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Development of Automated Digital Assessment and Innovative Learning Design in Higher Order Thinking Skills (HOTS)

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Abstract

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This study aims to examine the strategic role of developing automated digital assessments and innovative learning designs in fostering students' Higher Order Thinking Skills (HOTS) in the digital era. The study was conducted through a literature review of 14 scientific articles published between 2019 and 2023. The results show that automated digital assessments, such as Quizizz, Google Forms, and AI-based platforms, provide efficiency in learning evaluation and are able to measure students' analytical, evaluation, and creative abilities in real time. On the other hand, innovative learning approaches such as the flipped classroom, project-based learning, and mobile collaborative learning have proven effective in increasing students' cognitive participation and critical thinking skills. The integration of the two creates a learning ecosystem that is synergistic, adaptive, and relevant to the demands of 21st-century education. This study recommends improving teacher competency, providing digital infrastructure, and developing a HOTS-based national assessment policy as a transformative strategy for future education.

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1. Introduction

In today's digital era, education is required to not only convey knowledge, but also foster higher order thinking skills (HOTS) in students. HOTS is becoming an important pillar in 21st century education because these skills enable students to think critically, solve problems, and innovate in the face of complex global challenges (Aryana et al., 2022). In the midst of technological advancements, traditional approaches in assessment and learning are no longer adequate to develop these competencies. Therefore, the development of automated digital assessments and innovative learning designs is very crucial as a strategic instrument in improving the quality of learning and encouraging HOTS.

The change in the learning paradigm has led to the strengthening of the role of technology as a catalyst for educational transformation. One form of such transformation is automated digital assessment, which is a technology-based learning evaluation that can assess students' cognitive abilities in an adaptive and real-time manner. Automated digital assessments not only make it easier for teachers to monitor student progress, but also allow for instant feedback that encourages reflection and self-improvement by students (Nazarudin, 2023). This system is able to present HOTS-based questions that include the ability to analyze, evaluate, and create flexibly and contextually.

In this context, innovative learning design also plays an important role as a vehicle for the formation of a learning environment that encourages the exploration and elaboration of ideas. Approaches such as Problem-Based Learning, Flipped Classroom, and Collaborative Mobile Learning have been shown to be effective in

increasing students' cognitive engagement. Innovative learning is designed to place students as active subjects in learning, while encouraging them to use a variety of HOTS skills integratively. With the support of technology, this kind of learning design can be developed in a more flexible and personalized way.

The adoption of digital assessments and innovative learning cannot be separated from the challenges that come with it, ranging from the readiness of technological infrastructure, the digital competence of educators, to the security and validity aspects of assessments. Research from Setiawati (2021) shows that HOTS-based assessments tend to not be optimal in their implementation due to the lack of training for teachers and the limitations of a truly adaptive platform. On the other hand, innovative learning design is often hampered by rigid curriculum and the administrative burden of teachers.

Nonetheless, the great potential of the development of automated digital assessments is seen in recent studies that combine learning analytics, gamification, and artificial intelligence. The use of platforms such as Quizizz, Google Form with automation scripts, and AI-based LMS has shown success in measuring and growing HOTS at various levels of education (Putri & Dwijayanti , 2020). Game-based assessments, for example, have been shown to be more effective in building intrinsic motivation and encouraging students' intellectual exploration.

Innovative learning design also shows a positive direction when supported by the integration between technology, pedagogy, and content (TPACK). This integration allows for more contextual learning and according to the individual needs of the student. One interesting approach is the use of flipped classrooms that change

the role of teachers from information centers to active learning facilitators, with more in-depth and meaningful learning outcomes.

Against this background, this study aims to examine various approaches to the development of automated digital assessments and innovative learning designs, as well as how these two aspects can synergize in encouraging the strengthening of students' high-level thinking competencies. The study was carried out using the literature study method on various recent research results, to formulate an integrative model that is relevant to current and future educational needs. The main focus is directed at the analysis of approaches, implementation, and challenges and opportunities that arise in the use of educational technology to support the achievement of HOTS effectively. This study is expected to make a theoretical and practical contribution in designing a digital-based evaluation and learning system, as well as providing guidance for educators, curriculum developers, and policymakers in developing educational strategies that are relevant to global competency demands.

2. Literature Review

The development of automated digital assessments and innovative learning designs has become an important focus in educational research, especially in improving higher-level thinking competencies (HOTS). A number of studies show that digital assessments provide a significant alternative in measuring students' abilities more flexibly and objectively. For example, research by Oktaviani (2022) developed a mobile collaborative learning-based learning model that integrates digital formative assessments, and has been proven to improve the HOTS abilities

of PGSD students. In a study using an e-assessment approach within a problem posing model, it was found that higher levels of question interactivity were positively associated with improvements in students' analytical skills.

In the context of learning design, the flipped classroom approach and project-based learning that integrates technology has proven effective. Flipped classrooms can increase active participation and deepen students' conceptual understanding. A study by Handhika et al. (2020) suggests that virtual labs and HOTS assessments can be combined in science learning to strengthen digital literacy and science at the same time. However, there are challenges in implementation, such as low digital literacy of teachers and lack of integration between pedagogic, technology, and content components (TPACK). Setiawati (2021) note that although HOTS assessments are available, many teachers still use traditional evaluation methods due to time and training limitations. These literature emphasizes that the synergy between assessment innovation and learning design is crucial to encourage HOTS systematically and sustainably.

3. Methods

This study uses a qualitative approach with the literature study method (library research) as the main basis in examining the topic "Development of Automated Digital Assessments and Innovative Learning Designs in Encouraging Higher Level Thinking Competency (HOTS)". Literature studies were chosen because they are suitable for analyzing the development of theories, concepts, and practices from the results of previous research that have been published in scientific journals,

proceedings, and academic reference books in the period 2019 to 2023. This method allows for an in-depth investigation of themes that are conceptual and applicative, as well as relevant to the dynamics of change in the world of digital education. The first step in this method is the identification and selection of relevant scientific sources from the Google Scholar platform using keywords such as "automated digital assessment", "HOTS", "innovative learning design", "e-assessment", "edtech", and "collaborative learning". The selection is carried out based on inclusion criteria, namely articles in Indonesian or English that have been published within the last five years, have full access, and explicitly discuss the development or implementation of digital assessments and HOTS learning approaches.

From the initial search results, 14 articles were obtained that met the criteria. These articles are then categorized in two main domains: (1) the development and effectiveness of HOTS-based automated digital assessments, and (2) the design and implementation of innovative learning that drives HOTS. The secondary data collection process is continued by systematically reading and recording the findings, methodologies, and conclusions of each study. Data analysis was carried out through a thematic approach, namely identifying patterns of findings from various articles which were then classified into themes such as automated assessment supporting technology, HOTS-based innovative learning models, implementation challenges, and synergy between assessment and learning. The content analysis technique is also used to examine the depth of theoretical and empirical studies of each article. The validity of the research is maintained through triangulation of sources, namely by comparing the results of various authors and different academic institutions.

Meanwhile, reliability is maintained through systematic documentation of the article search process and data logging. With this approach, it is hoped that a comprehensive and critical understanding of the direction, strategy, and implications of the development of automated digital assessments and innovative learning designs can be obtained in improving students' high-level thinking competencies in the digital era.

4. Results

The results of this literature review show that the development of automated digital assessments and innovative learning designs play a strategic role in improving students' higher order thinking skills (HOTS) in the digital learning era. A number of important findings indicate that the two approaches can not only stand alone, but have a stronger impact if integrated synergistically in a single comprehensive learning system. Technology-based automated digital assessments have been proven to be able to provide efficiency in the learning evaluation process and are able to measure aspects of high-level thinking such as analysis, evaluation, and creation more objectively and systematically. In a study conducted by Rahmawati and Hijriyyah (2023), the use of the Quizizz application in assessment showed an increase in student active participation and an increase in scores in the HOTS question category compared to conventional assessment methods. The assessments are designed in an educational game format that provides feedback automatically, allowing students to reflect on their mistakes directly and improve accuracy in logical and analytical thinking. Similar findings were reported by Purwaningrum and Wati (2023), who

developed a HOTS-based assessment instrument in the subject of Islamic cultural history. The instrument is designed to assess students' ability to understand the relationship between historical events, analyze cause-and-effect relationships, and evaluate the moral values of the events that occur. The use of technology in this assessment has been proven to reduce teachers' workload and increase the effectiveness of assessments.

In addition to efficiency, automated digital assessments also provide flexibility in question distribution, data collection, and real-time analysis of student learning outcomes. According to Ashari et al. (2023), digital assessments not only support summative assessments, but are also very effective in sustainable formative assessments. Teachers can easily monitor student progress, adjust learning strategies based on results, and provide individualized support without needing to wait for the end of the semester. However, some studies note that digital assessments are currently still dominated by multiple-choice questions and are not yet fully able to assess argumentation skills in the form of essays or open-ended projects. Yusuf et al. (2023) suggests the need to develop artificial intelligence based on natural language processing to support the assessment of open answers, although its implementation still requires training data and manual supervision to maintain accuracy.

Meanwhile, in terms of innovative learning design, approaches such as flipped classroom, problem-based learning (PBL), and project-based learning (PjBL) are increasingly popular to stimulate higher-level thinking skills. Flipped classroom provides students with the flexibility to access learning materials independently

through videos, podcasts, or digital modules before face-to-face sessions, so that time in class can be used for discussions, analysis practices, and problem-solving. This strategy has been shown to improve students' conceptual understanding and cognitive engagement, as well as provide a wider space for the development of HOTS. The project-based learning model has also received widespread attention. Oktaviani (2022) developed a PBL-based mobile collaborative learning model, in which students are tasked with solving real-world-based challenges through digital projects that are collaborated online. The results showed significant improvements in aspects of analytical skills, reflective thinking skills, and teamwork. This kind of design not only improves thinking skills, but also strengthens students' digital and social-emotional literacy.

Research by Ferdiansyah et al. (2023) shows that the use of Canva and interactive infographics as learning mediums allows students to transform knowledge into conceptual visualizations that encourage creative thinking and divergent thinking. This broadens the understanding that innovative learning does not have to be based on complex methods, but can also be realized through the use of simple digital tools designed with a HOTS orientation. In technology-based learning, the context of the task and the role of the teacher as a facilitator greatly determine the effectiveness of the strategy. Many studies emphasize that the success of innovative design is highly dependent on teachers' ability to design learning activities that are appropriate to students' cognitive levels and support the achievement of critical thinking competencies.

In much of the literature, it has been found that the integration between automated digital assessments and innovative learning designs results in a much stronger synergistic impact on the development of HOTS. Aryana et al. (2022) stated that a learning system that unites assessments and learning processes in one continuous cycle is able to form a deep conceptual understanding while encouraging students to apply knowledge in a real context. In practice, this integration is carried out through project-based assessments that take place during the learning process. For example, students are asked to analyze an environmental issue, develop data-based solutions, and present the results digitally, where the assessment is carried out using the digitally developed HOTS rubric. In this context, assessment becomes part of learning, not a separate entity. Nazarudin (2023) also showed that when digital assessments were given after exploratory activities based on group discussions, students showed better performance in answering questions that tested evaluative and synthesis skills.

Nevertheless, the challenges of implementing this integration cannot be ignored. Many teachers do not have adequate digital and pedagogic competencies to develop HOTS assessments that are integrated into learning. Setiawati (2021) noted that the majority of teachers in the 3T (Disadvantaged, Frontier, and Outermost) areas still rely on conventional methods and are not familiar with digital assessment platforms such as Google Form or Quizizz. This is exacerbated by limited internet access and adequate technological devices. To answer this challenge, Mahmudah and Bahtiar (2023) developed a HOTS-based e-LKPD with integrated usage instructions for teachers. The results of the implementation show that with the right modular

approach, teachers can quickly adapt and implement HOTS assessments and learning without having to go through complex training.

In terms of policy, government support in providing TPACK (Technological Pedagogical and Content Knowledge) training, the development of a national platform for adaptive digital assessment, and technical assistance in schools are very important to bridge the implementation gap. This effort has begun to be seen in various programs such as Merdeka Mengajar and Rumah Belajar, although there is still a need to improve in terms of content quality and personalization of assessments. Atmojo et al. (2023) stated that today's digital learning must be equipped with assessment data that is able to provide a longitudinal picture of student development and be used as a basis for future learning adaptation.

Development opportunities are increasingly opening up as AI technology in education develops, especially to automate the process of evaluating open answers and providing personalized feedback. With the integration between AI, big data, and contextual pedagogy, the future of HOTS assessments will not only become more accurate, but also more inclusive and affordable. In the near future, learning models that combine virtual reality (VR), problem-based learning, and AI-based adaptive assessments could be a key driver of educational reform based on the development of higher-level thinking skills.

Thus, the findings of this study make it clear that the development of automated digital assessments and innovative learning designs have an essential role in shaping students who think critically, creatively, and adaptively. The combination of the two approaches has been shown to provide more effective results than if

applied separately. Therefore, the approach to future learning must be designed in a holistic and integrated manner, with the support of technology, inclusive education policies, and continuous teacher training so that students' high-level thinking competencies can develop optimally and evenly throughout Indonesia.

5. Conclusion

This study confirms that the development of automated digital assessments and innovative learning designs have a strategic role in encouraging higher-level thinking competencies (HOTS) in the digital education era. Technology-based assessments such as Quizizz, Google Form with automatic correction, and Learning Management System (LMS) have shown effectiveness in assessing students' analytical, evaluative, and creative abilities efficiently, objectively, and in real-time. On the other hand, innovative learning models such as flipped classroom, problem-based learning, and collaborative learning are able to create a learning environment that stimulates HOTS actively and contextually. The integration between digital assessment and innovative learning has a stronger synergistic impact on the improvement of HOTS, compared to when applied separately. However, implementation challenges such as the limitations of teachers' digital competence, technological infrastructure, and the readiness of the education system still need to be seriously addressed. Therefore, the strategy of strengthening teacher capacity through TPACK training, the development of practical HOTS-based teaching tools, and the formulation of supporting policies are the key to the success of this transformation. The findings of this literature review underscore the urgency of

education reform oriented towards active, collaborative, and data-driven learning, with the support of technology as the main lever. The education of the future demands an evaluation and learning system that not only measures results, but also facilitates the process of critical and creative thinking in an ongoing manner.

References

Aryana, S., Subyantoro, S., & Pristiwati, R. (2022). Tuntutan kompetensi guru profesional bahasa indonesia dalam menghadapi abad 21. *Semantik*, *11*(1), 71-86.

Ashari, M. K., Athoillah, S., & Faizin, M. (2023). Model E-Asesmen Berbasis Aplikasi pada Sekolah Menengah Atas di Era Digital: Systematic Literature Review. *TA'DIBUNA: Jurnal Pendidikan Agama Islam*, *6*(2), 132-150.

Atmojo, I. R. W., Chumdari, M. P., Matsuri, M. P., Adi, F. P., Ardiansyah, R., & Saputri, D. Y. (2023). *Assessment Kognitif pada Kelas Digital dalam Pembelajaran Abad 21*. CV Pajang Putra Wijaya, Surakarta, Jawa Tengah.

Ferdiansyah, E. A., Septyaningrum, A. N., Sari, D. A. M., & Wijayanti, M. D. (2023). Improved Capabilities Think Critically and Creatively in Learning Natural Science with Media Base HOTS in The Era Society 5.0. In *Social, Humanities, and Educational Studies (SHES): Conference Series* (Vol. 6, No. 3).

Handhika, J., Fatmaryanti, S. D., Khasanah, N., & Budiarti, I. S. (2020). *Pembelajaran sains di era akselerasi digital*. Cv. Ae Media Grafika, Magetan, Jawa Timur.

Mahmudah, M., & Bahtiar, M. D. (2022). Pengembangan E-LKPD berbasis higher order thinking skills pada mata pelajaran akuntansi keuangan sebagai upaya

meningkatkan berpikir kritis peserta didik. *Jurnal Pendidikan Akuntansi (JPAK)*, *10*(1), 80-93.

Nazarudin, R. S. Pengembangan Media Pembelajaran Aplikasi Quiziz Berbasis Soal HOTS Dalam Berpikir Kritis Untuk Siswa Kelas V SDN Pondokl Cabe Ilir 03. *Bachelor's thesis, Jakarta: FITK UIN Syarif Hidayatullah Jakarta*.

Oktaviani, R. N. (2022). Implementasi model pembelajaran problem based learning (pbl) berbasis lesson study untuk meningkatkan keterampilan komunikasi dan kolaborasi mahasiswa pada mata kuliah perencanaan pembelajaran di SD. *ELSE (Elementary School Education Journal): Jurnal Pendidikan dan Pembelajaran Sekolah Dasar*, *6*(2), 257-276.

Purwaningrum, S., & Wati, D. T. (2023). Pengembangan Buku Sejarah Kebudayaan Islam Kelas VIII Berbasis Higher Order Thinking Skills. *Edudeena: Journal of Islamic Religious Education*, *7*(1), 43-57.

Putri, N. W., & Dwijayanti, R. (2020). Pengembangan alat evaluasi bantuan aplikasi "quizizz" pada mata pelajaran marketing kelas X jurusan BDP di SMK Negeri 10 Surabaya. *Jurnal Pendidikan Tata Niaga (JPTN)*, *8*(3), 985-991.

Rahmawati, A. E., & Hijriyyah, U. (2023). Development of the Quizizz Application-Based Evaluation Tool for Learning Arabic for MTs Pengembangan Alat Evaluasi Berbasis Aplikasi Quizizz pada Pembelajaran Bahasa Arab untuk MTs. *Mantiqu Tayr: Journal of Arabic Language*, *3*(2), 135-150.

Setiawati, I. (2021). Analisis perangkat Pembelajaran Berbasis Higher Order Thinking Skill (HOTS) di Masa Pandemi Covid-19. *ALVEOLI: Jurnal Pendidikan Biologi*. 2(2), 78-97.

Yusuf, M., Julianingsih, D., & Ramadhani, T. (2023). Transformasi pendidikan digital 5.0 melalui integrasi inovasi ilmu pengetahuan dan teknologi. *Jurnal MENTARI: Manajemen, Pendidikan Dan Teknologi Informasi*, *2*(1), 11-19.