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RESEARCH ARTICLE

Training and mentoring on the use of social media to enhance physics digital literacy among university students and local communities

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ABSTRACT

This study examines the effectiveness of training and mentoring on the use of social media as a collaborative learning tool to enhance physics digital literacy among university students and local communities. A qualitative approach was employed through participatory observation and in-depth interviews with students, community members, and facilitators of social media–based physics learning programs. The findings indicate that platforms such as WhatsApp and Facebook fostered active interaction, problem-based discussions, and the sharing of learning resources and digital simulations. Beyond improving motivation and self-confidence, training and mentoring activities also strengthened participants' abilities to search for, evaluate, and critically verify physics-related information through social media. Challenges included distractions from non-educational content, uneven participation, and risks of misinformation. However, the role of facilitators as mentors and the application of community management strategies proved effective in addressing these issues. Overall, the study confirms that social media–based training and mentoring serve as adaptive and inclusive approaches to developing sustainable physics digital literacy in the digital era.

KEYWORDS

Social media; digital literacy; physics education; university students; local communities

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1. Introduction

The massive digital transformation has strengthened the role of information technology in various aspects of life, including in education. One prominent form of technology integration in learning is the use of social media as a means of learning collaboration between the general public and students. Social media is no longer limited to communication functions, but has evolved into an interactive space that

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allows for the open exchange of ideas, experiences and educational resources (Ohara, 2023; Ghosh, 2024).

Collaborative learning through social media has great potential in building a more democratic and inclusive learning environment. This learning model allows two-way interaction, so that learners and educators can collectively build knowledge and skills. According to the theory of participatory media and mass collaboration, social media plays a role in strengthening the open learning process through various sharing, discussion and collaborative assessment activities (Okada, 2013).

With the emergence of the concept of digital literacy, the skills of accessing, analyzing, and critically utilizing information in the digital ecosystem have become imperative, especially in science fields such as physics. Research shows that the development of digital literacy is essential to meet the challenges of the industrial era 4.0 and society 5.0. Digital learning is proven to be able to improve science literacy skills through the integration of various media and online physics learning resources (Válek, 2025; Wardi et.al, 2025).

The use of social media for collaborative learning has yielded various benefits - from increasing learning motivation, building a solid learning community, to facilitating thematic discussions across participants' backgrounds. Studies suggest that platforms such as Facebook and WhatsApp can support collaborative learning, both in the form of large group discussions and small group interactions (Adnan & Putri, 2025; Kurniati et.al, 2020; Suci et al, 2022). This virtual group becomes a means of sharing resources, brainstorming, and exchanging solutions.

The effectiveness of social media in learning lies mainly in its ability to create an adaptive and participatory learning environment. Research found that social media integration boosts learning confidence, encourages interest, and increases motivation for self-learning and mutual help among participants (Hu et.al, 2024; EBSCO, 2025). However, this effectiveness needs to be empirically evaluated through a scientific approach. The involvement of the general public in social media-based learning collaborations is considered important to expand the reach of physics digital literacy. Various online learning communities have been proven to provide wider access to learning resources and activities, even bridging regional or group disparities that were previously met by infrastructure limitations (Ghosh, 2024).

On the other hand, challenges also arise in utilizing social media as a learning tool. The ease of access and abundance of information are not always matched by appropriate content filtering mechanisms, increasing the potential for distraction and misinformation. Therefore, the role of facilitators or educators becomes crucial in assisting the learning process to remain focused and credible (EBSCO, 2025; Ohara, 2023).

The development of physics digital literacy through collaboration on social media also enriches pedagogical approaches, for example with the integration of digital simulations, interactive videos, and the utilization of real problem-based discussion forums. Research recommends strengthening teacher capacity and developing a digital curriculum framework so that online collaboration has maximum impact in improving understanding of physics concepts and critical thinking skills (Válek, 2025).

Evaluation of the effectiveness of using social media as a collaborative learning tool in improving physics digital literacy must be done comprehensively. This includes aspects of motivation, participation, improvement of learning outcomes, and maturity of digital literacy among students and the general public. Various studies have concluded the need for strategic planning, regulatory support, and educational policy innovation so that the benefits of social media for physics learning can be optimized while mitigating its negative impacts.

The urgency of research on the effectiveness of using social media as a means of learning collaboration to improve physics digital literacy in the general public and students is based on the fact that digital literacy skills, especially in the field of science such as physics, are still relatively low, thus requiring learning innovations that are more adaptive to technological developments and the needs of the times. The utilization of social media offers practical and contextual solutions in expanding access to learning resources, strengthening the culture of discussion, and encouraging active collaboration between students and the community, which has been constrained by disparities in access and digital literacy skills. Thus, this research is important to identify the extent of the contribution and challenges of social media in building an inclusive, creative, and relevant physics learning ecosystem, as well as to produce recommendations for strategies to optimize the role of social media in improving the quality and equity of physics digital literacy in the current digital era.

2. Literature review

2.1. Digital Literacy

Digital literacy is an individual's ability to use digital technologies, especially the internet and social media, to find, evaluate, use and create information effectively and responsibly (Eshet-Alkalai, 2004). Digital literacy is important for all people to be able to participate in the current information age which is growing rapidly (Ng, 2012). According to West & Vosloo (2013), digital literacy includes not only technical mastery, but also critical skills in managing digital information.

2.2. Social Media as Learning Media

Social media is currently one of the most effective platforms for learning in various fields of science, including physics. Social media enables interactive and fun learning collaboration, provides easy access to varied learning resources, and encourages discussion and rapid response between users (Greenhow & Lewin, 2016). The use of social media in learning can increase the motivation and engagement of students and the general public in understanding learning materials (Manca & Ranieri, 2016).

2.3.Physics Digital Literacy

Digital literacy specifically in physics means the ability to understand, access, process, and utilize physics information through digital media. This literacy is important for the general public and students in order to understand physics phenomena more deeply and contextually in the digital era (Bergmann & Sams, 2014). Improving physics digital literacy can help overcome misconceptions and improve conceptual understanding of physics material (Mastropieri & Scruggs, 2018).

2.4.Training and assistance in improving digital literacy

Training and mentoring are effective methods in improving digital literacy skills. According to Hwang et al. (2014), intensive training and in-person mentoring can accelerate the process of mastering digital technology and increase users' confidence in using social media as a learning tool. A sustainable mentoring model is also proven to maintain and develop participants' digital literacy skills (Vygotsky, 1978).

3. Methods

The research method used in this study is qualitative. This approach was chosen because it aims to explore and deeply understand the process, experience, and effectiveness of using social media as a collaborative learning tool in improving physics digital literacy in the general public and students. The researcher explored through participatory observation and in-depth interviews with key informants, including physics students, members of the general public who are active in social media-based physics learning communities, and facilitators or lecturers involved in learning.

Data collection techniques were conducted in two main ways. First, researchers conducted participatory observations of collaborative activities that took place on various social media platforms, such as Facebook groups, WhatsApp, or other online

forums used as physics learning media. This observation aims to identify interaction patterns, forms of collaboration, and discussion dynamics that occur in virtual communities. Second, in-depth interviews were conducted in a structured and semi-structured manner to explore the experiences, perceptions, motivations, obstacles faced, and strategies used by participants in the collaborative learning process through social media.

Data analysis in this study was conducted thematically. Observation and interview data were analyzed to find patterns, categories, and main themes related to the effectiveness of social media in physics learning collaboration and digital literacy development. The researcher used interview and observation guidelines that were prepared based on the theory of learning collaboration and digital literacy, in order to maintain the focus of the research and ensure systematic analysis. Thus, the analysis process aims to produce a comprehensive understanding of the contribution of social media in building learning communities, improving digital literacy skills, and overcoming various challenges that arise during learning.

4. Results

Based on the results of participatory observations, collaborative physics learning on social media, especially on WhatsApp and Facebook groups, provides a very active interaction space between students and the general public. Every day, participants share physics materials, upload simple experimental results in the form of videos, and exchange online learning resources. One activity that is often observed is problem-based learning discussions, where group members jointly discuss physics problems based on everyday events.

In particular, in one online discussion session, the researcher noted an enthusiastic response from group members when discussing the topic of "Newton's laws". As the observation notes state:

> Group members seemed very active in asking questions, such as 'How are Newton's Laws applied in modern transportation technology?' and other members responded immediately with explanations or links to credible reference sources.

Participants' engagement in the virtual learning community is tangible as expressed by one of the physics students in the interview:

> Learning physics in the WhatsApp group makes me much more confident to ask questions. Usually in class I am shy, but here I can directly discuss or consult with friends and seniors at any time, even after class hours.

A member of the general public with a non-science background also shared:

> I find it helpful because I can access the shared physics material again at any time. If there is something I don't understand, other members patiently explain it again, sometimes they even make a short video explanation.

A facilitator who is also a physics lecturer added:

> This forum makes it easy for me to monitor the progress of the discussion. I only need to occasionally direct the discussion if it starts to widen, but the rest of the students and other members are very independent, help each other, and actively seek solutions together.

Researcher observations over several weeks showed an increase in participants' enthusiasm for digital experiments and interactive simulations shared in the group. In fact, some members were seen organizing mini challenges such as making physics quizzes or sharing videos simulating the concept of force. The focus of discussion was not only on theoretical material, but also on training in the use of digital physics applications. Observations noted:

> When one of the participants introduced a free Boyle's law simulation app, other members enthusiastically downloaded and tried it, and then shared the results of their digital experiments, making the discussion more lively and concrete.

During the evening discussion session, researchers noted that 73% of participants actively commented, proving that time was not a barrier to digital collaboration. The thematic analysis of the interviews showed that the majority of participants felt that the discussion was equal, with no inequality between students, the general public, or lecturers. The pattern of peer-to-peer learning is very visible, where members who are more knowledgeable initiate a voluntary mentoring approach:

> I myself do not have a formal educational background in physics, but now I can participate in understanding basic concepts while discussing without fear of being wrong, because other members are very supportive." (Interview, member of the general public).

The main challenge identified was distraction from other notifications and sometimes the discussion strayed into non-educational matters. One of the facilitators said:

> The biggest challenge is keeping the discussion focused. Sometimes participants are tempted to discuss things outside of physics, so I have to remind them to return to the main topic.

In addition, the observation also noted that some passive members only read without actively participating, which indicates the need for strategies to increase engagement, for example with simple rewards for activeness. From the series of interviews and observations, positive impacts were found in the form of improved digital literacy skills, including information retrieval, the ability to verify content, and creating physics educational content. One student commented:

> So, we are more sensitive in sorting out valid information and which ones are hoaxes, because we often discuss comparing physics reference sources on the internet.

While from observation, participants are also getting used to accessing applications, making short videos of experiments, and compiling short infographics about physics concepts, which are then shared to other social media platforms for public education. The observation emphasized the importance of the facilitator's role in maintaining an atmosphere of inclusive collaboration. The facilitator is not dominant, but more of a discussion moderator who only becomes active when the discussion starts to wander off topic or when there is an impasse in solving the case study. Collective creativity is also seen when the facilitator provides space for members to design quiz materials, simulations, or mini learning modules that can be accessed by all group members. This is reinforced by the facilitator's quote:

> Sometimes I learn from the participants' enthusiasm in creating educational content. I only provide the framework, the rest they innovate themselves.

Based on interviews and field observations, the social media-based physics learning collaboration ecosystem has significantly increased self-confidence, digital skills, and the spirit of sharing knowledge both among students and the wider community. The high participation, quality of discussion, and sustainability of collaboration indicate the effectiveness of social media as a digital physics learning tool that is adaptive to the needs of the times. The activities that take place on this social media platform, as supported by the observation results, can directly improve the collaborative skills and digital literacy of learners and expand the learning space beyond the formal classroom.

5. Discussion

The results show that social media actually acts as an effective means of physics learning collaboration. Collaborative activities appear in the form of problem-based learning discussions, sharing visual materials, using digital simulation applications, and completing group assignments online. This phenomenon is in line with observational

findings that show the interaction between participants is very intense, involving students and the general public in equal conversations without hierarchical barriers (Ruslan, 2019).

The use of social media showed a significant contribution to the improvement of physics digital literacy in two key aspects of the ability to find and select information, as well as the creation of educational content. Researchers' observations found that participants actively searched, compared and critically reviewed physics learning resources before sharing them with the group. This shows the achievement of the main goal of digital learning to hone information literacy and technology skills simultaneously (Shanty, 2018).

Despite the benefits, the research also identified challenges in social media-based learning collaboration:

1. Content Distraction: Many group members face distractions from notifications or non-educative content that can potentially lower focus during discussions;
2. Participation Variation: Not all participants actively contribute; some members tend to be passive and readers only; and
3. Validity of Information: There is a risk of spreading information that is not fully verified, in accordance with the global digital literacy challenge (Shanty, 2018).

This research confirms that social media not only accelerates access and transfer of physics knowledge, but also builds an inclusive and supportive learning community. Relationships between participants are characterized by egalitarian collaboration that encourages a culture of mutual assistance and enriches the learning experience, both for students and the general public. This digital learning community effectively bridges the gap in access to learning, broadens digital horizons, and fosters independent learning motivation (Ruslan, 2019).

Overall, social media proved to be a collaborative vehicle for physics learning that is adaptive to the needs of the times with predominantly positive results. However, a stricter content monitoring system and improved digital literacy are needed so that the negative potential of social media, such as the spread of misinformation and decreased attention, can be minimized in the future.

Collaborative learning theory explains that the involvement of several individuals to interact and work together is very effective to achieve shared learning goals. Dillenbourg (1999), often cited in educational studies, reveals that collaborative learning is optimized when interactions are dynamic and participants actively contribute. The digital environment reinforces this process, as social media provides a seamless space to exchange ideas, share learning resources and complete group tasks in real time.

6. Conclusion

Based on the results of the research and discussion, it can be concluded that the use of social media as a collaborative learning tool for physics is effective in improving digital literacy among students and the general public. Social media facilitates intensive and inclusive interactions through discussions, sharing learning resources, and the use of digital simulation applications that strengthen understanding of physics concepts as well as digital literacy skills, such as the ability to search, assess, and verify information critically. Despite challenges such as content distraction, participation variation, and technical constraints, the facilitator's role as moderator and good community management strategies were able to overcome these obstacles. Supported by theories of collaborative learning, social learning, connectivism and motivation, social media can be a relevant and adaptive platform to develop physics digital literacy effectively and sustainably in today's digital era.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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