to reduce such behavior: teachers were advised to increase their oversight of students during the examination. Furthermore, the IT staff are developing an LMS system to prevent examination cheating. Based on previous research conducted by Prasetyadi (2023), to address issues related to cheating in computer-based exams, randomization of exam questions can be achieved using simulation and the Multiplicative Random Number Generator algorithm.

As an evaluation system, CBT exhibits both advantages and disadvantages. CBT possesses advantages that paper-based tests lack. The merits of CBT are evident in its automated scoring mechanism and the convenience it offers test takers. CBT has been demonstrated to simplify the distribution, administration, and management of exams, thereby reducing the workload of teachers or exam supervisors. The CBT system incorporates security features designed to safeguard the integrity of the testing process and mitigate the probability of cheating. CBT enables students to undertake the examination at a time and location that is convenient for them, obviating the need to attend a designated testing site. However, a notable disadvantage of CBT is its reliance on stable and reliable technology, which renders it vulnerable to disruptions caused by software or network issues. Despite the security features implemented in the CBT, the potential for cheating remains constant in the absence of adequate supervision during testing. Collaboration among test-takers in an unsupervised testing environment or attempts to circumvent the testing process are prime examples of this potential for cheating (Sultan, 2023).

In accordance with the interviews conducted with educators at SMKN 2 Bandung, the implementation of LMS-based CBT in summative assessments has been demonstrated to be highly effective. This method is characterized by its expedited process of question creation and scoring, thereby facilitating the execution of duties by educators. LMS-based CBT has advantages in terms of scoring because teachers set the scores in advance and determine the minimum criteria. This system has been shown to facilitate the process of scoring, thereby reducing the potential for human error. The automated nature of the assessment process, which utilizes computers or Android devices, contributes to the efficiency and accuracy of the evaluation process.

According to educators at SMKN 2 Bandung, the implementation of CBT has been demonstrated to minimize the occurrence of correction errors, as all assessments are

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conducted automatically via computer or Android devices. The implementation of CBT for examination purposes eliminates expenditures associated with printing and duplicating questions, as this system necessitates only the use of computers or Android devices by students for exam administration. CBT does not necessitate the utilization of paper as an examination medium, thereby reducing the consumption of paper resources. This contributes to environmental sustainability by decreasing the amount of paper used.

CONCLUSION

Summative learning assessment is defined as an evaluation activity that yields scores or grades, which are subsequently utilized to ascertain student performance. This evaluation activity is conducted subsequent to the completion of a learning experience unit or the entirety of the course material. Summative assessment is a method employed to determine the classification of awards at the conclusion of a course or program. The implementation of CBT at SMKN 2 Bandung is regarded as a significant step towards a more efficient and inclusive future of education. However, the implementation of these measures is encumbered by several challenges, including the availability of facilities and infrastructure, the training of teachers and school staff, and the necessity for implementable solutions. Solutions to address these challenges include thorough preparation, training, and competency development for educators, as well as outreach to students and parents about the benefits and use of CBT. The implementation of summative learning assessment and the integration of CBT are pivotal in enhancing the quality of education in Indonesia. Consequently, constructive efforts from the government, educational institutions, and society are imperative to address challenges and optimize the implementation of CBT in summative learning assessment. In order to address these challenges, SMKN 2 Bandung should implement solutions such as updating network infrastructure, enhancing exam security, and providing intensive training to teachers and school staff. Conducting research related to the development of a more advanced and responsive computer-based exam security system is expected to contribute significantly to improving the effectiveness and sustainability of computer-based exam implementation at SMKN 2 Bandung. The results of this research can be used as a reference for other schools in Indonesia.

AUTHOR'S NOTE

The authors declare that there are no conflicts of interest related to the publication of this article. The authors confirm that the data and content of the article are free from plagiarism.

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