

OPTIMIZING HIGH SCHOOL STUDENT LEARNING OUTCOMES THROUGH KAHOOT-BASED ON PRETEST–POSTTEST SCORE IMPROVEMENT: A SYSTEMATIC LITERATURE REVIEW

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Abstract: This study was conducted to summarize and analyze the effectiveness of Kahoot in optimizing the learning outcomes of high school students, based on indicators such as increasing scores before and after (pretest–posttest) or learning completeness. The method used is Systematic Literature Review (SLR) with an article search through Publish or Perish in the Google Scholar database in the range of 2021–2025. Study selection was carried out using inclusion/exclusion criteria (equivalent high school level, empirical studies, reporting quantitative learning outcome data, and access to complete texts). From the selection process, the author selected 10 articles as the final study. The results of the synthesis show that the integration of Kahoot, both as an evaluation medium and as an interactive quiz in learning, is consistently associated with improved learning outcomes (e.g., an increase in the average pretest–posttest, an increase in N-Gain, or an increase in the percentage of completeness in classroom action studies). The findings also indicate that the effectiveness of Kahoot is influenced by device readiness, question design quality, and teacher implementation strategies. Implicitly, Kahoot is considered relevant as part of a planned formative evaluation, not just a variation of classroom activities.

Keywords: Kahoot, Learning Outcomes, Learning Media, Systematic Literature Review (SLR), Game-Based Learning, Learning Evaluation, Gamification.

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INTRODUCTION

Learning in school requires a planned process so that students develop in the realm of knowledge, attitudes, and skills. In practice, the success of learning is often proxied through learning outcomes, such as grades, completeness, or competency achievements (Wahyu et al., 2024), both in the form of grades, completeness, and competency achievements set in each material. The learning process is closely related to the use of media, methods, and the achievement of learning outcomes. Learning media are any form of means used to convey messages through various channels that are able to stimulate students' thoughts, feelings, and willingness, thereby encouraging an effective learning process, enriching new knowledge, and helping to achieve learning goals optimally (Daniyati et al., 2023). The learning media have an important role in influencing the success rate of students, because the media functions as a supporting means in conveying learning materials from teachers to students so that they are easier to understand (Cahyani et al., 2024).

Along with the development of educational technology in the digital era, it encourages learning evaluation to shift from conventional methods to more interactive and faster forms. (Jusman, 2025). At the high school level, evaluation plays an important role in mapping the understanding of basic concepts and ensuring the achievement of competencies. (Sudianto, Amrillah Rosyadi 2024). However, conventional evaluations are often constrained by low student engagement and slow feedback due to the time-consuming examination process. (Putra 2025). One of the interactive evaluation alternatives is Kahoot, which is an interactive quiz platform that combines elements of play with learning (Pratiwi et al., 2025).

A number of studies show that improvement in learning outcomes is often in line with increased student participation and motivation when Kahoot is applied as an interactive form of evaluation and provides feedback quickly (Amalia et al., 2022). In addition, the effectiveness of Kahoot is also influenced by the quality of the preparation of question items, the suitability of the level of difficulty with the student's competence, and the timeliness of application, for example, when strengthening the material or in formative evaluation (Fajriyah et al., 2025). Research (Juliani, Erita, and Anggraini 2025) Argues that the use of Kahoot has the potential to increase learning outcomes. However, the findings are still diverse due to differences in class context, subjects, duration of application, and assessment instruments.

The pretest-posttest design is widely used to assess changes in ability before and after the intervention. However, specific evidence on the effectiveness of Kahoot in high school students measured through the improvement of pre-post scores is still scattered across a variety of subject contexts and has not been synthesized in a focused manner. Therefore, this study conducted an SLR to map the characteristics of the study and synthesize the findings of improving cognitive learning outcomes based on a pretest-posttest design. The research question asked was: the extent to which the use of Kahoot is related to the improvement of pretest and posttest scores in high school students/equivalent.

METHOD

The Systematic Literature Review (SLR) approach in this study is carried out through the process of identification, review, evaluation, and interpretation of all relevant and available studies. Through the SLR method, researchers review and select journal articles systematically, with structured work stages and follow established procedures (A. Putra & Afrilia, 2020). The source of literature in this study comes from scientific journal articles and proceedings that examine the optimization of learning outcomes of high school students through kahoot based on the increase in pretest–posttest scores, as well as reporting learning outcomes or corresponding indicators, such as evaluation scores, learning completeness, and increase in grades from pretest to posttest (Rahman et al., 2024). To complete the study, the researchers searched the articles on the Google Scholar database with the help of the Publish or Perish application. The search was conducted using the keywords "Kahoot", "Learning Outcomes", "Learning Evaluation", and "High School". Literature Review articles that contain a compilation of studies are also used to help map trends and avoid the absence of sources in certain contexts (Lusiana & Gustiana, 2025).

The eligibility criteria for the articles included in this study are presented in Table 1. The flow of tracing and study selection at the identification–screening–feasibility stage is summarized in Figure 1.

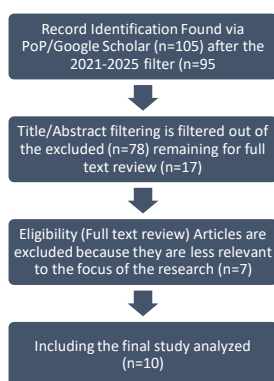


Figure 1. Study search and selection (SLR) flow.

Table 1. Study inclusion and exclusion criteria.

Criteria	Inclusions	Exclusion
Year of Publication	Articles published in the last 5 years (2021-2025)	Articles published before 2021
Publication Type	Scientific journal articles and proceedings.	Thesis, Opinion article, general review, or editorial
Research Subject	The research was conducted on the high school (SMA) educational pathway	The research was not conducted on the high school (SMA) educational pathway
Research Results	Articles that report pretest- and posttest-based cognitive learning outcome data, at a minimum: The average value of the pretest and posttest, or data that allows the calculation of gain (post – pre), or data that allows the calculation of other measures of improvement (e.g., N-gain/effect size) based on pre-post.	The article does not report data on pretest and posttest-based cognitive learning outcomes, at least: The average value of the pretest and posttest, or data that allows the calculation of gain (post – pre), or data that allows the calculation of other measures of improvement (e.g., N-gain/effect size) based on pre-post.
Accessibility	Fully accessible article.	Articles are not fully accessible.

Table 1 is used as a reference for literature screening so that the analyzed studies are relevant to the topic of Kahoot and reporting learning outcomes at the Senior High School (SMA) level, and are fully accessible.

The data extracted from each article in the Systematic Literature Review study included the identity of the author's publication and the year, the characteristics of the research context such as level/class and subject, research design for example: experiment, research and development, or literature study), and a summary of achievements related to learning outcomes (Dewi & Masniladevi, 2021). The results of the extraction were then analyzed using thematic synthesis to identify the tendency of Kahoot's influence patterns, as well as to map the factors that affect the level of effectiveness (Mahfirah & Yahfizham, 2024).

RESULT

The results of a literature search using Publish or Perish (PoP) on Google Scholar yielded 105 articles. After initial screening based on the 2021–2025 publication year range, 95 articles were obtained. The title and abstract screening stage produced 78 articles that were not relevant to the topic of Kahoot, and the learning outcomes at the high school level were equivalent, leaving 17 articles for feasibility assessment through a full-text review.

At the feasibility stage (full text review), 7 Articles were excluded because they were not in line with the focus of inclusion research (e.g., non-high school level equivalent, did not report quantitative learning outcome data, or were not empirical studies). Thus, 10 articles were designated as the final study analyzed (Figure 1).

A summary of the characteristics and key findings of the 10 selected articles is presented in Table 2.

Tabel 2. Ringkasan karakteristik dan temuan studi terpilih (n=10).

No	Author & Year	Level/ Subjects	Research Design	Research Results
1.	(SURAT 2022)	SMA PAK	Experiment (Pretest–Posttest Control Group)	The average learning outcomes of the experimental class were 85.8 higher than those of the control class of 74.1; the completeness of the experimental class was 91.7% (KKM 75).
2.	(Zulfikar and Sulistiani 2025)	SMA / PAI	Quasi experiments (Pretest–Posttest Control Group)	Sig.0.007 (<0.05) shows a significant influence of Kahoot on PAI learning outcomes.
3.	(Purba et al., 2025)	SMA / Ekonomi	Quasi experiments (Non-equivalent Control Group)	The value increased from 53.33 to 82.67; Motivation and learning outcomes are significantly increased.
4.	(Cahyani et al., 2023)	SMA Ekonomi	Kahoot-assisted PBL (2 cycles)	The percentage of learning outcomes increased: cycle I 71.17%→cycle II 82.8%.
5.	(Konengian and Marhadi 2023)	SMA Kimia	Pretest–Posttest Control Group	The average pretest–posttest of the experimental class was 45.29→82.06; control 41.36→66.06. Moderate N-Gain:

				0.65 (experimental) and 0.43 (control).
6.	(Sains, Azizah, and Cahyanti 2024)	SMA Bahasa Inggris	/Classroom action research(2 cycles)	The percentage of completeness increased from 47% (pre-cycle) to 69% (cycle I) and 83% (cycle II) with KKM 70; learning participation increased.
7.	(Meilila et al. 2025)	SMA Geografi	/One group pretest–posttest	The average score increased from 62.23 (pretest) to 78.94 (posttest); students reported learning more engagingly through Kahoot quizzes.
8.	(Harianja, Nainggolan, and Surbakti 2025)	SMA Fisika	/Quasi eksperimen (Nonequivalent Control Group)	Sample of 28 students per class. The single-party t-test showed significant differences (t count 6.565 > t table 1.703); learning outcomes improved after the implementation of Kahoot-assisted guided inquiry.
9.	(Putra 2025)	SMA Geografi	/Quasi eksperimen (Non-equivalent Control Group)	The t-test showed a significant effect (sig. 0.033 < 0.05). The experimental group showed an N-Gain of 60.37% and was superior to the controls.
10.	(Aidynnisa, Eminita, and Astriyani 2025)	SMA Matematika	/Classroom action research(2 cycles, PBL + Kahoot)	Classical completeness increased from 45% (pre-cycle) to 65% (cycle I) and 84% (cycle II) in trigonometry material (KKM 75).

Table 2 summarizes the variety of subjects (PAI, Economics, Catholic Religious Education, Chemistry, English, Geography, Physics, and Mathematics), methods (quantitative and classroom action research), and research design (e.g., quasi-experimental non-equivalent control group, pretest–posttest control group, one–group pretest–posttest, and two-cycle PTK). In general, all studies reported a tendency to improve learning outcomes after the implementation of Kahoot, either through an increase in average scores, an increase in N-Gain, or an increase in the percentage of completeness.

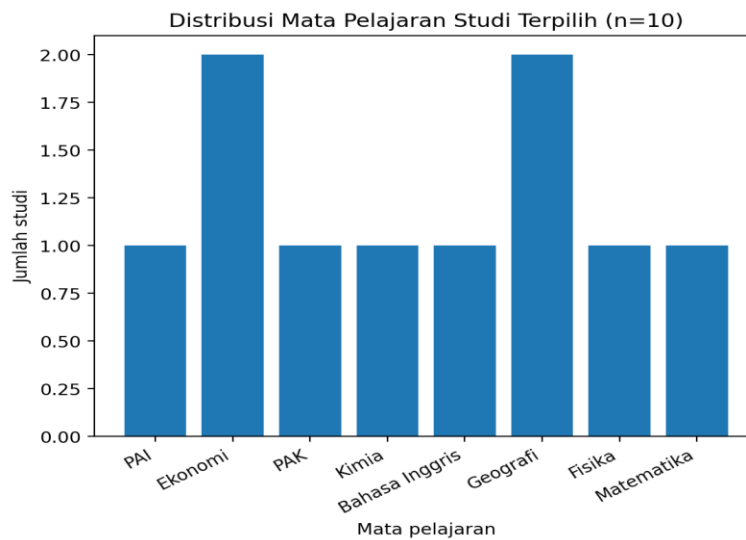


Figure 2. Distribution of subjects in selected studies (n=10).

Based on Figure 2, the selected studies cover a wide range of subjects at the high school level, with the highest frequency in Economics and Geography. These contextual variations suggest that Kahoot is cross-subject and can be used both as a formative evaluation and as a material reinforcement quiz, as long as the quality of the question items and feedback mechanisms are structured directionally.

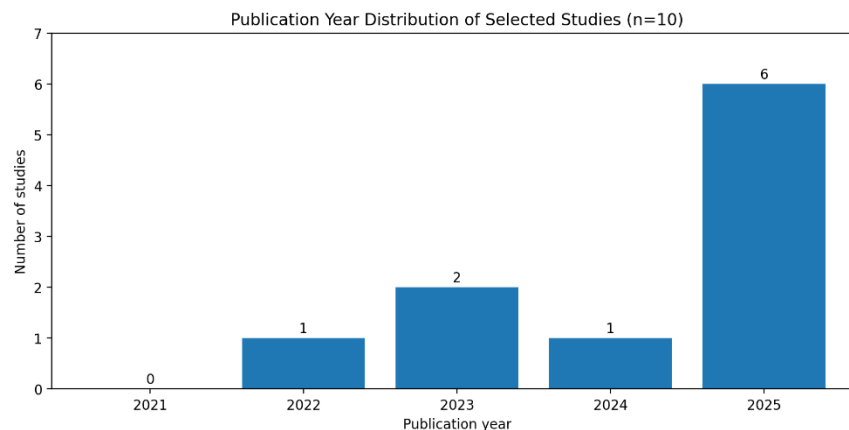


Figure 3. Distribution of the year of publication of selected studies (2021–2025)

Based on Figure 3, the distribution of selected studies in the 2021-2025 range is 1 publication study, 2 2023 publication studies, 1 2024 publication study, and 6 2025 publication studies. From the selected study results, the most studies will be selected for publication in 2025.

DISCUSSION

A synthesis of 10 articles shows that the application of Kahoot in high school/equivalent learning is generally followed by an improvement in cognitive learning outcomes. The improvement was seen in the increase in the average posttest, gain/N-gain, and completeness in

the PTK study, and a number of quasi-experimental studies reported significant differences compared to the control class.

Pedagogically, Kahoot works as a trigger for engagement: a quick quiz format, live feedback, and gamification elements (points, rankings, and deadlines) maintain attention and encourage repetitive practice (Setyowati et al., 2025). However, because of its competitive and real-time characteristics, Kahoot is more appropriately positioned as a low-risk formative assessment—e.g., a quiz at the end of a subtopic—than a summative assessment that demands strict integrity control.

The quality of the question construction is the main determinant. Items that are ambiguous or not aligned with competency indicators can make the score more reflective of answering speed, not mastery of concepts. Therefore, several development studies emphasize the validation of materials, media, and language, as well as the preparation of tiered questions from LOTS to HOTS so that the evaluation results are more representative (Jaya, 2022).

The variety of subjects in the selected study reinforces that Kahoot is not limited to one content domain. In conceptual maps, such as Chemistry, and maps that require problem solving, such as Mathematics, Kahoot can be used to diagnose misconceptions and reinforce exercises, as long as the teacher sets the tempo, provides discussion after the quiz, and links the results of the quiz to remediation/enrichment activities.

In terms of classroom implementation, the teacher's role includes preparing fair tools and rules of the game, managing competitions to stay healthy, and utilizing the report feature to identify students' difficulties and design follow-ups. In this way, Kahoot functions as part of the learning cycle, not a one-time activity.

When viewed from the improvement indicators, pretest-posttest studies generally showed a spike in scores in the group that used Kahoot, while in PTK, the improvement was reflected in the increase in classical completeness between cycles after improving the strategy and quality of the questions. This pattern suggests that the Kahoot effect can be amplified when used repeatedly, rather than occasionally.

The heterogeneity of the design, duration of interventions, and assessment instruments meant that the magnitude of the impact between studies was not fully proportional. This condition is the reason for the synthesis to be carried out thematically and has not yet arrived at a meta-analysis with a uniform effect size.

The most frequently mentioned supporting factors include device and network readiness, digital literacy, and clear and competency-aligned quiz design. Recurring obstacles include limited devices for some students, unstable connectivity, and time requirements for application usage orientation.

The implication is that schools need to prepare implementation support (internet access, devices, and teacher training) as well as guidelines for the preparation of question items based on competency indicators. With this support, Kahoot can be integrally integrated as a formative assessment and feedback tool that accelerates learning improvement.

CONCLUSION

Based on the Systematic Literature Review (SLR) of 10 articles at the equivalent high school level, the use of Kahoot shows a tendency to improve student learning outcomes, especially when

integrated as a planned formative evaluation and supported by device readiness and good question design.

Theoretically, these findings support the understanding that gamification-based evaluations can improve learning engagement through managed competitions, deadlines, and real-time feedback. The contribution of this SLR lies in mapping the pattern of evidence across studies as well as the identification of implementation prerequisites that affect impact variations.

The limitations of this study include focusing on a single database and a specific range of publications, so some relevant studies may not be included. In addition, the heterogeneity of the research design and the learning outcome indicators made the synthesis carried out thematically, not yet to the meta-analysis with uniform effect sizes.

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