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# Literature Review of E-Learning, Blended Learning, and Hybrid Learning and Their Implementation in Physics Learning

**Winda Sari Siregar[1], Josua Anly Hendra Sinaga[2], Peronika Simamora[3], Mariati Purnama Simanjuntak[4]**
[1]Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, North Sumatra, Indonesia

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**ABSTRACT**

**Purpose of the study:** This study aims to analyze the implementation, advantages, challenges, and impacts of E-Learning, Blended Learning, and Hybrid Learning models in physics education through a systematic literature review of nationally accredited journal articles published between 2016 and 2025.

**Methodology:** The research employed a literature review method, drawing on 55 articles from nationally accredited journals published between 2016 and 2025. Sources were obtained from Garuda Kemdikbud, Sinta, university journal portals, and open repositories. The selection process applied inclusion–exclusion criteria, keyword-based searches, and classification according to learning models (E-Learning, Blended Learning, and Hybrid Learning) in the context of physics education.

**Main Findings:** The results indicate that E-Learning enhances students' independence, creativity, and conceptual understanding through digital platforms such as Moodle, Google Sites, and Chamilo. Blended Learning effectively reduces misconceptions and improves learning outcomes by combining face-to-face and online instruction. Meanwhile, Hybrid Learning provides the most optimal academic achievement by integrating synchronous and asynchronous learning. Nevertheless, all three models face challenges related to infrastructure limitations, teacher preparedness, and students' digital literacy.

**Novelty/Originality of this study:** This study offers a comprehensive comparative analysis of E-Learning, Blended Learning, and Hybrid Learning in physics education, which has not previously been systematically reviewed. It enriches the body of knowledge by synthesizing empirical evidence, highlighting the strengths, weaknesses, and integration potential of the three models, and providing valuable insights for educators and policymakers in adopting effective digital learning strategies.



***Corresponding Author:***
Winda Sari Siregar,
Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Jl. William Iskandar Ps. V No.104, Kenangan Baru, Kec. Percut Sei Tuan, Kabupaten Deli Serdang, Sumatera Utara 2037, Indonesia
Email: windasariiii2000@gmail.com

## 1. INTRODUCTION

The development of information and communication technology has brought significant changes in education, particularly in the learning process. Physics, as one of the science subjects, requires critical and analytical thinking skills as well as a deep understanding of concepts. However, the reality in the field shows that many students still face difficulties in understanding physics concepts due to teacher-centered learning and limitations in media and methods [1], [2]. This condition demands innovation in learning models and strategies to make the process of learning physics more effective and meaningful. One of the widely developed solutions is the utilization of technology in learning, including E-Learning, Blended Learning, and Hybrid Learning.

E-Learning allows the learning process to be conducted entirely online using Learning Management Systems (LMS) such as Moodle or Google Classroom, which have been proven to improve students' scientific literacy and learning motivation [3], [4]. Blended Learning, which combines face-to-face and online learning, provides flexibility and enhances student engagement in the learning process [5], [6]. Meanwhile, Hybrid Learning, which integrates face-to-face and online learning simultaneously, has been shown to maximize learning outcomes and reduce students' misconceptions in understanding physics concepts [7], [8].

In the context of physics learning, the use of educational technology generates various learning models that combine face-to-face interaction with digital platforms. The three most widely studied models are E-Learning, Blended Learning, and Hybrid Learning. They share a common foundation in utilizing technology to expand learning access, increase flexibility, and foster student autonomy, yet they differ in the degree of integration.

- E-Learning emphasizes fully online learning through Learning Management Systems (LMS) or digital applications.
- Blended Learning combines face-to-face and online learning in certain proportions.
- Hybrid Learning integrates face-to-face and online learning simultaneously (synchronous and asynchronous), utilizing technological media that allow students to choose learning modes according to their conditions.

Several studies also indicate that digital media and gamification tools such as Blooket, Flip PDF Professional, and digital learning objects (DiLO-Phy) can support the effectiveness of technology-based learning [9]-[11]. The use of technology in education is not limited to knowledge transfer but also contributes to the development of 21st-century skills, such as collaboration, creativity, and digital literacy [12], [13].

Although research on the implementation of each technology-based learning model has been extensively conducted, to date there has been no comprehensive literature review that compares the application of E-Learning, Blended Learning, and Hybrid Learning in the context of physics education. Therefore, this study is essential to compile and analyze previous research findings on these three models

## 2. RESEARCH METHOD

This study employed a literature review method with the aim of examining, analyzing, and synthesizing previous research findings regarding the implementation of E-Learning, Blended Learning, and Hybrid Learning in physics education. The data were obtained from 55 national scientific articles published in accredited national journals within the last ten years, from 2016 to 2025. All articles were sourced from the Garuda Kemdikbud database, Sinta, university journal portals, and open repositories. The selected articles were ensured to be open access and contained complete article identity information.

The selection of articles in this literature review was carried out using specific criteria to ensure alignment with the research objectives. The analyzed articles had to be published in accredited national journals. Furthermore, the selected articles were required to discuss topics relevant to the implementation of E-Learning, Blended Learning, or Hybrid Learning in physics education. Only empirical research articles were included, while opinion papers, essays, or purely conceptual studies were excluded. In terms of accessibility, the scientific articles used in this review had to provide complete identity information.

Data collection in this study was conducted through a structured literature review approach to ensure that the sources used were relevant, credible, and accountable. The keywords used in the search process were formulated based on the research topic, namely: "E-Learning in physics education," "Blended Learning physics," and "Hybrid Learning physics." Using these keyword combinations, a number of articles were obtained and further screened. The selection was carried out by reviewing the abstracts, methods, and research findings of the articles to ensure their direct relevance to the study topic. To maintain focus, the data collection process was conducted through several systematic stages:

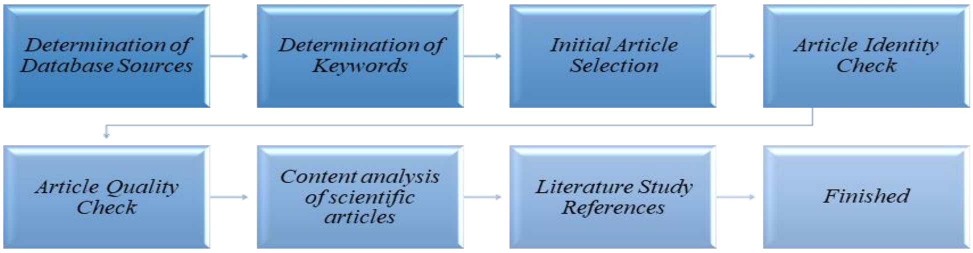


Figure 1. Data Collection Techniques

Data analysis in this literature review study was carried out systematically with the aim of presenting a comprehensive overview of the implementation of E-Learning, Blended Learning, and Hybrid Learning in physics education. Since the research data were derived from scientific articles, the analysis process was focused on identifying the main content of each article, including the research objectives, the learning model applied, the supporting media, the research methods, as well as the results and conclusions obtained by previous researchers. The following outlines the data analysis process.


Figure 2. Data Analysis Process

Data analysis in this study was carried out through a systematic literature review approach with the following stages:

1. **Coding**
   - Each selected article was coded according to its identity (author, year, title, and journal source).
   - Key information such as research objectives, learning model (E-Learning, Blended Learning, or Hybrid Learning), supporting media, research methods, and main findings was extracted into a summary table.
2. **Thematic Analysis**
   - The extracted information was then analyzed by grouping the findings into major themes, namely:
     - Learning outcomes (conceptual understanding, creativity, academic achievement).
     - Learning motivation.
     - Digital Era skills (collaboration, communication, critical thinking).
     - Supporting media/platforms.
     - Challenges/obstacles.
   - From these themes, patterns of similarities and differences across studies were identified.
3. **Descriptive Quantitative Synthesis**
   - The synthesis results were presented in the form of comparative tables to strengthen the narrative of the findings

## 3. RESULTS AND DISCUSSION

The literature review conducted on twenty-five nationally accredited scientific articles revealed consistent findings that the implementation of E-Learning, Blended Learning, and Hybrid Learning has made positive contributions to physics education, both at the secondary and higher education levels. Each article highlighted different aspects, ranging from media development, the effectiveness of learning models, to students' needs analysis regarding educational technology, which collectively enrich the understanding of the transformation of technology-based physics learning in Indonesia.

Table 1. Study Summary (Evidence Summary Table

| No | Authors & Year | Research Design | Sample | Instruments | Outcome Variables | Main Findings | Limitations |
|---|---|---|---|---|---|---|---|
| 1 | Pratiwi & Fathurohman (2024) [14] | Literature Review | 20 articles | Analysis checklist | Physics concept understanding | E-learning enhances conceptual understanding through LMS & interactive media | Literature only, no empirical data |
| 2 | Armanda & Putra (2023) [15] | Quasi-experiment | 60 high school students | Learning achievement test, motivation questionnaire | Learning outcomes, motivation | PBL-based E-LKPD improves physics learning outcomes | Small sample, 1 school |
| 3 | Yulanda et al. (2024) [16] | R&D (Borg & Gall) | 35 students | Expert validation, product trial | Feasibility & attractiveness of e-module | Discovery Learning E-LKPD is valid & practical to use | Long-term effectiveness not tested |
| 4 | Duri et al. (2024) [17] | Development Research | 2 teachers, 30 students | Validation questionnaire, observation | Validity of learning media | PBL-based E-LKPD is feasible for teaching sound concepts | No large-scale trial |
| 5 | Utami et al. (2023) [18] | Development Research | 32 high school students | Validation questionnaire, concept test | Learning independence, concept understanding | CTL-based E-Module improves understanding of elasticity | Limited to one topic |
| 6 | Mawaddah (2023) [19] | Meta-analysis | 15 articles | Article quality checklist | 21st-century skills | E-Module has a positive effect on critical thinking | High heterogeneity among articles |
| 7 | Purwita Sari et al. (2023) [20] | Systematic Review | 25 articles | PRISMA guidelines | Effectiveness of PBL | PBL is effective in physics & enhances HOTS | Literature limited to 2018–2022 |
| 8 | Nursipa et al. (2024) [21] | R&D (ADDIE) | 36 middle school students | Learning achievement test, expert validation | Learning outcomes, interest | PBL-based E-LKPD on heat material is effective | Limited generalizability |
| 9 | Mizentika et al. (2024) [22] | Development Research | 40 high school students | Expert validation, product trial | Validity of LKPD | POGIL-based E-LKPD is valid & easy to use | Effectiveness not tested |
| 10 | Wudda et al. (2024) [23] | R&D (Design-based research) | 28 students | Learning achievement test, observation | Learning outcomes, independence | CTL-based interactive E-LKPD is valid & effective | Limited sample, specific material |

In the field of E-Learning, numerous studies highlight the effectiveness of LMS-based systems and digital applications in improving learning quality. The use of Moodle, for instance, has been shown to facilitate teacher–student interaction while simultaneously enhancing learning outcomes [24]. Certain instructional design models implemented through E-Learning have also been found to strengthen students' creative thinking skills, particularly in terms of fluency and originality [25]. Applications of Moodle in topics such as fluid dynamics have increased student engagement, while the integration of the ICARE approach through Google Sites has encouraged more active participation and deeper conceptual understanding [26].

The development of digital teaching materials has also gained considerable attention. The application of Flip PDF Professional for problem-based learning on heat and temperature topics boosted students' motivation for independent study and facilitated conceptual understanding through digital visualization [27]. Game-based platforms such as Blooket made the learning process more interactive and enjoyable, generating high levels of enthusiasm among students [28]. Similarly, Chamilo LMS supported learner autonomy, both in secondary and higher education contexts.

Blended Learning has been recognized as an effective model for reducing misconceptions and improving academic performance. Incorporating animations within PowerPoint presentations on Newton's Laws in a blended setting proved more effective than conventional methods [29]. The combination of face-to-face and online components created a more engaging and flexible environment, helping to prevent student boredom [30]. Project-based digital modules in static fluid topics enhanced student participation, while LMS integration contributed to stronger science process skills and better mastery of concepts that are often difficult to grasp through traditional instruction [31].

Hybrid Learning, on the other hand, has demonstrated the strongest impact on academic achievement. Web-enhanced courses have shown significant effects on physics learning outcomes, while implementations in university-level physics laboratories fostered not only conceptual understanding but also collaborative skills [32]. Applications in high school wave sound lessons allowed students to learn more flexibly and effectively [33]. The integration of digital media further increased efficiency, engagement, and conceptual comprehension. Even simple tools such as WhatsApp, Google Forms, and email proved effective in supporting student activity and outcomes when structured properly [34].

Overall, the implementation of E-Learning, Blended Learning, and Hybrid Learning in physics education has produced positive contributions, each with distinctive characteristics. E-Learning is particularly strong in promoting learner independence, deepening conceptual understanding, and encouraging creativity through interactive digital media [35]-[37]. Blended Learning effectively reduces misconceptions, improves exam performance, and facilitates collaborative discussion [38]-[40]. Hybrid Learning produces the most optimal results by balancing synchronous and asynchronous sessions, though its success largely depends on the readiness of school infrastructure.

Nevertheless, potential biases in the existing literature need to be acknowledged. Many studies emphasize positive findings, while less favorable results are rarely published [41], [42]. Most of the reviewed research relied on case studies, development research, or small-scale quasi-experiments, which limit the ability to generalize findings [43]-[45]. The focus on nationally indexed journals also excludes relevant insights from international studies, conference proceedings, or field reports [46], [47]. Furthermore, most investigations concentrated on short-term cognitive outcomes, with little attention given to long-term impacts, affective skills, or equity in access [48], [49]. These limitations suggest the need for more robust experimental designs, larger and more diverse samples, and longitudinal studies to better evaluate the effectiveness of technology-based learning models in physics education.

To clarify these differences, the following comparative table summarizes the learning outcomes, motivation, 21st-century skills, media used, and challenges of each learning model:

Table 2. Comparison of E-Learning, Blended Learning, and Hybrid Learning

| Aspect | E-Learning | Blended Learning | Hybrid Learning |
|---|---|---|---|
| Learning Outcomes | Improves understanding of abstract concepts, student creativity, and independence. | Enhances exam performance and reduces misconceptions; concepts are easier for students to understand. | Provides the highest learning outcomes; proven statistically significant (t-count > t-table). |
| Learning Motivation | Very high with interactive media such as educational games (Blooket), LMS, and digital applications. | High due to the combination of face-to-face and online learning; students feel more flexible. | High because the variety of media (synchronous & asynchronous) keeps students more engaged. |
| Skills | Trains creative thinking skills (originality, fluency, flexibility, elaboration). | Develops collaboration, group discussion, and communication skills. | Sharpens problem-solving and teamwork skills through the integration of various methods. |

| | | | |
|---|---|---|---|
| Common Media/Platforms | Moodle, Google Sites, Chamilo, Flip PDF, Blooket. | LMS, animated PowerPoint, project-based digital modules. | Web-Enhanced Course, WhatsApp, Google Form, Email, digital modules. |
| Challenges | Limited by internet connectivity, teachers' skills in managing LMS, and student readiness. | Requires teacher and student readiness, as well as good time management. | Dependent on school infrastructure and technological readiness, more demanding in terms of equipment. |

This study provides a comprehensive and comparative analysis of E-Learning, Blended Learning, and Hybrid Learning in the context of physics education, which has not previously been systematically reviewed in the Indonesian academic setting. Unlike previous works that tend to focus on a single learning model or a specific instructional medium, this research synthesizes empirical findings from multiple studies to highlight the distinct strengths, weaknesses, and integration potential of each model. By mapping how these approaches influence conceptual understanding, creativity, motivation, and digital literacy, the study contributes to filling the knowledge gap and offers a broader perspective on the transformative role of digital-based learning in physics education.

The findings of this study imply that the adoption of E-Learning, Blended Learning, and Hybrid Learning can serve as strategic pathways to enhance the quality of physics education in Indonesia, particularly by fostering independence, reducing misconceptions, and optimizing academic outcomes. Practically, teachers and institutions are encouraged to integrate these models according to their resources and technological readiness. However, this study is limited by its reliance on nationally accredited journal articles, which may introduce publication bias and exclude relevant international or non-indexed studies. Furthermore, most of the reviewed research employs small samples, case studies, or development research designs, restricting the generalizability of the findings. Therefore, future research should employ stronger experimental designs, larger and more diverse samples, as well as longitudinal evaluations to validate and expand the current evidence base

## 4. CONCLUSION

The literature review shows that e-learning effectively increases motivation, independence, creativity, and conceptual understanding through interactive digital media, despite constraints on internet access and teacher readiness. Blended learning has been shown to reduce misconceptions and improve learning outcomes by combining face-to-face and online learning, but requires careful planning for balance. Hybrid learning is the most optimal strategy because it integrates synchronous and asynchronous learning, resulting in higher academic achievement and collaboration skills, although it is highly dependent on infrastructure and teacher readiness. In general, these three models have a positive impact on improving the quality of physics learning and have the potential to become a long-term strategy in science education in Indonesia.

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