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THE EFFECTIVENESS OF THE MULGRANING MODEL WITH GOOGLE CLASSROOM FOR ENCHANCING MEDIA AND DIGITAL LITERACY

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Abstract

The rapid development of digital technology has encouraged the integration of media and digital literacy into classroom practice so that students are able to access, analyze, evaluate, manage, and create information critically and responsibly. Responding to this need, this study aimed to examine the effectiveness of the Multiliteracy Integrative Learning (MULGRANING) model assisted by Google Classroom in improving students' media and digital literacy within scientific text learning. This research employed a descriptive quantitative method involving 68 grade XI students from two public high schools in Padang City as participants. Data were collected using an expert-validated observation sheet that systematically assessed students' literacy performances during the learning process, covering indicators of information access, evaluation, management, and utilization. The descriptive analysis revealed varied literacy tendencies among students, with 38.24% categorized as high, 44.12% moderate, and 17.64% low. These findings demonstrated that the implementation of the MULGRANING model effectively supported the development of media and digital literacy, particularly in indicators related to accessing, selecting, and critically evaluating digital information. However, the aspects of information management and utilization were still predominantly in the moderate category, suggesting that students require further guidance in organizing information and applying it to solve problems or produce scientific work. Overall, this study provides empirical evidence regarding the potential of technology-assisted learning models to strengthen students' media and digital literacy competencies. These findings highlight the importance of integrating digital platforms to create more innovative and relevant learning environments.

INTRDUCTION

The rapid development of digital technology has made media and digital literacy essential competencies in education, particularly given the increasing complexity of information circulating across digital platforms. Media literacy is understood as the ability to access, analyze, evaluate, and create media, emphasizing understanding the messages conveyed and the motives behind their construction (Moghaddam & Asghari, 2015). Digital literacy, in contrast, encompasses skills in utilizing technology effectively, including information retrieval, problem-solving, and understanding the ethical and legal aspects of digital engagement (Marksbury & Bryant, 2019). These two literacies are increasingly interdependent as students navigate information that shapes their perspectives, values, and behaviors (Yaman, 2020). Therefore, media literacy is not only related to understanding content but also encompasses the skills to assess, use, and interact constructively with various forms of media (Pérez-Rodríguez et al., 2019). In Indonesia, exposure to hoaxes, disinformation, and the misuse of digital media among youth indicates a growing need for stronger literacy competencies. Reports from (Fauzi & Marhamah, 2021) show that misinformation among students remains high, demonstrating the urgency of strengthening media and digital literacy in formal education. Therefore, integrating both literacies into school curricula is essential to prepare students not only as informed consumers but also as responsible digital participants capable of interacting critically with information.

Digital literacy comprises several interconnected components that collectively support the development of student competencies in navigating digital environments. Access to technology serves as the foundational aspect enabling students to effectively use digital devices and the internet for academic purposes (Miranda et al., 2018). Operational skills, including basic device and software management, remain a crucial requirement for students to perform learning activities independently and effectively (Torrato et al., 2023; Wang & Woo, 2021). Information literacy also plays a central role, as students must be able to locate, assess, and process information from diverse sources (Milenkova et al., 2020). Communication and collaboration through digital platforms must also be strengthened to support group-based learning in virtual contexts (Boronenko et al., 2020). Additionally, students need the ability to create digital content in text, visual, and multimedia formats (Torrato et al., 2023). Aspects of digital security such as privacy protection, identity management, and safe internet use are equally vital (Morgan et al., 2022). These dimensions of digital literacy demonstrate its complexity, reaffirming the need for structured pedagogical approaches that can effectively cultivate these competencies in school settings.

Today's media literacy teaches students not only to understand media messages but also to evaluate and use them constructively in their daily lives. This skill helps students recognize how media influences their perceptions and social interactions (Dezuanni, 2015). Through this process, students are encouraged to develop critical thinking skills and creativity by analyzing, evaluating, and creating media content. Media literacy also encourages reflective learning and new models of creativity oriented toward digital connectedness (Allen et al., 2012; Wijaya, 2020). Integrating media literacy into the educational curriculum helps students master functional skills including effective communication, collaboration, and information processing (Abbas et al., 2024). Evidence from Indonesian classrooms shows that students often struggle to critically analyze media representations, indicating that these competencies require explicit instructional reinforcement. Teachers play a central role in designing technology-based tasks that encourage students' exploration and promote advanced thinking. Their facilitation helps students bridge technical skills with conceptual understanding, allowing them to engage more deeply with both media content and digital platforms (Cheng et al., 2024).

In the Indonesian context, the urgency of strengthening students' media and digital literacy is reinforced by several national indicators. Currently, some students still struggle to critically analyze information, particularly when evaluating the credibility of digital sources. This is supported by data from the Ministry of Communication and Information Technology (Kominfo), which also shows that adolescents remain one of the groups most vulnerable to exposure to misinformation, with digital hoaxes increasing significantly during the online learning period (https://www.komdigi.go.id/). Furthermore, PISA 2022 results revealed that Indonesian students' reading literacy remains below the OECD average, indicating challenges in interpreting and synthesizing multimodal information (https://pusmendik.kemdikbud.go.id/pisa/). These empirical findings indicate that students' critical abilities in accessing, managing, and evaluating digital information are still limited, reinforcing the need for learning models specifically designed to address this gap. Therefore, developing pedagogical innovations that integrate media, digital, and multiliteracies skills is a strategic priority in the national education landscape.

The concepts of digital literacy, media literacy, and digital competence demonstrate the urgency of addressing the challenges of rapidly evolving technology and influencing how

individuals access and utilize information (Çocuk & Yelken, 2018; Surmelioglu & Seferoglu, 2019). Digital literacy is not only concerned with technical skills in operating digital devices and tools, but also encompasses critical skills in effectively assessing, managing, and manipulating information in a complex and dynamic environment (UNESCO, 2011 in (Camilli-Trujillo & Römer-Pieretti, 2017). Media literacy, on the other hand, focuses more on understanding and evaluating messages in various media forms, both traditional and digital, while also encouraging active participation in broader communication (Dalton, 2017). In Indonesia, observations and interviews conducted at a high school in Padang City indicate that students' digital literacy levels remain uneven, particularly in evaluating the credibility of information. This indicates a gap that must be addressed at the curricular and instructional levels. Together, media and digital literacy form a complementary and essential skill set to prepare students for the challenges of the 21st century. This perspective reaffirms the need for a comprehensive learning model capable of integrating both literacies into meaningful classroom practices.

The changing definitions of media and digital literacy demonstrate that these skills go beyond mere technical ability to use technology. Digital literacy is currently understood as a multilevel competency encompassing basic knowledge of technology, skills in using digital applications, and digital transformation, enabling the creation of new knowledge through technology (Gil-Flores et al., 2017). Thus, digital literacy encompasses not only operational skills but also an understanding of how information is produced, distributed, and communicated effectively (Tang & Chaw, 2016). In the Indonesian educational context, where digital integration efforts continue to expand, this competency becomes increasingly essential. Students are expected not only to access information but also to analyze and synthesize multiple sources responsibly. However, empirical evidence shows that many learners still experience difficulties distinguishing between credible and non-credible information, highlighting significant gaps in current instructional practices. Strengthening digital literacy is therefore a fundamental step for creating participatory and critical digital citizens.

The integration of media and digital literacy in education emphasizes the importance of students' abilities to manage, analyze, and synthesize information from diverse sources (Ata & Yildirim, 2019; Mills, 2013). This literacy not only requires skills in making responsible decisions regarding information but also develops the ability to create content using digital technology (Tutkun & Kincal, 2019). With this approach, students can utilize technology efficiently while simultaneously understanding and evaluating the content they consume and produce (Greene et al., 2014). Therefore, an integrated learning model is needed to develop students' media and digital literacy (Çocuk & Yelken, 2018). Consequently, an integrated learning model capable of supporting multilayered literacy processes becomes increasingly necessary. Such a model must facilitate students' engagement with digital resources while strengthening their analytical and creative capacities.

The Multiliteracy Integrative Learning (MULGRANING) model has been proposed as an effective learning alternative for developing students' media and digital literacy, as it integrates various dimensions of multiliteracy skills within an online learning framework (Indriyani et al., 2024). In the digital era, characterized by the need to read and produce multimedia texts, this model offers an adaptive approach. The MULGRANING syntax consists of eight steps: experiencing, conceptualizing, analyzing, producing & creating, networking, applying, comparing, and synthesizing (Indriyani et al., 2023; Indriyani & Zakarya, 2025). This

sequence of syntax enables students to move from initial experience to conceptual understanding, then to in-depth analysis, and finally to the creation of digital works as part of the online learning process. Furthermore, networking and applying in a digital context strengthen collaborative skills and interactive media use. Comparing and synthesizing activities are crucial for training reflective and critical skills in developing informative digital content. In the context of developing media and digital literacy, this syntax enables students not only to become consumers of information but also content producers capable of evaluating, creating, and sharing effectively in online environments.

Google Classroom is considered one of the most effective platforms for supporting interactive and flexible learning, as it can enhance teacher performance and student engagement (Iftakhar, 2016). Its features facilitate seamless interaction between teachers and students (Fauzi et al., 2021), enabling collaborative and well-organized learning experiences. Google Classroom's accessibility via smartphones is particularly relevant in Indonesia, where mobile device usage among students is high, making this platform feasible for school-level digital instruction(Gupta & Pathania, 2021). Its ease of use and students' rapid adaptation also support online learning and blended instructional models (Ulanday et al., 2021). In higher education and secondary schools alike, Google Classroom has been widely employed as a reliable digital learning environment (Triana et al., 2021). Since its launch in 2014, it has become a significant component of Google for Education, contributing to the development of enjoyable and integrated learning experiences (Albashtawi & Al Bataineh, 2020). The integration of MULGRANING with Google Classroom is therefore highly relevant, offering a structured and platform-supported approach to strengthening students' media and digital literacy in online learning contexts.

Given the importance of media and digital literacy in 21st-century education, a comprehensive instructional framework capable of integrating both skills is urgently needed. Although previous studies have explored media literacy programs, digital literacy interventions, or multiliteracy-based models, very few have examined how these components can be integrated into a coherent instructional model supported by digital platforms. In Indonesia, research on the effectiveness of multiliteracy-oriented models in digital learning remains limited, especially concerning the development of media and digital literacy through scientific text learning. This gap highlights the need for empirical evidence on how integrated models such as MULGRANING, when combined with Google Classroom, can address literacy challenges in secondary education. Therefore, this study aims to test the effectiveness of the MULGRANING model assisted by Google Classroom in scientific text learning to improve students' media and digital literacy. The expected contribution of this research is to provide theoretical insights into the integration of multiliteracies principles with digital learning platforms and practical guidance for teachers who seek to strengthen students' literacy competencies in technology-based learning environments.

METHODS

This study employed a descriptive quantitative approach intended to provide an evaluative description of the implementation of the MULGRANING Model supported by Google Classroom in scientific text learning, particularly in relation to students' media and digital literacy. This approach was selected because it aligns with the purpose of the study, which was not to test a causal effect but to systematically document literacy behaviors that emerged during the learning process (Creswell & Creswell, 2017). Through this approach, the

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data obtained can provide an objective picture of students' media and digital literacy levels after participating in the model.

The population consisted of all 11th-grade students in Padang City, while the sample was selected purposively based on two criteria: (1) schools that had consistently implemented digital-based learning, and (2) willingness to collaborate in research. Two schools met these criteria: SMA Negeri 2 Padang and SMA Negeri 9 Padang. Each school contributed one intact class with 34 students, yielding a total of 68 participants. All participants and schools took part voluntarily, with ethical assurances related to permission from school authorities, informed participation, and protection of data confidentiality.

The data source for this study was primary data obtained through systematic observation of student learning activities during the scientific text learning process using the MULGRANING Model on the Google Classroom platform. The research instrument was an observation sheet in the form of a rating scale developed based on media and digital literacy indicators, covering aspects of access, evaluation, management, and utilization of information. The instrument used was a structured rating-scale observation sheet developed based on commonly recognized indicators of media and digital literacy. These indicators included access, evaluation, management, and utilization of information in digital environments. Three experts in language education and digital literacy validated the instrument to ensure content representativeness. Reliability was further strengthened through inter-rater agreement procedures, in which two independent observers reached a high level of scoring consistency, confirming the dependability of the instrument.

Data collection took place over eight learning sessions, each representing a complete cycle of the MULGRANING syntax. The sequence includes experience, conceptualization, analysis, production & creation, networking, application, comparison, and synthesis. To ensure consistency across both schools, identical lesson plans, digital materials, instructional instructions, and Google Classroom layouts were used. Prior to data collection, both observers participated in a calibration meeting to align their interpretations of indicators, assessment criteria, and behavioral evidence. During each session, observers documented students' digital literacy behaviors, such as accessing resources, critically evaluating information, managing digital content, and producing multimodal outputs based on predetermined indicators. All learning took place online through Google Classroom, which served as the primary platform for content delivery, collaborative discussions, assignment submission, and digital resource management. The data were collected from January to June 2025.

Data were analyzed using descriptive quantitative techniques by calculating the average scores for each indicator of media and digital literacy. These scores were then converted into percentage trends and categorized into three levels (high, medium, and low) to describe the distribution of students' literacy tendencies. The analysis focused on providing an evaluative overview of how the MULGRANING Model was enacted in practice and how students demonstrated literacy behaviors during the learning process. All analyses followed the principles of descriptive statistics to maintain transparency, accuracy, and methodological rigor. Ethical procedures were observed throughout, ensuring confidentiality, voluntary participation, and non-disruption of the instructional process.

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RESULT AND DISCUSSION

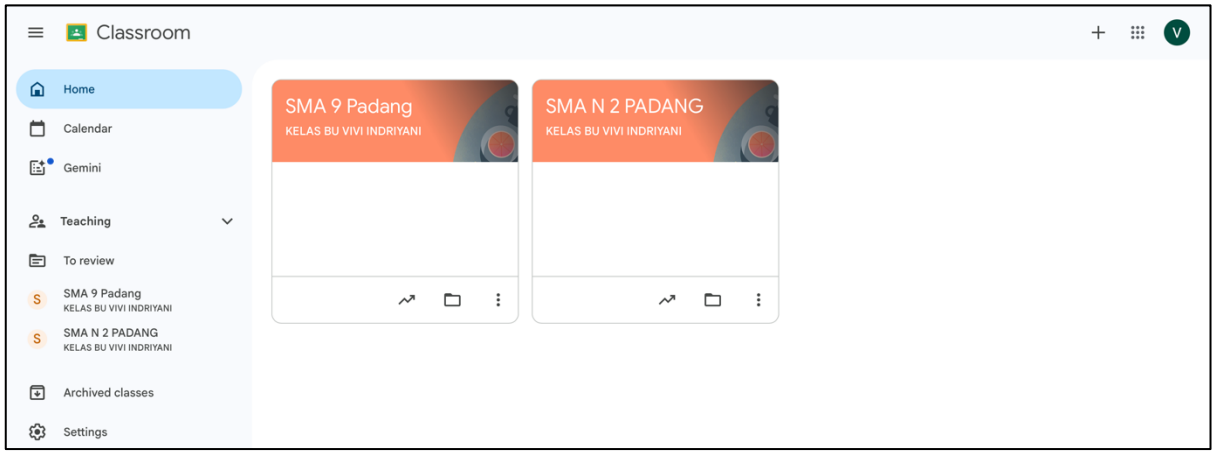
RESULT

This learning process was implemented in Indonesian language subjects using the Multiliteracy Integrative Learning model with the assistance of Google Classroom. The learning process was carried out on scientific texts. The learning process can be seen in the following table.

Table 1. Implementation of the Learning Process Using the MULGRANING Model assisted by Google Classroom

Syntax	Learning Process
Experiencing	Students observe social phenomena, the environment, or current issues available on Google Classroom through video links and news articles. Afterward, several students are asked to share their personal experiences or opinions on the issue through a Google Classroom discussion forum.
Conceptualising	Students gather information from various online and offline sources, such as scientific articles, e-books, and journals shared on Google Classroom. They work collaboratively using Docs or Jamboard to develop concepts that map out the main ideas and framework for writing a scientific paper.
Analysing	Students read two or three scientific texts uploaded by the teacher to Google Classroom and then analyze similarities and differences in terms of structure, writing style, and accuracy of information. Discussions are conducted in small groups using the comments feature or breakout discussions to critically analyze the text content.
Producing & creating	In groups, students draft a scientific paper based on their chosen topic. The writing process is carried out collaboratively through Google Docs, with writing tasks divided among group members. Revisions are then made based on feedback from the teacher and peers through the comments feature in Google Classroom.
Networking	The completed scientific paper is uploaded to Google Classroom. Each group is required to provide constructive feedback on the scientific work of other groups and to respond to comments received on their own work. This aims to foster media literacy through digital-based interactions.
Applying	Students apply their learning outcomes by creating simple digital projects, including campaigns related to the phenomenon being studied, including short videos related to their scientific work. These products are then published through Google Classroom or the school's digital media as a form of digital literacy implementation.
Comparing	Each group compares their scientific work with other groups available on Google Classroom. Discussions are conducted both synchronously (face-to-face online/offline) and asynchronously through the comments section to identify the strengths and weaknesses of each work.
Syntesis	Students reflect on the learning process, from information exploration, writing, publication, and application. These reflections are written in learning journals in Google Classroom and presented to the class, fully sharing their learning experiences.

The learning process using the MULGRANING model assisted by Google Classroom can be seen in the following picture.



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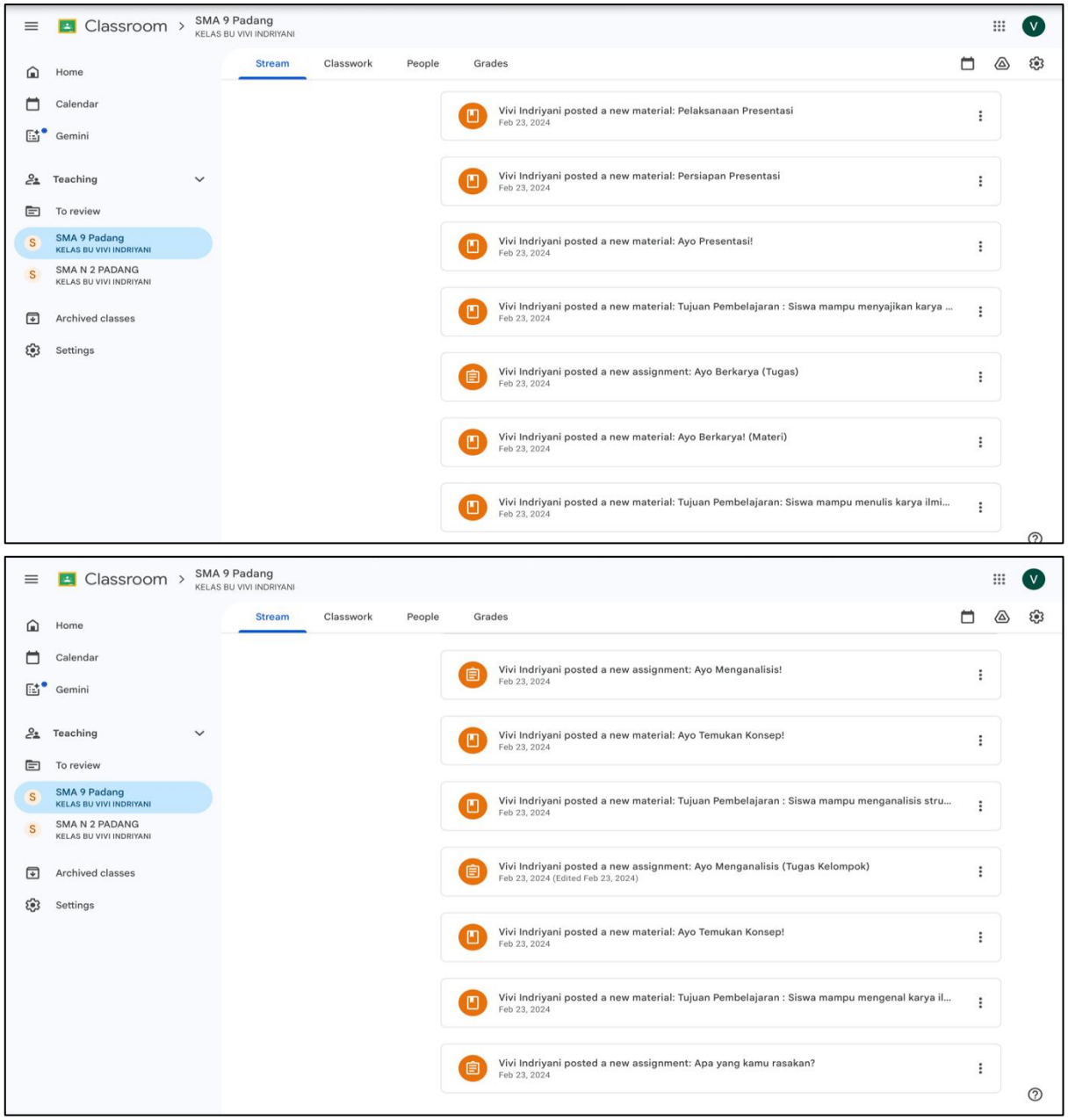

Figure 1. Learning using Google Classroom

During the learning process, observers assessed the students' media and digital literacy. Based on the analysis, a summary of the students' media and digital literacy assessments can be seen in the following figure.

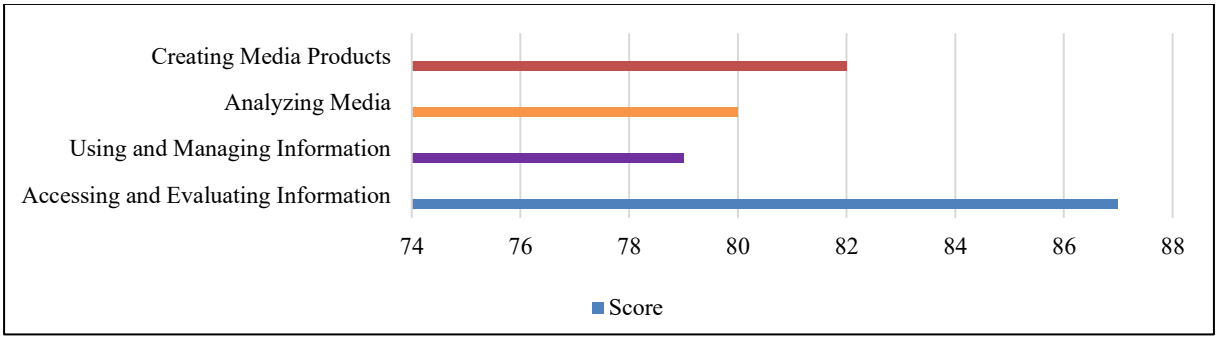

Figure 1. Recapitulation of Students' Media and Digital Literacy Scores

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Based on the figure, it can be seen that the media and digital literacy of students in the experimental class when learning using the MULGRANING model has an average score of good. Overall, student scores are categorized as medium and high, with a small number in the low category. The lowest score of the three assessments is managing and using information. Based on the observation results, it was found that students were able to find information from various media and digital media, but students still had difficulty organizing the information into text using their own language based on information obtained from various sources. The highest score is accessing and evaluating information. Students have been able to access information from various sources and have been able to distinguish between reliable and unreliable information.

Table 2. Media and Digital Literacy Assessment Based on Indicators

Learning Outcomes	Indicators	Scores	
		1	2
Students are able to access and evaluate information.	The ability to access information effectively and efficiently.	92	91
	The ability to evaluate information critically and competently.	84	85
	The ability to find valid and relevant sources for learning.	94	80
Students are able to use and manage information	The ability to use information creatively and accurately in the learning process of reading and writing.	79	76
	The ability to manage information from various sources in the learning process of reading and writing.	79	80
Students are able to use and manage information	The ability to understand why and how media messages are constructed and for what purpose.	76	77
	The ability to evaluate media to ensure its use is ethical and legally binding.	85	82
Students are able to create media products	The ability to understand and utilize appropriate media to share artifacts or products in learning.	82	82
	The ability to utilize the most appropriate expression and interpretation in various environments.	83	81

Description: (1) SMA N 2 Padang; (2) SMA N 9 Padang

Students' ability to access and evaluate information demonstrates that learning using the MULGRANING model, supported by Google Classroom, encourages them to be more critical and selective in selecting learning resources. Students are not only required to find information but also to ensure the relevance and validity of the sources used. This demonstrates a shift in learning patterns from simply receiving information to developing skills in assessing the accuracy and reliability of data. This is crucial because, in the context of media and digital literacy, students are challenged to select credible information amidst the flood of online data. Thus, the learning process fosters critical awareness of the quality of information sources used in writing scientific texts.

Students' ability to use and manage information demonstrates an active effort to process data from various sources into a learning context. Through Google Classroom, students are facilitated to collaborate, share, and restructure information in a more structured manner. This activity demonstrates that digital literacy extends beyond technical skills in searching for information to skills in organizing knowledge to generate deeper understanding. The use of the MULGRANING model encourages students to integrate creativity with precision in structuring ideas, enabling the information obtained to become the basis for writing scientific papers. This process indicates that learning using digital media can strengthen students' reasoning skills, enabling them to critically connect various sources.

Students' ability to analyze and produce media demonstrates development in the critical and creative dimensions of their digital literacy. Students not only understand media content but are also able to examine the intent, purpose, and ethics surrounding it. This process then continues with skills in producing media products, both articles and other digital works, such as campaign videos based on the articles they write. Through digital spaces like Google Classroom, students can share, provide feedback, and improve their work based on input from teachers and peers. This situation demonstrates that learning not only fosters thinking skills but also the ability to improve and develop work. Thus, the MULGRANING model plays a crucial role in fostering media and digital literacy through hands-on practice in producing scientific texts using digital media.

The following table outlines the results of the analysis of students' digital media literacy, categorized as high, medium, and low.

Table 3. Determination of High, Medium, and Low Categories of Digital Literacy Assessment

Achievements	School	Description of Reference Statistics for Category Determination				Total		
						High	Medium	Low
Digital Media Literacy	SMA N 2 Padang	$\bar{X}$G	83.73	$\bar{X}$G + Sg	92	12	16	6
	SMA N 9 Padang	Sg	9.3	$\bar{X}$G + Sg	73	3	25	6

The results of the study indicate a difference in media and digital literacy achievement between the two schools that were the subjects of the study. Students at one school tended to be more in the high category, indicating that the implementation of the MULGRANING model assisted by Google Classroom was able to facilitate them in accessing, processing, and producing information more optimally. Meanwhile, at the other school, the majority of students were in the medium category, indicating that although digital learning had been helpful, their mastery was still in the development stage. This difference indicates the influence of other factors, such as student readiness, the availability of facilities, and the learning culture that developed in the school. Thus, the effectiveness of the MULGRANING model depends not only on the learning design but also on the extent to which the learning environment is able to support active student engagement. This confirms that the success of media and digital literacy in this learning requires additional support.

DISCUSSION

The findings of this study show that the MULGRANING model supported by Google Classroom significantly enhanced students' media and digital literacy, particularly in accessing and evaluating information. This improvement occurs because the MULGRANING stages require students to engage in continuous interaction with multimodal texts. When combined with Google Classroom, these stages create a structured digital environment that facilitates consistent access to learning resources. The platform allows teachers to distribute materials, monitor student progress, and guide evaluation activities, which strengthens students' ability to filter and verify information. The synergy between the learning model and the platform works not as two separate components but as an integrated mechanism that simultaneously shapes students' cognitive and digital behaviors. Students benefit from guided exposure to multimodal sources while also learning to navigate digital tools independently. This dual reinforcement explains why access and evaluation skills improved more substantially than other indicators. However, these results also suggest that the

interaction between pedagogy and technology produces uneven gains, indicating the need for targeted intensification in specific literacy skills.

Although students demonstrated good performance in accessing and evaluating information, their information management skills remained relatively low. This gap emerges because managing information requires higher-order competencies such as organizing, synthesizing, and applying data in meaningful contexts. The MULGRANING model provides pathways for these skills, but many students still struggle to transform information into coherent learning products. Differences between the two research schools also influence this outcome. SMA Negeri 2 Padang with equipped with more stable Internet access, better device availability, and higher teacher readiness, tended to show more consistent learning engagement. Meanwhile, SMA Negeri 9 Padang faced uneven connectivity and more limited digital support, which affected students' ability to complete tasks requiring complex information processing. The digital learning environment significantly shapes how students manage information, as the process is highly dependent on infrastructure and teacher facilitation. These school-level differences confirm that digital literacy outcomes are not solely determined by learning models, but also contextual and environmental factors.

Furthermore, digital literacy, which emphasizes the ability to navigate digital devices and critically evaluate information, has been shown to be closely related to improved student learning outcomes. This aligns with the views of (Kyriakidis & Koikas, 2024) who emphasized the importance of integrating various communication channels in multiliteracies learning. However, challenges remain when students are faced with an abundance of information that requires skills in selection, analysis, and application. The findings of (Rylova-Grek & Shyshkina, 2020) reinforce that successful digital literacy is not limited to access, but also to the application of information in real-world contexts. Interventions in the form of digital media literacy courses can be a solution, although their effectiveness on technical skills is still limited (Zhang et al., 2025). In this regard, the role of teachers is central because they can create more interactive learning while guiding students in utilizing digital technology (Temirkhanova et al., 2024). With teacher support and appropriate learning strategies, students will be better prepared to face the challenges of media and digital literacy in the 21st century.

Recent studies further strengthen the interpretation of the present findings by highlighting the dynamic interaction between multiliteracy pedagogy and digital platforms. For example, (Lotherington & Jenson, 2011) demonstrated that structured multimodal learning tasks significantly enhance students' ability to synthesize digital information, supporting the argument that literacy development must be embedded within authentic digital contexts. Similarly, (Kalantzis & Cope, 2023) emphasized that multiliteracies frameworks become more effective when combined with digital learning ecosystems that facilitate collaboration and iterative knowledge construction. In addition, (L-Obaydi et al., 2025) found that students who engage in guided digital text practices show higher gains in analytical evaluation skills compared to those using conventional instructional methods, indicating the importance of teacher-mediated scaffolding. Meanwhile, (Amemasor et al., 2025) highlighted that school-level digital readiness including infrastructure, teacher competence, and institutional support plays a decisive role in shaping students' digital literacy performance. These studies collectively support the conclusion that the effectiveness of MULGRANING with Google Classroom integration is influenced not only by instructional design but also by environmental and technological factors that mediate students' learning experiences.

The findings of this study have important theoretical and practical significance. Theoretically, the results strengthen the position of the MULGRANING model as a learning model that can provide a basis for developing new conceptual models that emphasize the relationship between language skills through digital media. Practically, the application of this model can serve as a reference for teachers and educational institutions in designing learning strategies oriented towards the development of 21st-century skills, particularly in language learning. However, this study is limited by its relatively short implementation duration and the research context, which is still limited to two schools. Therefore, generalization of the findings should be done with caution. The lack of long-term measurement also poses a challenge in ensuring the sustainability of this model's impact on improving students' digital literacy. Therefore, further research is recommended to test the effectiveness of the MULGRANING model, supported by other digital technologies, in a broader context, considering other variables, and developing a more comprehensive evaluation system to assess the ability to access, evaluate, produce, and critically reflect on information.

CONCLUSION

This study concludes that the implementation of the MULGRANING model, supported by Google Classroom, in eleventh-grade Indonesian language learning effectively improved students' media and digital literacy, particularly in the dimensions of information access and evaluation. Descriptive data indicate that the highest improvement occurred in students' ability to identify credible sources and critically assess information, while information management skills, such as organizing, synthesizing, and utilizing digital content, improved but remained at a moderate level. The gap between strong access-evaluation skills and developing management skills is a key finding of this study and provides a basis for refining the MULGRANING syntax to better accommodate structured information processing tasks. This conclusion is nevertheless limited by the study context, which was limited to two high schools, and therefore generalizations of the findings should be interpreted with caution.

Theoretically, this study contributes to the development of multiliteracies pedagogy by demonstrating how the sequential stages of the MULGRANING model can engage students in digital reasoning and critical interpretation in learning scientific texts. These findings extend existing research by demonstrating that multiliteracies learning becomes more impactful when integrated with digital platforms that support multimodal interactions. Practically, this study offers concrete implications for teaching: educators are encouraged to design learning tasks that involve digital content production, multimodal information management, and engaging students in evaluative assessments rather than simply information retrieval. At the policy level, these findings highlight the importance of incorporating structured digital literacy components into the curriculum, providing targeted teacher training on multiliteracies-based digital instruction, and strengthening schools' digital ecosystems, including infrastructure, platforms, and supervisory guidelines, to support consistent implementation.

Future research is recommended to expand on the current findings by: (1) comparing multiple digital platforms such as Google Classroom, Moodle, and Edmodo to determine platform-model compatibility; (2) applying the MULGRANING model across educational levels to understand developmental variations in digital literacy acquisition; and (3) integrating moderating variables such as motivation, digital engagement, or self-regulated learning to gain a more comprehensive explanation of how students develop media and digital literacy in digital learning environments. These directions will strengthen the empirical

foundation for developing a more robust and measurable learning framework capable of addressing the demands of education in the digital age.

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Declarations

Author Contribution Statement
Vivi Indriyani: conceptualization, research design, data collection, data analysis, and manuscript preparation.
Jasmienti: instrument validation and data interpretation.
M. Aries Taufiq: manuscript editing
Nofrahadi: data analysis review and revision of the manuscript.

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Data Availability Statement

The data generated and/or analyzed in this study are available and retained by the authors. Data may be accessed upon reasonable request to the corresponding author for academic and research purposes, subject to ethical standards, confidentiality, and participant data protection.

Declaration of Interests Statement
The authors declare that there are no conflicts of interest, either financial or non-financial, that could have influenced the research design, data collection and interpretation, or preparation of this manuscript.

AI Use Statement
The authors used [ChatGPT] to support initial drafting and/or structuring of parts of the manuscript. All AI-assisted outputs were critically reviewed, rewritten where necessary, and verified against the study data and cited sources. The authors remain fully accountable for the accuracy, originality, and integrity of the manuscript.

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REFERENCES

Abbas, A., Gonzalez-Cacho, T., Radovanović, D., Ali, A., & Rincón, G. B. (2024). Students' Use of Social Media and Critical Thinking: The Mediating Effect of Engagement. In D. Radovanović (Ed.), *Digital Literacy and Inclusion* (pp. 99–112). Springer, Cham. https://doi.org/https://doi.org/10.1007/978-3-031-30808-6_7

Albashtawi, A., & Al Bataineh, K. (2020). The effectiveness of google classroom among EFL students in Jordan: An innovative teaching and learning online platform. *International Journal of Emerging Technologies in Learning (IJET), 15*(11), 78–88.

Allen, B., Caple, H., Coleman, K., & Nguyen, T. (2012). *Creativity in practice: Social media in higher education. ASCILITE: Future Challenges-Sustainable Futures Conference*, Wellington, New Zealand.

Amemasor, S. K., Oppong, S. O., Ghansah, B., Benuwa, B. B., & Agbeko, M. (2025). The influence of digital professional development and professional learning communities in the relationship between school digital preparedness and digital instructional inte. *PLoS One*, *20*(7), e0328883. https://doi.org/https://doi.org/10.1371/journal.pone.0328883

Ata, R., & Yildirim, K. (2019). Exploring turkish pre-service teachers' perceptions and views of digital literacy. *Education Sciences, 9*(40), 1–16.

Boronenko, T., Kaysina, A., & Fedotova, V. (2020). Conceptual model of the concept of digital literacy. *Perspectives of Science and Education, 46*, 47–73. https://doi.org/https://doi.org/10.32744/pse.2020.4.4

Camilli-Trujillo, C., & Römer-Pieretti, M. (2017). Meta-synthesis of literacy for the empowerment of vulnerable groups. Comunicar, 53, 9–18. https://doi.org/https://doi.org/10.3916/C53-2017-01

Cheng, L., Fang, G., Zhang, X., Lv, Y., & Liu, L. (2024). Impact of social media use on critical thinking ability of university students. *Library Hi Tech, 42*(2), 642–669. https://doi.org/https://doi.org/10.1108/LHT-11-2021-0393

Çocuk, H. E., & Yelken, T. Y. (2018). The effect of the web based digital story applications on the digital literacy levels of turkish teacher candidates. *Asian Journal of Education and Training, 4*(2), 132–136. https://doi.org/https://doi.org/10.20448/journal.522.2018.42.132.136

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Dalton, E. M. (2017). Beyond universal design for learning: guiding principles to reduce barriers to digital & media literacy competence. *Journal of Media Literacy Education,* 9(2), 17—29. https://doi.org/https://doi.org/10.23860/JMLE-2019-09-02-02

Dezuanni, M. (2015). The building blocks of digital media literacy: socio-material participation and the production of media knowledge. *Journal of Curriculum Studies, 47*(3), 416—439. https://doi.org/https://doi.org/10.1080/00220272.2014.966152

Fauzi, A., Wandira, R., Sepri, D., & Hafid, A. (2021). Exploring Students' Acceptance of Google Classroom during the COVID-19 Pandemic by Using the Technology Acceptance Model in West Sumatera Universities. *Electronic Journal of E-Learning, 19*(4), 233–240.

Fauzi, & Marhamah. (2021). Pengaruh literasi digital terhadap pencegahan informasi hoaks pada remaja di SMA Negeri 7 Kota Lhokseumawe. *Jurnal Pekommas, 6*(2), 77–84. https://doi.org/10.30818/jpkm.2021.2060210

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior, 68*, 441—449. https://doi.org/https://doi.org/10.1016/j.chb.2016.11.057

Greene, J. A., Yu, S. B., & Copeland, D. Z. (2014). Measuring Critical Components of Digital Literacy and their Relationships with Learning. *Computers & Education, 76*, 55–69. https://doi.org/https://psycnet.apa.org/doi/10.1016/j.compedu.2014.03.008

Gupta, A., & Pathania, P. (2021). To study the impact of Google Classroom as a platform of learning and collaboration at the teacher education level. *Education and Information Technologies, 26*(1), 843–857. https://doi.org/https://doi.org/10.1007/S10639-020-10294-1

Iftakhar, S. (2016). Google classroom: what works and how. *Journal of Education and Social Sciences, 3*(1), 12–18.

Indriyani, V., Atmazaki, A., & Ramadhan, S. (2023). Development of Multiliteracy Integrative Learning (MULGRANING) Model in Language Learning. *Egitim ve Bilim, 48*(215), 261–275. https://doi.org/10.15390/EB.2023.11413

Indriyani, V., Atmazaki, A., & Ramadhan, S. (2024). Promoting Environmental Awareness through language learning: A study on the Integration of Environmental Education in The Classroom. *AIP Conference Proceedings*, 3001(1), 060001.

Indriyani, V., & Zakarya, Z. (2025). The Effectiveness of the Multiliteracy Integrative Learning (MULGRANING) Model on Students ' Reading Skills in Indonesian Language Learning. *Internatioal of Language and Pedagogy, 5*(1), 27–37. https://doi.org/10.24036/ijolp.v5i1.102

Kalantzis, M., & Cope, W. (2023). Multiliteracies: A short update. *The International Journal of Literacies, 30*(2), 1–15. https://doi.org/https://doi.org/10.18848/2327-0136/CGP/v30i02/1-15

Kyriakidis, K., & Koikas, E. (2024). Literacy Evolution in the Digital era: A kaleidoscope of literacies for the 21st century. *Proceedings of the International Multi-Conference on Society, Cybernetics and Informatics, IMSCI,* 1, 45–56. https://doi.org/https://doi. org/10.54808/IMSCI2024

L-Obaydi, L. H., Pikhart, M., & Tawafak, R. M. (2025). Digital literacy of EFL student-teachers using empowerment outreach program: The role of engagement, cognitive learning, and performance. *International Journal of Educational Research, 134*, 102762. https://doi.org/https://doi.org/10.1016/j.ijer.2025.102762

Lotherington, H., & Jenson, J. (2011). Teaching multimodal and digital literacy in L2 settings: New literacies, new basics, new pedagogies. *Annual Review of Applied Linguistics, 31,* 226–246. https://doi.org/https://doi.org/10.1017/S0267190511000110

Marksbury, N., & Bryant, E. A. (2019). Enter the twilight zone: the paradox of the digital native. *Issues in Information Systems, 20*(2), 206–215. https://doi.org/https://doi.org/10.48009/2_iis_2019_206-215

Milenkova, V., Manov, B., & Peicheva, D. (2020). Shaping digital literacy in knowledge society. *International Conference on Human Interaction and Emerging Technologies*, 279–284. https://doi.org/https://doi.org/10.1007/978-3-030-44267-5_42

Mills, M. S. (2013). Facilitating multimodal literacy instruction through digital curation. In J. Whittingham, S. Huffman, W. Rickman, & C. W. Hershey (Eds.), *Technological tools for the literacy classroom* (pp. 46–63). Idea Group Inc (IGI).

Miranda, P., Isaias, P., & Pifano, S. (2018). *Digital literacy in higher education a survey on students' self-assessment.* Springer International Publishing AG. https://doi.org/https://doi.org/https://doi.org/10.1007/978-3-319-91152-6_6

Moghaddam, H. K., & Asghari, A. (2015). Comparison of media and digital knowledge among university of technology Birjand (Iran), pune in India and university of liege in Belgium. *Asian Journal of Information Technology, 14*(7), 268–272. https://doi.org/https://doi.org/10.3923/ajit.2015.268.272

Morgan, A., Sibson, R., & Jackson, D. (2022). Digital demand and digital deficit: conceptualising digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management, 44*, 1–18. https://doi.org/https://doi.org/10.1080/1360080X.2022.2030275

Pérez-Rodríguez, A., Delgado-Ponce, A., Marín Mateos, P., & Romero-Rodríguez, L. M. (2019). Media competence in spanish secondary school students. assessing instrumental and critical thinking skills in digital contexts. *Educational Sciences: Theory & Practice, 19*(3), 33—48. https://doi.org/https://doi.org/10.12738/estp.2019.3.003

Rylova-Grek, Y., & Shyshkina, M. (2020). Impact of Online Training on the Formation of Media and Cyber Literacy Skills during Quarantine (COVID-19). *DisCo,* 70–77.

Surmelioglu, Y., & Seferoglu, S. S. (2019). An examination of digital footprint awareness and digital experiences of higher education students. *World Journal on Educational Technology: Current Issues, 11*(1), 048–064. https://doi.org/https://doi.org/10.18844/wjet.v11i1.4009

Tang, C. M., & Chaw, L. Y. (2016). Digital literacy: A prerequisite for effective learning in a blended learning environment? *The Electronic Journal of E - Learning, 14*(1), 54-65.

Temirkhanova, M., Abildinova, G., & Karaca, C. (2024). Enhancing digital literacy skills among teachers for effective integration of computer science and design education: a case study at Astana

International School. *Frontiers in Education*, 9, 1408512.

Torrato, J., Aguja, S., & Prudente, M. (2023). Educators' digital literacy competence in a hybrid learning environment. *IC4E '23: Proceedings of the 2023 14th International Conference on E-Education, E-Business, E-Management and E-Learning*, 19–24. https://doi.org/https://doi.org/10.1145/3588243.3588250

Triana, M., Herman, H., Sinurat, B., & Silalahi, D. E. (2021). An Analysis of Students Perception on the Use of Google Classroom in English Language Learning. *Cetta: Jurnal Ilmu Pendidikan, 4*(3), 607–618. https://doi.org/https://doi.org/10.37329/cetta.v4i3.1474

Tutkun, T., & Kincal, R. Y. (2019). The relationship between the teacher candidates' level of media literacy and participation levels to protest and social change. *International Education Studies, 12*(4), 208—216. https://doi.org/https://doi.org/10.5539/ies.v12n4p208

Ulanday, M. L., Centeno, Z. J., Bayla, M. C., & Callanta, J. (2021). Flexible learning adaptabilities in the new normal: E-learning resources, digital meeting platforms, online learning systems and learning engagement. *Asian Journal of Distance Education*, 16(2).

Wang, Y., & Woo, D. (2021). Investigating digital literacy skills in examination-oriented education system for the post-pandemic era. *ICETM '21: Proceedings of the 2021 4th International Conference on Education Technology Management*, 169–175.

Wijaya, A. (2020). The role of mathematics teacher in the digital era. *Journal of Physics: Conference Series*, 1581, 12069. https://doi.org/https://doi.org/10.1088/1742-6596/1581/1/012069

Yaman, M. (2020). Examining media literacy levels and personality traits of physical education and sports students according to certain demographic variables. *TOJET, 19*(1), 1–8.

Zhang, L., Iyendo, T. O., Apuke, O. D., & Gever, C. V. (2025). Experimenting the effect of using visual multimedia intervention to inculcate social media literacy skills to tackle fake news. *Journal of Information Science, 51*(1), 135–145.