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Utilization of Media in Science Learning Evaluation: Weaknesses & Solutions [A Systematic Review]

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ABSTRAK

Evaluasi pembelajaran sains abad 21 membutuhkan media digital untuk menilai keterampilan kompleks, namun implementasinya masih menghadapi banyak tantangan. Penelitian ini menggunakan metode Systematic Literature Review (SLR) dengan pedoman PRISMA untuk mengidentifikasi media evaluasi sains, memetakan kelemahan, dan menemukan solusinya. Analisis terhadap 11 artikel (2020-2025) menemukan media yang sering digunakan adalah gamifikasi (seperti Kahoot, Quizizz) dan aplikasi khusus (CBT, Web, Mobile). Kelemahan utama yang teridentifikasi meliputi: potensi kecurangan , fokus siswa teralih pada elemen permainan atau kecepatan , masalah teknis, dan akses terbatas. Berdasarkan hasil studi literatur dapat disimpulkan bahwa pengembangan Aplikasi Mobile yang dirancang khusus adalah solusi best practice. Aplikasi ini dinilai paling efektif karena mampu membatasi kecurangan (seperti memblokir tab lain) , lebih fleksibel, dan dapat memberikan feedback *real-time* untuk penilaian yang lebih akurat.

ABSTRACT

This research is motivated by the low ecoliteracy of elementary school students caused by the ineffectiveness of 21st-century science learning evaluation requires digital media to assess complex skills, but its implementation still faces many challenges. This study uses the Systematic Literature Review (SLR) method with PRISMA guidelines to identify science evaluation media, map weaknesses, and find solutions. Analysis of 11 articles (2020-2025) found that the media frequently used were gamification (such as Kahoot, Quizizz) and special applications (CBT, Web, Mobile). The main weaknesses identified include: potential for cheating, students' focus being diverted to game elements or speed, technical issues, and limited access. Based on the results of the literature review, it can be concluded that developing a specially designed Mobile Application is the best practice solution. This application is considered the most effective because it is able to limit cheating (such as blocking other tabs), is more flexible, and can provide real-time feedback for more accurate assessment.

1. PENDAHULUAN

The rapid development of Science and Technology (IPTEK) marks the beginning of the 21st century. Many changes have occurred in various aspects of life due to the rapid development of IPTEK. The Industrial Revolution is one concrete example of the changes taking place in the 21st century (Lestari et al., 2025). Skills that have high urgency in the 21st century era are critical thinking, communication, collaboration, and creativity (Mahrunnisya, 2023). The implementation of learning in the 21st century era focuses on changes in the entire learning process to be able to facilitate the development of 21st century skills, the main point of which includes the use of technology. The complexity of the challenges facing the world of education in the 21st century is a great responsibility to implement 21st century skills published by the 21st Century Skills Partnership which emphasizes the need to develop competitive skills in the 21st century that are in line with the demands of the times (Chusna et al., 2024). Higher Order Thinking Skills (HOTS) skills are a sign of students' ability to solve problems, analyze problems, and apply their knowledge to new situations (Abraham et al., 2021). In science learning, scientific literacy is a key pillar because students with scientific literacy skills are able to solve problems using scientific concepts, creatively create simplified technological products, and make decisions (Utami & Setyaningsih, 2022).

The process of assessing the quality or significance of something, whether a program, individual, or learning outcome, is called evaluation. In education, evaluation functions include competency assessment, performance

evaluation, and identifying the strengths and weaknesses of a program or method in the learning process (Ningtyas et al., 2022). The main role of evaluation is being able to provide useful feedback for improvement. Several crucial roles ensure that evaluation results reflect students' true abilities, with the characteristics of good test evaluations including validity, reliability, discriminatory power, and fairness (Afrilianti et al., 2025). This explanation relates to the importance of evaluation in the science learning process to determine students' abilities in science learning. In science learning, Science Process Skills (SPS) are related to improving critical thinking skills to support 21st-century skills, where SPS in its implementation is supported by experimental activities (Rahayu et al., 2022). The evaluation process in science learning to determine science process skills shows less accurate results when carried out in written evaluations because it is difficult to describe the assessment of a process skill if it is only a written report whose assessment is regulated by the teacher without considering how appropriate a student's skills are in the real science learning process (Fatimah Millenia Fauziah, 2022).

The existence of problems in the evaluation process does not mean we are stuck with just one issue. Advances in science and technology have provided a powerful solution to address gaps in the evaluation process. Evaluation media are no longer limited to written materials; now, sophisticated science and technology are available that can administer tests digitally (Dalimunthe et al., 2021). These evaluation media utilize digital technology connected to the internet. The primary purpose of digital evaluation is to provide more interactive, efficient, and diverse evaluations for students (Achmad Zaenudin, 2021). Types of digital-based evaluation media include interactive quiz applications (gamification), Learning Management System (LMS) platforms, online forms, digital project-based media, and simulations and virtual laboratories (Martanti et al., 2021). These media have specific characteristics according to the type of evaluation we desire. The presence of various evaluation media offers the potential for the world of education to be able to create authentic, interactive evaluations that can measure more complex skills such as science process skills (Afifah et al., 2021).

However, despite these advantages and potential, implementing media-based evaluation for students is certainly not as easy as expected. This is certainly related to the challenges that have also increased with the development of science and technology. Digital media is used only as a substitute for conventional multiple-choice tests, resulting in students' lack of focus during the evaluation process (Ramadhani, 2021). Although many individual studies report these challenges and weaknesses, there has been no comprehensive study that systematically maps the main weaknesses and proven effective solutions in the literature. Therefore, this Systematic Literature Review aims to answer the questions about the media used in the science learning evaluation process, the weaknesses in implementing these media in the science learning evaluation process, and what solutions (Best Practices) can be proposed to overcome these weaknesses.

2. METHOD

This research is a Systematic Literature Review (SLR), which is a research conducted to collect and evaluate research related to a specific focus topic (Triandini et al., 2019). This SLR article uses a method with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, based on the formulation of research-related questions to direct the discussion of the study, focusing more on identifying relevant data (Page et al., 2021). The following is the problem formulation for this SLR research, attached in Table 1.

Table 1. Research Question

Number	Question	Analysis is sought
1	What are the media most frequently used as tools for evaluation in science learning?	At this stage, researchers analyzed various articles regarding media that have been applied as tools for evaluation in science learning.
2	What are the weaknesses in designing and implementing media-based science learning evaluations?	At this stage, researchers analyzed various articles to identify weaknesses in designing or implementing media-based science learning evaluations.
3	What are the recommended solutions (Best Practices) to overcome the weaknesses in optimizing the use of media in the science learning evaluation process?	In this final stage, researchers identified solutions to overcome the weaknesses recommended in various articles regarding the use of media in evaluating science learning.

This literature review study was conducted using articles sourced from Crossref, Google Scholar, OpenAlex, and Semantic Scholar. The topic of the relevant literature search was carried out by searching for the keywords "Learning Evaluation, Media, Science". The literature search was conducted from August to November 2025. The articles found were filtered based on their relevance to research studies, resulting in 11 research articles published within 5 years (2020-2025) representing all aspects of research on the Use of Media in Science Learning Evaluation. Based on the PRISMA guidelines, the selection of these articles was based on inclution and exclution

criteria to focus the selection of relevant scientific papers for the literature review. The following inclution and exclution criteria used in this article are attached in Table 2.

Table 2. Exclution and inclution criteria

Exclution Criteria	1)	Publication whose complete text is not available
	2)	Incomplete abstract
Inclution Criteria	1)	Research articles published in the period 2020-2025 (5 years)
	2)	The research focuses on learning evaluation
	3)	Research is limited to science learning
	4)	Literature sources from proceedings, theses and scientific works
	5)	Research methods include development, experiments, classroom action research and quantitative.

Based on Table 2, researchers were able to identify articles that met the requirements for analysis. After establishing the inclusion and exclusion criteria, the next step was to select articles for the literature review. This process can be illustrated in the flowchart attached to Figure 1.

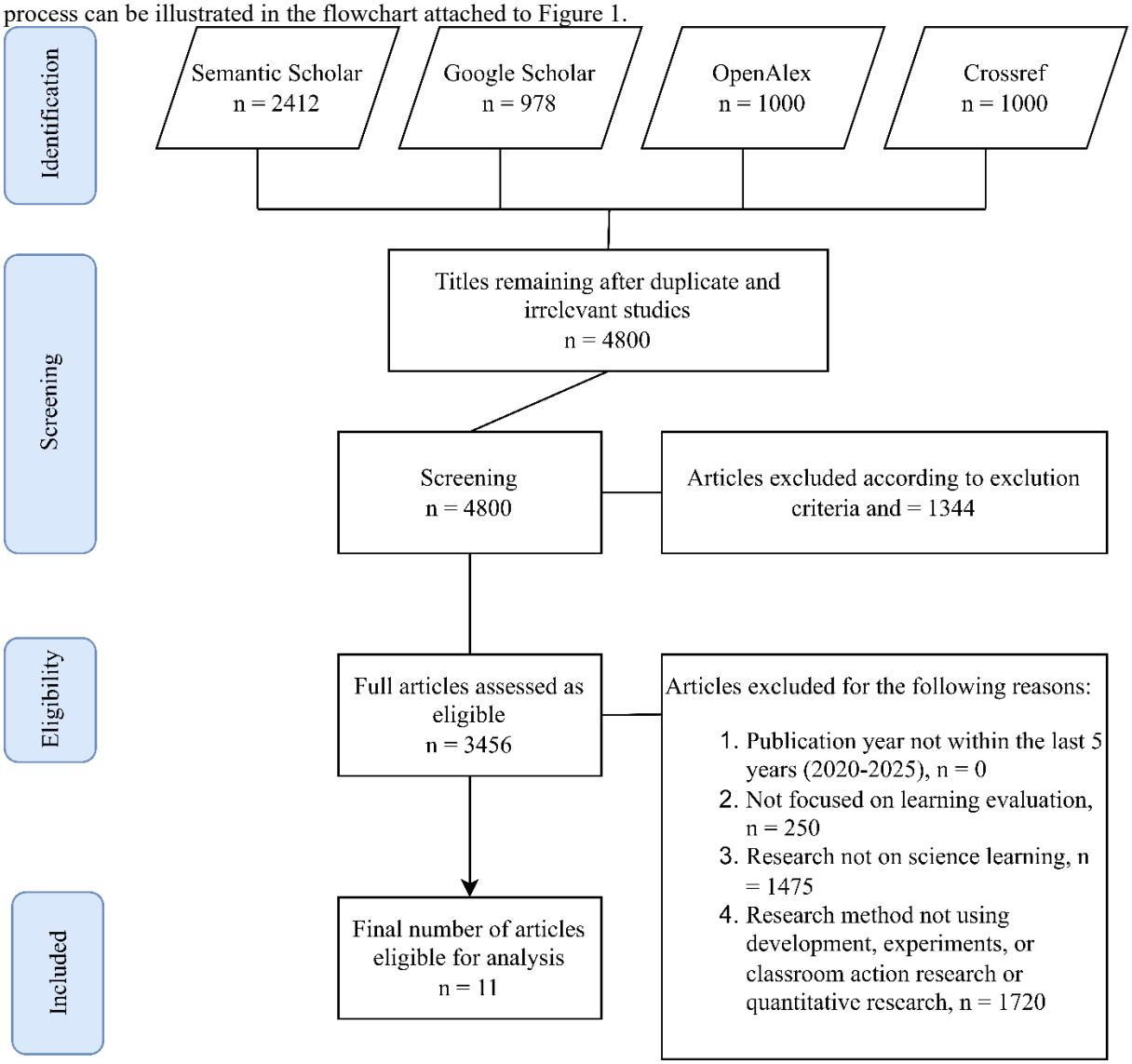

Figure 1. Research procedure

Figure 1 shows that 11 articles were eligible for the analysis stage. The data obtained from these articles will be analyzed using a narrative method with table and diagram visualization (Lubis et al., 2024). This method is used to fully explain the media used, weaknesses in design or implementation, and solutions to weaknesses in the use of media in science learning evaluation.

3. RESULT AND DISCUSSION

3.1. Result

Based on the results of the literature review, 11 articles were identified as suitable for further analysis regarding the use of media in evaluating science learning. The analysis results for these 11 articles are presented in Table 3.

Table 3. Results of analysis of articles on the use of media in evaluating science learning

Citation	Article Title	Types of Research	Research Result
(Munjaidah et al., 2021)	The use of the QUIZIZZ application as a learning evaluation tool in Newton's Laws of Motion	Quasi-experiment	Based on the research results in the use of the Quizizz evaluation tool, including funds in the effective category, Quizizz can help students in facilitating evaluations with various questions.
(Santoso & Maulani, 2021)	Design and construction of a Web-based Computer Based Test application at SMPN 1 Katapang, South Bandung Regency	Development	This web-based Computer Based Tests application is able to simplify the examination process at Katapang 1 Junior High School, replacing conventional examinations which require a lot of money and energy, making it easier to correct examination results.
(Roro Santi, 2021)	Android Mobile Application Design for Learning Evaluation	Development	Based on the trial results, this Android mobile application can carry out real-time processes because the database tool used is online.
(Setyowati et al., 2022)	The "QuizzMe" application for Android-based student learning evaluation at junior high school level	Development with ADDIE	Based on the trial results of the media in the form of the "Quiz" application, it was found that this application was declared suitable for use as an evaluation tool at the junior high school level.
(Rahardiyanto & Alfatiha, 2022)	Development of an Android-based learning monitoring and evaluation application for students at SMP Negeri 2 Gempol using the RAD (Rapid Application Development) method.	Development with ADDIE	Based on the research results, the trials conducted showed that this application was 100% successful. This application makes it easier for parents and teachers to monitor students' educational progress and monitor student evaluation activities.
(Sumiasyih et al., 2023)	Utilization of Mentimeter in Science Learning with Cooperative Learning	Development	Based on the research results, it can be seen that the use of mentimeter is very good, there are 80% of students in the complete category in understanding the questions and solving them.
(Anggriani et al., 2024)	Application of KAHOOT game learning media to improve science learning outcomes of class VIII students at SMP Negeri 13 Makassar (Study on the main material of the Digestive System)	Pre-Experiment	The research results showed that student learning outcomes improved moderately. The Kahoot game helped students understand the questions better due to its interactive features.

Citation	Article Title	Types of Research	Research Result
(Candra et al., 2025)	Creation of a web-based online exam application at NU Miftahul Jannah Middle School to evaluate student learning outcomes	Development	Based on the research results, it was found that this application was successfully developed and was able to support the process of evaluating student learning outcomes effectively and efficiently.
(Nurfarizki & Mahpudin, 2025)	The use of WORDWALL media to increase students' learning motivation in the science subject at Junior High School 1 Lebakwangi	Quasi-experiment	Based on the results of the research that has been conducted, it was found that the use of word walls is effective in increasing students' learning motivation in science subjects at Junior High School 1 Lebakwangi.
(Nurjani et al., 2025)	Online Questionnaire-Based Learning Evaluation Application at Mahdaliyah Jambi Middle School	Development	Based on the results of the research that has been conducted, it was found that the development of this application has succeeded in providing a practical solution for learning evaluation at MTs Mahdaliyah, which is able to make it easier for students and teachers to carry out the evaluation process.
(Hasanuddin et al., 2025)	Application of KAHOOT learning media in increasing interest in learning science among class IX students at State Junior High School 2 Sumber	Classroom Action Research	Based on the results of the research conducted, it was found that the use of Kahoot successfully increased students' interest in learning. Kahoot has a positive and effective influence in increasing students' interest in science because it is more engaging, interactive, and motivates students.

3.2. Discussion

Based on Table 3, it can be analyzed that various types of media have been utilized in the learning evaluation process over the past five years in the field of education. These media also enable applications in fields other than exact sciences. Table 3 also shows that some media are developed with specific bases (Aodina et al., 2024). This also proves that these media can be divided into several types: conventional media (paper-based and written) and digital evaluation media (*technology-based*) (Neni Nurhasanah et al., 2023). The focus of the discussion in this study is the use of evaluation media that directs towards the digital or technological world. Digital evaluation media is also divided into several types: Gamification (game-based evaluations such as Kahoot, Quizizz, Mentimeter, and others), Online forms (such as Google Forms and Microsoft Forms), LMS-assisted (Google Classroom and Moodle), project-based, virtual simulations, and special exam applications (such as CBT/web and mobile apps). The following percentage of digital media integration in science learning evaluation is shown in Figure 2.

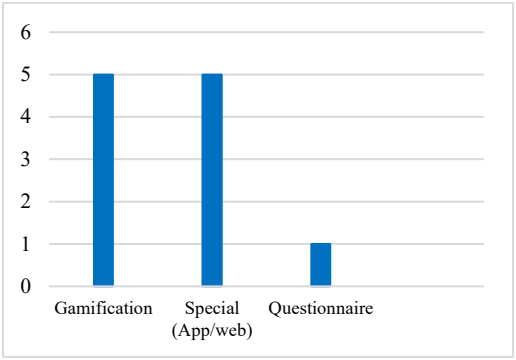

Figure 2. Utilization of media in science learning evaluation

Figure 2 shows that over the past five years, several media have been used to assist the learning evaluation process: gamification, specialized media, and questionnaires. These three media are frequently used, each with several advantages. Figure 2 shows that the media consistently chosen to assist the evaluation process is gamification, specifically in the form of applications or websites. One frequently used gamification medium is Kahoot. This medium is a choice for educators in conducting learning evaluations because it can create quizzes and discussions based on the learning process, which engages students and motivates them (Hasanuddin et al., 2025). Mobile app-based evaluation is an attractive option among specialized media, designed to provide time efficiency during final evaluations (Candra et al., 2025). However, behind these advantages, there are certainly weaknesses that must be recognized in each medium (Mellyzar et al., 2022). The following is a synthesis of the weaknesses of media-based evaluation in science learning, presented in Table 4.

Table 4. Synthesis of weaknesses of media-assisted evaluation in science learning

Media	Weakness	Description
Gamification		
Quizizz	Fraud	Quizizz helps with the evaluation process, but because it is done independently and the questions appear on each layer, it allows students to open another search tab to look for answers from the internet.
	Accuracy and Precision Inequality	Students only focus on time in solving questions without reading and understanding the questions.
Kahoot	Lack of Focus	In its use, students must look back and forth between the projector to read the questions and then their smartphones to select the answers. This makes it difficult for them to focus on the assessment.
	Finger speed contest	Kahoot favors fast students, not those who understand. This is because points are awarded based on the speed of answering questions.
	Less flexible	The quiz is managed by the host, which makes it less time efficient in carrying out the evaluation depending on the host to continue each question.
Wordwall	Focus on character	In answering questions, students focus more on the game features in moving the character rather than thinking about the answer.
	Limited access	The free version is less extensive and requires teachers to pay for access to more features.
	Too many features	This wordwall is almost like a game, because its features are full of elements that are less focused on evaluation.
Mentimeter	Limited access	Only able to create 2 to 3 free question slides, then you need to upgrade access by paying
	Presenter (teacher) dependency	Mentimeter access must be commanded by the presenter in guiding evaluation or learning activities.
	Less measurable results	Assessments cannot be displayed directly and there must be subsequent value processing by the teacher.

Special		
CBT	Must use a computer/laptop	This is as the name suggests, a computer-based test which requires the evaluation process to use a device.
	Special needs	From the research results, CBT has device requirements based on processor, memory and monitor.
	Technical issues	When the power goes out or the server is down or there is another problem with the device, it will disrupt the evaluation process.
Web	Allows cheating during the evaluation process	The web-based evaluation still allows students to open tabs other than the exam tab.
Mobile Apps	External interference	There is a possibility of external interference such as phone calls or messages appearing from smartphones.
Online Forms		
Questionnaire	Limited assessment	Questionnaires are the basic choice in carrying out evaluations, the weakness is when carrying out the essay evaluation process in the assessment in the questionnaire.

Table 4 provides information on several weaknesses of the media used in the evaluation process. Based on this information, these weaknesses depend on the purpose of the evaluation. These weaknesses can be managed based on the type of media and the function of the evaluation. Based on a synthesis of these weaknesses, the following solution map for weaknesses in media utilization in the science learning evaluation process is presented in Figure 3.

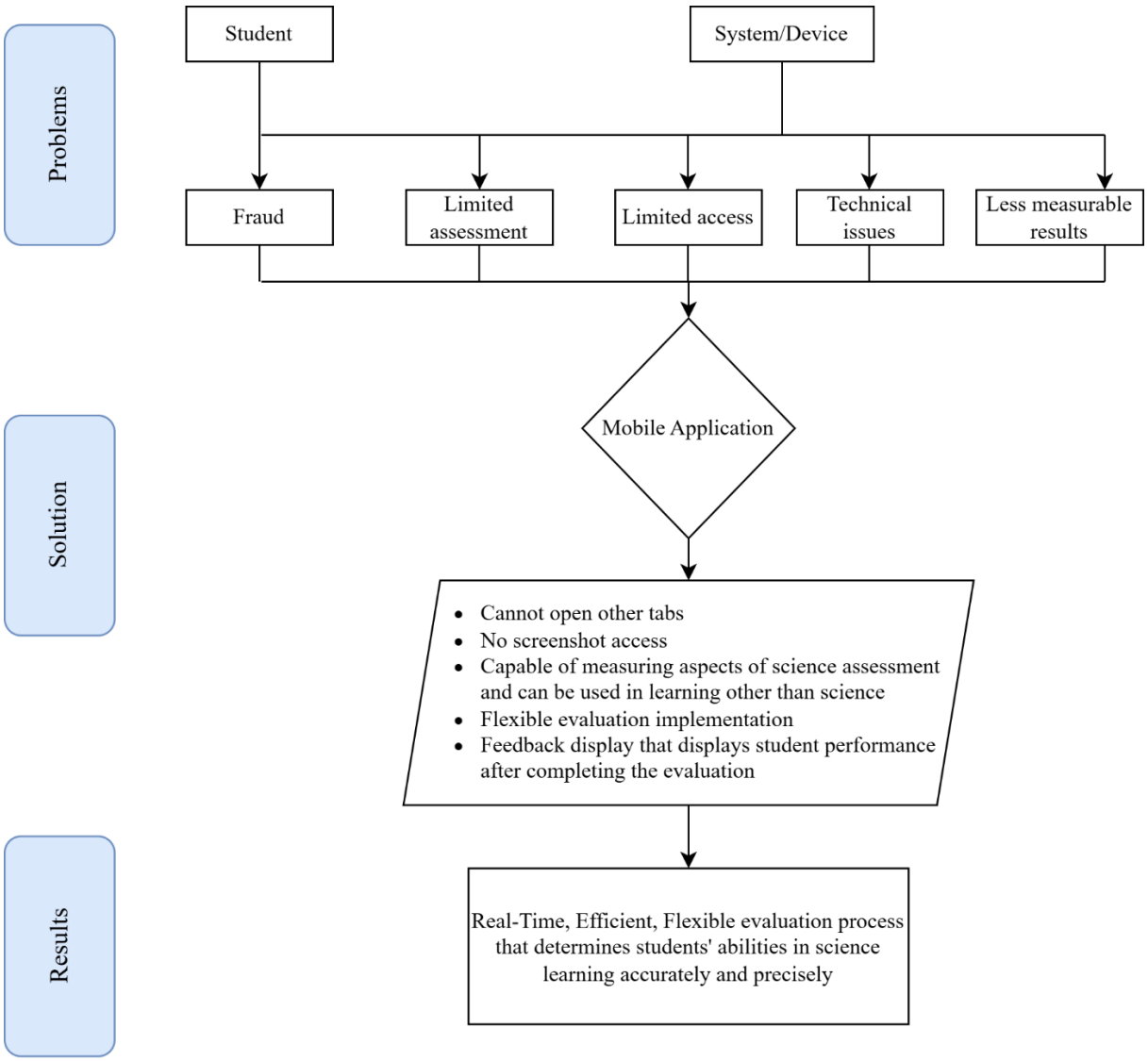

Figure 3. Map of solutions to weaknesses in media utilization in science learning evaluation

Based on the solution mapping in Figure 3, out of the three combined media, one provides a solution with minimal weaknesses: a mobile application. This mobile application can evaluate the learning process using several programming methods tailored to the application's objectives. The use of mobile applications for evaluation is expected to provide real-time evaluation results, demonstrate student abilities, and provide feedback on the learning evaluation results.

4. CONCLUSION AND RECOMMENDATION

Based on the Systematic Literature Review (SLR) method with PRISMA guidelines that have been carried out, this study identifies the media used in evaluating science learning, maps the weaknesses of its implementation, and formulates best practice solutions. From the results of the analysis of 11 selected articles, it was found that the most frequently used media are divided into two main categories: Gamification, such as Quizizz, Kahoot, and Wordwall; and Special Applications, such as Computer Based Test (CBT), Web-based applications, and Mobile Applications. The main weaknesses identified from the use of these media include the high potential for cheating (students opening other tabs), students' focus being diverted to game elements or speed, technical problems (device/server dependence), limited access to free features, and evaluation results that are less measurable in depth.

As a solution to the synthesis of these problems, the researchers concluded that the development of a specially designed Mobile Application is the most recommended best practice solution. Mobile applications are considered most effective because they have advantages in limiting cheating (for example, blocking other tabs), are more flexible in implementation, and are able to provide real-time feedback. Thus, a well-designed mobile application can produce more efficient, accurate, and precise science learning evaluations.

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