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Immersive Google Tools for Active Learning in Education: A Comprehensive Systematic Review

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ABSTRACT

The integration of immersive Google tools in educational settings has proven to have significant potential to enhance active learning among school students. This Systematic Literature Review (SLR) aims to synthesize existing research on the efficacy of these tools in promoting student engagement, learning strategies, and evaluation in education. The problem addressed in this study is the need for a comprehensive understanding and evidence-based assessment of how immersive technologies, specifically those developed by Google, can be effectively implemented in school environments. The methodology involved a thorough search and analysis of indexed and final articles from reputable databases Scopus and Web of Science (WoS) published between 2022 and 2024. The flow of the study is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. A total of (n = 33) studies were selected based on predefined inclusion criteria, focusing on Google tools such as Google Classroom (GC), Google Sites, Google Form, Google Slides, Google Meet, Google Docs, and Google Earth. The findings were divided into three themes: (1) technology integration in education, (2) blended and online strategies, and (3) assessment and evaluation in education. The conclusion underscores the transformative potential of immersive Google tools in fostering an active learning environment, recommending further research to explore long-term impacts and best practices for integration. This review provides educators and policymakers with valuable insights into the effective utilization of technology to enhance educational outcomes.

1. Introduction

1.1 Google Tools in Education

In the evolving landscape of education, the integration of technology into the classroom has transformed traditional teaching methods, offering new avenues for enhancing student engagement and learning outcomes. Among the plethora of technological tools available, Google's tools have

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emerged as a frontrunner in facilitating active learning [1], [2]. This article explores the potential of Google tools to create dynamic, interactive, and student-centred learning environments that align with contemporary educational paradigms. Active learning, characterized by student engagement in activities that promote analysis, synthesis, and evaluation of class content, has been recognized for its effectiveness in improving student comprehension and retention [3], [4], [5]. Unlike passive learning, where students merely receive information, active learning encourages participation, collaboration, and critical thinking. Google's immersive tools, such as Google Classroom (GC), Google Docs, Google Meet, Google Forms, Google Sites, Google Slides, and Google Earth, provide an integrated platform that supports these pedagogical approaches, making learning more interactive and accessible [6], [7], [8].

GC serves as the cornerstone of Google's educational tools, offering a streamlined, user-friendly interface for teachers and students to manage assignments, collaborate on projects, and communicate effectively [9], [10], [11]. By facilitating real-time feedback and fostering a collaborative learning environment, GC enhances student engagement and accountability. Meanwhile, Google Docs and Google Slides further complement the active learning model by enabling collaborative document and presentation creation. These tools support synchronous and asynchronous collaboration, allowing students to work together in real-time or at their own pace [12], [13]. In addition, the comment and suggestion features in Google Docs encourage peer review and constructive feedback, promoting a deeper understanding of the material [14]. Similarly, Google Slides allows students to co-create presentations, enhancing their ability to synthesize and present information coherently [15]. At the same time, Google Forms is another versatile tool that can be leveraged to support active learning. It allows educators to create surveys, quizzes, and polls, which can be used to assess student understanding, gather feedback, and facilitate formative assessment. The immediate availability of results allows teachers to swiftly identify areas where students might be lacking and modify their instruction accordingly. This responsiveness ensures that learning is continuously tailored to meet student needs [16], [17], [18].

Meanwhile, Google Earth provides a unique opportunity to incorporate geospatial learning into the curriculum. By allowing students to explore detailed satellite imagery and 3D representations of various locations around the world, Google Earth fosters experiential learning. Notably, this tool can be particularly effective in subjects such as geography, history, and environmental science, where visualizing and interacting with real-world data can significantly enhance comprehension and engagement [19]. The integration of these Google tools in the classroom supports the principles of active learning by promoting collaboration, critical thinking, and student-centred instruction.

In conclusion, the adoption of Google's immersive tools in educational settings holds significant promise for advancing active learning. As education evolves in reaction to technology developments, effective utilisation of these tools will be crucial in educating students for the challenges of the twenty-first century. This article delves into specific case studies and empirical research to further elucidate the impact of Google tools on active learning, offering insights and practical recommendations for educators aiming to attain the full potential of these innovative technologies.

1.2 Literature Review

The COVID-19 pandemic has revolutionized education, forcing an immediate and extensive transition to online learning environments. Vadivel *et al* [20] highlighted that while platforms such as Google Meet have become essential for continuing education, significant challenges persist in engaging students, monitoring attendance, conducting assessments, and fostering creativity. The abrupt shift has exposed a need for innovative Information Communication Technology (ICT) tools to

enhance teaching and learning effectiveness. Notably, integrating such tools can address issues like student engagement and assessment in an online context.

The adoption of digital technologies by Kuznetcova *et al*. [21] delved into the domain of Immersive Storytelling (IST) within elementary school civic learning. Traditionally, IST has been heavily associated with advanced technologies such as virtual reality, augmented reality, and mixed reality. These technologies are renowned for their visual fidelity, interactivity, and ability to provide an embodied, first-person perspective. However, their high technological and financial demands render them inaccessible to many educational institutions. Kuznetcova and colleagues proposed a novel, low-tech alternative that leverages the innate power of storytelling through accessible classroom technologies like Google Slides. This approach aimed to achieve psychological immersion without the need for expensive equipment.

Herreid *et al*. [22] explored the adaptation of case studies for remote instruction during the COVID-19 pandemic, highlighting the versatility of case-based learning in maintaining student engagement online. The transition to remote learning saw instructors using a blend of synchronous and asynchronous methods to deliver case studies, with tools like Google Forms aiding in tracking student participation. This approach maintained the interactive and engaging nature of case studies, even in a virtual setting. This research complements Kuznetcova *et al* [21] findings by demonstrating that effective educational experiences can be achieved with minimal technological investment, stressing the importance of innovative pedagogical strategies over high-end technological solutions.

In the realm of secondary education, Mangkhang *et al.* [23] investigated innovative pedagogical approaches to teaching indigenous history in Thailand. Their research focused on enhancing students' historical consciousness and happiness through a multi perspective pedagogy integrated into a hybrid learning model. The study emphasized the importance of motivation, independent learning, task-based activities, and a holistic approach in fostering a deeper understanding of social conditions and future societal trends. The developed E-learning package, including lesson plans and GC, was discovered to enhance students' engagement and happiness significantly, demonstrating the effectiveness of blended learning approaches in diverse cultural contexts. Accordingly, the integration of these tools facilitated better collaboration and active participation, demonstrating the benefits of incorporating ICT in traditional classroom settings to improve learning outcomes.

In summary, integrating ICT via Google tools and innovative teaching methodologies has proven essential in addressing the challenges posed by the shift to online education. The experiences and findings from various studies demonstrate the potential of Google tools, collaborative curriculum development, and active learning strategies in enhancing student engagement and learning outcomes. These insights contribute to a growing body of evidence supporting the adoption of technology and innovative practices in education, particularly in the context of remote and hybrid learning environments. Thus, the current systematic analysis was constructed to answer the following research questions;

1. How do educators integrate Google tools in education after the COVID-19 pandemic?
2. What are the experiences and outcomes of utilizing Google tools for blended and online learning in education after the COVID-19 pandemic?
3. What are the benefits and challenges of using Google tools for assessment and evaluation

2. Methodology

a. Review Protocol

This systematic literature review (SLR) adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA is a recognized standard for conducting SLRs, ensuring transparent reporting of methodology, findings, and rationale [24]. The document search technique consisted of three systematic phases: identification, screening, and eligibility. The selected publications were then subjected to a series of processes, including data extraction and analysis. The gathered data were then analysed by thematic synthesis.

b. Identification

The systematic review approach was utilised in three main phases to select a substantial number of relevant papers for this investigation. The first stage entails choosing keywords and looking for similar terms via a thesaurus, dictionaries, encyclopaedias, and previous research. All relevant phrases were chosen after searching the Scopus and Web of Science (WoS) databases (see Table 1). Both databases generated 549 papers for the current study project during the first step of the systematic review approach.

Table 1
The search strings

Databases	Searching string and searching terms
WoS	(Topic) (("Google Tools" OR "Google Classroom" OR "Google Sites" OR "Google Form" OR "Google Docs" OR "Google Earth" OR "Google Slides" OR "Google Meet") AND ("Active" OR "effective") AND learn* AND ("Education" OR "School*"))
Scopus	TITLE-ABS-KEY (("Google Tools" OR "Google Classroom" OR "Google Sites" OR "Google Form" OR "Google Docs" OR "Google Earth" OR "Google Slides" OR "Google Meet") AND ("Active" OR "effective") AND learn* AND ("Education" OR "School*"))

c. Screening

During the first phase, 549 papers were assessed using the researchers' inclusion and exclusion criteria (Table 2). The major selection criterion was research publications containing pertinent information. As a result, the study excluded items such as systematic reviews, reviews, meta-analyses, meta-syntheses, monographs, book chapters, and conference proceedings. Furthermore, the review only includes research written in English. It is essential to mention that the study lasted three years after the COVID-19 pandemic (2022-2024). Only articles in the fields of social science and computer science that have received final publication are considered. Overall, 423 publications were excluded based on a specific parameter. Following that, duplicate papers were removed during the second stage of screening. A total of 18 duplicate articles were deleted, resulting in 108 papers.

Table 2
Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2022 – 2024	< 2022
Literature type	Journal (Article)	Conference, Book, Review
Subject Area	Social Science, Computer Science	Besides Social Science and Computer Science
Publication Stage	Final	In Press

1.3 Eligibility

In the third phase, known as the eligibility evaluation, 108 articles were compiled. During this step, all articles' titles and main content were thoroughly reviewed to ensure that they met the inclusion criteria and were relevant to the ongoing study's research objectives. As a result, 75 papers were excluded because they were outside of the topic, had no pertinent title, no abstract relevant to the study's objective, and lacked full-text access based on empirical evidence. Therefore, 33 items remain for further review.

These studies were further examined using Gough's 2007 Weight of Evidence (see Table 3). This scoring method is used in this study since it offers a thorough assessment that can be used to analyse past literature, ensuring that only compatible and relevant articles are selected for the current investigation [25]. The analysis selection was conducted by three experts, two experts in education technology and the other one in science engineering, to determine the validity of the problems. The expert review phase ensures the methodological quality, methodological relevance and topic relevance by establishing the domain validity. Only articles with an overall evaluation based on the 'excellent' and 'good' criteria are included. Finally, two articles were excluded, and the remaining 31 articles were selected for additional review to address the study's research concerns (see Table 4). Figure 1 displays overall flow diagrams of the search process.

Table 3
The weight of evidence [25], [26]

Level/ Criterion	Methodological quality	Methodological relevance	Topic relevance
Excellent	Excellent research design that justifies all decisions taken, e.g., sample, instruments, and analysis. Clear evidence of measures taken to maximize validity and reliability.	Research questions are clearly stated. The methodology is highly relevant to research questions and answer them in detail.	The study is closely aligned with one of the key review questions and provides strong evidence to base future policy/action.
Good	Research design is clearly stated with evidence of sensible decisions to provide valid and reliable findings.	Research questions are explicit or can be deduced from text. Findings address the research questions.	The study broadly aligns with one of the key review questions and provides useful evidence.
Satisfactory	Research design may be implicit but appears sensible	Research questions are implicit but appear broadly	At least part of the study findings is relevant to one

	and likely to yield useful data.	matched by research design and findings.	of the key review questions.
Inadequate	The research design is not stated and contains flaws.	Research questions are not stated or not matched by design.	The study does not address key questions.

Table 4
The weight of evidence for the studies

No	Author, Year	Methodology quality	Methodology relevance	Topic relevance	Action
1	Fasiah et al., 2023	excellent	excellent	excellent	included
2	Nkanyani et al., 2024	good	good	excellent	included
3	Marmoah et al., 2024	good	good	good	included
4	Raje & Tamilselvi, 2024	good	good	good	included
5	Lamond & Cunningham, 2022	excellent	excellent	excellent	included
6	(Mamedova et al., 2023)	good	good	good	included
7	(Stock & Singh, 2023)	excellent	good	excellent	included
8	Alsharafat et al., 2023	satisfactory	good	satisfactory	excluded
9	Chirobocea-Tudor, 2022	excellent	excellent	excellent	included
10	Sharpe & Young, 2023	excellent	excellent	excellent	included
11	Badiozaman et al., 2022	good	excellent	excellent	included
12	Sime et al., 2024	excellent	excellent	excellent	included
13	Ismiyani, 2022	excellent	excellent	excellent	included
14	Babu et al., 2023	good	good	good	included
15	McDaniel, 2022	excellent	excellent	excellent	included
16	Anh & Truong, 2023	excellent	excellent	excellent	included
17	Pratiwi & Waluyo, 2023	excellent	excellent	excellent	included
18	Peeters & Mynard, 2023	excellent	excellent	excellent	included
19	Gregory et al., 2022	excellent	excellent	excellent	included
20	Gil & Dueñas, 2023	excellent	excellent	excellent	included
21	Jeyarajaguru, 2023	excellent	excellent	excellent	included
22	(Ana et al., 2022)	excellent	excellent	excellent	included
23	Gafur et al., 2023	good	satisfactory	satisfactory	excluded
24	Anisimova et al., 2022	good	good	excellent	included
25	Kim & Fienup, 2022	excellent	excellent	excellent	included
26	Soroka, 2022	good	good	good	included
27	Wahyuningsih et al., 2023	excellent	excellent	excellent	included
28	Wale, 2024	excellent	excellent	excellent	included
29	Lobo, 2023	excellent	excellent	excellent	included
30	Salas-Rueda et al., 2022	excellent	excellent	excellent	included
31	Manipatruni et al., 2023	good	good	excellent	included
32	Omeh et al., 2024	excellent	good	excellent	included
33	Zhou et al., 2022	good	good	good	included

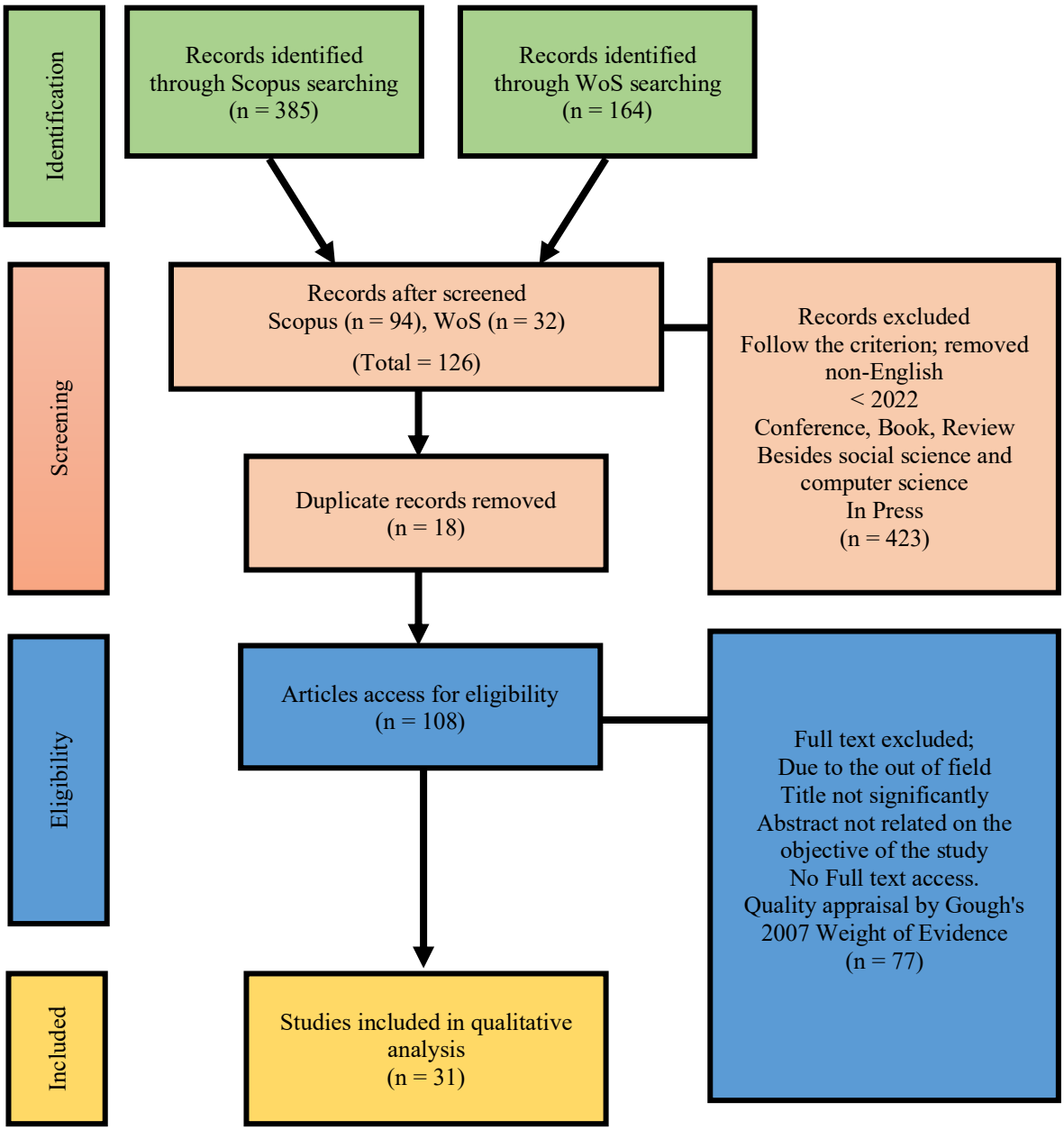

Fig. 1. Flow diagram of the searching process [59]

3. Results

The thematic analysis of 31 selected papers yielded three key themes: (1) technology integration in education, (2) blended and online learning methodologies, and (3) assessment and evaluation in education. These three topics offer solutions to the three research questions in this review. Table 5 below explains the findings of the selected investigations.

Table 5
The findings of selected studies

No	Author, Year	Google Tool(s) used	Tools Function	Themes		
				TIE	BOLS	AEE
1	Fasiah *et al*., 2023	G. Classroom	As a learning platform for measuring, collecting, analysing, and reporting student information.	⁄		
2	Marmoah *et al.,* 2024	G. Form	As a tool to collect data for learning.	⁄		
3	Lamond & Cunningham, 2022	G. Docs	As an editing assistance program for writing.	⁄		
4	Sharpe & Young, 2023	G. Classroom	As an assistive technology for inclusive classrooms.	⁄		
5	Pratiwi & Waluyo, 2023	G. Form	As a tool in online English classrooms.	⁄		
6	Peeters & Mynard, 2023	G. Classroom	As a learning platform for measuring, collecting, analysing, and reporting student information.	⁄		
7	Gil & Duenas, 2023	G. Form, G. Docs, G. Slides	As digital tools to promote online collaboration.	⁄		
8	Wale, 2024	G. Docs	As a tool for group students to learn writing skills.	⁄		
9	Lobo, 2023	G. Classroom	As a tool for learning physical education.	⁄		
10	Salas-Rueda *et al.*, 2022	G. Classroom, G. Meet	G. Classroom as a platform of learning. G Meet as a platform for online synchronous meetings.	⁄		
11	Manipatruni *et al*., 2023	G. Form	As a tool for improving the students' English vocabulary.	⁄		
12	Nkanyani *et al*., 2024	G. Classroom	As a platform to learn Physical Science.		⁄	
13	Mamedova *et al*., 2023	G. Classroom	As a digital tool for engineering and chemistry learning.		⁄	
14	Stock & Singh, 2023	G. Form	As a tool for online active learning with automatic feedback.		⁄	
15	Bekele Sime *et al.*, 2024	G. Classroom	As a platform to learn English writing.		⁄	
16	Ismiyani, 2022	G. Classroom	As an asynchronous distance learning platform for elementary pupils.		⁄	
17	Babu *et al*., 2023	G. Form	As a tool to collect data in learning.		⁄	
18	Badiozaman *et al.*, 2022	G. Classroom	As a platform for digital e-learning.		⁄	
19	Ana *et al*., 2022	G. Classroom	As a platform for Project-based Blended Learning.		⁄	
20	Soroka, 2022	G. Form	As a tool for remote collection and processing of information.		⁄	
21	Zhou *et al*., 2022	G. Classroom	As a platform for digital e-learning.		⁄	
22	Raje & Tamilselvi, 2024	G. Form	As a tool for polling formative assessments.			⁄
23	Chirobocea-Tudor, 2022	G. Form	As supplementary learning material for English class.			⁄
24	Anh & Truong, 2023	G. Sites	As a tool for project-based learning in physics education.			⁄
25	Gregory *et al*., 2022	G. Earth	As a tool for virtual field sites in Earth Science programs.			⁄

26	Jeyarajaguru, 2023	G. Sites	As a simplified virtual curation lab.	/
27	Anisimova *et al*., 2022	G. Classroom	As a distance learning tool.	/
28	Kim & Fienup, 2022	G. Classroom	As a platform for digital e-learning.	/
29	Wahyuningsih *et al.*, 2023	G. Docs	As a tool for online collaborative writing.	/
30	Omeh *et al*., 2024	G. Classroom, G. Meet	As the innovative pedagogy learning in a computer programming course.	/
31	McDaniel, 2022	G. Earth	As a tool for virtual field trips and projects.	/

*TIE = Technology Integration in Education; BOLS = Blended and Online Learning Strategies; AEE = Assesment and Evaluation in Education

3.1 Technology Integration in Education
(How educators integrate Google tools in education after the COVID-19 pandemic?

Technology integration in education has been extensively analysed to understand its effectiveness and the factors influencing its adoption. Fasiah *et al.* [27] highlighted the importance of teachers' acceptance of technology as a significant predictor for the effective use of Learning Analytics (LA) in GC. Their study demonstrated that perceived usefulness and behavioural intention were crucial in enhancing the performance of LA, which helps in measuring, collecting, and analyzing student data to improve teaching and learning. Similarly, Marmoah *et al*. [29] explored via Google Form the adoption of Learning Management Systems (LMS) using the Unified Theory of Acceptance and Use of Technology (UTAUT) model among primary school teachers revealed a strong correlation between factors such as performance expectancy, effort expectancy, and social influence with teachers' behavioural intentions and user behaviour.

The role of digital tools in supporting autonomous learning and improving learning outcomes has also been emphasized. The impact of various digital tools, including Google Forms and Quizizz, on learner autonomy in online English classrooms indicated that these tools significantly enhanced students' self-reliance, information literacy, and learning strategies, promoting better learning outcomes than traditional methods [41], [54]. Additionally, Peeters and Mynard [42] examined the use of structured awareness-raising approaches in supporting self-regulated language learning online via GC discovered that such approaches effectively fostered students' awareness of learning strategies and collaborative work, contributing to their overall learning effectiveness. In addition, the effectiveness of GC as an assistive technology in inclusive classrooms has demonstrated that both teachers and students perceived GC as an effective tool in meeting diverse learning needs within a universal design for learning framework [34].

Editing assistance tools have also been explored for their potential to support English Language Learners (ELLs) by compared the performance of different editing assistance programs, including Google Docs, in identifying writing errors [31]. While these tools were useful, human raters still outperformed them, indicating that editing assistance technology needs further development to fully replace human editing. Similarly, the effects of Automated Writing Evaluation (AWE) programs, such as Google Docs, on academic writing instruction discovered that integrated AWE programs significantly improved students' writing performance and were positively perceived by students for their effectiveness and goal-oriented nature [51]. These studies collectively highlighted the importance of technology acceptance, structured support, and continuous professional development in maximizing the benefits of digital tools in education. Table 6 concludes the key findings for this theme.

Table 6
The key findings of the theme Technology Integration in Education

Author(s) & Year	Key Findings
Fasiah *et al*., (2023)	Learning Analytics (LA) in GC helps in measuring, collecting, and analyzing student data to improve teaching and learning
Marmoah *et al*., (2024)	Explore via Google Form about adoption of LMS based on performance expectancy, social influence, and facilitating conditions.
Lamond and Cunningham, (2022)	Editing tools like Grammarly and Google Docs are valuable for ELLs, helping to identify and correct grammatical and spelling errors.
Sharpe and Young (2023)	GC is an effective assistive technology in inclusive classrooms.
Pratiwi and Waluyo (2023)	Google Forms improve autonomous learning in online English classrooms.
Peeters and Mynard (2023)	Structured awareness-raising approaches in online collaborative environments using GC.
Gil and Duenas (2023)	Google tools in professional development programs for university lecturers enhance pedagogical skills and student engagement.
Wale (2024)	AWE tools like Google Docs improve academic writing performance by providing valuable feedback.
Lobo (2023)	Students perceive GC as an effective tool in physical education.
Salas-Rueda *et al.,* (2022)	GC and Google Meet played a crucial role during the COVID-19 pandemic by maintaining educational activities and enhancing student engagement.
Manipatruni *et al.,* (2023)	Digital gamification tools like Google Forms with AutoProctor are effective in improving vocabulary learning and preventing malpractice during assessments.

3.2 Blended and Online Learning Strategies

(What are the experiences and outcomes of utilizing Google tools for blended and online learning in education after the COVID-19 pandemic?)

Blended and online learning strategies have become integral in modern education, particularly in the wake of global disruptions like the COVID-19 pandemic. These strategies combine traditional classroom methods with online educational tools, facilitating a flexible learning environment that enhances both accessibility and engagement. The effectiveness of these methods varies based on factors such as the digital divide, institutional support, and the adaptability of educational technologies [1], [28], [58].

The transition to blended and online learning has demonstrated mixed effects on academic performance across different educational levels. For instance, in engineering education, tools like GC have been pivotal in maintaining academic standards, with significant improvements observed in students' performance [58]. Similarly, in medical education, the use of Google Forms for remote learning has facilitated active engagement and improved academic outcomes [1]. However, challenges such as poor internet connectivity and limited access to digital devices continue to hinder the full potential of online learning, particularly in under-resourced areas [28], [38].

Implementing blended learning strategies faces several challenges, especially in rural and underdeveloped regions. Issues such as inadequate teacher training, heavy workloads, and limited parental involvement as significant barriers [28]. Moreover, disparities in digital literacy among teachers and students further complicate the effective adoption of these strategies. The need for continuous professional development and better infrastructure is emphasized to bridge these gaps and improve educational outcomes [35], [37]. The success of blended learning heavily relies on the integration of appropriate technologies and adequate support for teachers. The adoption of platforms like GC and the implementation of comprehensive training programs for educators are crucial for the effective delivery of blended learning. The findings from a study at Swinburne University underline the importance of teacher familiarity with these tools and the need for ongoing

professional development to adapt to new teaching methodologies [35], [57]. Blended and online learning strategies must also account for socio-cultural factors to ensure inclusivity and effectiveness. Soroka, [49] emphasized the importance of considering students' cultural backgrounds and the challenges of social adaptation in multicultural environments. The resilience and adaptability of students in such contexts play a critical role in the success of distance learning initiatives, highlighting the need for tailored approaches that address the diverse needs of learners [50], [57]. Continuous efforts to improve these areas will ensure that blended learning remains an effective educational approach, particularly in the face of future disruptions. Table 7 summarizes the focus and key findings of experiences and outcomes by utilizing Google tools for blended and online learning in education.

Table 7
The focus and key findings of the theme Blended and Online Learning Strategies

Author(s) & Year	Focus	Key Findings
Nkanyani *et al*., (2024)	Rural Blended Learning Strategies in Physical Sciences	Tools like GC and WhatsApp enhanced student self-directed learning and motivation.
Mamedova *et al*., (2023)	Online Platforms for Engineering Students During Pandemic	GC maintained academic performance with no significant difference in results compared to pre-pandemic levels.
Stock and Singh (2023)	Remote Active Learning in Medical Education	The use of Google Forms for remote learning facilitated engagement and continuous learning through automated feedback, which is effective for large classes.
Sime *et al*., (2024)	Blended Instruction in Health Science Education	Blended instruction via GC significantly improved paragraph writing skills among first-year health science students through collaborative tasks and instant feedback.
Ismiyani (2022)	Elementary School Teachers' Perceptions in Indonesia	Positive perceptions and high motivation towards GC, with some scepticism about its impact on student learning.
Babu *et al*., (2023)	Online Learning for Engineering and Business Students	Faced challenges like poor internet connectivity, but digital tools and LMSs enhanced the educational experience overall.
Badiozaman *et al*., (2022)	Remote Learning at Swinburne University	Teachers were positive but required more support and training to use platforms for effective online education.
Ana *et al*., (2022)	Project-Based Blended Learning in Vocational High Schools	Effective in combining online and offline education, promoting active and creative student engagement during the pandemic.
Soroka (2022)	Distance Learning in a Multicultural Environment	Students displayed high levels of resilience and adaptability, maintaining engagement and facilitating social adaptation.
Zhou *et al*., (2022)	Adoption of Virtual Learning During COVID-19	Adoption is driven by performance and social influence, highlighting the need for continuous development of blended learning models.

3.3 Assessment and Evaluation in Education
(What are the benefits and challenges of using Google tools for assessment and evaluation?)

The COVID-19 pandemic has accelerated the adoption of digital tools in educational settings, highlighting their importance in enhancing learning outcomes and maintaining assessment. The efficiency of Google Forms in language education helped diversify class activities, asses the effectiveness of learning and boost student motivation through engaging and interactive exercises [33]. Anh & Truong [40] demonstrated that mobile e-portfolios on Google Sites improved project-based learning outcomes by facilitating greater student involvement and motivation, supporting the idea that digital tools are essential for effective learning and evaluation in both remote and face-to-face settings.

Virtual and digital tools have proven to be particularly beneficial in courses requiring hands-on and practical experience, which were significantly impacted by the pandemic. The development of an online field geology course utilizing virtual reality and 3-D printed models, which effectively engaged students and provided practical experience despite the lack of in-person learning [43]. This approach ensured continuity in education and facilitated the development of essential skills, together helping educators to evaluate the students practically. The application of platforms like Moodle and GC in Science, Technology, Engineering and Math (STEM) education, which proved effective in training specialists for the digital economy, underscoring the value of these tools in both emergency and regular educational contexts [47].

The pandemic presented unique educational challenges, particularly in ensuring that all students, including those with disabilities, could access learning resources. Kim & Fienup [48] addressed these issues by implementing an online intervention using GC for students with disabilities, significantly increasing their engagement and to evaluate their academic performance. This approach highlighted the importance of tailored digital solutions for diverse student needs. Similarly, Wahyuningsih *et al*. [50] explored using Google Docs for collaborative writing in online learning environments, online assessment, facilitating communication and cooperation among students, leading to better learning outcomes.

The integration of digital tools in education is not only crucial for current learning needs but also for developing and evaluating the essential skills for the future workforce. Omeh *et al*. [55] demonstrated that using platforms like GC and Google Meet in teaching and evaluating computer programming courses significantly enhanced student engagement and digital skills. Their study underscored the importance of innovative teaching strategies that incorporate digital tools to prepare and assess students' performance for a technologically advanced future. McDaniel [39] also emphasized the benefits of using Google Earth for virtual field trips in geography education, which increased student engagement and provided practical experience and evaluation with geospatial technology, reinforcing the role of digital tools in fostering essential skills and knowledge. Table 8 provides an overview of the tools and key findings the benefits and challenges using Google tools for assessment and evaluation.

Table 8
The tools and key findings of the theme Assessment and Evaluation in Education

Author(s) and Year	Tool/Platform	Key Findings
Raje and Tamilselvi (2024)	G. Forms	Gamified formative assessments
Chirobocea-Tudor (2022)	Google Forms	Effectively enhances language education by diversifying activities for evaluation and boosting student engagement.
Anh and Truong (2023)	Google Sites	Mobile e-portfolios enhance project-based learning, prepare material for evaluation.
Gregory *et al*. (2022)	Virtual Reality, 3-D Models	Provide practical experience and assessment, together maintain student engagement in online geology courses.
Jeyarajaguru (2023)	Google Sites	Facilitates the creation of virtual labs in biochemistry for evaluation.
Anisimova *et al*. (2022)	Moodle, Google Classroom	Effective in training and evaluating STEAM specialists in both emergency and regular educational settings.
Kim and Fienup (2022)	Google Classroom	Online interventions significantly increase engagement and assist to assess performance among students with disabilities.
Wahyuningsih *et al*., (2023)	Google Docs	Evaluate online collaborative writing, together with improving communication and cooperation among students.
Omeh *et al*., (2024)	GC, Google Meet	Digital tools used to evaluate students, improve engagement and digital skills in computer programming courses.
McDaniel (2022)	Google Earth	Virtual field trips increase student engagement and provide practical experience and evaluation in geography education.

4. Discussion

4.1 Technology Integration in Education

(How educators integrate Google tools in education after the COVID-19 pandemic?)

The integration of technology in education has been extensively studied to gauge its effectiveness and the factors influencing its adoption. Teachers' acceptance of technology emerges as a critical factor, influencing the effective use of LA in platforms like GC and the adoption of LMS. Studies underscored the importance of perceived usefulness, behavioral intention, performance expectancy, effort expectancy, and social influence in enhancing the performance of LA and the overall effectiveness of digital tools in supporting autonomous learning and improving learning outcomes. Tools such as Google Form, Quizizz, and structured awareness-raising approaches within GC have been discovered to significantly enhance students' self-reliance, information literacy, learning strategies, and awareness of learning strategies and collaborative work, contributing to their overall learning effectiveness.

Additionally, the role of GC as an assistive technology in inclusive classrooms and its acceptance in specific domains like physical education are noted, emphasizing perceived ease of use and usefulness as key factors influencing adoption and usage. While editing assistance tools like Google Docs show promise in supporting ELLs, there is a recognition of the need for further development. Furthermore, professional development programs incorporating digital tools have also demonstrated positive outcomes, promoting active learning, digital competence, and effective communication in virtual classrooms. Overall, these findings highlight the significance of technology acceptance, structured support, and continuous professional development in maximizing the benefits of digital tools in educational settings.

4.2 Blended and Online Learning Strategies

(What are the experiences and outcomes of utilizing Google tools for blended and online learning in education after the COVID-19 pandemic?)

The post-pandemic integration of Google tools in blended and online learning has revealed both promising outcomes and persistent challenges across diverse educational contexts. Platforms like Google Classroom (GC) and Google Forms have played a significant role in sustaining academic continuity and enhancing student engagement, especially in fields like engineering, health sciences, and medical education. GC was particularly instrumental in maintaining academic standards during the pandemic, and in some instances, improving specific skills such as writing. Moreover, automated feedback mechanisms and collaborative features of these tools promoted active learning, especially in large or remote classrooms. Students in rural and multicultural settings also exhibited adaptability, benefiting from self-directed learning fostered by tools like WhatsApp and GC.

However, these positive outcomes are tempered by systemic issues that limit the full potential of technology-enhanced learning. In rural and under-resourced areas, barriers such as inadequate infrastructure, lack of digital devices, and insufficient teacher training hindered effective implementation. Teachers often expressed the need for more support and professional development to use these platforms confidently and effectively. Additionally, disparities in digital literacy among both educators and students complicated the transition. To ensure long-term success, blended learning must evolve with improved infrastructure, inclusive design strategies, and tailored support systems that consider socio-cultural diversity and educational equity.

4.3 Assessment and Evaluation in Education
(What are the benefits and challenges of using Google tools for assessment and evaluation?)

The integration of Google tools for assessment and evaluation has brought significant benefits across various educational contexts. These tools enhance student engagement, diversify evaluation methods, and provide practical experiences even in remote settings. For example, Google Forms has proven effective in language education by making assessments more interactive, while Google Sites supports mobile e-portfolios and virtual labs, improving project-based learning and STEM evaluations. In fields like geology and geography, tools such as virtual reality and Google Earth enable hands-on learning experiences, ensuring continuity of practical assessments during online learning. Additionally, platforms like Google Classroom and Google Meet foster digital skill development, particularly in technical courses like computer programming, preparing students for a digital future.

However, challenges persist, especially in ensuring equitable access and inclusivity. Students with disabilities benefited from tailored online interventions via Google Classroom, but this also highlights the need for adaptive solutions to support diverse learning needs. Moreover, while collaborative tools like Google Docs encourage communication and group learning, managing group dynamics and ensuring individual accountability remain concerns. The transition to digital assessments also demands educators' technical proficiency and continuous adaptation. Thus, while Google tools offer scalable, interactive, and skill-oriented evaluation methods, educators must address accessibility, training, and pedagogical balance to fully realize their potential in assessment and evaluation.

5. Conclusion And Future Research

Based on a thorough review of the studies, integrating Google tools in education after COVID-19 has drastically changed the learning landscape. The review addressed three main questions, each providing valuable insights into the evolving educational scenario. After the pandemic, students' views on technology in education have improved significantly. The transition to online and blended learning has normalized digital tools, making students appreciate their convenience and accessibility more. Tools like GC and Google Meet became essential for maintaining educational continuity, enabling active participation from any location. The ease of use and flexibility of these tools contributed to a positive response, especially as students adapted to remote learning. This period of increased digital literacy is likely to benefit students in the long term, preparing them for future educational and professional challenges.

The use of Google tools for blended and online learning has led to mainly positive outcomes. The transition to these platforms has allowed for more interactive and engaging learning experiences. Tools like Google Forms, Google Docs, and Google Sites have supported collaborative learning and improved educational interactions. Students have reported better engagement and participation, attributing this to the dynamic nature of these platforms. Additionally, the ability to provide real-time feedback and access to numerous online resources has supported personalized learning, leading to higher academic achievement and satisfaction. These experiences highlight the effectiveness of Google tools in supporting a smooth transition to a hybrid educational model that combines both in-person and online learning.

Using Google tools for assessment and evaluation has brought several benefits and challenges. Tools like Google Forms have simplified assessments, making it easier to conduct quizzes, collect data, and analyse results efficiently. The ability to automate grading and provide instant feedback has improved the learning experience by helping students quickly identify and address gaps in their

knowledge. However, challenges such as ensuring academic integrity and addressing technical issues have emerged. Despite these challenges, the consensus is that integrating Google tools in assessment practices has improved the transparency, efficiency, and effectiveness of educational evaluations, providing a strong foundation for continuous improvement in teaching and learning.

Future research should focus on assessing the long-term effects of Google tools on academic achievement and skill development through longitudinal studies. Exploring their effectiveness across different educational settings, including rural and under-resourced schools, will ensure equitable benefits and highlight unique challenges. Examining their impact on different age groups and subjects will help tailor integration strategies to specific educational needs. Addressing digital equity and inclusion is crucial to ensure all students can access and benefit from these technological tools. Additionally, examining best practices for teacher training will equip educators with the skills required to integrate technology effectively into their teaching. Further research should also explore the psychological and behavioural impacts of prolonged digital tool use on students' well-being, including screen time and mental health. Overall, addressing these areas will optimize the use of technology in education, ensuring it meets the evolving needs of students and educators in an increasingly digital world.

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