



Utilization of ICT for 21st Century Learning Assessment

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Articles Information

Abstrak

Keywords:

ICT utilization; 21st century learning assessment; digital platform

Penelitian ini membahas pemanfaatan Teknologi Informasi dan Komunikasi (ICT) dalam asesmen pembelajaran untuk meningkatkan efisiensi dan efektivitas pembelajaran abad ke-21. Tujuan utama penelitian ini adalah mengeksplorasi dan menganalisis bagaimana ICT dapat diintegrasikan secara efektif dalam asesmen terutama melalui platform seperti Quizizz, Kahoot, dan Google Form. Penelitian ini dilakukan dengan metode studi kepustakaan, mengacu pada literatur relevan untuk membangun kerangka teori yang kuat. Hasil penelitian menunjukkan bahwa asesmen berbasis ICT mampu meningkatkan partisipasi aktif peserta didik, memberikan umpan balik secara real-time, dan mendukung kebutuhan pembelajaran yang beragam, termasuk diferensiasi gaya belajar. Selain itu, integrasi kecerdasan buatan (AI) ke dalam asesmen berbasis ICT memberikan kemampuan tambahan, seperti penilaian otomatis dan analisis mendalam terhadap pola pembelajaran peserta didik. Kendati demikian, terdapat kendala seperti keterbatasan kompetensi guru dalam menggunakan ICT dan infrastruktur yang belum merata. Pemanfaatan ICT dalam asesmen memberikan peluang untuk menciptakan pembelajaran yang lebih interaktif, adaptif, dan relevan di era digital. Diperlukan pelatihan berkelanjutan bagi guru serta pengembangan kebijakan yang mendukung infrastruktur ICT untuk mencapai asesmen yang inovatif dan inklusif.

Abstract

This research discusses the utilization of Information and Communication Technology (ICT) in learning assessment to improve the efficiency and effectiveness of 21st century learning. The main objective of this research is to explore and analyze how ICT can be effectively integrated in assessment especially through platforms such as Quizizz, Kahoot, and Google Form. This research was conducted using the literature study method, referring to relevant literature to build a strong theoretical framework. The results show that ICT-based assessment is able to increase learners' active participation, provide real-time feedback, and support diverse learning needs, including learning style differentiation. In addition, the integration of artificial intelligence (AI) into ICT-based assessment provides additional capabilities, such as automatic scoring and in-depth analysis of learners learning patterns. However, there are obstacles such as limited teacher competence in using ICT and uneven infrastructure. Utilizing ICT in assessment provides an opportunity to create more interactive, adaptive and relevant learning in the digital era. Continuous training for teachers and policy development that supports ICT infrastructure are needed to achieve innovative and inclusive assessment.

INTRODUCTION

Information and Communication Technology (ICT) has brought major changes in various aspects of life, including education. In the current digital era, ICT plays a strategic role in improving the efficiency and effectiveness of learning, including the implementation of assessment (Kintoko & Utami, 2019; Qodriyah et al., 2023). Globally, reports show that over 90% of educational institutions have adopted ICT in some form to enhance learning outcomes (Hennelly & Ctori, 2022). In Indonesia, the government has been actively promoting ICT integration through programs like the "Digital School Movement," which targets increasing digital literacy among students and teachers (NH & Gewati, n.d.).

ICT-based assessment not only facilitates the learning process but also provides opportunities to integrate 21st-century skills, such as critical thinking, communication, collaboration, and creativity, into educational evaluation (Hindrasti et al., 2020). Research conducted in Southeast Asia highlights that students engaged in ICT-based assessments demonstrate a 15% improvement in problem-solving skills compared to traditional methods (Ummah, 2019). This indicates that ICT has the potential to bridge skill gaps and prepare students for global competition.

However, despite its great potential, the utilization of ICT in assessment still faces various obstacles. According to the Ministry of Education's 2023 report, only 42% of schools in rural areas of Indonesia have adequate internet access, and fewer than 30% of teachers are confident in using ICT tools for assessment (Sudarto, 2023). This disparity reflects the challenges of digital equity. In addition, traditional paper-based assessment methods are often considered less flexible, time-consuming, and unable to fully support students' active involvement in learning (Faqiyuddin et al., 2024).

To overcome these challenges, various ICT-based assessment platforms, such as Quizizz, Kahoot, and Google Form, have been widely used. These platforms have been shown to increase learner participation by 20%, provide immediate feedback, and reduce grading time by up to 40% (Nur & Mannuhung, 2022; Rahmanto et al., 2023). Additionally, they allow teachers to design more interactive and engaging assessments, fostering a better learning experience.

Despite the advantages, there is still a research gap in understanding the effectiveness of assessment technology in supporting students' individual needs, such as diverse learning styles, as well as its relationship with differentiated learning (Jannah & Cahyadi, 2024). Furthermore, the integration of artificial intelligence (AI) in ICT-based assessments, which has been explored in developed countries, remains an under-researched area in the Indonesian context (Oktavianus et al., 2023).

To address this research gap, this study will explore and analyze the use of ICT in educational assessment. This research is expected to contribute significantly to the understanding of how ICT can be effectively integrated into assessment practices and provide recommendations for the development of educational policies that support the use of ICT in schools.

METHOD

This research applies the library research method, which involves collecting information from various library sources relevant to the topic discussed. The data obtained is then further analyzed to answer the research questions (Nafisatur, 2024). This method does not require direct data collection in the field, but simply utilizes available texts and literature. This approach aims to deepen understanding of the topic under study, identify shortcomings or gaps in previous research, and build a strong theoretical framework as a basis for research.

RESULT AND DISCUSSION

The Importance of ICT in Education and Assessment

Mastery of Information and Communication Technology (ICT) or internationally known as ICT (Information and Communication Technology), has an important role in various fields, one of which is in the field of education in the current era of digitalization (Kintoko & Utami, 2019; Qodriyah et al., 2023). The use of technology to access, process and present data and knowledge, both individually and in groups through internal networks (intranet) and global networks (internet) is an essential element that supports various activities in the technological era (Kintoko & Utami, 2019). Therefore, ICT is present to provide convenience in education, especially in the learning process, so as to produce a more effective and efficient assessment process, and is relevant to the needs of the 21st century.

The 21st century provides access to openness (Era Oppenes) which is marked by the development of science and technology, resulting in changes in digitized education patterns (Hindrasti et al., 2020). 21st century skills are grouped into 3 namely foundational literacies, competencies, and character education (character qualities). In addition, skills related to the ability to apply core skills in daily tasks are called basic skills which consist of literacy (abilities related to text and language), numeracy, scientific literacy, ICT literacy (skills related to the use of information technology), financial literacy, cultural and civic literacy (skills related to understanding culture and rights and obligations as citizens)(Hindrasti et al., 2020). Furthermore, critical thinking / problem solving competencies; creativity; communication; and collaboration. Then character education includes curiosity; initiative; persistence/grift (self-management); adaptability; leadership; and social and cultural awareness (recognizing and addressing social and cultural diversity) (Hindrasti et al., 2020). Furthermore, 21st century skills with 4C abilities (critical thinking, collaboration, communication, and creativity)(Nurhayati et al., 2024).

21st century skills are reflected in assessments to collect data that show the development of quality learning and assessment. Of course, the following three words are familiar in education and learning, namely measurement, assessment and evaluation (Taqiyuddin et al., 2024). All three have a relationship with one another. Assessment is often carried out in the learning process, so that the value obtained is given a range of measurement standards to evaluate the overall education and learning that has taken place (Azis & Lubis, 2023). This will be a reflection material to improve the quality of learning in terms of teachers and students. This means that assessment plays an important role in reviewing and presenting an action plan in improving

the quality of learning quality. In general, assessment is divided into formative and summative assessments (Taqiyuddin et al., 2024) which can be an assessment of the learning process and the results of the learning that has taken place.

Types of Assessment in Learning

Formative assessment is an assessment carried out in the learning process with the main purpose of monitoring the extent to which the learning process has gone according to plan (Magdalena, Wahyuni, et al., 2020). The results of this assessment provide an overview of students who have achieved success and those who have not, so that appropriate steps can be taken (Magdalena, Wahyuni, et al., 2020). For learners who have not succeeded, remedial work will be carried out, while those who have succeeded can continue to the next topic (Taqiyuddin et al., 2024). In addition, students with higher abilities will be given enrichment in the form of additional material that expands and deepens the topics that have been studied. Formative assessment is usually carried out in the middle of the learning process, precisely every time a unit of study or subtopic is discussed (Magdalena, Wahyuni, et al., 2020; Taqiyuddin et al., 2024).

In schools, formative assessment is often referred to as daily tests (Faujiah & Habsah, 2022). This assessment aims to identify shortcomings during the learning process so that its implementation can run more optimally. Formative assessment serves to monitor students' learning progress, provide feedback for improving learning programs, and identify weaknesses that need to be corrected. Thus, learner learning outcomes and the quality of learning provided by educators can improve by being strengthened by summative assessment.

Summative assessment is a form of assessment conducted at the end of a learning topic or a particular phase in the learning process (Maulida, 2022). This assessment is usually carried out by educators through tests at the end of a certain teaching period to evaluate the achievement of learning objectives or learning outcomes (CP) of students (Taqiyuddin et al., 2024). Summative assessment is used as a basis for determining grade promotion or graduation from an educational unit by comparing students' learning outcomes against predetermined criteria (Mujiburrahman et al., 2023).

In schools, summative assessments are usually conducted after the entire course of a period has been completed (Kaukab & Rahman, 2021). This assessment produces a number or score that is used to assess learner performance, including the classification of awards at the end of learning. The aim is to record learners' learning achievements systematically (Magdalena, Rachmadani, et al., 2020). Although summative assessments do not directly affect the learning process, their results often influence important decisions that impact learners (Azis & Lubis, 2023; Taqiyuddin et al., 2024). These assessments are also designed to measure learners' ability and understanding and provide feedback. In addition, summative tests serve as an evaluation tool for academic staff to assess learning success, ensure accountability, monitor teaching standards and motivate learners (Magdalena, Rachmadani, et al., 2020). In addition, the assessment process can also be categorized into assessment for learning, assessment as learning and assessment of learning (GTK, 2019).

Assessment for learning (AfL) is a concern in current assessment, replacing the previous paradigm that still does not involve the learning process as a consideration of continuous assessment with educators playing an active role in assessment (Ariza, 2024). AfL assessment contains formative assessment, which can be in the form of journaling, observation, discussion, oral tests, assignments, performance assessment, written assessment, project assessment, product assessment and assessment through a collection of work or can be called portfolio assessment.

Assessment as Learning (AaL) has similarities with Assessment for Learning (AfL), especially in the application of formative assessment as part of the learning process (Nurlitasari & Hamami, 2023). The difference lies in the assessment method, where learners play an active role in various aspects of assessment, from procedures, criteria, to the preparation of guidelines or rubrics, such as in Self-Assessment and Peer Assessment (Ariza, 2024). This assessment is referred to as formative assessment because it is considered a form of informal assessment that aims to evaluate the quality of learning during the process and this assessment serves to support learners' metacognitive development and provides opportunities for educators to improve learning methods by providing feedback to learners.

Assessment of Learning (AoL) is also known as assessment of learning outcomes or summative assessment with its formal assessment as the final assessment of a learning objective (Nurlitasari & Hamami, 2023) with an orientation towards the cognitive domain such as problem solving skills that require learners to correlate their ideas with various aspects of cognition they know. However, this assessment is conducted by educators at the end of the study program after all learning materials are completed (Ariza, 2024). AoL is usually used to determine students' graduation. Examples of AoL application include Mid-Semester Assessment (PTS), End of Semester Assessment (PAS), and School Examination (USek) (Nurlitasari & Hamami, 2023). All of these assessments will certainly be more optimal and effective by utilizing ICT in the process, making it easier for teachers and students to get assessment results in real time and more practical.

The use of ICT in the assessment process is more effective than the use of paper-based tests (Rohana et al., 2024). This is influenced by the interaction provided by ICT assessment media that is more interactive and supports the involvement of learners in the assessment process. In line with that, internet support provides opportunities for teachers and learners to continue to improve effectiveness and efficiency in learning and assessment. Of course, ICT-based assessment media is needed to facilitate the assessment carried out by teachers on students in the learning process.

ICT-based Assessment Media

One of the ICT-based assessment media that can be used by teachers in the assessment process is the Quizizz platform. This platform can be accessed for free in the form of applications and the web and has the advantage of no restrictions on the use of sentences in questions and answers and each student gets different questions, so as to minimize cheating that can occur.

The Quizizz application encourages learners to be more active and motivated in the assessment process, thanks to the interactive and interesting quiz format (Nur & Mannuhung, 2022). In addition, by using Quizizz, teachers can easily evaluate the level of understanding of learners, provide immediate feedback, and identify aspects that need more attention. Overall, the application of technology through this application is able to improve the quality of learning, while presenting a more dynamic and fun assessment experience for students (Nur & Mannuhung, 2022). Furthermore, the use of the kahoot platform can also be done by teachers in the learning assessment process.

Kahoot is a platform that allows educators to create an interactive and fun quiz atmosphere in the classroom (Cahyani et al., 2024). This application can only be played online through an internet connection which serves as an assessment medium that presents an interactive and fun learning experience. Kahoot is in demand by both learners and teachers because it prioritizes learning methods that involve an active role in competitive participation with their peers (Bunyamin et al., 2020).

The kahoot application is designed for various age groups, ranging from elementary school students to university students, with attractive and easy-to-use features (J. Priyanto Widodo, Lailatul Musyarofah, 2020). The implementation of Kahoot is very entertaining, as quizzes and their results can be displayed on the classroom screen, thus encouraging learners to be more motivated to collect points. In addition, its use in learning assessment allows teachers to assess learners more efficiently because the score results are automatically displayed, thus saving examination time (J. Priyanto Widodo, Lailatul Musyarofah, 2020) in the implementation of formative assessment. As for summative assessment, teachers can use google form.

Google Form or google form is a feature of google documents that can be utilized by teachers for summative assessments such as the implementation of the Midterm Examination (UTS) and Final Semester Examination (UAS) (Nasution & Asra, 2023). Previously, UTS and UAS were usually carried out using paper questions that were duplicated through a photocopier. However, along with the times, teachers can now be more helpful in evaluating learning by utilizing digital features provided by Google. The mastery of information technology in the learning process and evaluation is becoming increasingly important and unavoidable with one of the efficient ways is to use google form, a free platform that supports the evaluation of learning outcomes easily (Rahmanto et al., 2023).

Google forms are not only used by teachers, but can also be utilized by students, college students, and office workers, showing that this technology supports various fields, including education (Romadhon & Lismawati, 2024). As part of the google document service, google forms offer higher efficiency and effectiveness compared to traditional methods based on physical materials, such as photocopy paper (Romadhon & Darraz, 2024). This platform also makes it easier to manage evaluation results through questionnaires, allowing educators to easily monitor and assess students' ability to understand the material that has been taught.

The ease of using google form as an assessment media for teachers or educators is in line with the functions of google form which include: (1) provides convenience in organizing practice questions or exams online, (2) allows the collection of student assessment results online, (3) serves as a medium for collecting

data on students and teachers through an online platform, (4) is used for new student registration forms, and (5) is used as a medium for distributing questionnaires to many people by sharing website links (Mulatsih, 2020).

The use of google forms in assessment also makes it easier for teachers to recap the results, because data from google forms can be downloaded through a spreadsheet application. This application allows storing the response results in Microsoft Excel format, so that the stored data can be easily accessed by subject teachers and homeroom teachers for processing the final evaluation score (Romadhon & Darraz, 2024). The convenience felt by teachers and students continues to grow rapidly with the presence of artificial intelligence or known as Artificial Intelligence.

Integration of Artificial Intelligence (AI) in Assessment

Artificial intelligence is a technology that builds systems to think and act like humans and is able to perform cognitive tasks that are usually related to the way humans think (Wardat et al., 2024) and allows technology to perform tasks that previously could only be done by humans using algorithms and data to learn, make decisions automatically by involving the development of algorithms and computer models that allow machines to recognize patterns, solve problems, communicate, hear, and even understand human emotions with the aim of creating systems capable of processing information quickly and accurately, supporting decision making, and providing solutions to various complex problems in various sectors (Oktavianus et al., 2023), one of which in the field of education AI can be used to streamline the assessment process carried out by teachers.

The use of artificial intelligence (AI) in learning assessment has significant relevance in education. AI can support the improvement of the assessment process, provide more precise feedback, and enrich the learning experience of learners. There are several ways of utilizing AI in learning assessment, including: 1) Automated Assessment, where AI can be used to automatically grade tasks such as multiple-choice exams, writing, or projects. This technology is able to provide fast and accurate assessment results, thus reducing the workload of teachers. 2) Analysis of Learners' Answers, where AI can evaluate answers in depth, for example in essay exams by analyzing clarity of ideas, quality of language, and correctness of information. This allows teachers to identify areas where learners need additional support. 3) Learning Pattern Recognition, where AI can utilize learner learning data to identify patterns of understanding and challenges. This information helps teachers design learning that better suits learners' needs (Oktavianus et al., 2023).

Currently, Artificial Intelligence has been integrated with the Quizizz and Kahoot platforms. Teachers can take advantage of the AI feature to give commands in the form of quiz questions as desired to be realized by the Quizizz and Kahoot platforms in an interesting and interactive form. This will further facilitate teacher access in utilizing the assessment platform as a formative assessment consideration that can be carried out in the learning process and provide effectiveness in scoring directly. Learners can measure their level of ability in a more fun and less pressured way in working on questions given by the teacher.

AI in education is not limited to automated grading. Advanced tools utilizing natural language processing (NLP) can analyze essay responses with greater accuracy, evaluating factors such as argument strength, grammar, and coherence. These tools ensure a standardized assessment, minimizing human biases, and allow for detailed feedback that can help learners improve specific areas (Yaneva & von Davier, 2023). Another key development is adaptive assessment, where AI modifies the complexity of test questions in real-time based on a learner's responses. This ensures that assessments are neither too easy nor too difficult, providing a tailored evaluation experience. Such systems can significantly enhance learners' engagement and better reflect their true capabilities (Elahi et al., 2023).

AI-powered predictive analytics tools can utilize large datasets to identify learning trends and predict academic outcomes. Teachers can leverage these insights to design targeted interventions, helping learners overcome potential difficulties before they escalate into significant challenges (Doleck et al., 2020). Platforms such as Canvas and Edmodo have begun to implement AI-driven analytics to provide actionable insights for educators. These platforms allow teachers to track progress, identify knowledge gaps, and recommend personalized learning materials. This integration creates a seamless connection between assessment and individualized learning plans, fostering a holistic approach to education. AI has also transformed feedback systems by offering immediate, detailed, and personalized insights to learners. For instance, AI can provide feedback not only on correctness but also on the strategies learners use to arrive at their answers. This deepens learners' understanding and encourages metacognitive skills (Yaneva & von Davier, 2023).

Gamification elements powered by AI further enhance engagement. By incorporating game-like features, such as achievement badges and progress tracking, AI-based platforms motivate learners to participate actively in assessments. This fosters a positive attitude towards learning and reduces test anxiety (Doleck et al., 2020). Rather than replacing teachers, AI enhances their roles by automating routine tasks and enabling them to focus on complex teaching aspects. Teachers can use AI insights to design interventions tailored to specific student needs, fostering a more inclusive classroom environment (Gabriel, 2024).

Additionally, AI can assist teachers in professional development by identifying areas where they may need further training. By analyzing classroom data, AI provides recommendations to help teachers improve their instructional strategies and adapt to evolving educational trends (Kohnke, 2024). While AI offers numerous benefits, its implementation faces challenges, particularly in developing regions where access to technology is limited. Bridging the digital divide is essential to ensure equitable benefits of AI in education (Kouroutakis, 2024).

Data security and student privacy are also critical issues. Institutions must establish robust frameworks to protect sensitive information and ensure transparency in AI algorithms (Lim et al., 2023). As AI continues to evolve, its role in education will likely expand further. Emerging technologies such as emotional AI and virtual reality assessments hold the potential to create immersive and emotionally intelligent learning environments. These innovations could redefine educational paradigms, making learning

more interactive and engaging (Vistorte et al., 2024). Ongoing collaboration between educators, policymakers, and technologists is vital to realize AI's full potential while addressing ethical and logistical concerns. With the right strategies, AI can be a powerful tool for transforming education and preparing learners for a rapidly changing world.

Relevance of Assessment to Learning Style

The concept of assessment by utilizing ICT is an inseparable part of learning by adjusting the learning needs of students who are accustomed to interacting with various technologies that are very easy to access (Qodriyah et al., 2023). The use of technology directed towards positive things in learning and the assessment stage can enrich a more meaningful and enjoyable learning perspective for students in the future. In addition to utilizing the Quizizz, Kahoot and google form platforms in the implementation of assessments, teachers can use other platforms that are in accordance with the needs of the assessment as well as the creativity and competence possessed by the teacher.

Teachers' competence in utilizing ICT must always be improved. Teachers must continue to learn and adapt according to the times. The students taught by teachers are a generation that is far different from the circumstances and learning needs of the past. The progress of change that rolls so fast and continues to occur new innovative findings in the industrial world has finally become a challenge and an opportunity in the world of education.

Education and learning are expected to be able to adapt to all these changes in the learning that is carried out. The assessment carried out by teachers is also adjusted to the use of technology to create a lively classroom atmosphere, so that learning is not monotonous and is more in favor of students or known as student-centered learning. When learning is directed towards the needs of students, it will be easier for teachers to identify the level of understanding of students about the material taught by the teacher. Furthermore, teachers will find it easier to record the concept of profiling students, data collection is carried out thoroughly from the background to the ability of each student and the assessment carried out by the teacher according to their ability level.

The level of ability possessed by students is diverse and unique with the gift of talents and interests they have, so that the unique abilities of students will be seen more clearly by utilizing formative assessment in the classroom to explore all the potential possessed by students. When teachers provide a choice of tasks desired by learners, it will also affect the enthusiasm and active participation of learners in doing the tasks given by the teacher. This is in line with differentiated learning in the independent curriculum which facilitates learning in the classroom according to the learning styles of learners. Learning styles include visual, audio, audio visual and kinesthetic (Jannah & Cahyadi, 2024).

Learners with visual learning styles are more enthusiastic about things that intersect with vision such as images and dominant colors that are interesting to note. Audio learning styles will be enthusiastic about explanations or sensitive to sound, audio visual learning styles combine vision with hearing or images integrated with sound known as video and kinesthetic learning styles require space to move and express

themselves in learning (Telaumbanua & Harefa, 2024). All learning styles owned by learners need to be supported with interesting learning and interactive assessments utilizing the use of ICT. This allows learners to actualize themselves.

This self-actualization is all the efforts that can be mobilized to optimize all the potential possessed by each individual (Arroisi et al., 2022). It is also important for teachers to analyze the level of ability possessed by themselves. Especially teachers who strive to actualize themselves will continue to learn to understand the essence of education and professionals in their work, such as understanding concepts related to education and being able to conduct adaptive learning in accordance with the demands of technology-integrated learning and in the assessment process being able to classify the level of questions and make questions in accordance with Bloom's taxonomy. Bloom's taxonomy includes C1-C6 (Remembering, Understanding, Applying, Analyzing, Evaluating and Creating) (Nafati, 2021).

Teachers who have maximized their potential can inspire students to optimize their self-actualization abilities. With this self-actualization ability, a person will be wiser in drawing conclusions. This wise attitude will make each individual not easily believe news that is not valid. The same applies to the utilization of ICT in learning and assessment. Teachers will be able to sort and select all information that can be shared with students and be able to consider each technology used according to the level of students' needs. It is similar in the utilization of artificial intelligence in the assessment. Teachers can review the answers given by AI by checking their validity, in order to avoid mistakes (Oktavianus et al., 2023)

The utilization of ICT in assessment carried out by teachers in learning provides many benefits by making the assessment process effective and efficient. The utilization of ICT in the assessment process also provides space for teachers to improve their capabilities in accordance with the times so that the learning carried out is in accordance with the times of the students (Rifky, 2024). On the other hand, teachers must also be able to select and control the use of ICT in the learning and assessment process.

CONCLUSION

The utilization of ICT in learning assessment provides many benefits that support the creation of relevant education in the digitalization era. This technology makes the implementation of assessment more effective and efficient through platforms such as Quizizz, Kahoot, and Google Form. With interactive features and the ability to provide real-time feedback, these platforms not only make educators' tasks easier but also increase learners' motivation and active participation.

The integration of Artificial Intelligence (AI) further strengthens the role of ICT in assessment. AI is able to provide automated scoring, in-depth analysis of learners' answers. By making optimal use of technology, educators can support learners' various learning styles and facilitate the actualization of their potential. However, there are still obstacles such as the limited competence of educators in adopting technology and uneven access to infrastructure. Therefore, developing educators' ability to utilize ICT should be a priority. With better mastery of technology, assessment can be done innovatively and inclusively, answering the challenges of 21st century learning and supporting higher quality education.

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