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The Trend of Multimodal Use in School Learning from The Past to The Future : A Systematic Literature Review

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Abstract: This study aims to investigate the trends of multimodal use in school learning from the past to the future as an important reflection for education practitioners. This research used SLR method with 19 articles that met the criteria for analysis after inclusion and exclusion process used PRISMA. The result showed that a total of 19 articles conducted research using the most dominant approach, namely a qualitative approach of 73.68% followed by a mixed and quantitative approach. The main keywords that often appear using the VOSviewer application are multimodality, learning, school, and literacy. Related keywords that do not have a direct relationship with multimodality are digital media, media literacy, school, creativity, and cyberspace. This is an opportunity for future research. Regarding the country of origin of the authors, the most are from Australia, namely five articles. The results of the analysis using VOSviewer on the 19 articles showed that Neil Mercer had the most publications cited by other articles. The analysis of the 19 articles illustrates that the most frequent contribution is the development of learning materials, both virtual and non-virtual, using various media, ranging from manual to smartphones. The results of this study provide valuable insights and implications for current and future education policies, particularly in guiding the integration of multimodal learning approaches in schools. These findings offer a foundation for researchers and policymakers to explore and develop strategies aligned with diverse educational objectives and backgrounds.

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Introduction

In education, written learning evaluation is one of the most commonly used evaluation methods. By applying such evaluation, teachers can use student's written responses to measure their potential and understanding during the teaching and learning process (Danielsson & Selander, 2021). A written response is defined as the words or notes written on a paper (Wu & Fitzgerald, 2021), usually in the form of a sentence, paragraph, and document gained from the results of information search, text analysis, information extraction, categorization, visualization, technology, and learning results (Liu et al., 2017).

In the last decade, several studies have reported that evaluation can be carried out by analyzing the response and anything written on the paper (Bezemer & Kress, 2020). However, the evaluation can also be performed by analyzing students' learning understanding through images, video activities, experiments, speeches, and shoulder-hands-fingers movements. In

light of the COVID-19 outbreak, educators have employed pictures, video activities, experiments, interviews, spoken and other forms of responses except the written ones as the main options to conduct learning evaluation processes (Ekowati & Suwandayani, 2021; Zarate & Medina, 2021). This results from classroom learning that has integrated and maximized various student resources. This integration potentially allows a learning evaluation that combines written responses, spoken responses, the movements of hands-arms-fingers (gesture), facial expressions, images (Maulida et al., 2024), artifacts, and concrete objects called multimodal (Danielsson & Selander, 2021).

Students who use multimodal learning can improve their comprehension, ability to evaluate, and mastery of the course topics. Multimodal also refers to the use of various learning modes or media to assist students with their understanding and communication skills improvement. Applying multimodal learning has some benefits, such as a) using a variety of interactional modes and media to increase students' participation in the learning and instruction process; This might help teachers keep the student's motivation and interest during the teaching and learning process; b) improving understanding and integrating various resources to assist students in comprehending and analyzing the materials; c) inclusivity: implementing multimodal can help teachers fulfill the variety of students' needs by providing several ways to access and interact with learning materials; d) flexibility: multimodal can be suited to various learning styles and choices (Mahler et al., 2018). Students can choose a certain way that suits them best; e) real-life relevance: multimodal reflects information found in real-life settings. This can prepare students to face the 21st century's labor market demands. Therefore, using multimodal learning can help students improve their involvement and understanding, support inclusivity, provide flexibility, and reflect on the relevance of the real-life setting (Shazly, 2021).

Using multimodal, students can communicate their understanding in various ways (Moreno-Morilla et al., 2021). Several research discovered that communication in learning can be done through video activities, interview recordings, student movements, and others (Zhang & Cassany, 2021). The different ways of communication sometimes give different meanings. At a particular moment, the spoken response can go against the information delivered by another medium, such as a written response or body movement (K A Mills & Brown, 2022). In another moment, each way gives mutual support that completes each other (Unsworth, 2021). Hence, multimodal integration becomes an essential part of education. The functions of multimodal education should be thoroughly examined because of their significance in the process of instruction and study in schools.

The results of the article search in the Scopus database show that there are only six articles related to "multimodal literature review". If examined more deeply, then the five articles focus on multimodal topics applied in fields outside of education. Their main topic is the diagnosis and medication in the field of medicine (Değer et al., 2022; Rickmann et al., 2020). The results of the article search in the Scopus database show that there are only six articles related to "multimodal literature review". A deeper examination reveals that five of these articles primarily focus on multimodal topics applied in fields outside of education. This highlights an urgent gap in the academic discourse, as the integration of multimodal approaches in education remains underexplored despite its potential to transform learning experiences. Addressing this issue is crucial, considering the growing complexity of educational needs in a digital era. This research brings novelty by bridging the gap, emphasizing the relevance of multimodal frameworks within educational contexts, and providing a foundation for further scholarly exploration.

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Only one article focuses on education, talking about the contribution of TIME magazine in visualizing and communicating the ideas in education between 1923 and 2019. The article discusses some theories on visual art development and the semiotic approach in multimodal used to analyze 115 TIME magazine covers with education and school themes using content analysis (Kachorsky et al., 2020). However, the Scopus database has not published any article on multimodal learning in school that discusses the learner's ability, material development, learning strategy, facility, curriculum development, and teacher resource development (Zuhri et al., 2024). This explains why the multimodal components of learning at school have not been the subject of any Systematic Literature Reviews (SLRs). SLR's goal is to conduct an in-depth analysis and comparison of articles on multimodal learning in the classroom that are indexed in the database of Scopus.

The SLR aims to contribute to the advancement of research on multimodal learning in the classroom by systematically analyzing and synthesizing existing studies. This research serves as a resource for scholars and readers interested in the topic, offering a foundation for future investigations. Specifically, it focuses on identifying gaps in the literature, as the original article addressed aspects of multimodal learning in the classroom that had not been explored by previous scholars. By doing so, it provides a baseline study and a conceptual framework to guide future multimodal research. The operational objectives of this study are to map the existing research trends, identify underexplored areas in multimodal learning, and highlight the practical applications of these findings in educational settings. The study expects to inform professionals, educators, policymakers, and the general public about the potential of multimodal instruction to enhance teaching and learning processes. By outlining these objectives and expectations, the study underscores its relevance as both a scholarly and practical contribution to the field.

Research Method

This research used a qualitative approach, with a systematic literature review method using the PRISMA. This type of research is done by performing in-depth analysis (Ekowati et al., 2023; Hennessy et al., 2020). The findings of SLR offer a concise overview of the direction and impact of multimodal research in education, as well as prospects that are explored through methodical and transparent approaches to addressing research problems (Ekowati et al., 2024). Therefore, questions of research describe a clear scope of research focus. The research questions are: (1) How is the publication trend of the "multimodal learning in school" topic in journals indexed by Scopus? (2) How does the concept of "multimodal learning in school" contribute and its future opportunity?.

This research used the keywords "multimodal AND learning AND school" in the Scopus database. We performed an in-depth search for articles until April 2024. The Mendeley reference manager was synced with the data search results, which were recorded in *CSV and *RIS formats. We used VOSviewer software to present the data more clearly, interestingly, and effectively. By using the keywords, 1251 articles were located. We performed exclusion and inclusion using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) approach to get relevant publications. This PRISMA model is widely employed by several writers who have released their SLR articles (Ekowati et al., 2023). Some essential notes that can be used as the fundamental inclusion criteria of SLR are (1) the subject area should be "Social Sciences"; (2) Original and research papers should be included in publications; (3) English should be the language of writing for articles; (4) open access articles should to be available; and (5) It is recommended to filter the articles

using the keywords "multimodal," "multimodal learning," and "school." Figure 1 displays the inclusion and exclusion criteria for this study.

Figure 1 displays that 1251 items were found in the first search. We found 19 articles that met the criteria for analysis after inclusion and exclusion process.

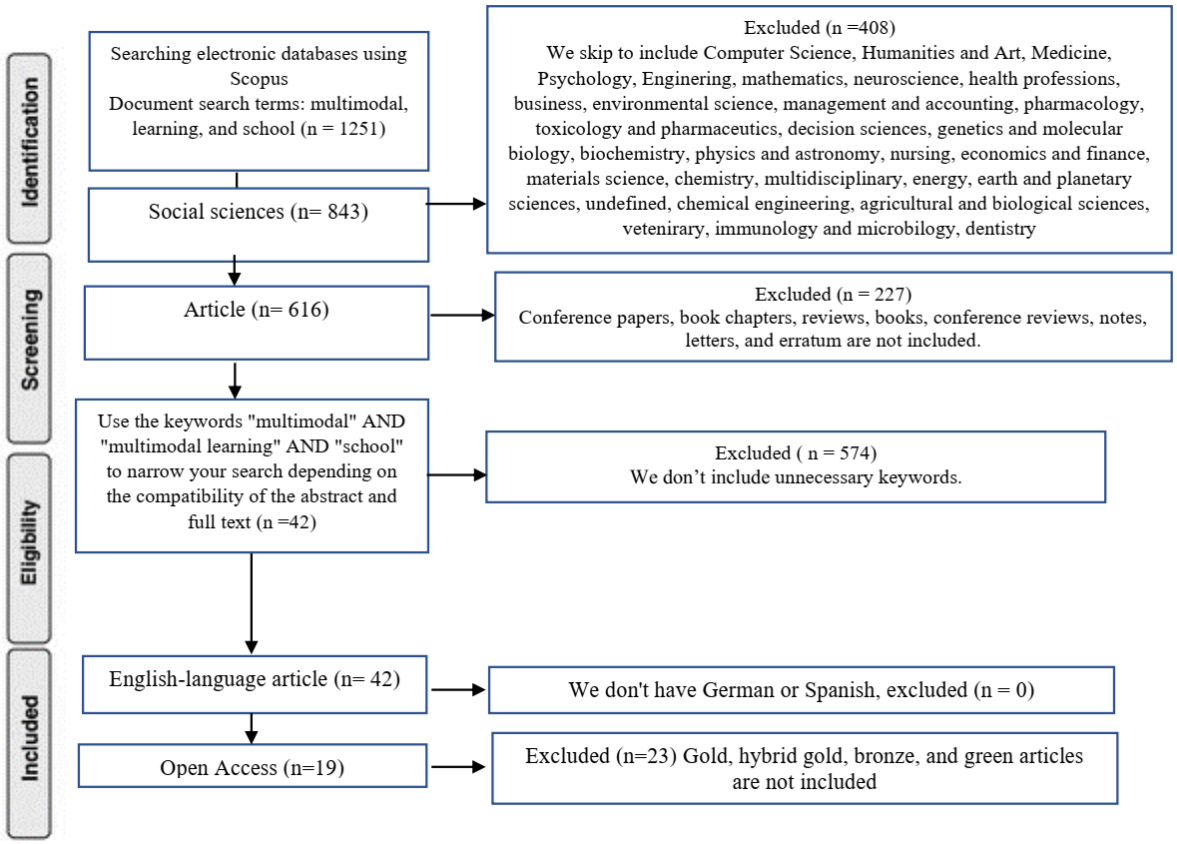

Figure 1. A Diagram for A Systematic Review Utilizing the PRISMA Model

Results and Discussion

The results and discussion are explained to answer the publication trends and the contribution of the concept of "multimodal learning in schools" and its opportunities in the future. The results and discussion are explained based on year distribution, research types, keywords, document by country, and research contribution.

Year Distribution

Figure 2 illustrates the number of papers published annually from 2010 to 2023 to the year distribution. Figure 2 shows the number of publications on multimedia learning in schools yearly. From 2010 to 2014, only one article with this theme was published. Even though there was a decline in 2017, it continued to increase in the following year. There was a rising trend of publications from 2014 to 2023. The peak was in 2023 when four articles were issued with the possibility of additional publications. The possibility happened because the data search was conducted only in April 2024, so the number might gradually rise if the search continues until December 2024.

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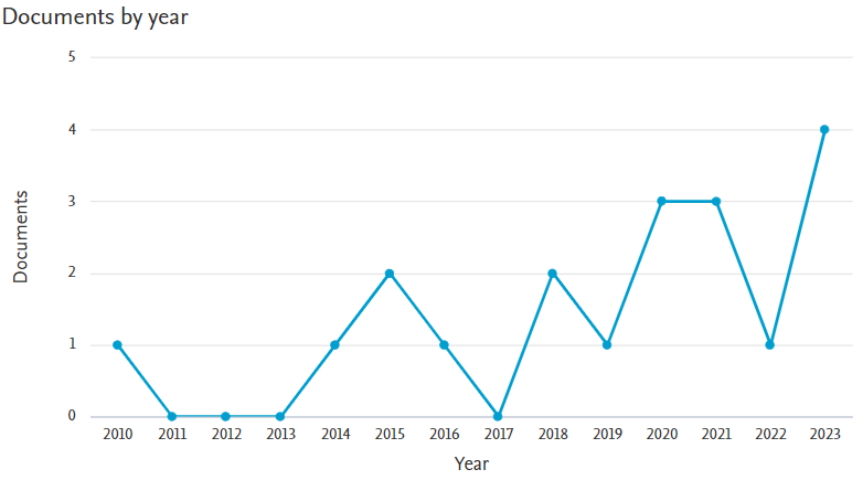

Figure 2. The Articles' Distribution Year

Research on multimodal learning in school has been identified since 2010. In the first five years, the amount of research on this matter was low, while the period from 2014 to 2023 saw a significant rise. The rising number of publications could happen due to several factors, one of which was the use of multimodal learning in school. Some recent studies in education underlined the expanding concepts of answering. Students nowadays use various means of communication to answer questions, such as written answers integrated with illustrations or videos or spoken responses incorporated with body movements (Lustig et al., 2021).

How students answer the question would be expanded into multimodal, It has a range of semiotic materials, including words and diagrams, coding systems, graphics, images, or multiple symbols, written answers, visual images, body movements, postures, movements, voices, or silences (K A Mills & Doyle, 2019). Using multimodal, someone can communicate with various means. Multimodal can represent things differently (Moreno-Morilla et al., 2021). Each part of a student's answer can potentially bring meaning in a certain way. However, to adequately describe and record how all new resources are made to have situational significance, multimodal frameworks must be developed. This phenomenon should be studied further.

Research Types

Three research types could be identified after examining these 19 articles, as stated in Table 1. Table 1 indicates that the most favored research type was qualitative, with 73.68%, followed by mixed method and quantitative, with 15.79% and 10.52%, respectively. Qualitative research design is the most dominant research type on multimodal learning in school. This might happen since multimodal learning in school focuses on the resources people use to define, understand, and express themselves (Alvarez et al., 2021). This situation requires qualitative analysis. A qualitative approach is required since it can explore the great potential of the multimodal of each student.

Table 1. Research Types on Multimodal Learning in School

No	Research Types	Amount
1	Qualitative	14
2	Mix-method	3
3	Quantitative	2

The next type of research applied by the authors was the mixed method (Taylor & Clarke, 2021). The multimodal relationship was fully shown by combining qualitative and quantitative methods. Qualitative analysis primarily focuses on student resources (Chen, 2016). Regarding quantitative testing, the authors conducted several statistical analyses on

the studied indicators (Debras, 2021). Testing in this context is that the combination of these approaches would help the authors gain information about the obstacles and how to solve them. Authors can benefit from additional research that explains how researchers conduct complex mixed-method approaches to study multimodal (Creswell & Clark, 2018). Three articles applied the mixed method. This means there is an excellent opportunity for future researchers to conduct further research using this approach. Next, the authors also applied a quantitative approach. The authors conducted a test using SPSS. The quantitative analysis tests the variables involved in the research (Debras, 2021). However, very few researchers have applied this approach to study multimodal. On the other hand, we cannot find any research applying the approaches of research and development and case studies. Hence, it is a terrific opportunity for future researchers to apply research and development and case study approaches.

Keywords

Figure 3 below illustrates the keyword trends used mainly by the authors when writing articles with the theme of multimodal learning in school. Figure 3 shows four main keywords frequently appearing and having mutual relations: multimodal, learning, school, and literacy. These keywords were gained using the VOSviewer application, which stated that co-occurrence—the minimum number of keywords occurrence is one—was 55 keywords. The top four keywords were multimodal, learning, school, and literacy. These keywords showed that multimodal had no direct relationships with digital media, media literacy, school, creativity, and the virtual world.

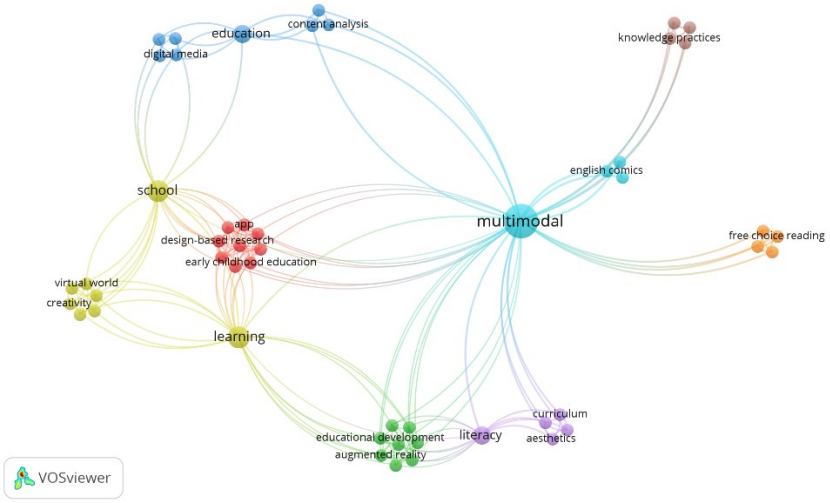

Figure 3. The Trends of Keywords in Research on Multimodal Learning in School

Information on research gaps was gained based on keyword analysis of the 19 articles using the VOSviewer application. First, very few research identified that multimodal keywords are directly connected to digital media. Digital media is a medium that has rapidly developed during the 21st century. This media combines texts, data, images, and voices stored in digital format. Digital media enables teachers and students to see, modify, listen, distribute, and store data digitally (Papadopoulou, 2019). It includes advertisements, songs, videos, podcasts, or audiobooks. This also can be a good opportunity for future researchers since, during the pandemic, schools and learners have made themselves familiar with digital media for learning (Chung & Huang, 2022).

Second, we could not find any research on multimodal using the school keyword. The school itself is the student's learning place, concerned with the fundamental needs of

communication. Even the 21st-century learning ability declares that communication is one of the main competencies (Mabena et al., 2021). The multimodal in school creates meaning from texts, voices, written texts, videos, artifacts, and other resources to improve communication (Kozhemyakin & Lovyagina, 2020). In the development of school learning, research on the use of multimodal learning in school and the mutual connection between them might be potential future research.

Third, multimodal research directly related to creativity was also rarely identified. It is worth knowing that one of the main competencies of the 21st-century learning is creativity. The student's ability to create new things or products or new ways to solve an existing problem is the definition of creativity. Meanwhile, using multimodal learning might help students understand and analyze the situation and condition and can improve their problem-solving ability (Ke & M. Clark, 2020). Therefore, research with the keywords of multimodal and creativity can be a good opportunity for future researchers.

Fourth, these 19 articles stated that multimodal research in virtual worlds was rarely conducted. The virtual world is a virtual environment used to interact at a particular time (Allahmoradi, 2018). The virtual world occurs on simulations, games, and other social platforms (Ke & M. Clark, 2020). Some examples of frequently used virtual world platforms are Second Life, Minecraft, and Sand Box. On the other hand, one of the benefits of multimodal is the flexibility principle. Multimodal suits each student's unique learning styles and preferences. The 21st-century students have the freedom to choose and decide the most suitable resources for them. The learning product in the form of the artifact is not only concrete but also virtual (ul Sabah et al., 2020). This could also be an excellent opportunity for the researchers to conduct further studies.

Document by Country

Figure 4 presents the document information identified as the authors' home country. In terms of research articles published on multimodal learning in schools, Australia led the world, with five articles. The second country was the United Kingdom, which had three articles. The next place was held by three countries, Finland, Sweden, and the United States, with two articles each. The rest were Brazil, the Czech Republic, Estonia, France, and Indonesia, with each publishing an article.

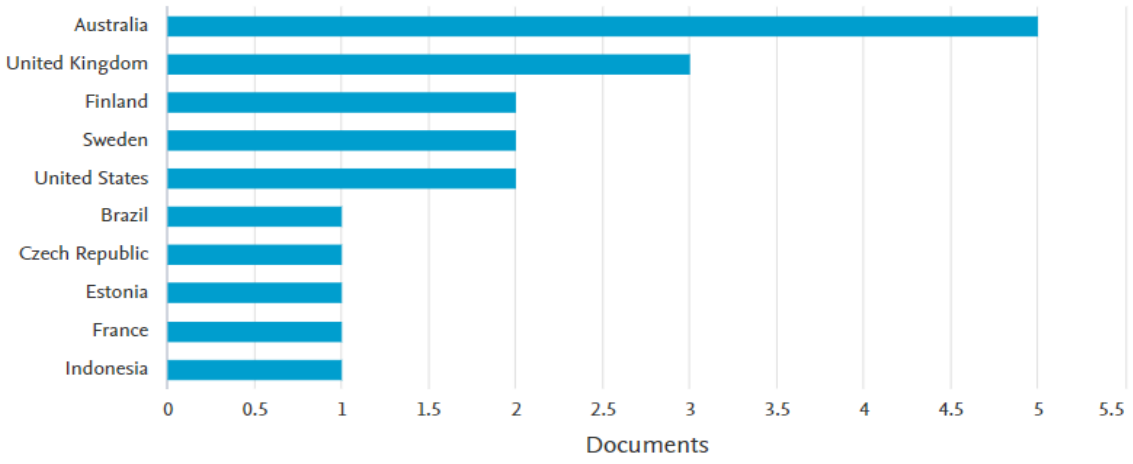

Figure 4. Document by Country

The following information related to the continents from which the authors came is given in Table 2.

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Table 2. The Multimodal Approach to Learning the Home Country and Continent of Authors

No	Country	Continent	Amount
1	Australia	Australia	5
2	United Kingdom	Europe	3
3	Finland	Europe	2
4	Sweden	Europe	2
5	United States	America	2
6	Brazil	America	1
7	Czech Republic	Europe	1
8	Estonia	Europe	1
9	France	Europe	1
10	Indonesia	Asia	1

Australia has recorded the highest number of research on multimodal learning in schools. It needs to be known that the curriculum applied in Australia has had direct references to multimodal communication channels, such as spoken or written language (Exley & Mills, 2012), as shown in Figure 5.

Figure 5. The references in the Australian curriculum which state multimodal as a means of communication (Exley & Mills, 2012)

The references in the curriculum are interesting since they have three systems of meaning, they are tenor, mode, and field. The field is related to the lessons learned or the themes covered in that work. Tenor describes the 'relationship between language users.' Communication mode directly refers to 'modality' or communication mode used, such as spoken or written language. The emergence of modality in the Australian curriculum has become one of the beginnings of various research related to multimodal learning themes in schools. The following countries were Sweden and the United States. The next grouping is based on each author's continent. The highest number of authors was from the European continent, with 44.44%. The second one was authors living in the Australian continent, with 27.78%. The next one is the American and Asian continents, with percentages of 16.67% and 11.11%, respectively. There was no research on multimodal learning written by authors living in Africa. This could be an excellent opportunity for authors residing in Africa.

Research Contribution

The contributions of research on multimodal learning in school can be categorized by its learning elements, such as a) the learners, b) learning materials, c) learning strategies, d) facilities, e) curriculum, and f) teachers. The analysis of the 19 articles illustrates that the most frequent contributions were the development of learning materials, both virtual and non-virtual, using various media, from manual ones to smartphones. The following contribution was the resource development of the learners followed by the development of the curriculum

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development and the development of facilities. Only one article stated the development of learning strategies. No article focused on the teacher's resources. The complete distribution of research contributions is summarized in Table 3.

Table 3. Research Contribution

No	Research Contribution	Amount
1.	Learning materials	57.89 %
2.	Learners	15.78 %
3.	Curriculum	10.52 %
4.	Facilities	10.52 %
5.	Learning strategy	5.26 %
6.	Teachers	-

The findings of the 19 papers' analyses demonstrated that each one examined the evolution of the resources available to learners, including discourses, digital materials, direct acts like postures and bodily motions, and the physical environments that support students' knowledge practices (Kajamaa & Kumpulainen, 2020). Besides that, an article talks about the information of images, voices, movements, expressions, and digital designs the learners created on their social media accounts. This research aims to measure how far the learners learn about information beyond what they learn in school (Wernholm & Reneland-Forsman, 2019). The research contributions in the learner's resources development include the linguistic skills in school-age children with direct interventions using a metalinguistics approach (Zwitserlood et al., 2015).

Research on multimodal learning in school themes contributes to the research on the development of application-based learning material, such as augmented reality or other applications that utilize various media like smartphones. Multimodal applied is the interactions between users and the augmented reality application (Wang & Tan, 2023). The development of learning materials from comics or movies involves the multimodal of the learner's linguistic skills, artifacts, movie results, stories, and memories (DeJaynes, 2015; Pazaer & Assaiqeli, 2023), student's written texts, visual images, documents, placements, music, architecture designs. Even it was found in research that applied the multimodal media of alcohol literature as a learning material (Gordon et al., 2016).

The research contribution to learning strategy goes through different orientation stages, representation challenges, the development of consensus, and the application and broadening of the representative systems through multimodal. The usage of multimodal focuses more on the student's multimodal inquiry into learning than it does on the teacher's role of leading students through many phases of inquiry (Tytler et al., 2023). Another research contributes to curriculum development. Teaching and learning that relates to the teaching literacy of aesthetics or arts for students' assignments, particularly the ones relating to the composition of multimodal texts for work readiness, has become part of curriculum development involving multimodal (Barton & Le, 2023; Fadeev, 2020).

The contributions to facility development have been mentioned in an article discussing the relationship between new technology, student multimodal design, and classroom social reproduction. It analyzes the social meaning within the classroom multimodal—dialogic room, physical, material, architectonics, and screen. The use of new technology and student's multimodal learning is connected to the vital transformation in the classroom (Kathy A. Mills, 2010). Besides, the findings of a literature study of media stories on education are often used to provide research contributions on facilities, particularly the discussions about the importance of TIME magazine and its cover from its inception in 1923 until 2019. Findings that include (a) names and places showing authority, power, and

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relevance in the area of education; (b) Education and learning are occasionally depicted as being in a constant state; (c) depictions of wide education stakeholders that are too metonymic and too broad; (d) school presented as it requires fixing; and (e) school considered a more prominent place for sociopolitical debates (Kachorsky et al., 2020). Findings that include (a) names and places showing authority, power, and relevance in the area of education; (b) learning and schooling presented as in steady state from time to time; (c) overgeneralized and metonymic representations of broad education stakeholders; (d) school presented as it requires fixing; and (e) school considered as a more prominent place for sociopolitical debates (Kachorsky et al., 2020). We cannot find any multimodal article discussing the development of teachers' resources. This could be a good opportunity for future researchers to examine multimodal learning in school, focusing on the teacher's resource development. However, this resource is determined by the number of subjects a school offers. Each subject has its characteristics. Therefore, this gap could be something worth studying by future researchers.

The findings of this study offer valuable insights into the potential of multimodal learning approaches and their implications for shaping both current and future education policies. By highlighting the benefits and challenges of integrating multimodal strategies in schools, this research underscores the need for a more inclusive and dynamic approach to learning. These results serve as a significant step toward understanding how multimodal methods can address the diverse needs of students and enhance the overall educational experience. Moreover, the study provides a robust foundation for researchers and policymakers to delve deeper into multimodal themes in education. It encourages the development of strategies and frameworks that align with varying educational objectives and socio-cultural contexts. By offering a clear direction for future studies and policy development, these findings aim to foster innovation and inclusivity in educational practices, ensuring their relevance and adaptability in an ever-evolving learning environment.

Conclusion

The SLR study uncovered several key findings. First, the publication of multimodal learning studies began in 2010, with a significant increase observed between 2014 and 2024. Second, qualitative methods dominated the research, followed by mixed methods, with no articles employing research and development or case study approaches. Third, analysis using VOSviewer revealed four frequently occurring keywords: multimodality, learning, school, and literacy, alongside related but indirectly connected terms such as digital media and creativity. Australia emerged as the leading country for research on this theme, followed by Sweden and the United States, while no studies were found from Africa, indicating a promising opportunity for future research. Neil Mercer was identified as the most cited author, with his contributions significantly influencing the field. Finally, the research contributed predominantly to developing learning materials, both virtual and non-virtual, alongside enhancing resources, strategies, facilities, and curricula for multimodal learning in schools.

Recommendation

We have not found any research that examines teacher resource development. This development requires further research on each subject because each subject has different characteristics. This information can be a good opportunity for further research. For education policymakers, the findings emphasize the need to prioritize research and initiatives focused on teacher resource development tailored to specific subjects. Each subject has

unique characteristics and requirements that demand customized multimodal resources to optimize teaching and learning outcomes. Policymakers should consider supporting studies and pilot programs that explore effective strategies for creating and integrating these resources into the curriculum. Policies could promote professional development programs to equip teachers with the skills and tools needed for multimodal instruction. Investing in such initiatives will ensure that educators are well-prepared to address the diverse learning needs of students and enhance the overall quality of education. Encouraging collaboration between researchers, educators, and policymakers can further foster innovation and ensure that resource development aligns with practical classroom demands and educational goals.

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