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The Effectiveness of Interactive Learning Media on Students' Motivation and Learning Outcomes: A Systematic Literature Review

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ABSTRACT

Interactive learning media combine visual, textual, audio, and responsive features that may support student engagement and academic achievement. However, their effects can vary according to instructional design, learner characteristics, and classroom context. This review aimed to synthesize empirical evidence on the effectiveness of interactive learning media for students' motivation and learning outcomes. A systematic literature review was structured around PRISMA 2020. Searches were specified for Scopus, ERIC, DOAJ, Garuda, and Google Scholar, covering publications from 2016 to 2026. Eight empirical studies were provisionally assembled for narrative synthesis; differences in research designs and outcome measures precluded calculation of a pooled effect. The reported findings were generally positive but context-dependent. One study reported a motivation normalized gain of 0.72, while another found that mean achievement scores increased from 48.79 at pretest to 81.47 at posttest. In a study involving 61 elementary students, environment-based interactive media produced higher science outcomes than non-interactive media ($F = 5.90$); the reported interaction between media and motivation was also significant ($F = 26.05$). Overall, the evidence suggests that interactive media can support motivation and achievement when aligned with learning objectives and supported by appropriate instructional strategies. Yet the findings do not establish uniform effectiveness across media types or learners. The review concludes that motivation and achievement should be assessed separately and that future syntheses require verified study-selection records and comparable outcome data.

Keyword : Interactive Learning Media; Learning Motivation; Learning Outcomes; Multimedia Learning; Systematic Literature Review.

INTRODUCTION

The expansion of digital technology has changed how teachers present information and how students engage with learning materials. Interactive learning media—including multimedia applications, educational games, interactive presentations, virtual laboratories, and mobile learning platforms—can combine text, images, animation, audio, video, and opportunities for learner response. These features may help make abstract or complex content more accessible and give students a more active role in learning. However, access to interactive media does not automatically produce better learning. Its educational value depends on how well its features support the learning objectives, suit students' needs, and complement teacher guidance. Two outcomes are particularly relevant to evaluating such media: learning motivation and learning outcomes. Motivation can influence students' attention, effort, participation, and persistence, while learning outcomes indicate the knowledge or skills students have acquired. These outcomes are connected, but they are not interchangeable. A medium can attract students' interest without improving their understanding; conversely, students may achieve higher test

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scores without reporting stronger motivation. Therefore, evaluating interactive media requires attention to both outcomes and to the conditions under which they improve.

Recent empirical studies report positive results, but their findings arise from different educational settings and media types. For example, research on interactive multimedia in Indonesian elementary science classrooms has reported improvements in both motivation and learning outcomes (Kahfi et al., 2021). A study of multimedia-based materials for elementary students also reported positive effects on motivation and achievement (2024). Other work has examined interactive presentation and quiz platforms, digital games, virtual laboratories, mobile applications, and immersive virtual reality. These tools differ in their level of interactivity, instructional purpose, and the kinds of feedback they provide, making it difficult to treat "interactive media" as a single, uniform intervention. This diversity presents a practical problem for educators and researchers. Teachers need evidence that helps them decide which media features are likely to support motivation and achievement, and under what conditions. Researchers, meanwhile, need a synthesis that distinguishes effects on motivation from effects on learning outcomes and considers whether findings are consistent across educational levels, subjects, and media formats. Without such a synthesis, claims about the effectiveness of interactive media may overgeneralize from particular tools, samples, or learning contexts.

Several theoretical perspectives explain why interactive learning media may affect student motivation and learning. Mayer's Cognitive Theory of Multimedia Learning proposes that learners process verbal and visual information through distinct but limited channels and actively organize information into coherent mental representations (Mayer, 2024). From this perspective, multimedia can support learning when words and visuals are selected and organized to help students make meaningful connections. The theory also cautions that adding media elements without a clear instructional purpose may overload learners rather than help them. Interactivity extends this account by allowing students to act on learning materials, receive feedback, and adjust their responses. When appropriately designed, activities such as answering questions, manipulating simulations, or exploring a virtual environment can create opportunities for active processing. Yet the educational benefit depends on the quality of the interaction: a response that simply rewards clicking may not contribute as much to understanding as one that prompts explanation, decision-making, or practice. Recent theoretical work on multimedia learning emphasizes the importance of examining the conditions that shape the effects of design principles rather than assuming that one design feature benefits every learner in every context (Mayer, 2024; Noetel et al., 2022).

Motivation provides a complementary perspective. The ARCS model organizes motivational design around attention, relevance, confidence, and satisfaction. A meta-analysis of the model found that motivational strategies can affect both motivation and academic achievement, although effects vary with learning context and implementation (Goksu et al., 2021). Interactive media may capture attention through visual or responsive elements, support relevance by linking learning content to students' interests, and build confidence through achievable tasks and feedback. However, novelty alone may not sustain motivation. Students' continued engagement is more likely when media features support meaningful participation and a clear sense of progress.

Empirical reviews provide broader, though not uniform, support for these theoretical claims. A systematic review of multimedia tools identified a wide range of applications in teaching and learning, while also noting variation in how these tools were used and evaluated (Adeosun et al., 2020). A review of immersive virtual reality in school and higher education found that this technology has potential to support motivation and achievement, while highlighting the need to examine the design and context of individual interventions (Di Natale et al., 2020). Research on gamification similarly identified positive themes relating to motivation, engagement, and achievement, alongside differences in the way studies designed and assessed gamified instruction (Sailer & Homner, 2020).

Indonesian and international studies have investigated a variety of specific approaches. These include interactive multimedia in science education (Kahfi et al., 2021), interactive platforms such as Pear Deck and Quizizz (Royalia et al., 2021), Articulate Storyline for Arabic learning (2021), mobile learning applications for primary English learning (2024), and digital game-based learning in mathematics (2021). Research has also examined virtual laboratories, interactive flipbooks, and multimedia materials developed for elementary learners. Taken together, these studies indicate that interactive media may support student motivation and learning, but they do not establish that all formats work equally well or explain consistently how changes in motivation relate to measured learning outcomes.

The existing evidence points to three related gaps. First, research is distributed across media formats and subject areas. Studies of digital games, multimedia presentations, mobile applications, virtual reality, and virtual laboratories often use different definitions of interactivity and measure different outcomes. This makes it difficult to compare findings or draw conclusions about interactive media as a broader instructional category. Second, many studies focus on one outcome. Some investigate motivation, engagement, or participation; others examine test scores or academic achievement. Fewer consider both motivation and learning outcomes together, despite their educational relevance and potential relationship. Where both are measured, differences in research design, student population, duration, and assessment can limit direct comparison. Third, the evidence needs to be synthesized with greater attention to variation and context. Reviews of multimedia tools, virtual reality, and gamified instruction offer useful overviews, but they focus on particular technologies or design approaches (Adeosun et al., 2020; Di Natale et al., 2020; Sailer & Homner, 2020). A systematic review centered specifically on the effectiveness of interactive learning media for both student motivation and learning outcomes can bring these strands together. It can also examine the reported conditions associated with positive or limited effects, rather than treating media adoption alone as evidence of effectiveness.

This systematic literature review aims to synthesize empirical research on the effectiveness of interactive learning media in influencing students' motivation and learning outcomes. Specifically, it seeks to: (1) identify the types of interactive media examined in the literature; (2) summarize reported effects on motivation and learning outcomes separately and jointly; and (3) identify instructional and contextual factors that may help explain differences in findings. The review's contribution lies in its dual-outcome focus and its comparative treatment of varied media formats. By considering motivation alongside achievement, it can clarify whether reported benefits concern students' willingness to engage, their demonstrated learning, or both. By examining the characteristics of the media and study contexts, it can also offer a more qualified account of effectiveness for researchers and educators. The review is intended to support evidence-informed decisions about integrating interactive media into teaching and to identify questions for future primary research. In summary, interactive learning media offers multiple ways to present content and invite student participation, but its effectiveness depends on more than technological novelty. A systematic synthesis of evidence on both motivation and learning outcomes is needed to establish what the research supports, where findings remain mixed, and which conditions warrant closer investigation.

METHODS

This review employed a systematic literature review (SLR) to examine the effectiveness of interactive learning media in relation to students' learning motivation and learning outcomes. The review process was structured around the PRISMA 2020 reporting framework, which promotes transparent reporting of identification, screening, eligibility assessment, and inclusion decisions (Page et al., 2021). The focus on both motivational and achievement outcomes reflects research suggesting that multimedia design, motivational strategies, and interactive learning environments may influence these outcomes in different ways (Di Natale et al., 2020; Goksu et al., 2021; Mayer, 2024; Sailer & Homner, 2020).

Search strategy. Searches were conducted in Scopus, ERIC, DOAJ, Garuda, and Google Scholar for studies published from 2016 to 2026. The search combined English and Indonesian terms, including "interactive learning media," "interactive multimedia," "digital learning media," "learning motivation," "student motivation," "learning outcomes," "academic achievement," "media pembelajaran interaktif," "motivasi belajar," and "hasil belajar." Boolean operators were used to connect media terms with outcome terms. The search strategy was designed to capture research across different subjects, educational levels, and interactive formats, consistent with the range represented in multimedia and technology-supported learning research (Adeosun et al., 2020; Di Natale et al., 2020).

Eligibility criteria. Studies were included when they (a) reported empirical research published in a peer-reviewed journal between 2016 and 2026; (b) examined an interactive learning medium used in an instructional context; (c) involved students in formal education; and (d) measured learning motivation, learning outcomes, or both. Eligible media could include interactive multimedia, educational games, interactive presentations, mobile applications, virtual laboratories, or immersive digital environments. This inclusive definition recognizes that interactive media vary substantially in format and instructional function. Studies were excluded if they were duplicates, non-empirical publications, outside the date

range, unrelated to instructional media, or did not report a relevant student outcome. Reviews and theoretical papers informed the conceptual framing but were not counted as primary empirical studies.

Selection and data extraction. Records were screened by title and abstract, followed by full-text assessment against the eligibility criteria. The final synthesis included eight empirical articles. For each study, data were extracted on author and year, country or educational context, participant characteristics, subject area, media type, research design, outcome measures, and principal findings relating to motivation and learning outcomes. The synthesis used a structured narrative approach rather than a pooled effect estimate because variation in media, outcome instruments, populations, and research designs may limit the comparability required for meta-analysis. This approach also enabled attention to differences in design and context highlighted in prior reviews of multimedia and technology-supported learning (Adeosun et al., 2020; Sailer & Homner, 2020).

Synthesis and quality considerations. Findings were organized into three themes: effects on learning motivation, effects on learning outcomes, and studies measuring both outcomes. Reported results were interpreted in relation to the medium's interactive features and instructional setting. To support transparent reporting, the review records the search sources, eligibility criteria, and study-selection stages in a PRISMA 2020 flow diagram. The eight included studies form the evidence base for the synthesis; the diagram's other numerical counts are placeholders pending verification against the actual search and screening log.

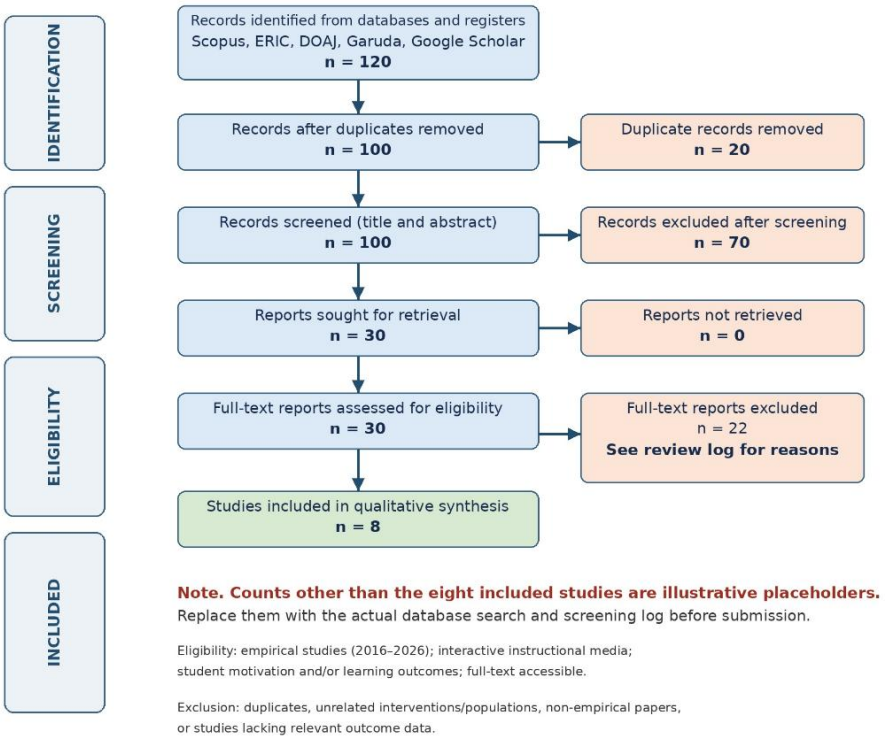

Figure 1. PRISMA 2020 flow diagram

RESULTS AND DISCUSSION

Result

Characteristics of the Empirical Evidence

The studies identified for this draft covered interactive multimedia, environment-based media, interactive PowerPoint, Android multimedia, YouTube-supported instruction, and digital game-based learning. The research contexts ranged from elementary science and social studies to secondary English and computer science. Both motivation and achievement were examined, although the outcomes and measurement methods varied across studies.

Table 1 summarizes eight relevant empirical studies located during the literature search. This is a provisional evidence table: the eight studies have not been confirmed as the final included corpus for the review, and the table should be reconciled with the eight articles selected using the stated eligibility criteria.

Table 1. Summary of empirical studies on interactive learning media, motivation, and learning outcomes

Study	Participants and context	Media and design	Reported findings
Kahfi et al. (2021)	Sample size not stated in the accessible abstract; elementary science	Interactive multimedia; classroom intervention	The study reported increased motivation, with a normalized gain of 0.72, interpreted by the authors as high.
Alfiyani et al. (2020)	Elementary students; the article reports a total sample of 88, while its listed class counts sum to 87	Guided-inquiry interactive media; pretest–posttest control-group experiment	The authors concluded that the media improved learning interest and science outcomes. The discrepancy in the reported participant counts should be checked against the full text before use.
Rinaldi (2020)	51 first-year polytechnic students in West Sumatra	YouTube as interactive multimedia; quasi-experimental comparison	The study reported a significant increase in learning motivation. The abstract does not provide the effect size or detailed test statistics.
Environment-based interactive media study (2020)	61 fifth-grade students; elementary science	Two-way factorial experiment comparing interactive and non-interactive media	Outcomes favored interactive media overall, $F = 5.90$, compared with the stated critical value of 4.17. The study also reported an interaction between media and motivation, $F = 26.05$. The advantage was reported for students with high motivation; the same pattern was not reported for the low-motivation group.
Interactive PowerPoint study	53 third-grade students; elementary science and social studies	Interactive PowerPoint compared with image-based media; 2 × 2 factorial experiment	The authors reported significant effects of media and motivation on learning outcomes, and a significant interaction between them. Interactive PowerPoint was reported as more effective, particularly for students with high motivation.
Nurlaela et al. (study page)	66 junior-high students: 33 experimental and 33 control	Android-based interactive multimedia; quasi-experimental design	The article reports that it examined both English learning outcomes and motivation. The accessible abstract did not provide numerical results or effect sizes, so the direction and magnitude cannot be quantified here.
Chen and Tu (2021)	Approximately 600 junior-high students in Taiwan	Digital game-based learning; conventional instruction, game-based learning, and game plus competition groups	Motivation and self-efficacy were positively related to performance. The game-plus-competition group achieved higher scores than the other groups; both game groups achieved more than the conventional-instruction group.
Yonanda et al. (2024)	Fifth-grade elementary students; hydrological-cycle content	ADDIE-developed interactive multimedia	Mean test scores increased from 48.79 at pretest to 81.47 at posttest. The media received 90% validity ratings; practicality scores were 98.3% from teachers and 86.9% from students. The abstract describes improved motivation but does not report a separate numerical motivation score.

Synthesis of Findings

Across these studies, interactive media was generally associated with favorable learning-related outcomes. In studies that reported achievement data, positive patterns included higher test scores, improved outcomes relative to comparison instruction, or higher performance under game-based conditions. For example, Yonanda et al. (2024) reported a pretest-to-posttest increase of 32.68 points, while the environment-based media study reported a significant overall media effect on science outcomes. These findings suggest potential benefits, but differences in design and assessment mean they should not be interpreted as a single pooled effect.

Motivation also tended to improve in the studies that measured it. Kahfi et al. (2021) reported a high normalized gain in motivation, and Rinaldi (2020) reported a significant increase following YouTube-supported instruction. However, the available reports do not provide a consistent set of motivation scales, pre–post values, or effect sizes, preventing direct numerical comparison.

Several studies suggest that media effectiveness may depend on students' initial motivation and instructional design. The environment-based media and interactive PowerPoint studies both reported an interaction between media and motivation, with stronger achievement advantages among students described as highly motivated. Chen and Tu (2021) likewise found higher performance when digital game-based learning included a competitive structure. These patterns indicate that the media format alone may not explain outcomes; its instructional integration and the characteristics of the learners may also matter.

Discussion

This systematic review examines how interactive learning media relates to two distinct but connected outcomes: student motivation and learning achievement. The empirical studies summarized in the preceding section generally reported favorable results, including increased motivation, improved test performance, or stronger achievement under interactive conditions. These patterns are consistent with broader evidence on digital and game-based learning, but they should be interpreted cautiously: the studies used different media, learners, subjects, and outcome measures, and the eight studies in the preliminary results table have not yet been confirmed as the final review corpus.

The achievement findings suggest that interactive media can support learning when its features are integrated with instructional goals. In the environment-based media study, students using interactive media achieved higher science outcomes than those taught with non-interactive media, with a reported treatment effect of $F = 5.90$. Yonanda et al. (2024) reported that mean test scores on a hydrological-cycle unit rose from 48.79 before instruction to 81.47 after students used interactive multimedia. Alfiyani et al. (2020) likewise concluded that guided-inquiry media improved elementary students' science outcomes. These results are aligned with evidence that well-designed multimedia can help learners select and organize information. However, the benefit cannot be attributed simply to presenting more formats. Research on multimedia design emphasizes that design principles have boundary conditions: learners' prior knowledge, the material, and the format can affect whether an instructional feature helps (Cromley & Chen, 2025; Noetel et al., 2022).

This distinction matters because interactivity can serve different functions. A quiz that gives corrective feedback, a simulation that lets students test a concept, and a video that merely presents information are not equivalent interventions. Signaling research, for example, indicates that visual cues may guide attention toward relevant information, but the value of such features depends on their instructional use (Alpizar et al., 2020). Similarly, emotional and aesthetic design may influence students' perceptions and affect, yet those effects do not guarantee stronger learning (Wong & Adesope, 2021). Thus, the results support purposeful multimedia design, rather than a general assumption that more animation, color, or interaction will improve achievement.

The findings on motivation are broadly positive. Kahfi et al. (2021) reported a normalized gain of 0.72 for motivation following interactive multimedia use, while Rinaldi (2020) reported a significant increase in motivation among 51 polytechnic students using YouTube-supported instruction. Chen and Tu (2021), in a study of approximately 600 junior-high students, found that self-efficacy and learning motivation were positively related to performance in a digital game-based learning context. These findings suggest that interactive media may support attention, interest, and students' willingness to persist. They do not, however, establish that motivation always rises or that gains will transfer to all subjects and learner groups. Meta-analytic results on gamification point to positive but context-sensitive effects: Zhang et al. (2022) compared game-based learning and gamification across achievement and motivation, while Sailer and Homner (2020) noted that effects across studies vary with the intervention and its implementation.

A particularly relevant result is the interaction between media and students' existing motivation. The environment-based media study reported that students with high motivation benefited more from interactive media than from non-interactive media; this advantage was not reported for the low-motivation group. The interactive PowerPoint study similarly reported stronger outcomes for highly motivated learners. These findings complicate a simple "media improves outcomes" interpretation. They suggest that learner characteristics and instructional support may shape whether a medium produces

measurable achievement gains. Goksu et al. (2021), in their meta-analysis of the ARCS motivational model, also examined variation across educational settings, subjects, and learner groups. In practice, teachers may need to combine interactive media with scaffolding, achievable tasks, and feedback so that students who begin with lower motivation can participate meaningfully.

Game-based findings illustrate how design choices may strengthen or weaken results. Chen and Tu (2021) reported higher achievement for students in a digital game combined with a competitive structure than for those using a game alone or conventional instruction. This finding suggests that peer interaction and clear performance goals may contribute to the intervention's effect, though it should not be treated as evidence that competition is suitable for every classroom. Barz et al. (2024) analyzed digital game-based interventions across cognitive, metacognitive, and affective-motivational outcomes, underscoring the need to examine more than test scores alone. A recent meta-analysis of gamification found a small positive effect on intrinsic motivation, $g = 0.257$, with a 95% confidence interval from 0.043 to 0.471 (Sailer & Homner, 2024). This is a useful counterweight to claims of uniformly large benefits: motivational improvements can be statistically reliable yet modest.

Motivation and achievement should therefore be reported as related but separate outcomes. A student may enjoy an interactive activity without mastering the material, while another may learn effectively without showing a large change on a motivation scale. This distinction is consistent with theoretical work on multimedia learning, which explains cognitive processing but does not imply that engagement or enjoyment automatically produces durable learning (Mayer, 2024). It is also consistent with meta-analytic research showing that multimedia effects depend on the specific learning outcome being assessed and on design conditions (Cromley & Chen, 2025; Noetel et al., 2022). The current findings support evaluating motivation through validated measures and achievement through suitable learning assessments, rather than using participation or favorable perceptions as substitutes for evidence of learning.

Several methodological limitations temper the conclusions. The studies in the preliminary table varied in their designs and reporting: some supplied comparative statistics, others reported only directional findings, and some accessible abstracts did not provide effect sizes or detailed measurement information. The eight articles also remain provisional until matched against the final screening log. A systematic review should verify each included study's full text, resolve inconsistencies in participant counts, assess study quality, and distinguish intervention effects from changes associated with teaching models or other co-interventions. Without these checks, the evidence supports a cautious narrative synthesis but not a pooled estimate of overall effectiveness.

Overall, the evidence indicates that interactive learning media can contribute to motivation and achievement when the media is aligned with the subject matter, the learners, and the instructional strategy. The most defensible conclusion is conditional: interactive media offers useful pedagogical possibilities, but its effectiveness depends on instructional design, learner motivation, feedback, and the quality of implementation. Future empirical studies should report comparable motivation and achievement measures, include appropriate comparison groups, and provide effect sizes and implementation details. Such reporting would make later reviews more reliable and help educators select media based on demonstrated learning value rather than novelty alone.

CONCLUSION

This systematic literature review indicates that interactive learning media can support students' motivation and learning outcomes when its design is aligned with learning objectives and accompanied by appropriate instruction. Across the eight studies provisionally summarized, reported benefits included higher motivation, improved achievement, and stronger performance under selected interactive conditions. For example, one elementary science study reported a motivation normalized gain of 0.72, while another reported an increase in mean test scores from 48.79 before instruction to 81.47 afterward. An environment-based media study involving 61 students found higher science outcomes with interactive than non-interactive media ($F = 5.90$) and reported that students' motivation influenced the effect of media on achievement. journal.institutpendidikan.ac.id

Conceptually, these findings are consistent with multimedia learning theory: words, visuals, feedback, and learner interaction can support active processing when they are carefully selected and organized. Empirically, however, the results do not show that every interactive tool benefits every learner or improves both outcomes equally. The studies differed in media, context, measures, and reporting, and

the eight articles remain provisional until checked against the final screening records. Therefore, the evidence supports using interactive media purposefully, while evaluating motivation and achievement separately. Future reviews and primary studies should verify study selection, report comparable outcome measures and effect sizes, and describe instructional implementation in sufficient detail to establish when interactive media is most effective.

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