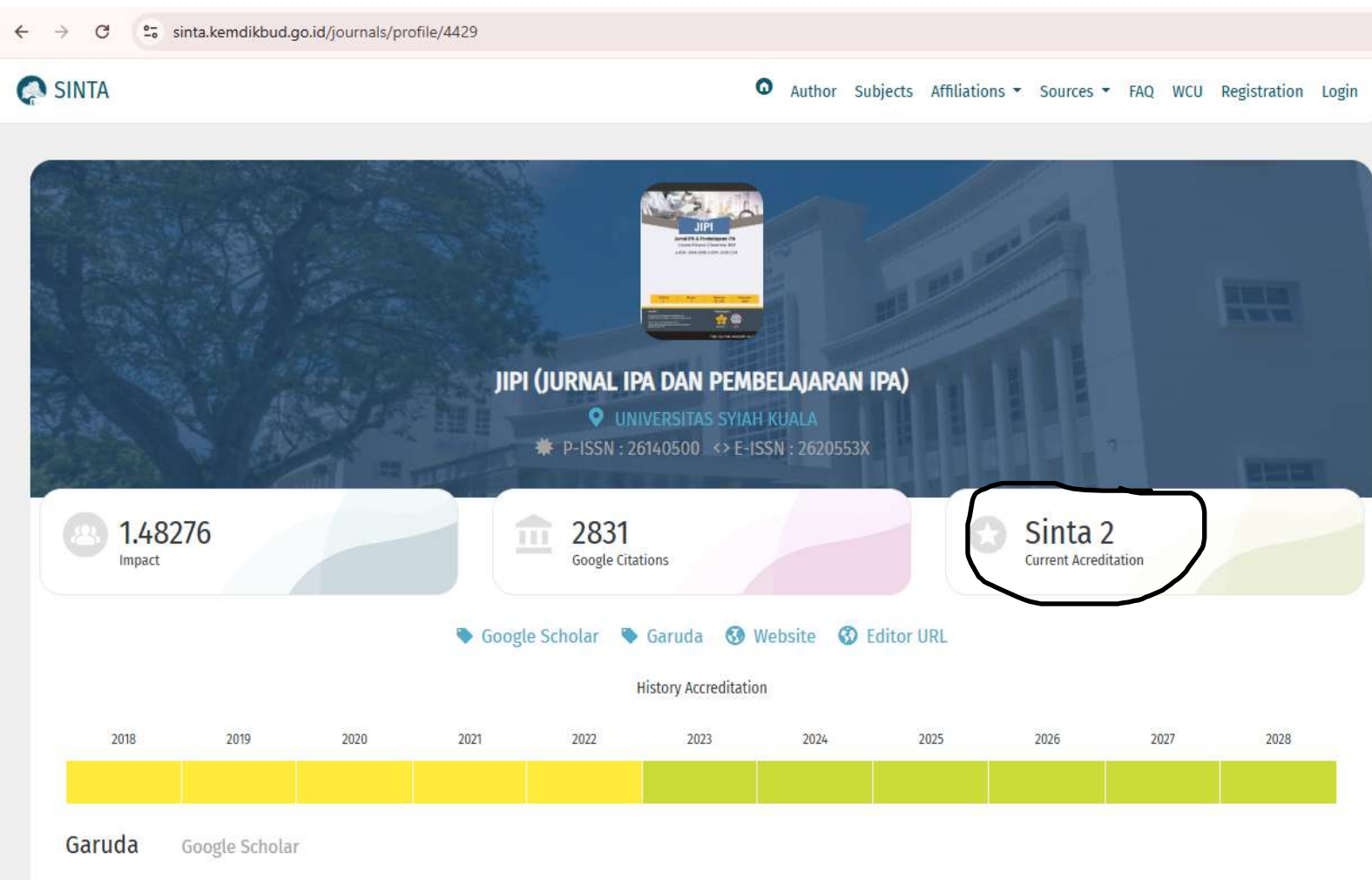


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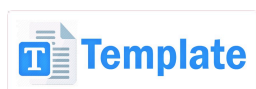


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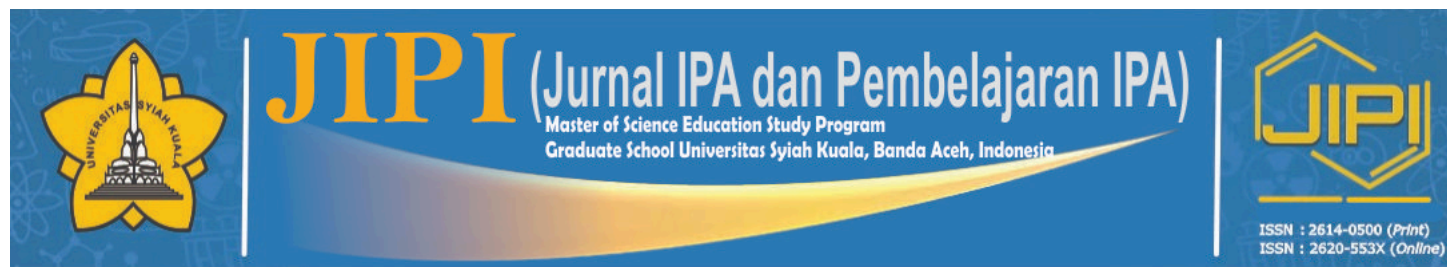
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JIPI (Jurnal IPA dan Pembelajaran IPA) aims to serve original articles on the latest issues and trends in high-quality research focused on technology-integrated science and/or science learning (chemistry, biology, physics, and environment).

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The editors welcome submissions of papers on recent theoretical and experimental research related to:

1. Results of theoretical and empirical research studies on science learning with integrated technology. We invite manuscripts that investigate science learning with the integration of web-based technology, Android, Arduino, nanotechnology, virtual labs, technological and pedagogical content knowledge research, STEM and/or STEAM, sociological issues, virtual reality, augmented reality, and other relevant issues. relevant to science learning.
2. The results of research on the application of science learning media which focuses on studies related to the latest trends in the use of technology-based science learning media at all levels of education and in society.
3. The results of research related to the implementation of the science learning curriculum (chemistry, biology and physics) have contributed to developing the latest trends in the implementation of the science learning curriculum with the integration of technology at all levels of education including science learning design, competency analysis and syllabus.
4. The results of research related to the assessment of science learning processes and outcomes contribute to developing the latest trends in technology-integrated science learning assessment at all levels of education.
5. The results of research related to science teacher education include original theoretical and empirical studies, including professional preparation of teachers, implementation of their work, and/or career development based on the latest technology.
6. Research results related to technology-based science learning in everyday life outside the formal classroom. Papers should examine experiences in environments such as the community, home, internet, museums, and other aspects that develop interest, knowledge, and/or application of science. Science learning that emphasizes attention to aspects of problems and factors related to equality.
7. Research results related to pure science research that is currently trending (chemistry, physics, biology and the environment).

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The Use of Liveworksheets as an Assessment Tool to Enhance Students' Conceptual Understanding and Engagement in Science Learning: A Case Study at a Junior High School

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Abstract. Assessment serves as a pivotal component in education, functioning as a means to evaluate the effectiveness of the learning process. In the context of the digital era, the integration of technology into assessment practices has become increasingly essential. Digital platforms such as liveworksheets offer educators streamlined tools to design, administer, and evaluate assessments with greater efficiency and interactivity. This study explored the use of liveworksheets as an assessment tool to enhance students' understanding and engagement in science learning by employing a qualitative method with a case study approach. Data were gathered through observations, interviews, and document analysis. This study involved four science teachers and twelve eighth-grade students at a junior high school in South Sumatra Province, Indonesia. The findings revealed that the teachers who participated in this study demonstrated a sound understanding of liveworksheets-based assessment instruments in science learning. These instruments were well-implemented, especially for objective questions such as multiple-choice, matching, and short-answer questions. Liveworksheets-based assessment instruments have proven effective in measuring students' understanding of science concepts. Most students derived substantial benefit from utilizing liveworksheets, as it facilitated a more interactive and engaging learning experiences. In implementing this assessment tool, the teachers faced obstacles, such as limited internet access, inadequate school devices, and students' digital learning space at home. Meanwhile, the teachers also encountered challenges such as the complexity of designing assessments, developing effective worksheets, and the limitations in question types. This study provided insights into creating more interactive and effective learning assessments, aligned with technological advancements and students' needs.

Keywords: Liveworksheets, Digital Assessment, Science Learning, Junior High School

Introduction

Science learning in junior high schools aims to develop students' critical thinking, creativity, independence, and scientific behavior while encouraging them to understand, apply, and appreciate science and technology (Kemendikbudristek, 2022). This aligns with the digitalization of the 21st century, which has driven the learning and assessment processes in educational institutions to begin adapting to technology (Putri & Asrizal, 2023). The use of technology in assessment enables instant and detailed feedbacks for students (Mitra et al., 2024). This helps students quickly understand and correct their errors (Cosi et al., 2020). According to Raaheim et al. (2019), technology-based assessment instruments are seen as capable of providing new experiences for students and reducing the weaknesses of conventional assessment systems, such as manual grading, which requires a long time for teachers to provide feedback to students.

Assessment plays a crucial role in education as a tool to measure the success of the learning process (Ernawati et al., 2022). Through assessment, teachers can evaluate the extent to which students have understood the material taught while identifying their strengths and weaknesses (Driana et al., 2021). Mcmillan (2014) stated that assessment is the core of the learning process, serving not only to evaluate learning outcomes but also to support overall learning improvement. Through assessment, teachers can reflect on the effectiveness of teaching methods and make necessary adjustments to enhance learning outcomes (Andrade & Brookhart, 2020). The information obtained from the assessment serves as the basis for designing more effective and targeted learning strategies (Hamdi et al., 2023).

In the context of science learning, teachers are encouraged to innovate by utilizing digital tools to enhance students' learning success (Maysara et al., 2023). Maulidya and Ambarwati (2022) asserted that liveworksheets is an online platform suitable for technology-based assessment. Liveworksheets enables educators to design interactive worksheets, which students can access and complete in a digital format (Rachma et al., 2023). Hidayah and Asari (2022) noted that liveworksheets can be used as an assessment tool that is free to access and serves as an interactive assessment medium. Liveworksheets provides advantages for both teachers and students. For teachers, it saves time due to its ability to automatically check students' answers, while for students, it offers an engaging and interactive learning experience that enhances motivation (Hernanto et al., 2023). Liveworksheets as an assessment tool has been successful in developing students' higher-order thinking skills (Maulidya & Ambarwati, 2022).

The use of liveworksheets in evaluation helps expand students' knowledge by integrating multimedia into questions, making them more attractive and motivating students to learn (Faradisa et al., 2023; Triningsih & Amidi, 2023). Assessment using liveworksheets positively impacts students' active participation and enhances their understanding of science subjects (Fardinelly et al., 2024; Prakoso & Rusnilawati, 2024) and contributes to students' academic achievement (Maysara et al., 2023; Oktafiani et al., 2024; Sa'adah et al., 2023). Liveworksheets as an assessment instrument is highly feasible and practical for classroom learning activities (Arifianti & Dwiningsih, 2022; Hidayati et al., 2023; Ramdani & Amelia, 2024; Selvia & Tambunan, 2024). Liveworksheets has been proven effective in improving students' learning outcomes (Amalia & Lestyanto, 2021; Felitasari & Rusmini, 2022; Rachma et al., 2023).

Despite these advantages, gaps remain in the literature—particularly regarding the practical application of liveWorksheets in classroom assessment, from planning to implementation. Therefore, the primary objective of this study is to explore the use of liveworksheets as an assessment tool to enhance students' conceptual understanding and engagement in science learning at junior high school level.

Methods

41 34 This study was conducted at a public junior high school in Buay Pemuka Peliung District, Ogan Komering Ulu Timur Regency, South Sumatra Province, from August to October 2024. The study employed a qualitative research method with a case study approach (Hatch, 2002). Through a case study, this study aimed to capture the dynamics occurring during the implementation of liveworksheets, from teachers' understanding and readiness in using liveworksheets to students' experiences in completing digital assessments. This method allows for an in-depth and detailed exploration, ensuring that every aspect related to the use of liveworksheets, including teachers' understanding and application, students' responses, as well as challenges and obstacles faced, can be clearly revealed. This approach was chosen because each school has different conditions, leading to variations in how liveworksheets was integrated into learning activities.

The subjects of this study consisted of four science teachers and 12 eighth-grade students, selected as informants using the purposive sampling technique (Etikan et al., 2016). This technique allows researchers to deliberately choose individuals or groups considered most relevant or experienced in providing in-depth data on the phenomenon being studied. To maintain the confidentiality of informants' identities and protect their personal data, the researchers used coded identifiers. This ensures that the information provided by informants remains anonymous, helping to build trust between researchers and participants. This anonymity encourages informants to share their perspectives and experiences honestly and comfortably. The following are the informant codes for teachers used in this study.

Table 1. Teacher Informant Codes

| Informant Code | Age | Status | Educational Background | Teaching Experience (Years) | Subjects Taught |
|----------------|-----|-----------------------------|------------------------|-----------------------------|-------------------------------------|
| GA-7 | 57 | Civil Servant (PNS) | Physics Education | 37 | Science in Grade VII |
| GA-8.1 | 23 | Non-Civil Servant (Non-PNS) | Chemistry Education | 2 | Science in Grades VIII.1 and VIII.2 |
| GA-8.2 | 26 | Civil Servant (PNS) | Chemistry Education | 3 | Science in Grades VIII.3 and VIII.4 |
| GA-9 | 46 | Civil Servant (PNS) | Physics Education | 20 | Science in Grade IX |

In addition to the teachers, students who served as informants in this research were also assigned coded identifiers to protect their real identities. The students were assigned codes from S-01 for the first student up to S-12 for the twelfth student.

Data collection was carried out through observations, interviews, and document analysis by the first author. The observation method used in this study was non-interactive participatory observation (Stickdorn et al., 2018) where the researcher was present in the classroom but did not interfere with the learning process. Observations were conducted during science lessons according to the class schedule agreed upon with the respective teachers.

A structured observation sheet was prepared in advance to record key aspects of the implementation. Each observation session lasted 45 to 90 minutes, following the standard class duration at the school. Observations were conducted in two sessions for GA-7, GA-

8.1, and GA-9, while GA-8.2 was observed for three sessions. GA-8.2 was observed in three sessions, unlike the other participants, due to technical issues caused by a power outage that disrupted the internet connection. Therefore, the observation was repeated to obtain a more accurate representation.

The interview method used in this study was a semi-structured interview (Creswell & Poth, 2017). An interview guide with several predetermined questions were prepared while allowing informants the freedom to elaborate further or add relevant information. The interviews were conducted face-to-face to understand body language and facial expressions, as well as to clarify responses through follow-up questions if necessary. Interviews with the teachers as informants were conducted in the teacher's room, with each session lasting approximately 20 to 45 minutes. The interviews with the students were conducted in the counseling room, chosen for its quiet and comfortable atmosphere, allowing students to speak openly without interruptions from classroom activities. These interviews were also conducted face-to-face, with each session lasting approximately 10 to 20 minutes. The first author used a voice recorder to document the interviews (with the consent of teachers and students) and also took notes on key points during the interviews.

A document analysis was conducted to collect relevant documents (school policy documents related to the use of technology in learning, internal school guidelines on the use of digital learning applications or platforms, teaching modules integrating liveworksheets, examples of liveworksheets used in science learning, and student evaluation results from liveworksheets as assignments/quizzes to obtain a more comprehensive picture of the implementation of liveworksheets-based assessment instrument.

The data analysis in this study followed the model of Miles et al. (2014), which consists of three main steps: data condensation, data presentation, and conclusion drawing. Data condensation was carried out by sorting the data to identify key themes, patterns, or emerging categories (Kalpokaite & Radivojevic, 2019). Data presentation in this study was done in table format to facilitate the identification of patterns or relationships within the data, making it easier to understand and analyze further (Linneberg & Korsgaard, 2019). Conclusion drawing was conducted by analyzing data patterns and ensuring their validity through triangulation to produce reliable and credible conclusions (Creswell & Poth, 2017). This study employed a variety of sources and data collection techniques (Fusch et al., 2018). The source variation included primary sources, namely science teachers and students, as well as secondary sources, such as school policy documents on the use of technology in learning, internal school guidelines on digital learning applications or platforms, teaching modules integrating liveworksheets, examples of liveworksheets used in science learning, and student evaluation results from liveworksheets as assignments or quizzes. Meanwhile, the variation in techniques in this study included observation, interviews, and document analysis.

Results and Discussion

The study on the implementation of liveworksheets-based assessment instruments in science learning at the public junior high school yielded several key findings. These findings can be categorized based on the research focus, namely teachers' understanding, assessment implementation, assessment effectiveness, students' experiences, as well as challenges and obstacles.

Teachers' Understanding of Liveworksheets-Based Assessment Instruments in Science Learning

Teachers' understanding of liveworksheets-based assessment instruments encompasses knowledge of their definition, purpose, skills in creating worksheets on liveworksheets, and the ability to integrate them into science learning assessments. A strong understanding of the definition and basic concepts of liveworksheets is fundamental for effectively implementing this technology in learning. A solid grasp of liveworksheets allows teachers to optimize its features, tailor assessment instruments to learning needs, and overcome technical challenges that may arise during the assessment process (Hale & Prabjandee, 2023). Liveworksheets is a digital platform that enables the creation and use of interactive worksheets for assessment, exercises, and online learning (Rachma et al., 2023). With liveworksheets, teachers can design questions that involve various types of interactions, such as multiple-choice, fill-in-the-blank, drag-and-drop, and others, which can be automatically graded (Hernanto et al., 2023). The following is a statement from one of the teachers:

"A liveworksheets-based assessment instrument is a digital assessment tool that uses the liveworksheets platform to measure students' learning outcomes. This instrument allows educators to create interactive questions in various formats such as multiple-choice, short answer, matching, and exercises involving multimedia, providing variety in assessment methods." (GA-9)

Most of the purposes of using liveworksheets at a public junior high school in Buay Pemuka Peliung District focused on formative assessment. One of the teachers stated:

"I use liveworksheets as a formative assessment tool that helps me evaluate students' understanding in real time. This allows me to immediately identify areas that need further explanation before moving on to the next topic." (GA-8.2)

With formative assessments using liveworksheets, teachers can identify areas that require additional explanation before progressing to the next topic, making learning more effective and targeted (Hale & Prabjandee, 2023; Lin & Mariana, 2024; Maulidya & Ambarwati, 2022). Formative assessment ensures that learning is not solely focused on achieving final scores but also on deep comprehension of each taught concept (Dixson & Worrell, 2016). These research findings aligned with a study conducted by Rahmawati and Zaini (2022) that found that the use of liveworksheets as an evaluation tool allows teachers to quickly determine areas where students struggle and provide additional explanations or exercises. This makes the learning process more responsive to students' needs and promotes a better understanding before students move on to more complex topics (Mcmillan, 2014).

Liveworksheets is an online platform that allows educators to create interactive worksheets that can be accessed and completed by students digitally, thereby facilitating the assessment process and providing a more dynamic and engaging learning experience for students (Mitra et al., 2024; Prakoso & Rusnilawati, 2024). All science teachers at the junior high school understood and mastered the design of effective assessments by utilizing the various features available on this platform, enabling the evaluation of learning outcomes to be conducted more systematically and efficiently. In the process of designing assessment questions, teachers did not rely solely on liveworksheets but also used various supporting applications, such as Microsoft Word or Canva, to create visually appealing question designs that align with students' needs and characteristics. These engaging designs aim to enhance student participation and motivation in completing assignments, making them more enthusiastic about understanding the concepts being taught. Moreover, LiveWorksheets offers various interactive features that allow for more diverse assessments,

such as drag-and-drop, matching, short answer, and multiple choice, which not only help students complete assignments in a more engaging way but also enable teachers to assess students' understanding more accurately and comprehensively. Through these features, the assessment process can be conducted more flexibly, both in the classroom and as individual assignments that students can complete from home. This aligns with the findings from the following interview:

"I create worksheets on liveworksheets, including multiple-choice questions, fill-in-the-blanks, matching, true/false, or essay questions according to the material I have taught in class. For example, if students are learning about cells and their development, I can create questions related to that topic." (GA-7)

As a digital platform, liveworksheets offers a variety of interactive features that not only facilitate the assessment process but also enhance students' learning experiences, making them more engaging and meaningful (Amalia & Lestyanto, 2021; Lin & Mariana, 2024). Teachers have the flexibility to design worksheets according to instructional needs, allowing assessments to be tailored to both the subject matter and students' abilities. In line with this, research conducted by Rhosyida et al. (2021) revealed that liveworksheets enables teachers to independently create worksheets by integrating various multimedia elements, such as images, website links, audio, and even videos that can be played directly within the worksheet. These features help visualize abstract or complex concepts, making it easier for students to grasp difficult topics in an interactive and enjoyable way. In practice, the effective use of liveworksheets relies heavily on teachers' creativity in utilizing the available features. The teachers who participated in this study recognized that designing assessments with an interactive approach increases student engagement in the learning process. Questions formatted with drag-and-drop, matching, short answer, and multiple-choice features add variety to assessments, preventing students from completing tasks mechanically and instead encouraging them to think more actively. Beyond making assessments more engaging, integrating liveworksheets also provides another significant advantage: the ability to deliver instant feedback to students. With automated grading and real-time result displays, students can immediately see whether their answers are correct or incorrect, allowing them to quickly identify mistakes and reinforce their understanding of the material. As expressed by GA-8.2 in the following interview excerpt:

"Liveworksheets helps me design more interactive and effective assessments, making the learning experience more enjoyable for students. It includes an automatic grading system for objective questions. Once students complete the questions, they can instantly view their results. The automatic grading feature allows me to receive assessment results immediately after students submit their work, unlike traditional methods that require more time for manual grading."

The utilization of liveworksheets in assessment not only provides students with a more interactive learning experience but also helps teachers manage the evaluation process more efficiently (Rusdan & Mulya, 2023). For teachers, this feature serves as a practical solution to save time while enhancing the accuracy of assessments (Hasanudin et al., 2024). The instant feedback mechanism allows students to immediately identify their mistakes and correct them without long delays (Fuadi et al., 2023). Teachers' ability to integrate liveworksheets into science learning assessments reflects the level of digital technology utilization in supporting an effective, efficient, and student-centered evaluation process (Mitra et al., 2024). By optimizing the available interactive features, teachers can develop more diverse assessment instruments to measure students' conceptual

understanding while also enhancing student engagement and motivation through a more engaging and interactive assessment experience.

Implementation of Liveworksheets-Based Assessment Instruments in Science Subjects

Based on interview results, it was revealed that the successful implementation of this assessment instrument depends on several key stages, namely worksheet preparation, distribution to students, assessment execution, as well as grading and feedback. Each of these stages plays a crucial role in ensuring that the assessment runs effectively and aligns with the learning objectives.

The preparation stage is a critical initial step in the successful implementation of liveworksheets as assessments. Interview findings indicated that the teachers designed worksheets that aligned with the science material being taught while considering the difficulty level of the questions to match students' competencies. In the process of designing questions, the teachers could utilize various features provided by liveworksheets, such as multiple-choice questions, short-answer questions, drag-and-drop, matching, and audio- or video-based questions to enhance interactivity. These findings aligned with a study by Mitra et al. (2024) that using liveworksheets as an assessment tool in learning facilitates teachers in designing questions with various interactive formats, such as drag-and-drop, matching, or short-answer questions. The distribution of questions was carried out by sharing a link via the class WhatsApp group, which can then be accessed by each student.

"I copy the link and then send it to the class WhatsApp group. Usually, I send it to the homeroom teacher first. Once the link is sent, I just monitor from the application who has completed the assignment." (GA-8.2)

The distribution of questions via WhatsApp allowed the teachers to ensure that all students received the questions at the same time. By using WhatsApp, the assessment distribution process became faster, easier, and more efficient. Additionally, the teachers could communicate directly with the students and the homeroom teachers, ensuring that all students participate in the assessment without any issues. Once the link was shared, the students began working on the questions, and the teachers could monitor their progress in real-time through the features available on liveworksheets. The teachers could see who had completed the assessment, when they worked on it, and the scores they obtained. The practicality offered by liveworksheets makes it an ideal tool for use in learning assessments. Based on classroom observations, it was evident that all students used smartphones during the assessment activities. Most students appeared enthusiastic while using their respective devices to access the worksheets. The teachers provided clear instructions and assisted students in overcoming technical difficulties, such as login issues or trouble accessing the assessment page. Throughout the assessment, the teachers moved around the classroom to offer guidance to students experiencing difficulties or requiring further clarification.

The assessment was conducted online via the liveworksheets platform, where the students accessed digital worksheets created by the teachers. This platform allowed students to engage directly with the questions through a range of interactive features, such as drag-and-drop answers, fill-in-the-blank fields, and multiple-choice selections. The implementation of liveworksheets as assessment tools in the learning process can enhance student engagement through interactive and diverse question formats (Felitasari &

Rusmini, 2022; Hernanto et al., 2023). Once students complete the worksheet, liveworksheets automatically provides a score and feedback for each question, marking correct and incorrect answers. Regarding assessment and feedback, the following is the feedback display on the liveworksheets after the students have completed the questions.

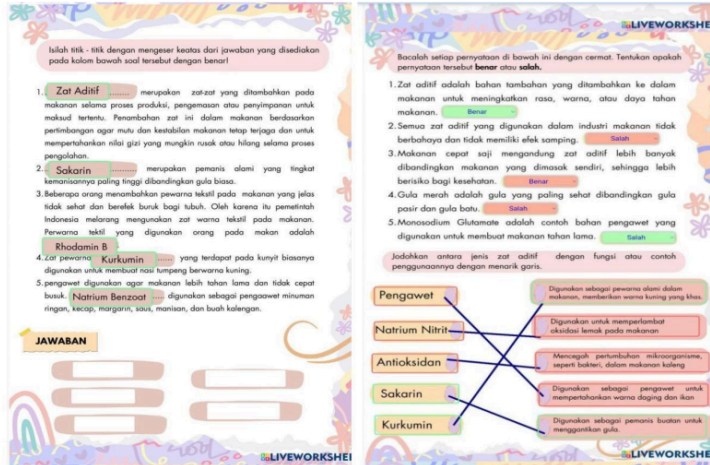


Figure 1. Feedback display on liveworksheets

After students complete the worksheet in liveworksheets, the system automatically displays the assessment results, including the overall score and feedback for each answer. This feedback is provided in the form of visual markers that help students understand how well they performed on the questions. If the given answer is correct, liveworksheets marks it with a green checkmark, indicating that the student has understood the concept being tested. Conversely, if the answer is incorrect, the system provides a red cross as a warning that there is an error in comprehension or problem-solving. In some cases, especially for short-answer questions, liveworksheets may also display the correct answer for comparison, allowing students to immediately see where their mistake was. After completing the worksheet, students will immediately see the final score displayed by liveworksheets. This score is calculated based on the number of correct answers compared to the total number of questions given, allowing students to gauge their understanding of the material they have learned, as shown in Figure 2. Therefore, with this system, students no longer have to wait long to see their results. They can instantly view their scores and the accompanying feedback, enabling them to quickly understand their mistakes and make corrections in their next attempt. This promotes better comprehension and accelerates the learning process. Additionally, it helps boost students' confidence, as they can track their progress in real time and feel more motivated to continue learning and improving.

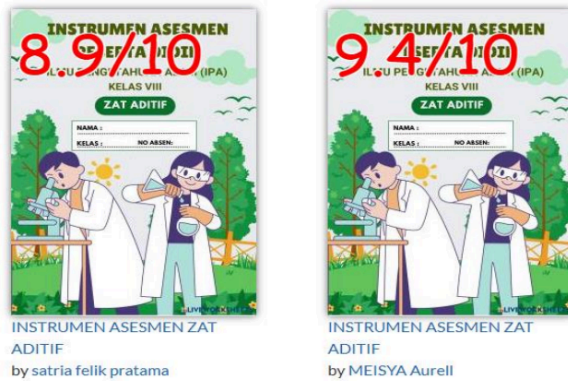


Figure 2. The final score displayed on liveworksheets

Moreover, the automatic feedback and assessment make it easier for teachers to review and evaluate students' work (Maharani & Marhamah, 2024; Maulidya & Ambarwati, 2022; Rosnaeni, 2021). Rosdianah and Sofwan (2024) stated that liveworksheets meet validity and practicality standards, making them a viable alternative for interactive exercises and learning activities, as well as a supporting tool in achieving learning objectives. Additionally, a study by Shelviana et al. (2023) indicated that liveworksheets meet eligibility criteria and can be used as an alternative for completing exercises online and deepening learning material.

Effectiveness of Liveworksheets-Based Assessment Instruments in Measuring Student Learning Outcomes in Science Subjects

The effectiveness of liveworksheets-based assessment instruments in measuring student learning outcomes in science subjects can be evaluated from several aspects that reflect how this platform supports the learning assessment process. Based on the findings, liveworksheets is considered quite effective in providing an interactive and engaging assessment experience, being easily accessible, and offering a variety of activities tailored to students' characteristics. As a digital platform, liveworksheets enables direct and automatic assessments, making it easier for teachers to evaluate students' conceptual understanding, critical thinking skills, and application of theories learned, as reflected in the interview excerpt below:

"There is a significant improvement in conceptual understanding and memory retention due to the immediate feedback provided after students complete the tasks or questions. Students can instantly see their results." (GA-7)

This statement was also supported by S-08 in the following interview excerpt:

"I feel that using liveworksheets helps improve my learning outcomes in science subjects. With interactive questions and instant feedback, I can quickly grasp the concepts being taught."

The liveworksheets-based assessment instrument is highly effective in measuring students' understanding of fundamental science concepts (Sa'adah et al., 2023). A study conducted by Ismaniar et al. (2024) showed that liveworksheets can serve as a tool to help students better understand learning materials, especially those perceived as boring. An increase in students' average learning outcomes has been observed with the implementation of liveworksheets-based assessment instrument in learning activities (Afifah & Junaedi, 2024). Additionally, liveworksheets has been found to be valid, practical, and effective in measuring students' conceptual understanding (Buhera et al., 2025; Fardinelly et al., 2024; Maulidya & Ambarwati, 2022; Oktafiani et al., 2024). Liveworksheets is supported by various interactive features that allow students to practice questions dynamically, such as drag and drop, matching exercises, audio recording, and automatic grading (Nurhaliza & Titikusumawati, 2023; Sari & Jusra, 2023). These features not only make learning more engaging but also help students grasp concepts more effectively through a more active and immersive learning experience. The automatic grading system provided by liveworksheets enables students to receive real-time feedback, which reinforces their understanding of concepts they struggle with (Hasanudin et al., 2024). Student engagement and motivation are among the key advantages of using liveworksheets (Afira et al., 2024; Faradisa et al., 2023). This is further illustrated in the following interview excerpt.

"I have observed a significant change in students' interest and motivation toward learning science after implementing liveworksheets. With a more interactive and enjoyable learning approach, students are more engaged and motivated to learn."
(GA-9)

This statement is reinforced by S-04 who noted:

"Doing the exercises feels like playing a game. Besides that, I can immediately see the results of what I have done, and I can even know which answers are correct or incorrect. This makes me more enthusiastic and increases my motivation to learn."

The interactive features of liveworksheets make students feel very happy and motivated to learn. This finding is supported by Faradisa et al. (2023), who stated that the development of worksheets assisted by the liveworksheets platform has been proven to enhance students' learning motivation, as indicated by a significant difference in motivation levels before and after the worksheet trial. With the interactive features of liveworksheets, students receive instant feedback, enabling them to identify mistakes, improve their understanding, and enhance their learning outcomes independently (Hasanudin et al., 2024; Mitra et al., 2024; Zainab & Halang, 2022). Providing feedback after students complete exercises can further support and boost their motivation to learn (Brookhart & Durkin, 2003).

Students' Experiences in Using Liveworksheets-Based Assessment Instruments in Science Learning

Overall, the students perceived the use of liveworksheets as enhancing the interactivity and engagement of the learning process, making it more enjoyable and less monotonous than traditional paper-based worksheets as reflected in following excerpt:

"With liveworksheets, I can click or drag answers instead of writing them manually, making it faster and more practical. Additionally, its interactive interface keeps me focused and prevents boredom." (S-07)

This statement was supported by field observations, which indicated that students engaged with the exercises on LiveWorksheets by directly interacting with the provided questions, as illustrated in Figure 3:



Figure 3. Students were Working on Exercises Using Liveworksheets as Assessment Instruments

The interaction between the students and the questions demonstrates their engagement in completing tasks. This situation illustrates how liveworksheets can create a more interactive learning environment, where students do not merely complete exercises passively but actively engage with the learning material. Furthermore, students do not feel bored as they can interact with various engaging features, making the learning process more enjoyable and effective, ultimately contributing to an improvement in their understanding and learning outcomes. In relation to this, Mitra et al. (2024) stated that students enjoy interactive learning because they can directly engage with the questions presented in various appealing formats. Similarly, Firtsanianta and Khofifah (2022) revealed that students do not feel bored and are more interested in participating in lessons when liveworksheets is used as an evaluation tool. Liveworksheets not only provides a variety of exercises but also presents an interactive format that enhances student engagement and motivation in completing assignments. The immediate feedback feature allows students to understand their mistakes and correct them promptly. This is in line with the following excerpt from an interview with S-03.

"...this platform is more interactive, engaging, and enjoyable compared to traditional assignments that require excessive writing. The instant feedback also helps me determine whether my answers are correct or if I need to study more. This motivates me to keep learning."

The automatic grading feature, which provides instant results, also encourages students to attempt more questions and independently correct their mistakes (Cristy & Pamenang, 2023; Fardinelly et al., 2024). Overall, this enhances students' intrinsic motivation to explore science concepts further. Ismaniar et al. (2024) stated in their research that using liveworksheets in learning activities provides a well-structured way of presenting materials, increases student engagement, motivates them, and enhances

concept comprehension while improving learning outcomes. Instant feedback allows students to immediately identify and correct mistakes, contributing to more effective learning. Rachma et al. (2023) also argued that using liveworksheets as an assessment tool is effective in making students more active and engaged, ultimately improving their science learning outcomes. The implementation of liveworksheets can enhance students' interest and learning outcomes (Daud, 2024; Nihayatun & Rusnilawati, 2023). Overall, students' responses to the use of liveworksheets-based assessment instruments in science learning were highly positive, particularly in terms of interactivity, engagement, and ease of use. These findings aligned with Hasanudin et al. (2024), who stated that the majority of students responded very positively to the use of liveworksheets as an assessment tool in science learning. Liveworksheets is highly engaging and greatly beneficial for students due to its diverse range of exercise formats (Indriani et al., 2022; Maharani & Marhamah, 2024). Additionally, this platform supports self-directed learning, allowing students to access and complete exercises anytime and anywhere based on their individual needs.

Barriers and Challenges Faced by Educators in Implementing Liveworksheets as an Assessment in Science Learning

Barriers

One of the biggest barriers faced by the teachers, based on research findings, is limited internet access, as expressed by GA-8.2 in the following statement:

"We have adequate internet access, but the network is sometimes unstable, especially when many students use it simultaneously. The computers and learning devices in the computer lab are also supportive, but their number is limited."

Liveworksheets-based assessments require a stable internet connection for students to access and complete their tasks (Daud, 2024; Dewi & Arifin, 2024; Fardinelly et al., 2024). If the internet connection is unstable, students will face difficulties in accessing questions, submitting answers, or receiving immediate feedback, which can hinder the learning process (Nihayatun & Rusnilawati, 2023). In addition to internet access issues, the limited number of devices available at school is also a major obstacle for educators in implementing this assessment tool. In the implementation of technology-based learning, infrastructure limitations, such as ICT tools and unstable internet access, are among the key barriers that reduce the effectiveness of digital learning (Jamiludin & Darnawati, 2022; Mitra et al., 2024; Sillat et al., 2021). Rodiyah et al. (2023) stated that digital disparities, the lack of necessary devices to support the learning process, internet connectivity issues, and educators' low level of digital literacy remain significant challenges in digital learning. Therefore, a comprehensive solution is needed to overcome these barriers. To address the limitations of technological infrastructure in schools, school administrators or policymakers allow students to bring their personal devices, such as smartphones or laptops, for digital assessment activities in the classroom. This is emphasized in the statement from GA-9 below:

"...the limitation of devices. However, under certain conditions, the school allows students to use their personal devices, such as smartphones or laptops."

Challenges

School infrastructure readiness is one of the key factors influencing the successful implementation of technology-based assessment instruments in learning activities (Haq et

al., 2023). Adequate technological infrastructure, such as hardware (computers, tablets, projectors), software, and a stable internet connection, is essential to support the use of liveworksheets. Without proper infrastructure support, the implementation of digital assessments will not be optimal and will face many technical difficulties (Cosi et al., 2020; Rosnaeni, 2021). This presents a challenge for schools to prepare infrastructure that meets the needs of digital learning. Research findings reveal that educators' digital competence plays a crucial role in ensuring the effective implementation of liveworksheets as assessments. With sufficient digital skills, educators can ensure that the assessment process runs smoothly and supports the overall achievement of learning objectives. Bates (2019) stated that educators' digital competence is also one of the key success factors in implementing digital-based assessment instruments in learning. Therefore, continuous training and technical support are essential for educators to use liveworksheets effectively and optimally.

The use of liveworksheets requires time and effort in designing interactive and engaging questions. Nihayatun and Rusnilawati (2023) stated that developing interactive liveworksheets that align with learning objectives takes more time compared to creating questions using traditional printed worksheets. Similarly, Rusdan and Mulya (2023) explained that while liveworksheets allow teachers to transform printed worksheets into more interactive and easily accessible digital versions, the preparation process still requires a longer time. Additionally, teachers need to consider attractive designs and appropriate question types to ensure that the worksheets are not just digital but also effective in enhancing students' understanding. Although liveworksheets offer convenience and interactivity in assessment, teachers must still consider its various limitations to optimize its use according to learning needs. The findings of this study revealed challenges in using liveworksheets as an assessment tool. This platform is more suitable for objective questions or measuring cognitive thinking skills but has limitations in assessing affective aspects, such as attitudes, and psychomotor skills, such as conducting scientific experiments. Therefore, teachers need to find alternative strategies to overcome these limitations to ensure a more comprehensive assessment. Furthermore, liveworksheets is also limited in accommodating essay-based questions or those requiring lengthy responses and in-depth analysis, as highlighted by GA-8.2.

"There are limitations in liveworksheets features. For example, concepts that require direct observation or experiments are difficult to replicate interactively. For questions requiring in-depth analysis, problem-solving, or essay responses, its features are still inadequate."

Triningsih and Amidi (2023) explained that liveworksheets still has limitations in supporting essay-based assessments or project-based tasks. Moreover, Puspitasari dan Wulandari (2021) found that liveworksheets still has limitations in measuring students' higher-order thinking skills. This is due to the constraints of the automatic grading system, which is not yet capable of evaluating answers in depth, thereby requiring teacher's intervention in the assessment processes. Therefore, to obtain a more comprehensive understanding of students' comprehension, teachers need to combine liveworksheets with other assessment methods. Classroom discussions, project-based tasks, and manual grading for essay questions can serve as effective alternatives to complement the limitations of this platform.

Conclusion

The findings of this study indicate that the science teachers at the junior high school level have demonstrated a good understanding of the use of liveworksheets as a digital assessment tool. The platform was effectively implemented, particularly for objective-type questions such as multiple-choice, short-answer, and matching formats. Its automated grading and instant feedback features were instrumental in enhancing students' conceptual understanding and engagement in science learning. However, the implementation of liveworksheets also presented several challenges. These included infrastructural limitations such as unstable internet connectivity, insufficient access to school-owned digital devices, and limited digital learning environments at home. Additionally, teachers faced challenges in designing interactive worksheets, especially in terms of time investment, digital literacy, and the platform's limitations in assessing affective and psychomotor domains or complex analytical tasks. To address these challenges, there is a need for enhanced digital infrastructure in schools, ongoing teacher training on technology integration, and the adoption of blended assessment approaches that complement liveworksheets with other methods. Future studies are encouraged to explore strategies for expanding the platform's use beyond objective assessments and to examine its impact on various learning domains in broader educational contexts.

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