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GOOGLE SERVICES AS DIGITAL TOOLS FOR EDUCATIONAL INFORMATION MANAGEMENT: A NARRATIVE REVIEW

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ABSTRACT

The rapid growth of educational technology has encouraged teachers, students, schools, and higher education institutions to rely on online platforms for teaching, learning, communication, collaboration, and information management. This study examines the role of Google Services as digital tools that support the management of educational information, particularly in relation to learning materials, academic searching, communication, collaboration, and student learning activities. Using a narrative literature review approach, this study discusses selected Google-based tools, including Google Scholar for academic information retrieval, Google Classroom as a learning management system, Google Docs, Google Sheets, and Google Slides for document creation and collaboration, Google Meet for online communication, and Google Drive for cloud storage and document management. The review indicates that Google Services offer several benefits in educational settings, including easier access to learning materials, real-time collaboration, flexible online learning, improved academic searching, and more efficient management of teaching and learning processes. However, the use of Google Services also presents several challenges, including dependence on internet connectivity, data privacy and security concerns, information overload, limited interaction in online learning, and reliance on proprietary platforms. Overall, Google Services can support educational information management when used effectively and responsibly. Therefore, educational institutions should strengthen digital literacy, data governance, offline learning support, and teacher readiness to ensure that Google-based tools are used meaningfully in digital education environments.

Keywords: Educational technology, Google Services, e-learning, educational information management

INTRODUCTION

A Management Information System (MIS) supports organizational decision-making by collecting, storing, managing, and distributing information for operational and strategic purposes. In education, MIS is not limited to administrative records; it also supports teaching, learning, communication, assessment, collaboration, and the secure management of academic information. Within this context, Google Services can be viewed as part of an educational MIS because they help teachers, students, and institutions organize, access, share, and use information more efficiently (El-Ebiary et al., 2023).

Google Classroom enables teachers to manage learning materials, assignments, feedback, and student submissions in a single digital environment. Google Drive, Docs, Sheets, and Slides support document storage, sharing, editing, and collaborative work, while Google Meet enables synchronous online communication. Google Scholar also supports academic searching by helping students and educators locate scholarly sources. Collectively, these tools form a digital ecosystem that supports educational information management and learning operations.

Google is one of the world's most influential technology companies. Founded in 1998 by Larry Page and Sergey Brin, Google operates in the technology and internet services industry (Hall & Hosch, 2025). The company is widely known for search engine technology, digital advertising, cloud computing, software, and hardware (Osterloh, 2018). Over time, Google has expanded its services to include Android, Google Workspace, cloud-based productivity tools, and artificial intelligence solutions (Salas-Pilco et al., 2022). Google Search also illustrates the role of information management because it uses indexing and algorithmic relevance to help users retrieve information rapidly from billions of webpages (Schmidt, 2010). Based on this background, the objectives of this review are:

1. To examine how Google Services can be used as digital educational tools.
2. To discuss the issues and challenges associated with using Google Services for educational information management.
3. To suggest practical considerations for improving the effective and responsible use of Google Services in education.

METHODOLOGY

This study adopts a narrative literature review approach to examine the role of Google Services as digital tools for educational information management. The review synthesizes literature related to Google-based tools used in teaching, learning, communication, collaboration, information storage, and academic resource management. The discussion focuses on selected tools, including Google Classroom, Google Meet, Google Drive, Google Docs, Google Sheets, Google Slides, Google Scholar, cloud computing, and learning management systems. This approach allows the study to identify the main benefits, challenges, and operational implications of using Google Services in education. It also enables the discussion to move beyond tool description by linking Google Services to MIS functions and educational operations management.

Google Services as Educational MIS Tools

Several information management technologies support the use of Google Services in education. These include cloud storage for storing educational materials, Google Meet for online communication, and

Google Classroom as a learning management platform for interaction between educators and learners. The following sections discuss how these technologies contribute to educational information management.

Storage and Computing for Data

Cloud storage and cloud computing refer to the storage and processing of data on remote servers rather than on users' local devices (Borra, 2024; Sikka & Ojha, 2021). In education, cloud storage enables teachers and learners to access files from different locations and devices, provided that an internet connection is available. This reduces the need for institutions to maintain costly local data centres and allows educational materials to be stored, retrieved, and shared more efficiently.

Cloud computing also supports collaborative learning by allowing students and teachers to work together in real time even when they are not physically present in the same location (Huang et al., 2013). For example, online meeting platforms and collaborative whiteboard features allow users to write, draw, and exchange ideas simultaneously. From an MIS perspective, these functions support information sharing, learning continuity, and operational flexibility.

Ibrahim (2019) described Google Drive as a platform that enables organizations to upload, create, edit, share, and retrieve files across multiple devices. Its main advantages include mobility, flexibility, reduced dependence on physical documents, easier collaboration, faster file searching, and continuous access to stored materials. For educational institutions, these features support document management and improve access to teaching and learning resources.

Online Meeting

Google Meet became widely used during the COVID-19 pandemic because it enabled teachers and students to continue learning when face-to-face classes were disrupted. It remains relevant in open and distance learning because it allows teaching, consultation, presentation, and group discussion to take place without geographical limitations (Buchi & Nkechi, 2021). In this sense, Google Meet supports the communication function of educational MIS.

Learning Management System (LMS)

A Learning Management System (LMS) is a software platform used to plan, deliver, monitor, and assess the learning process (Buchi & Nkechi, 2021; Furqon et al., 2023). In education, an LMS acts as an intermediary system that enables teachers and learners to communicate, access materials, submit assignments, and monitor learning progress. Teachers can upload notes, slides, quizzes, and other learning resources once, while learners can access them according to their needs.

Previous studies present different perspectives on online learning platforms. Basar et al. (2021) found that online learning may be less effective than face-to-face learning when interaction between teachers and learners is limited. Reduced interaction can affect motivation and make group work more difficult. In contrast, Zheng et al. (2021) reported that many learners accepted online learning and were willing to continue using it after the pandemic. These mixed findings indicate that the effectiveness of online learning platforms depends not only on the technology itself but also on learner readiness, teaching strategy, interaction quality, and institutional support.

Perumal and Jalaluddin (2023) reviewed the use of Google Classroom in English language learning and found that it can improve writing, speaking, and listening activities through its user-friendly interface, instant feedback, and organized assignment management. However, the review also emphasized that the platform's effectiveness depends on internet access, suitable devices, and the digital readiness of teachers and learners. This reinforces the need to examine Google Classroom not only as a teaching tool but also as an information management platform within the broader educational ecosystem.

Education Platform

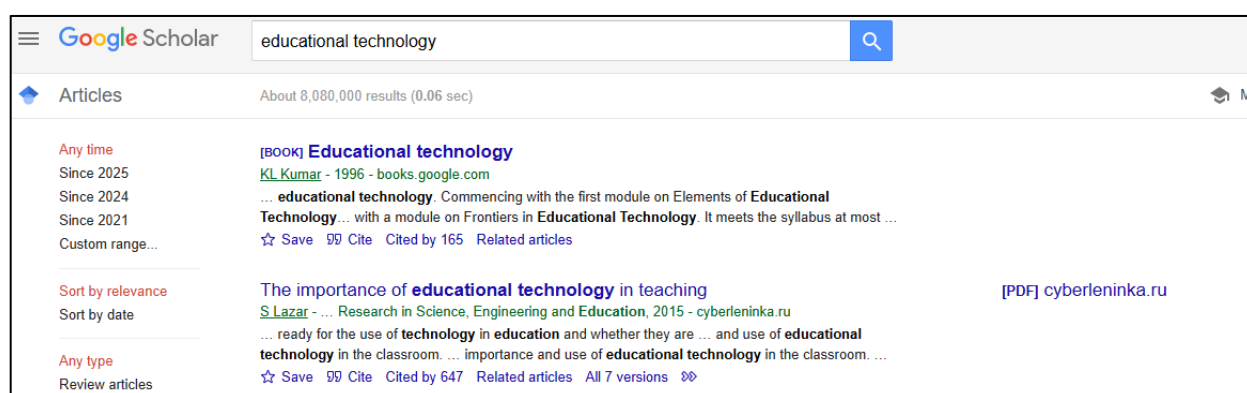
The growth of online and blended learning has increased the importance of digital platforms in education. Google has developed several services that support accessibility, collaboration, communication, and information management. This section reviews selected Google Services that are commonly used in educational settings.

Google Scholar

Google Scholar is widely used by students, researchers, and educators to search for academic resources. It was developed to support scholarly information retrieval by indexing peer-reviewed articles, theses, books, conference proceedings, and other academic materials. Compared with a general search engine, Google Scholar narrows the search environment and helps users locate more relevant academic sources.

The platform allows users to refine search results by author, publication year, citation count, and relevance. These features help users identify authoritative sources and reduce exposure to irrelevant or unreliable materials. However, Google Scholar does not eliminate the need for critical evaluation because users must still assess the quality, relevance, and credibility of the sources they retrieve.

By prioritizing scholarly publications, Google Scholar supports the information retrieval function of educational MIS. It assists students and educators in locating academic content more efficiently, but its use should be supported by digital literacy skills. Figure 1 shows a Google Scholar webpage.



Source. Authors' screenshot from Google Scholar search results for "educational technology", accessed on June 12, 2026.

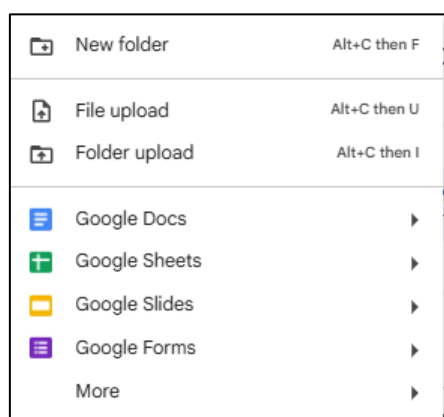
Figure 1

Google Scholar Search Results Page for Educational Technology

Google Docs, Sheets and Slides

Google Docs, Sheets, and Slides enable users to create, edit, share, and collaborate on documents, spreadsheets, and presentations. These tools store files in the cloud, allowing users to access their work across devices and locations. When offline features are enabled, users can continue working without an internet connection, and changes are synchronized once connectivity is restored.

In educational settings, these tools support assignments, lesson planning, report writing, group projects, and collaborative learning. Their real-time editing and version control features reduce document duplication and improve teamwork. However, real-time collaboration still depends on stable internet connectivity, and users require proper file organization and access permissions to avoid confusion or unauthorized access. Figure 2 shows Google Docs, Sheets, and Slides.



Source. Authors' screenshot from Google Drive, accessed on June 12, 2026.

Figure 2

Google Drive Interface Showing Document Creation and Upload Options

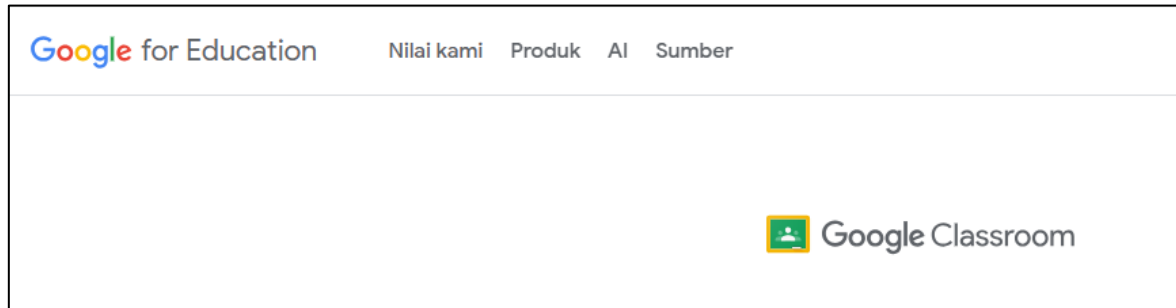
Google Classroom

Google Classroom is one of the most frequently used Google tools for managing interaction between teachers and students. As part of Google for Education, it supports learning management by allowing teachers to distribute materials, create assignments, provide feedback, collect submissions, and monitor student participation. It also supports institutional information management by organizing classroom activities in a single digital space.

Google for Education includes security features such as encryption, cloud storage, and access control mechanisms. These features help institutions manage user permissions and protect sensitive information. For example, teachers can control who may view, edit, or access learning documents, while administrators can monitor platform usage and manage accounts (Hasan, 2023).

Nevertheless, the use of Google Classroom also raises concerns about privacy, data security, and responsible data management. Although the platform supports teaching and learning operations, educational institutions must ensure that student information is protected through clear policies, appropriate access control, and responsible digital practices.

Zulkifli and Kassim (2021) examined Malaysian university students' attitudes toward Google Classroom as a learning management system. Using a survey based on the Technology Acceptance Model, the study found that students reported positive perceptions of ease of use, usefulness, and intention to use. However, the study was limited by its relatively small sample and did not examine the relationship between students' attitudes and their academic performance or demographic characteristics. Figure 3 shows the Google Classroom interface.



Source. Authors' screenshot from Google for Education, accessed on June 12, 2026.

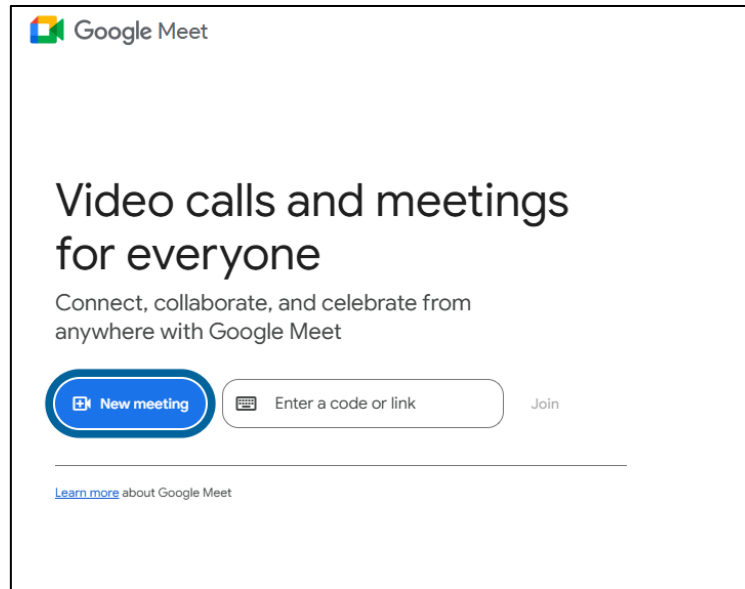
Figure 3

Google Classroom Page Under Google for Education

Google Meet

Google Meet is an online meeting platform used to facilitate virtual classes, consultations, presentations, and group discussions. Through webcam, microphone, chat, and screen-sharing functions, teachers can deliver learning materials and interact with students remotely. Although it became especially important during the COVID-19 pandemic, it continues to support open and distance learning and flexible communication in education (Nikman et al., 2022). Figure 4 shows the Google Meet interface.

Hadi and Dewi (2021) explored the use of Google Meet for teaching English to secondary school learners. Their qualitative study found that Google Meet supported face-to-face interaction, screen sharing, speaking practice, and oral assessment. However, the study also reported practical challenges such as students turning off cameras, audio problems, and unstable internet connections. These findings suggest that Google Meet can support communication management, but its effectiveness depends on internet quality, classroom management, and active teaching strategies.



Source. Authors' screenshot from Google Meet, accessed on June 12, 2026.

Figure 4

Google Meet Interface for Video Calls and Online Meetings

CHALLENGES IN USING GOOGLE AS EDUCATIONAL TOOLS

Although Google Services provide several benefits for education, their use also creates operational, technical, and governance challenges. The main issues identified in the literature include security concerns, network dependency, information overload, limited interaction in online learning, and platform dependency.

Security Concerns

Google Services such as Google Classroom, Google Docs, Google Forms, and Google Drive are widely used in education because they support collaboration, resource access, and user-friendly digital learning. However, their use also raises concerns about privacy, data security, and the possible misuse of sensitive information, particularly when the users include children or young learners.

A major concern is the amount of data generated and stored through Google-based educational tools. Student names, email addresses, submitted assignments, classroom communications, search activities, and learning records may be stored on Google servers. While such data can support personalization and platform improvement, it also creates governance risks if access, storage, and sharing are not properly managed.

For example, Google Classroom records interactions such as assignment postings, feedback, messages, and submissions. These records can support teaching and learning management, but they also require responsible data handling. Educational institutions therefore need clear policies on account management, user permissions, data access, and the ethical use of cloud-based platforms.

The expansion of artificial intelligence tools within the Google ecosystem adds another layer of concern. When learners use AI-enabled tools for personalized learning or content generation, institutions should

ensure that sensitive data are not shared unnecessarily. This makes digital literacy and data governance essential components of responsible technology adoption in education.

Network Issues

Most Google Services are cloud-based; therefore, their effectiveness depends heavily on internet connectivity and server reliability. Educational activities such as online classes, assignments, examinations, document sharing, and communication can be disrupted when users experience unstable internet access or slow platform performance.

Students and educators in rural or underserved areas may face greater difficulty accessing Google Classroom, Google Docs, or Google Meet because of weak connectivity or limited devices. These constraints may lead to missed deadlines, incomplete submissions, reduced participation, and an uneven learning experience.

Hassan et al. (2020) found that internet connectivity was a significant barrier for students using Google Classroom during the pandemic. One of the highest-rated challenges was difficulty accessing internet facilities at home. This finding highlights the need for institutions to provide flexible learning arrangements and infrastructure support when adopting Google-based educational tools.

Information Overload

Information overload is another challenge associated with Google-based tools in education. It occurs when users are exposed to excessive information from multiple sources, making it difficult to identify, process, and apply relevant knowledge effectively (Stanley, 2021). In educational settings, this issue is particularly important because students and educators often depend on online searches to locate academic materials and learning resources.

Although Google Search provides rapid access to a wide range of information, users may face difficulty distinguishing credible academic sources from less reliable or irrelevant content. For example, a student searching for a broad topic may receive thousands or millions of results within seconds. Without adequate digital literacy, this can lead to confusion, poor source selection, and inefficient learning.

Therefore, Google-based tools should be supported by guidance on source evaluation, information credibility, and responsible academic searching. Based on the challenges discussed, Table 1 summarizes the key advantages and disadvantages of using Google Services as educational MIS tools.

Table 1*Advantages and Disadvantages of Google Services as Educational MIS Tools*

Advantage	Disadvantage
1. Real-time collaboration between educators and students enhances teamwork and communication across locations.	1. Student and educator data are stored on Google servers and may be exposed to unauthorized access or misuse.
2. Educators and students can access learning materials anytime and anywhere.	2. Collected data may be used for analytics, advertising, or behavioural tracking.
3. User-friendly interfaces support faster adoption by educators and students.	3. Several key functions require stable internet connectivity.
4. Data-driven personalization can enhance learning pathways and resource recommendations.	4. Google service outages or slow platform performance can disrupt educational activities.

RESULTS AND DISCUSSION

Based on the reviewed literature, Google Services should not be understood merely as classroom applications. They can also be positioned as part of an educational MIS because they support the collection, storage, sharing, retrieval, and use of information in teaching and learning operations. From this perspective, Google Scholar supports academic information retrieval, Google Classroom supports learning management and student activity monitoring, Google Drive supports document storage and access, Google Docs, Sheets, and Slides support collaborative content creation, and Google Meet supports communication management.

This interpretation is consistent with the Technology Acceptance Model, which explains that users are more likely to adopt a system when they perceive it as useful and easy to use (Davis, 1989). It is also aligned with the DeLone and McLean Information Systems Success Model, which emphasizes system quality, information quality, service quality, system use, user satisfaction, and net benefits (DeLone & McLean, 2003). Therefore, the value of Google Services in education should be assessed not only based on tool availability but also based on their contribution to educational operations, accessibility, collaboration, information quality, user readiness, and learning continuity.

Google-based tools therefore support both instructional and operational functions in education. However, their effectiveness depends on institutional support, digital literacy, infrastructure readiness, teacher readiness, and clear policies for responsible use. Table 2 summarizes how selected Google Services support different MIS functions in education.

Table 2

Google Services as Educational MIS Tools

Google Service	MIS Function	Educational Benefit	Limitation	Operational Implication
Google Scholar	Academic information retrieval	Helps students and educators search for scholarly materials such as journal articles, theses, books, and conference papers more efficiently.	Students may still face difficulty evaluating the credibility, relevance, and quality of sources.	Supports research activities and academic decision-making, but should be supported by digital literacy skills.
Google Classroom	Learning management and student activity monitoring	Allows teachers to organize learning materials, assignments, feedback, quizzes, and student submissions in one platform.	Its effectiveness depends on teacher readiness, student participation, and stable internet access.	Improves classroom management, learning coordination, and monitoring of student progress.
Google Drive	Cloud storage and document management	Enables teachers and students to store, access, and share learning materials from different devices and locations.	Requires proper file organization and permission management to avoid confusion or unauthorized access.	Supports centralized information storage and improves access to educational resources.
Google Docs, Sheets, and Slides	Collaboration and content creation	Allows real-time editing, group work, lesson preparation, report writing, and collaborative learning activities.	Offline features are useful, but real-time collaboration still requires internet connectivity.	Enhances teamwork, version control, document sharing, and productivity in teaching and learning.
Google Meet	Communication management	Supports online classes, consultations, meetings, presentations, and group discussions without geographical limitations.	May reduce interaction and student engagement if not supported by active teaching strategies.	Supports learning continuity, flexible communication, and open and distance learning.
Google Workspace for Education	Integrated educational information management	Combines classroom management, communication, file sharing, scheduling, and collaboration tools in one ecosystem.	Raises concerns related to data privacy, security, platform dependency, and institutional data governance.	Supports educational operations, but requires clear policies on data protection, access control, and responsible use.

Google Scholar helps reduce information overload by offering a more focused platform for academic searching. In digital learning environments, learners and educators are exposed to large volumes of information from different websites and databases. By indexing scholarly materials, Google Scholar supports the information retrieval function of MIS and helps users access academic information more efficiently for teaching, learning, and research.

However, Google Scholar should not be treated as a complete solution to information overload. Learners may still struggle to evaluate the quality, relevance, and credibility of retrieved sources. Other academic databases such as Scopus, Web of Science, and Semantic Scholar provide more advanced search and indexing functions. Therefore, the use of Google Scholar should be complemented by digital literacy training, particularly in source evaluation, comparison of findings, and responsible use of academic information.

Google for Education supports educational MIS by helping institutions manage learning activities, classroom communication, document sharing, and learner submissions. Google Classroom, for example, allows teachers to organize learning materials, assignments, feedback, quizzes, and learner work in one

platform. This improves operational efficiency because teaching materials, submissions, and feedback can be managed systematically rather than across separate tools.

These functions are consistent with the role of an LMS, where teachers deliver learning materials, monitor student activities, and assess student understanding (Buchi & Nkechi, 2021; Furqon et al., 2023). However, the effectiveness of Google Classroom depends on teacher readiness, learner participation, institutional support, and internet access. These factors determine whether the system can improve teaching and learning operations.

Data privacy and security are major concerns when Google Services are used as educational MIS tools. Because these services are cloud-based, information such as assignments, communication records, learning activities, and user data may be stored online. This is especially sensitive in educational settings involving children and young learners. Data privacy should therefore be treated not only as a technical issue but also as an institutional governance issue. Educational institutions need clear policies on data access, user permissions, account management, and responsible platform use.

Google Docs, Sheets, and Slides support collaboration and document management in educational settings. These tools allow teachers and learners to create, edit, share, and update documents in real time. They are useful for group assignments, lesson planning, report writing, classroom activities, and collaborative learning. Google Drive further supports these activities by storing and organizing documents in a centralized cloud environment.

Cloud-based collaboration can reduce dependence on local infrastructure and enable users to work together even when they are not physically in the same location (Borra, 2024; Sikka & Ojha, 2021; Huang et al., 2013). These tools improve document access, version control, sharing, and teamwork. Offline features are also beneficial because they allow users to continue working during unstable internet connectivity and synchronize their work when the connection is restored.

Nevertheless, offline access only partially addresses internet dependency. Many learning activities, including online classes, real-time quizzes, instant feedback, and classroom announcements, still require stable connectivity. Hassan et al. (2020) found that students faced challenges when using Google Classroom because of limited internet access at home. This indicates that digital tools may improve educational processes, but they may also widen access gaps between students with reliable connectivity and those with limited access.

Google Meet supports communication management and learning continuity by enabling online classes, consultations, presentations, meetings, and group discussions. During the COVID-19 pandemic, it became particularly important when face-to-face learning was disrupted. It continues to support open and distance learning and flexible communication in education (Nikman et al., 2022).

However, the effectiveness of online meetings depends on interaction quality, teaching strategy, learner motivation, and internet stability. Basar et al. (2021) found that online learning may be less effective when interaction between teachers and learners is limited. In contrast, Zheng et al. (2021) reported that some learners accepted online learning and were willing to continue using it after the pandemic. These mixed findings suggest that Google Meet can support educational communication, but active teaching strategies are needed to maintain engagement and learning quality.

Overall, Google Services provide several advantages in educational settings, including easier access to academic resources, more efficient management of learning materials, real-time collaboration, flexible communication, and improved organization of learning activities. At the same time, the review identified several limitations, including internet dependency, privacy and security concerns, information overload, limited online interaction, and reliance on third-party platforms. Educational institutions should therefore support Google-based tools with digital literacy, teacher training, data governance, access control, and infrastructure planning.

CONCLUSION

This study concludes that Google Services play an important role in supporting educational information management. Google Scholar, Google Classroom, Google Docs, Google Sheets, Google Slides, Google Meet, and Google Drive support academic information retrieval, learning material management, document sharing, online communication, collaborative learning, and classroom coordination. These functions show that Google Services are not only useful as teaching tools but also contribute to the operational management of education.

However, the benefits of Google Services should be evaluated alongside their limitations. Stable internet access, data privacy and security, information overload, online learner engagement, and platform dependency remain important concerns. To use Google-based tools effectively, educational institutions should strengthen data governance, teacher readiness, digital literacy, infrastructure support, and responsible technology practices. When implemented strategically, Google Services can enhance accessibility, collaboration, and information management in digital education environments.

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REFERENCES

- Basar, Z. M., Mansor, A. N., Jamaludin, K. A., & Alias, B. S. (2021). The Effectiveness and Challenges of Online Learning for Secondary School Students – A Case Study. *Asian Journal of University Education*, 17(3), 119–129. <https://doi.org/10.24191/ajue.v17i3.14514>
- Borra, P. (2024). Comparison and Analysis of Leading Cloud Service Providers (AWS, Azure and GCP). *International Journal of Advanced Research in Engineering and Technology (IJARET)*, 15(3), 266-278. <https://doi.org/10.17605/OSF.IO/T2DHW>
- Buchi, R., & Nkechi, C. (2021). Open and distance learning (ODL) for lifelong learning: Student's perception. *International Journal of Scientific & Engineering Research*, 12(11), 152–163. https://www.researchgate.net/publication/376450515_Open_and_Distance_Learning_ODL_for_Lifelong_Learning_Student's_Perception
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>

- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 19(4), 9–30. <https://doi.org/10.1080/07421222.2003.11045748>
- El-Ebiary, Y. A. B., Hatamleh, A., Moaiad, Y. A., Amayreh, K. T., Mohamed, R. R., Al-Haithami, W. A., & Saany, S. I. A. (2023). A Review of The Effectiveness of Management Information System in Decision Making. *Journal of Pharmaceutical Negative Results*, 14(2), 1281–1288. <https://doi.org/10.47750/pnr.2023.14.S02.155>
- Furqon, M., Sinaga, P., Liliyasi, L., & Riza, L. S. (2023). *The impact of learning management system (LMS) usage on students*. *TEM Journal*, 12(2), 1082–1089. <https://doi.org/10.18421/TEM122-54>
- Hall, M., & Hosch, W. L. (2025). Google. *Encyclopaedia Britannica*. Retrieved May 30, 2026, from <https://www.britannica.com/money/Google-Inc>
- Hasan, R. (2023). Understanding EdTech's privacy and security issues: Understanding the perception and awareness of education technologies' privacy and security issues. *Proceedings on Privacy Enhancing Technologies*, 2023(4), 269–286. <https://doi.org/10.56553/popets-2023-0110>
- Hölzl, J., Keusch, F., & Sajons, C. (2025). The (mis)use of Google Trends data in the social sciences: A systematic review, critique, and recommendations. *Social Science Research*, 126, Article 103099. <https://doi.org/10.1016/j.ssresearch.2024.103099>
- Huang, L. N., Liu, F. H., & Liu, C. L. (2013). Design and research on collaborative learning program based on cloud-services. *Advanced Materials Research*, 756–759, 1199–1203. <https://doi.org/10.4028/www.scientific.net/AMR.756-759.1199>
- Kassim, W. Z. W. (2021). Google Classroom: Malaysian university students' attitudes towards its use as learning management system. In *Proceedings of the First International Conference on Science, Technology, Engineering and Industrial Revolution (ICSTEIR 2020)* (pp. 438–446). Atlantis Press. <https://doi.org/10.2991/assehr.k.210312.072>
- Li, Y., Wu, R., Liu, J., & Wang, S. (2023). The impact of targeted online advertising's pushing time on consumers' browsing intention: A study based on regret theory. *Journal of Global Information Management*, 31(1), 1–17. <https://doi.org/10.4018/JGIM.319713>
- Muhammad, I. A. (2019). The benefit of Google Drive for an organization document management system. SSRN. Retrieved May 30, 2026, from https://studys.ssrn.com/sol3/studys.cfm?abstract_id=3333030
- Nikman, K., Hasan, H., Syed Wahid, S. N., & Aminuddin, A. S. (2022). Open and online distance learning (ODL) challenges during COVID-19: A factor analysis among UiTM students. *Journal of Social Science and Humanities*, 5(4), 34–40. <https://doi.org/10.26666/rmp.jssh.2022.4.4>
- Osterloh, R. (2018). Google hardware: Designed to work better together. *Google Blog*. Retrieved February 20, 2025, from <https://blog.google/products/platforms-devices/made-by-google-family-2018/>
- Salas-Pilco, S. Z., Xiao, K., & Hu, X. (2022). Artificial intelligence and learning analytics in teacher education: A systematic review. *Education Sciences*, 12(8), Article 569. <https://doi.org/10.3390/educsci12080569>
- Schmidt, E. (2010). How I did it: Google's CEO on the enduring lessons of a quirky IPO. *Harvard Business Review*. Retrieved February 20, 2025, from <https://hbr.org/2010/05/how-i-did-it-google-ceo-on-the-enduring-lessons-of-a-quirky-ipo>
- Sikka, R., & Ojha, M. (2021). An overview of cloud computing. *International Journal of Innovative Research in Computer Science & Technology*, 9(6), 135–138. <https://doi.org/10.55524/ijirest.2021.9.6.31>
- Sofian Hadi, M., & Dewi, F. R. (2021). Google Meet application as an online learning media for descriptive text material. *Jurnal Studi Guru dan Pembelajaran*, 4(1). <https://doi.org/10.30605/jsgp.4.1.2021.533>

- Stanley, O. E. (2021). Information overload: Causes, symptoms, consequences and solutions. *Asian Journal of Information Science and Technology*, 11(2), 1–6. <https://doi.org/10.51983/ajist-2021.11.2.2887>
- Thayabaran, P., & Jalaluddin, I. (2023). Effectiveness of using Google Classroom in learning English: A literature review. *International Journal of Advanced Research in Education and Society*, 5(3). <https://doi.org/10.55057/ijares.2023.5.3.40>
- Ullah, I., Boreli, R., & Kanhere, S. S. (2023). Privacy in targeted advertising on mobile devices: A survey. *International Journal of Information Security*, 22(3), 647–678. <https://doi.org/10.1007/s10207-022-00655-x>
- Villegas-Ch, W., Román-Cañizares, M., & Palacios-Pacheco, X. (2020). Improvement of an online education model with the integration of machine learning and data analysis in an LMS. *Applied Sciences*, 10(15), Article 5371. <https://doi.org/10.3390/app10155371>
- Wan Hassan, W. A. S., Ariffin, A., Ahmad, F., Sharberi, S. N. M., Nor Azizi, M. I., & Zulkiflee, S. N. (2020). COVID-19 pandemic: Langkawi Vocational College student challenge in using Google Classroom for teaching and learning (T&L). *International Journal of Advanced Trends in Computer Science and Engineering*, 9(3), 3299–3307. <https://doi.org/10.30534/ijatcse/2020/127932020>
- Zheng, M., Bender, D., & Lyon, C. (2021). Online learning during COVID-19 produced equivalent or better student course performance as compared with pre-pandemic: Empirical evidence from a school-wide comparative study. *BMC Medical Education*, 21(1), Article 495. <https://doi.org/10.1186/s12909-021-02909-z>