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INNOVATION AND DEVELOPMENT OF MULTIMODAL LEARNING MEDIA: A LITERATURE STUDY ON THE INTEGRATION OF PRINT, AUDIOVISUAL, AND COMPUTER TECHNOLOGY TO IMPROVE THE QUALITY OF 21ST CENTURY LEARNING PROCESSES

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Abstract
This study aims to systematically examine the concepts, theories, and practices of multimodal learning media innovation as a strategy for improving the quality of 21st-century learning. This study uses a library research method by examining various scientific sources such as journals, proceedings, and textbooks that discuss the integration of print, audiovisual, and computer technology media. The results of the study show that multimodal learning is based on *the Cognitive Theory of Multimedia Learning* and the social semiotics approach, which emphasises the importance of combining various modes of communication in constructing meaningful understanding. The integration of print, audiovisual, and computer technology media produces pedagogical synergy that can strengthen motivation, improve cognitive effectiveness, and support collaborative and independent learning. The application of multimodality in learning media design has been proven to support the development of 21st-century competencies such as critical thinking, creativity, communication, and digital literacy. Thus, multimodal learning media can become a strategic foundation for the renewal of a modern education system that is adaptive to technological developments and the learning needs of students.
Keywords: learning innovation, multimodal media, media integration, educational technology, 21st century learning

Introduction

The development of information and communication technology in the 21st century has brought fundamental changes to various aspects of life, including education. Digital transformation has influenced the way individuals interact, obtain information, and build knowledge. Amidst these changes, the education system is required to adapt in order to prepare students to face global challenges, the complexity

of knowledge, and future competency needs (Sudarmo et al., 2021) ; (Hattie & Timperley, 2007) . One of the main challenges in education today is creating a learning process that not only transfers knowledge but also develops critical thinking, collaborative, creative, and communicative skills, known as the four core competencies of the 21st century. In this context, innovation and development of learning media become important elements in improving the quality of the teaching and learning process(& Aslan, 2025) ;(Purike & Aslan, 2025) ; (Komari & Aslan, 2025) .

Learning media has a strategic function in bridging the interaction between teachers and students. Basically, media acts as an intermediary or communication channel that helps students understand learning messages more easily and interestingly . However, in traditional practice, the use of learning media is often limited to textual and static forms, such as printed books, student worksheets, or simple visual presentations. These forms of media tend to stimulate only one learning sense, making them less than optimal in supporting the diversity of student learning styles(Laurillard, 2012) . Modern research in the field of educational technology shows that the use of various modalities such as text, images, sound, and digital interaction can help strengthen the process of encoding information into long-term memory, which in turn has an impact on improving conceptual understanding and learning retention(Laurillard, 2002) .

The multimodal approach to learning is based on the theory that humans learn more effectively when information is presented through more than one form of representation or modality. Modalities can include verbal text, visual graphics, auditory elements, and computer-based interactive experiences. The integration of these various modalities enables learners to build a richer understanding through the combination of sensory and cognitive stimulation (Beetham & Sharpe, 2013) . This principle is also in line with Mayer's (2009) *Cognitive Theory of Multimedia Learning*, which explains that the right combination of text and visuals can reduce cognitive load while increasing knowledge transfer. Therefore, the development of multimodal learning media is not just a technological trend, but a pedagogical strategy rooted in strong theoretical and empirical foundations.

In the context of 21st-century education, the multimodal approach is increasingly relevant as technological advances have opened up a range of possibilities for media integration. For example, print media can now be combined with QR codes that link students to audiovisual content or computer-based interactive simulations. This type of integration creates a dynamic and contextual learning experience, allowing learners to explore concepts actively and independently (Mayer & Moreno, 2003) . Furthermore, this approach supports a student-centred learning paradigm, where the role of the teacher shifts from being the primary source of knowledge to being a facilitator and designer of learning experiences (Kress & van Leeuwen, 2001) . Thus, the development

of multimodal media can be seen as a form of pedagogical transformation that supports digital literacy, independent learning, and reflective thinking.

However, the implementation of multimodal learning media is not without challenges. One of these is the technological capability gap between teachers and students, as well as limited digital infrastructure in some educational institutions. In addition, not all teachers have the instructional design competencies required to combine various modalities in a balanced manner without overburdening students' cognition (Mayer, 2009) . Several studies also note that the integration of computer technology in learning is often not accompanied by a change in the teaching paradigm, so that the use of digital media only becomes a new form of presentation without methodological innovation. This shows that the development of multimodal media requires a holistic approach, covering technological, pedagogical, and psychological aspects simultaneously (Jonassen, 2011) .

In practical terms, innovations in multimodal learning media must also consider the suitability of content to learning objectives. The use of various types of media should not only aim to attract attention, but must also support the achievement of predetermined competencies. For example, a combination of narrative text, experimental videos, and computer simulations needs to be designed to complement each other in explaining certain scientific concepts. Multimodal design principles emphasise the importance of consistency, relevance, and cohesion between media elements so as not to cause confusion among learners (Salvatore & Marek, 2017) . Therefore, the process of multimodal media innovation needs to involve literature research, analysis of learner needs, and effectiveness testing to ensure that the resulting media actually improves the quality of the learning process. Additionally, multimodal-based learning media can contribute to efforts to improve access and inclusivity in education. By utilising a combination of print, audiovisual, and digital formats, educators can tailor the delivery of material to learners with special needs or different learning styles (Firmansyah & Aslan, 2025b) ; (Aslan & Arifudin, 2025) . Flexible content delivery also allows students to learn anytime and anywhere, supporting *the principle of lifelong learning*. In the digital age, characterised by abundant information availability, the ability to select, interpret, and integrate information from various sources has become an essential skill(& Carr-Chellman, 2009) . Therefore, multimodal media can function not only as a teaching aid but also as a means of developing information literacy and critical thinking.

Globally, many education policies emphasise the importance of using digital technology in learning to encourage innovation and efficiency. However, many studies also remind us that the successful implementation of technology-based media greatly depends on the readiness of human resources and managerial support from schools. Factors such as teacher training, digital education infrastructure policies, and curriculum integration play an important role in the sustainability of multimodal learning innovation

(Firmansyah & Aslan, 2025a) ; (Caroline & Aslan, 2025) ;(Rokhmawati et al., 2025) . In the Indonesian context, digital education transformation has been driven by various programmes such as Sekolah Penggerak (School Movement), Kampus Merdeka (Independent Campus), and the digitisation of learning. However, the development of learning media that combines three aspects—print, audiovisual, and computer—still requires in-depth study so that its application is more effective and targeted (Zhang et al., 2006) .

Thus, this study attempts to systematically explore the concepts and practices of multimodal learning media innovation through a literature review approach. This study identifies theories, models, and best practices that integrate print, audiovisual, and computer technology media in the context of 21st-century learning.

Research Method

The research method used in this study is a systematic literature review. This research was conducted by collecting, analysing, and synthesising various relevant scientific literature sources, such as accredited international journals, seminar proceedings, textbooks, and recent research reports discussing innovation and development of multimodal learning media (Eliyah & Aslan, 2025) . The literature selection process was carried out through academic databases such as Google Scholar, Scopus, and ERIC using specific keywords, such as "multimodal learning", "multimedia learning", "21st century learning media", and "integration of print, audiovisual, and computer media". The data obtained was then analysed thematically to identify trends, models, and empirical evidence related to the effectiveness of media integration in learning, thereby producing a comprehensive understanding and practical recommendations for the development of learning media in the digital age .

Results and Discussion

Innovation and Design Concepts for Multimodal Learning Media

Innovation in education is a dynamic process that seeks to provide new solutions to improve the effectiveness, efficiency, and appeal of the learning process. In the context of 21st-century learning, innovation no longer focuses solely on teaching materials or methods, but also on the learning media used as a medium for knowledge transfer (Dede, 2009) . One form of innovation that is gaining attention is the development of multimodal learning media, which utilises various types of media and modalities to convey information in a richer and more meaningful way. Multimodality does not only involve visual or auditory aspects, but also combines text, images, sound, animation, video, and computer-based interactivity to create an immersive and contextual learning experience (Aslan & Sidabutar, 2025) ; (Saputra et al., 2024) .

The concept of multimodality is rooted in the theory of social semiotics proposed by Kress and van Leeuwen (2001), which states that meaning in communication is not

only formed by verbal language but also by various other modes of representation such as visual, gestural, and spatial. In learning, multimodality means that instructional messages can be conveyed through a combination of various representations so that learners can interpret them based on their individual sensory and cognitive preferences. This approach is highly relevant because learners have different learning styles: some are more responsive to visual stimuli, some understand better through hearing, and others learn effectively through direct interaction with digital media. Thus, multimodal learning design is a solution to accommodate this diversity.

In the *Cognitive Theory of Multimedia Learning* developed by Mayer (2009), humans have two main channels of information processing, namely the auditory-verbal channel and the visual-pictorial channel. The basic principle of this theory is that learning will be more effective if information is presented in an integrated manner between the two channels, taking into account the limited cognitive capacity of each individual. This means that multimodal learning media designs must be carefully crafted to avoid cognitive *overload*. This principle requires media designers to consider the balance between visual and textual information loads and to ensure that audiovisual elements are used to enhance understanding, not to add unnecessary complexity.

One form of innovation that has emerged from the multimodal approach is the integration of print media with digital elements through additional technologies such as QR codes, augmented reality, and interactive hyperlinks. Textbooks, for example, now contain not only static text, but can also be linked directly to relevant instructional videos, animations, or digital simulations (Clark & Lyons, 2011) . This approach creates a bridge between conventional media and modern technology, transforming the reading experience into a more active and engaging learning activity. Thus, learners are not only recipients of information but also explorers of knowledge who can independently choose their learning paths (Kay & LeSage, 2009) .

Multimodal design also considers interactivity, allowing learners to engage directly in the learning process. Computer-based interactive media, such as *learning management systems* (LMS), learning applications, and simulation platforms, facilitate students in exploring material at their own pace. Interactivity not only enriches the learning experience, but also provides real-time feedback that helps students understand their mistakes and correct them immediately (Means et al., 2010) . This is in line with the constructivist principle which emphasises that knowledge is actively constructed by learners through interaction and reflection. When designing multimodal learning media, it is important to understand the principles *of multimedia design* that have been developed based on empirical research. These principles include *the coherence principle* (eliminating irrelevant information), *the signalling principle* (marking important parts of the media), *the redundancy principle* (avoiding repetition of identical text and voice narration), and *the modality principle* (using voice to complement, not replace, text) (Salmon, 2013) . These principles serve as technical guidelines to ensure

that multimodal media remain effective in conveying messages and do not cause excessive cognitive load for learners (Means et al., 2010) .

In addition to cognitive aspects, multimodal design must also consider affective and motivational aspects. Media designed with attractive visual elements, harmonious sound , and natural narration have been proven to increase learning motivation. Students tend to be more focused and diligent when faced with interactive and interesting learning content (Clark & Mayer, 2016) . Therefore, the design process should incorporate cohesive aesthetic and narrative elements to make the learning experience more emotionally meaningful. User comfort, visual aesthetics, and accessibility also play a crucial role in maintaining long-term learner engagement.

Furthermore, innovations in multimodal design in education must take into account the social and cultural context of learners. The selection of symbols, colours, narratives, language, and forms of digital interaction can vary in effectiveness depending on the learning culture and social environment of users. For example, students in urban environments who are familiar with digital technology may find it easier to adapt to simulation-based media and educational games, while students in areas with limited access may require a combination of print and offline audiovisual media(Paivio, 1991) . Therefore, multimodal design must be contextual, inclusive, and sensitive to the diversity of educational environments.

From a pedagogical perspective, the development of multimodal learning media also supports the philosophy of *student-centred learning*. Teachers no longer act as the sole source of information, but as facilitators who guide students to interact with various learning resources. Multimodal media facilitates independent and collaborative learning, as students can access material through various channels and work together with friends to understand the same content through different approaches (Moreno, 2004) . Thus, multimodal media contributes to the development of metacognitive and self-reflective abilities in students.

The evaluation aspect in multimodal design cannot be ignored. The effectiveness of learning media must be measured not only in terms of cognitive achievement, but also in terms of increased motivation, engagement, and critical thinking skills of learners. Evaluation can be carried out through comprehension tests, observation of interactions, analysis of user behaviour, and subjective responses from learners regarding the use of media. The results of this evaluation are then used to improve the quality of media design through an iterative process, in which the media is continuously refined based on empirical findings and user feedback (Garrison et al., 2001) . Advances in artificial intelligence (AI) and learning analytics-based educational technology now also enable further innovation in multimodal design. AI-based adaptive learning systems can tailor content and media formats to each learner's profile. With this capability, the learning experience becomes more personalised and efficient. Data from student interactions with digital media can be analysed to identify patterns of learning

difficulties, so that the media can be optimised to truly suit the needs of each individual(& Aslan, 2025) ;(Pugu & Aslan, 2025) .

At the same time, the success of multimodal media development is not only determined by technological aspects, but also by the pedagogical competence of its developers. Teachers and instructional designers need to master technological literacy and understand theory-based learning principles so that media development is not merely technical, but also pedagogical and reflective. Continuous training, cross-disciplinary collaboration between educators and technology developers, and educational policy support are important factors that determine the sustainability of this innovation in the context of Education (Wilson, 1996) .

Innovation in multimodal learning media design also plays a strategic role in shaping students' digital literacy. Through the use of various forms of digital representation and interaction, students not only learn the subject matter, but also learn how to use technology wisely and productively. This supports the goals of 21st-century education, which emphasises critical thinking, communication, collaboration, and technological literacy (Duffy & Cunningham, 1996) . Thus, multimodal media not only increases the effectiveness of learning but also prepares students to face the digital ecosystem of the future.

The overall concept and innovation in multimodal learning media design show that education is no longer a one-way process between teachers and students, but rather a complex interaction between humans, media, and technology. Good design is design that is able to synergise various communication modalities into an integrated learning experience that touches on the cognitive, affective, and psychomotor dimensions of learners. With a theory-based and continuously innovative approach, the development of multimodal media can become a major pillar of educational transformation towards learning that is more adaptive, creative, and relevant to the challenges of the 21st century.

Integration of Print, Audiovisual, and Computer Technology Media in 21st Century Learning

The paradigm shift in 21st century education demands adaptive, interactive, and learner-centred learning. These three characteristics require innovative and integrated learning media to accommodate diverse learning styles and facilitate the mastery of 4C competencies, namely *critical thinking*, *creativity*, *communication*, and *collaboration*. The integration of print, audiovisual, and computer technology media is one effective strategy for realising multimodal learning that supports these demands (Jonassen, 2000) . This approach not only offers a variety of forms of information presentation, but also strengthens the interconnection between modalities so that learners gain a richer, more contextual, and meaningful learning experience.

Print media has long been a key instrument in education due to its concrete, measurable and accessible nature. Books, modules, worksheets and learning guides still have significant value as a basis for systematic learning. The advantages of print media lie in its ability to encourage concentration, provide a clear structure for material and facilitate step-by-step learning. However, its main weakness is its limitation in presenting visual and audio dynamics that can enrich conceptual understanding(Sweller, 1988) . Therefore, in the context of modern learning, print media needs to be integrated with other modalities so that its informative function can be complemented by audiovisual and interactive digital elements.

Audiovisual media, such as educational videos, educational films, animations, and audio recordings, have great power in visualising abstract concepts in a more concrete way. For example, scientific phenomena that are difficult to observe directly can be explained through experimental videos or animated simulations that dynamically illustrate the process. The integration of audiovisual media with print media helps learners connect textual information with visual-auditory sensory experiences, thereby improving absorption and memory retention. Based on the Dual Coding theory developed by Paivio (1991), information processed through two channels of representation (verbal and visual) tends to be more memorable because it involves two forms of cognitive processing simultaneously.

Meanwhile, computer technology has brought about a major revolution in the way learning is presented and interacted with. Through digital devices such as laptops, tablets, and smartphones, students can access various online learning resources, participate in interactive simulations, and use educational applications that adapt to their individual abilities. The development of *learning management systems* (LMS) also strengthens this integration by providing space for virtual collaboration, automatic evaluation, and two-way communication between teachers and students. In this context, computers function not only as a medium for conveying information, but also as a dynamic and adaptive *learning environment* (Bower & Hedberg, 2010) .

The integration of print, audiovisual and computer media is not merely a matter of combining different types of media, but rather a systematic effort to create pedagogical synergy between the three. In this case, each medium has a complementary function. Print media provides conceptual structure and a framework for thinking; audiovisual media presents realistic contexts and sensory experiences; while computer technology facilitates interactivity and personalisation of learning (Schraw & Olafson, 2005) . This integration enables teachers to design layered multimodal learning pathways, where each modality is used to its best advantage to maximise the achievement of instructional goals. To achieve effective integration, instructional designers need to apply multimodal design principles that consider cognitive load, learning flow, and the suitability between content and media format. Material that is first presented through printed text can be reinforced with visual

illustrations or demonstrative videos accessed through digital links or QR codes (Alonso et al., 2005) . Furthermore, students can interact using computer devices to answer adaptive quizzes or run programme-based simulations. This design allows learning to take place in layers and progressively, from reading to active interaction, which is in line with the principles of modern constructivism(Fitriyanti & Aslan, 2025) .

One tangible form of innovation resulting from this integration is the concept of *hybrid learning* and *blended learning*, which combines face-to-face learning with technology-based learning. In this model, print media is used as the primary source, audiovisual media serves to reinforce understanding outside the classroom, and computer technology becomes a means of online interaction that connects all components of learning. This approach allows for flexibility in terms of time and space, and supports both independent and collaborative learning (Herrington & Oliver, 2000) . Thus, media integration not only improves the efficiency of material delivery, but also expands learning opportunities across contexts.

Media integration also has a positive psychological impact on student motivation and engagement. Learning that combines various modalities creates refreshing variety and prevents boredom. Students feel more challenged and motivated because they can learn in various ways according to their individual preferences (Hattie & Timperley, 2007) . For example, students who are more visually inclined can focus on diagrams and graphics in printed modules, while those who prefer audio find it easier to understand through video explanations or educational podcasts. This kind of personalisation makes learning feel more relevant and enjoyable, which ultimately improves overall learning outcomes(Laurillard, 2012) .

From a pedagogical perspective, the integration of print, audiovisual, and computer media reinforces the application of *active learning* and *project-based learning*. Through this combination, students can read theory in texts, watch practical demonstrations, and then use digital devices to solve real problems or create creative works. For example, in science lessons, students can read experiment guides from books, watch the process in virtual laboratory videos, and then perform simulations through computer applications. This approach fosters scientific, analytical, and innovative thinking skills in an integrated manner(Laurillard, 2002) .

In addition to improving the quality of learning, media integration also supports curriculum digitisation and the development of technological literacy among students. In an era where information is easily accessible, the ability to manage, select, and evaluate information sources has become an essential competency. Computer media integrated with print and audiovisual teaching materials can train students to think critically about digital information sources (Beetham & Sharpe, 2013) . Teachers can also play a role as facilitators of digital literacy by providing guidance on the productive and ethical use of technology.

Despite its great potential, the implementation of media integration is not without its challenges. Infrastructure gaps, access to digital devices, and teachers' pedagogical skills are often the main obstacles to successful integration. In some areas, limited electricity and internet connectivity still hinder the implementation of technology-based learning (Mayer & Moreno, 2003) . Therefore, media integration implementation strategies must be adapted to local conditions through a phased approach, for example by utilising a combination of offline print and audiovisual media before switching to a fully computerised system.

From a policy perspective, institutional support also greatly influences the sustainability of media integration. Schools and universities need to provide adequate facilities, training for educators, and flexible curricula to support the use of various types of media in a single learning system. The government, through its digital education policy, can also encourage cross-modality integration by providing infrastructure and open content sources that are easily accessible to educators throughout the country (Kress & van Leeuwen, 2001) . With an inclusive policy approach, media integration will be more equitable and sustainable.

From a research perspective, the integration of print, audiovisual, and computer technology opens up vast opportunities for the development of empirical and conceptual studies. Further research needs to explore the effectiveness of specific media combinations on various learning styles and educational contexts. In addition, it is also necessary to develop a multimodal learning evaluation model that not only assesses cognitive outcomes but also 21st-century skills such as critical thinking, creativity, and digital literacy (Mayer, 2009) . Such studies will help identify *best practices* in media integration that can be adapted by various educational institutions.

Epistemologically, the integration of print, audiovisual, and computer media also reflects the evolution of the knowledge paradigm. Knowledge is no longer considered a single collection of information from printed text, but rather the result of complex interactions between humans and various forms of digital representation (Jonassen, 2011) . Understanding the concept of multimodal learning is important so that education can be transformed to be more relevant to the realities of the 21st century, which is characterised by high connectivity and rapid technological change. By combining stable print media, engaging audiovisual media, and interactive computers, education can maintain a balance between depth of reflection and the dynamics of technological innovation (Salvatore & Marek, 2017) .

Thus, the integration of print, audiovisual, and computer technology media is a strategic step towards building a holistic, adaptive, and future-oriented learning system. When these three types of media are used synergistically, the learning process is no longer merely the delivery of material, but becomes a comprehensive learning experience that touches on the intellectual, emotional, and social dimensions of learners' . With the support of continuous innovation, cross-disciplinary collaboration,

and visionary education policies, this multimodal integration can become a solid foundation for improving the quality of education in Indonesia amid the global digital transformation of the 21st century.

Conclusion

Innovation and development of multimodal learning media show that the integration of various modalities—namely print, audiovisual, and computer technology—plays an important role in improving the quality of the 21st-century learning process. The multimodal approach enables the delivery of teaching materials in a more interactive, contextual manner that is tailored to the characteristics and learning styles of students. Supported by multimedia learning theory and social semiotics, multimodal media not only enriches the cognitive learning experience, but also strengthens student motivation and active participation in the learning process.

In addition, the success of multimodal learning media innovation depends on a balanced design principle between cognitive load, learning objectives, and contextual appropriateness. The integration of these three types of media forms a pedagogical synergy in which print media plays a role in building conceptual structures, audiovisual media provides concrete visual-auditory stimuli, and computer technology provides interactivity that supports independent and collaborative learning. Through a planned and theory-based approach, multimodal integration can increase learning effectiveness while building students' digital literacy and critical thinking skills.

In general, innovation and development of multimodal learning media are not only a response to technological advances, but also a future education strategy that places learners at the centre of the learning process. To achieve optimal results, collaboration between teachers, learning designers, and educational institutions is needed to develop relevant, inclusive, and research-based media. Thus, multimodal learning media becomes an important bridge in shaping an adaptive, creative, and competitive educational ecosystem amid the global challenges of the 21st century.

References

Alonso, F., Lopez, G., Manrique, D., & Viñals, F. (2005). An Instructional Model for Web-Based e-Learning Education with a Blended Learning Process Approach. *British Journal of Educational Technology*, *36* (2), 217–235. https://doi.org/10.1111/j.1467-8535.2005.00454.x

Aslan, A., & Arifudin, O. (2025). ANALYSIS OF THE IMPACT OF THE LOVE CURRICULUM IN ISLAMIC EDUCATION AS TRANSFORMATIVE EDUCATION THAT CHANGES THE PERSPECTIVE AND ATTITUDE OF STUDENTS: A THEORETICAL AND PRACTICAL LITERATURE REVIEW. *Proceedings of the Indonesian National Seminar*, *3*(1), 83–94.

Aslan, A., & Sidabutar, H. (2025). APPLICATION OF PIAGET'S THEORY IN EARLY CHILDHOOD EDUCATION CURRICULUM DEVELOPMENT. *International Journal of Teaching and Learning*, *3* (1), Article 1.

Beetham, H., & Sharpe, R. (2013). *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*. Routledge. https://doi.org/10.4324/9780203107673

Bower, M., & Hedberg, J. G. (2010). Blended learning and online tutoring: A good practice guide. *Australian Journal of Educational Technology*, *26* (3), 293–306. https://doi.org/10.1186/s13639-011-0019-5

Caroline, C., & Aslan, A. (2025). Improving Accessibility to Education through Technology: Challenges and Solutions in Developing. *Educational Scientific Journal*, *11* (1), Article 1. https://doi.org/10.37567/jie.v11i1.3696

Clark, R. C., & Lyons, C. (2011). Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials. *Pfeiffer*.

Clark, R. C., & Mayer, R. E. (2016). E-learning and the Science of Instruction. *Wiley*. https://doi.org/10.1002/9781119239082

Dede, C. (2009). Immersive Interfaces for Engagement and Learning. *Science*, *323* (5910), 66–69. https://doi.org/10.1126/science.1167311

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the Design and Delivery of Instruction. *Handbook of Research for Educational Communications and Technology*, 170–198.

Eliyah, E., & Aslan, A. (2025). STAKE'S EVALUATION MODEL: RESEARCH METHODOLOGY. *Proceedings of the Indonesian National Seminar on*, *3* (2), Article 2.

Firmansyah, F., & Aslan, A. (2025a). EFFECTIVENESS OF SPECIAL EDUCATION PROGRAMMES IN PRIMARY SCHOOLS: AN ANALYSIS OF THE LITERATURE. *INJOSEDU: INTERNATIONAL JOURNAL OF SOCIAL AND EDUCATION*, *2* (2), Article 2.

Firmansyah, F., & Aslan, A. (2025b). THE RELEVANCE OF STEAM EDUCATION IN PREPARING 21ST CENTURY STUDENTS. *International Journal of Teaching and Learning*, *3* (3), Article 3.

Fitriyanti, F., & Aslan, A. (2025). THE ROLE OF INCLUSIVE EDUCATION IN REDUCING LEARNING DISPARITIES AMONG STUDENTS FROM DIFFERENT ECONOMIC BACKGROUNDS. *Indonesian Journal of Education (INJOE)*, *5* (3), Article 3.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education*, *2* (2–3), 87–105. https://doi.org/10.1016/S1096-7516(01)00037-6

Green, B. N., Johnson, C. D., & Adams, A. (2006). Writing Narrative Literature Reviews for Peer-Reviewed Journals. *Chiropractic & Manual Therapies*, 52–57.

Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, *77* (1), 81–112. https://doi.org/10.3102/003465430298487

Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, *48* (3), 23–48. https://doi.org/10.1007/BF02319856

Jonassen, D. H. (2000). *Computers as Mindtools for Schools: Engaging Critical Thinking*. Prentice Hall. https://doi.org/10.1300/J025v12n01_02

Jonassen, D. H. (2011). *Learning to Solve Problems: A Handbook for Designing Problem-Solving Learning Environments*. Routledge. https://doi.org/10.4324/9780203866228

Judijanto, L., & Aslan, A. (2025). ADDRESSING DISPARITIES IN MULTISECTORAL EDUCATION: LEARNING FROM AN INTERNATIONAL LITERATURE REVIEW. *Indonesian Journal of Education (INJOE)*, *5* (1), Article 1.

Kay, R. H., & LeSage, A. (2009). Examining the Benefits and Challenges of Using Audience Response Systems: A Review of the Literature. *Computers & Education*, *53* (3), 819–827. https://doi.org/10.1016/j.compedu.2009.05.002

Komari, K., & Aslan, A. (2025). Exploring the Optimal of EarlyA Literature . *Educational Scientific Journal*, *11* (1), Article 1. https://doi.org/10.37567/jie.v11i1.3605

Kress, G., & van Leeuwen, T. (2001). Multimodal Discourse: The Modes and Media of Contemporary Communication. *Arnold*. https://doi.org/10.4324/9780203999289

Laurillard, D. (2002). Rethinking University Teaching: A Conversational Framework for the Effective Use of Learning Technologies. *Routledge*. https://doi.org/10.4324/9780203304044

Laurillard, D. (2012). *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*. Routledge. https://doi.org/10.4324/9780203125082

Mayer, R. E. (2009). Multimedia Learning. *Cambridge University Press*. https://doi.org/10.1017/CBO9780511811678

Mayer, R. E., & Moreno, R. (2003). Nine Ways to Reduce Cognitive Load in Multimedia Learning. *Educational Psychologist*, *38* (1), 43–52. https://doi.org/10.1207/S15326985EP3801_6

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. *U.S. Department of Education*. https://doi.org/10.1037/e527352012-001

Moreno, R. (2004). Decreasing cognitive load for novice students: Effects of explanatory versus corrective feedback in discovery-based multimedia. *Instructional Science*, *32* (1–2), 99–113. https://doi.org/10.1023/B:TRUC.0000021812.66958.1e

Paivio, A. (1991). Dual Coding Theory: Retrospect and Current Status. *Canadian Journal of Psychology*, *45* (3), 255–287. https://doi.org/10.1037/h0084295

Pongpalilu, F., & Aslan, A. (2025). THE ROLE OF TEACHERS AS AGENTS OF CHANGE IN SHAPING STUDENTS' CREATIVITY, CHARACTER, AND SOCIAL SENSITIVITY: A LITERATURE REVIEW. *International Journal of Teaching and Learning*, *2* (11), Article 11.

Pugu, M. R., & Aslan, A. (2025). GENDER DIFFERENCES IN LITERACY AND NUMERACY ACHIEVEMENT: A CRITICAL REVIEW. *Indonesian Journal of Education (INJOE)*, *5* (1), Article 1.

Purike, E., & Aslan, A. (2025). A COMPARISON OF THE EFFECTIVENESS OF DIGITAL AND TRADITIONAL LEARNING IN DEVELOPING COUNTRIES. *Indonesian Journal of Education (INJOE)*, *5* (1), Article 1.

Reigeluth, C. M., & Carr-Chellman, A. A. (2009). *Instructional-Design Theories and Models: Building a Common Knowledge Base*. Routledge. https://doi.org/10.4324/9780203877194

Rokhmawati, Z., Aslan, A., & Farchan, A. (2025). Technological Innovation in Distance Education: A Literature.. *Ilmiah Edukatif*, *11* (1), Article 1. https://doi.org/10.37567/jie.v11i1.3735

Salmon, G. (2013). *E-tivities: The Key to Active Online Learning*. Routledge. https://doi.org/10.4324/9780203102296

Salvatore, J., & Marek, M. (2017). Integrating Print and Digital Media for Enhanced Learning. *Journal of Educational Multimedia and Hypermedia*, *26* (3), 243–262. https://doi.org/10.1080/13540602.2017.1313472

Saputra, H., Usman, S., Sakka, A. R., & Aslan, A. (2024). The Effect of Using Learning Media on Learning Motivation About Creed and Morals at Mas Ushuluddin Singkawang. *IJGIE (International Journal of Graduate of Islamic Education)*, *6* (1), Article 1. https://doi.org/10.37567/ijgie.v6i1.3698

Schraw, G., & Olafson, L. (2005). Assessing Metacognitive Awareness. *Contemporary Educational* Psychology, *30*

Sudarmo, S., Arifin, A., Pattiasina, P. J., Wirawan, V., & Aslan, A. (2021). The future of instruction media in Indonesian education: Systematic review. *Al-Ishlah: Jurnal Pendidikan*, *13*(2), 1302–1311.

Sweller, J. (1988). Cognitive Load Theory. *Educational* Psychologist, *38*

Wilson, B. G. (1996). Constructivist Learning Environments: Case Studies in Instructional Design. *Educational Technology Publications*.

Zhang, D., Zhou, L., Briggs, R. J., & Nunamaker, J. F. Jr. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management*, *43* (1), 15–27. https://doi.org/10.1016/j.im.2005.01.004