



# Exploring Multimodal Studies in the Classroom

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## ABSTRACT

Due to the increasing diversity of cultures and languages in today's classrooms, more and more studies continue to explore various methods, media, and modalities for the sake of harnessing the academic and linguistic strengths of students. In an attempt to apprehend the empirical landscape of the evolving studies, the authors systematically reviewed the literature on multimodal composition occurring in the classroom across various conditions and situations. Through an inductive study, the authors analyzed 37 articles published in international journals indexed by Scopus Q1 and Q2 in the last five years (2017-2021) to comprehend the findings of keywords and characteristics of the existing studies. This study revealed that most studies supported students in terms of learning success, but did not examine the expression, the emergence of ideas, and the communication taking place. Second, many studies demonstrated how the language emerged and developed through the unique semiotic resources of several modes as they occurred in the classroom. Third, this literature study discovered how multimodal composition offered the opportunity to expand the linguistic state in the classroom. Finally, this literature study illustrated the potential of multiple modes to mediate the learning during the learning process in the classroom. The authors provided the implications of the themes acquired and critical new directions for future multimodal research in the classroom.

**Keywords:** *Multimodality, Classroom, Literature*

## 1. INTRODUCTION

Multimodal research in the classroom is interdisciplinary research that is currently developing, which combines educational science, especially education in the classroom, and multimodal method in order to recognize the function of education in the classroom and provide new learning strategies in the classroom [1]. However, the method of multimodal research in the classroom is relatively simple and the progress in this field is relatively slow over a certain period of time [2]. It has the effect of not meeting the need of exploration and understanding of educational science. Therefore, in the past five years, multimodal method has been increasingly used in the field of educational research, and has promoted the development of education. At the same time, the introduction of multimodality has also brought positive and negative things to the world of education. Modality refers to the way or mode that something happens in the presence of images, words, sounds, and smells. A study of which research datasets contain several modalities as such meet the characteristic of multimodal research [3-4]. Heterogeneous multimodal data provides unique challenges in its processing. Therefore, the main problems that a multimodal researcher investigates are like how to map data from one modality to another as

accurately as possible, how to determine the correspondence amongst sub-elements in several modalities, and how to combine information from two or more modalities to obtain accurate predictions [5]. The combination of multimodality and education in the classroom has broad research base and development prospects.

Multimodal research has been applied in several fields, such as science, law, medicine and education. Multimodal research in science can be applied in various sub-disciplines of science to obtain more comprehensive results and answer the challenges of current and future scientific problems [6-9]. There have been several multimodal studies in the field of science, namely [10] and [11] who conducted multimodal studies in the field of pure science. [10] conducted multimodal research to investigate mixed ionic-electronic conductor ceramics-based membrane material used in solid oxide fuel cell and membrane separation (compounds  $\text{Ce}_{0.8}\text{Gd}_{0.2}\text{O}_{2-x}$  and  $\text{CoFe}_2\text{O}_4$ ) indicating the presence of material phase which emerged, and measure chemical complexity at the nanoscale. Meanwhile, [11] combined the perspectives of comparative psychology and behavioral ecology of adult apes in multimodal communication, regarding the function of signals and

cues that accompany speech, such as gestures, facial expressions, and gazes of the adult apes.

Differently, [12] and [13] conducted multimodal studies in applied science, namely classroom science learning. The multimodal studies were applied to find out how the students interacted in the science learning. These studies examined how the students processed the information provided by the teaching staff with audio and visual media carried out in the classrooms and in the laboratories. Additionally, [14] also applied multimodal research to learning. They analyzed multimodal interaction by checking the students' understanding through providing opportunity to use notebooks after obtaining the material from the teacher. [15] in their study explored how the students used science notebooks and simultaneously how the students and the teacher interacted. This study examined the students' interaction with open science notebooks during inquiry science material on condensation and evaporation. Another multimodal research applied in the field of science was 59 students' learning of science vocabulary related to practical terms and how the teacher's instruction and the students' perceptions of their learning environment were. The finding in this qualitative study was that both the students and the teacher could articulate the use of resources to support the improvement of the students' academic vocabulary [13].

In the legal field, several researchers have explored how fraud detection system was able to reveal facts and truth [16-18]. In addition, [19] and [20] used verbal and non-verbal modalities to build a fraud detection system that could distinguish between truthful and deceptive statements uttered by the defendants and used a combination of multimodal systems to detect hate speech from video content by extracting image features, features extracted from audio, text and machine learning and natural language processing. In line with the previous researchers, [21] revealed a method of detecting face presentation attack which was then presented and discussed and critically evaluated, followed by discussion and comprehensive evaluation of existing public data sets and commonly used evaluation metrics.

Multimodal studies in the legal field were also carried out to detect problems of violence against women and legal protection of personal data. [22] used multimodal approach to measure whether the level of atmospheric pollution had an effect on Gender-Based Violence Index (GBVI) based on satellite monitoring. Based on the results of the identification using the technique of computer vision applied to the satellite, it was detected that it was the level of alcohol which exacerbated or causes the violence against women. Then, [23] examined the legal system for protecting personal information in the big data era. Multimodal research was applied by introducing big data and data technology, then explaining and introducing information related to personal information, using case analysis method, logical analysis method, comparative analysis,

and other methods to explore and improve personal information in the era of globalization for legal protection and security. The results of experiment in this article showed that the risk of leakage of personal information in the big data era was very high, where personal identity information had the largest proportion of leaks, which was 78.2%. To overcome this problem, the introduction of a relevant legal system was required to protect personal information. The multimodal studies applied in the legal field were able to explore things that had been previously untouched to be visible and were able to prove the accuracy of the results.

Applying multimodal research is the latest trend in studies in the legal field, especially during the COVID-19 pandemic in the world [24-28], for example a study conducted by [29] on the analysis of multimodal textual data contained in tweets related to COVID-19 by Indian society. The data were related to 8 emotion scales (anger, anticipation, disgust, fear, joy, sadness, surprise, and trust) across categories such as nature, lockdown, health, education, market and politics. The goal was to find out and understand the emotional state of the community during the pandemic and become strategic information for the government and policy makers.

Next, multimodal research in education will be discussed. This field covers teaching and learning and all aspects that compose them, including the application of multimodal research in the classroom. Learning and teaching that synergize all components, be it audio, visual, and text, will accommodate students with various learning styles to gain maximum knowledge, skills, and learning experiences, and this can be achieved through the application of multimodal research [30-35]. Multimodal research has also been carried out by many researchers in the field of education who generally revealed that the multimodal research was very representatively applied to solve current and future educational problems [36-38].

However, at present, there is still lack of progress in multimodal research in the field of education, especially classroom learning, carried out by academicians, and lack of review of trend in the development of this research design in the future. Therefore, this article was written to summarize the current progress of multimodal research in the field of education, especially classroom learning, and to recommend future research trend in this field. The aims of writing this article were to: 1) collect Scopus-indexed peer-reviewed articles of multimodal studies in the classroom from 2018 to 2022, and ensure the completeness and representativeness of the articles collected; 2) obtain research content and evolution in this field based on the analysis of keyword emergence, publishing time, keyword analysis zone and keyword analysis respectively; 3) sort out the research articles in this field through cluster analysis and determine potential research topics for future researchers; and 4) establish a framework for multimodal research in the classroom to highlight achievements and shortcomings

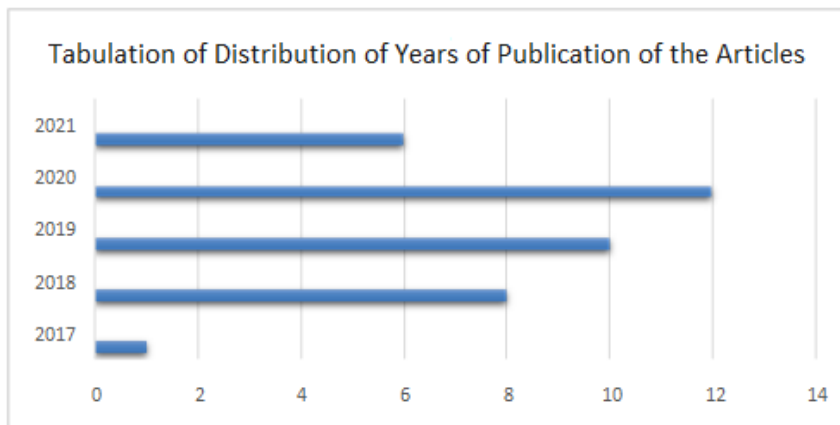
so that future researchers can look deeper to understand this field.

## 2. METHOD

This study was a bibliometric literature review that examined multimodality in the classroom. The sources of data were Scopus-indexed reputed international scientific articles consisting of 37 articles published in the 2017-2022 range. The data were obtained through the selection step by step. The initial stage was the search for all articles of multimodal studies in the classroom through the Google Scholar webpage. In the second stage, the articles were sorted and selected to get only articles published in reputable international journals which were recorded in the Scopus database. In the third stage, the data were re-sorted in terms of quality so that only articles in journals indexed in Scopus Q1-Q2 were selected. In the fourth stage, the data were re-sorted based on relevant keyword in this study, namely multimodality in the classroom. In the analysis stage, the selected articles were categorized based on several clusters: year of publication, research location/ country of origin, level of education, and keyword. In the last stage, the analyzed data were visualized using the VOS Viewer application to show the network of connection among various topics and keywords forming trend of multimodal research in the classroom.

## 3. RESULTS AND DISCUSSION

After carrying out a fairly strict data sorting, here are a few things related to multimodality in the classroom. Amongst the articles that had been collected, the articles published in 2022 were not available because none met the criteria. The articles related to multimodality in the classroom were published more in the range of 2018-2020 than in 2017 and 2021 (see Figure 1). The articles published most were in 2020 (12 articles), while the least was in 2017 (1 article). The trend of multimodal research tended to decrease in 2021. Despite this fact, it could not be said that multimodal research was no longer taken into account by the researchers. In the wider scope of publication, multimodal studies in the classroom were still widely published. This downward trend could be interpreted as an indication that publications in Scopus Q1-Q2 related to this topic experienced saturation. This assumption came up due to the tendency of the multimodal studies to be more student-centered. These studies also predominantly focused on lingual, visual, and audio-visual aspects. Likewise, in terms of the choice of theoretical analysis applied, these studies tended to be uniform, revolving around a non-specific multimodal framework. The implication was that the multimodal studies only reviewed the same thing over and over, although there were updates in some parts carried out by the researchers. The factor of advancement of technology had a significant influence on semiotic modes observed by the researchers [39-43]. These researchers did not ignore the role of digital devices and machines in their multimodal studies.



**Figure 1.** Distribution of Years of Publication of the Articles of Multimodal Studies in the Classroom

The distribution of research locations (see Figure 2) shows that multimodal studies in the classroom were dominant in United States of America (12 articles). Meanwhile, multimodal studies in the other countries were evenly distributed in dense numbers—one or two articles apart. The data collected showed that multimodal studies in the classroom attracted the attention of researchers from America (USA, Chile, Colombia, and Brazil), Asia (China and Singapore),

Europe (Germany, Spain, UK, Norway, Italy, and Scotland), and Australia (Australia). Literature studies on multimodality were quite often done. One of the indicators was that the research location was not mentioned (6 articles). This study did not find any article showing the implementation of multimodal studies in Africa. Of course, this becomes a challenge and concern for multimodal research enthusiasts to carry

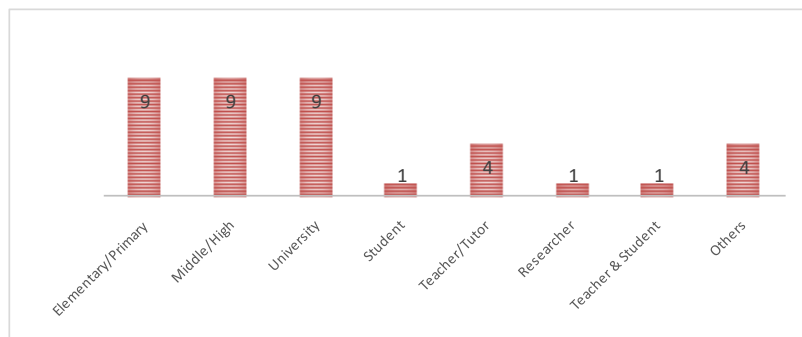
out multimodal studies in the classroom in Africa in the future.

No.	Country	Number of Articles
1	United States of America (USA)	12
2	Unknown	6
3	Australia	3
4	Spain	2
5	China	2
6	Chile	2
7	Singapore	2
8	Germany	2
9	United Kingdom (UK)	1
10	Norway	1
11	Brazil	1
12	Italy	1
13	Scotland	1
14	Colombia	1
TOTAL		37

**Figure 2.** Distribution of Locations of the Multimodal Studies in the Classroom

The multimodal studies that had been collected focused more on students as the research subjects. Things that were highlighted were related to competence, creativity, as well as evaluation and assessment. If sorted more specifically, the research subjects were classified as shown in Figure 3. This figure shows that the majority of the research subjects were students who were evenly distributed, at the levels of basic education (elementary/primary school), secondary education (secondary/middle/high school), and higher education (university). Other targets that also

received attention were teachers/instructors/tutors and researchers. There were also researchers whose research targets were teachers and students. It is baffling to notice that the multimodal studies in the classroom very predominantly examined the students compared to the teachers. In fact, the continuity of learning is determined not only by students, so it should be measured not only from one perspective. Therefore, future multimodal research also needs to pay attention to the role and behavior of teachers in the classroom.



**Figure 3.** Cluster of Subjects/Participants of the Multimodal Studies in the Classroom

The analysis based on keywords in the articles of multimodal studies revealed some interesting issues. The multimodal studies in the classroom based on topics/keywords will be explained below.

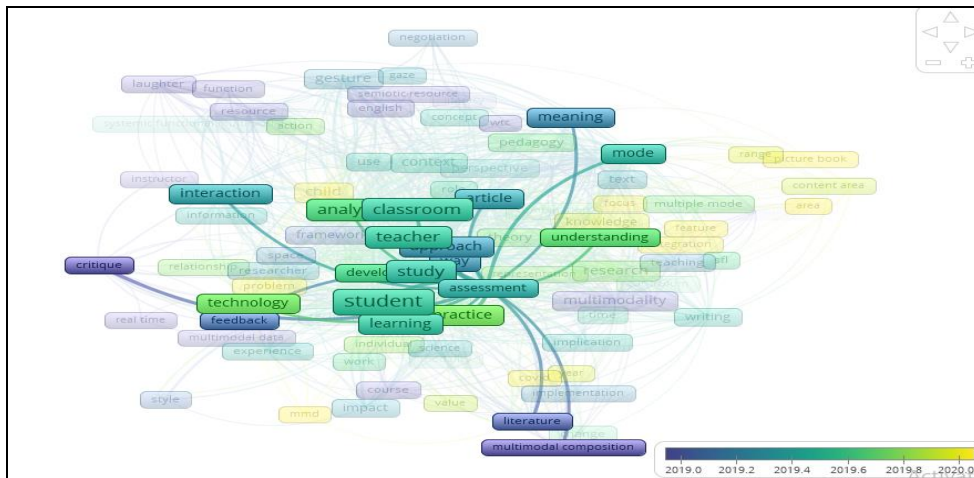
**The Multimodal Studies in the Classroom: Topics/Keywords**

Multimodal analysis has contributed a lot in supporting the learning process in the classroom, including in the field of applied linguistics. Problems

related to classroom interaction, learning outcomes assessment, and literacy are topics that are often discussed in multimodal research. As stated by [44], pedagogy and pedagogical literacy cannot rely only on language aspects. Multimodal research broadens the spectrum of analysis in applied linguistics by involving other modes of meaning making, namely visual, auditory, spatial, and gestural in order to create more holistic meaning. This article reviewed studies that had been done related to three categories of topics involving





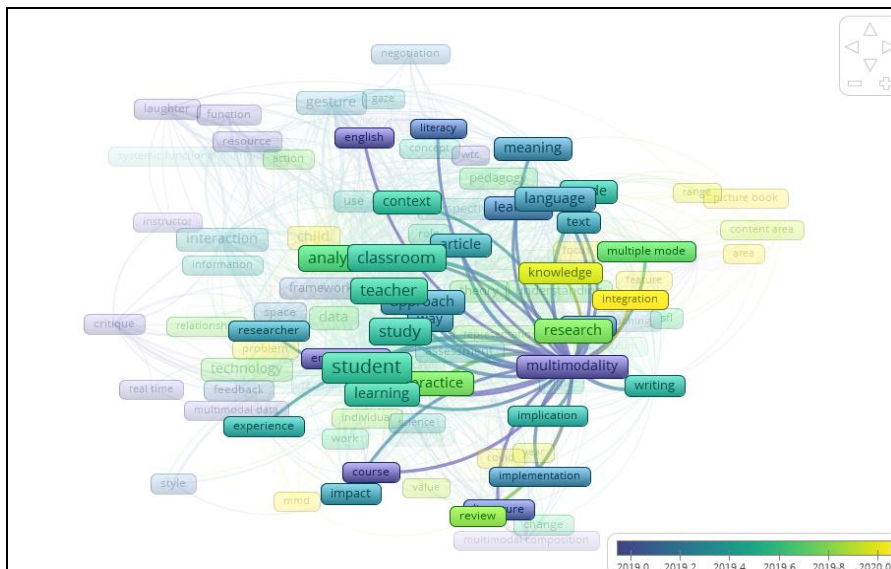


**Figure 7.** Connection between Multimodality and Assessment and Evaluation

**Literacy**

The issue of literacy has always been a concern of the world of education. Unfortunately, creating literacy which is applicable and motivating students to be active in it is not always successful. This challenges researchers to try to uncover this problem. The topic that related literacy, multimodality, and children was one of the most interesting discussions based on the data collected, especially in efforts to introduce literacy to children [55], enhance children's literacy skills [56], and teach literacy to children in the classroom [57] and [58]. The practice of multiliteracy in the multimodality

framework promoted by [59] and the development of critical multimodal literacy framework, the concern of [60], are also inseparable from the current literacy issue. This is also in accordance with the results of data collection based on grouping of keywords for the literacy topic as shown in Figure 8 below. This visualization shows that in the literacy topic, the keywords such as text, writing, meaning, learning, integration, review, multiple modes, experience, and language appeared in three color clusters.



**Figure 8.** Connection between Multimodality and Literacy

From the description above, it can be concluded that multimodality in the classroom is an option in solving problems of teaching in the classroom,

especially to increase students' competence and activity, as well as participation in the classroom. In addition, multimodality in the classroom can also be used to examine the extent to which teachers/lecturers solve the

problems they face. Multimodality can act as an analytical framework, a method, and an alternative idea to solve problems in the classroom experienced by both teachers and students. The flexibility of multimodal studies and technology advancement makes this study accelerated in improving the quality of learning.

#### 4. CONCLUSION AND SUGGESTION FOR FURTHER RESEARCH

The final section of this article will describe future directions for multimodal research in the classroom. The mechanism used by the authors was to review the multimodal studies based on two main things, namely the theoretical framework developed and the topics that attracted the researchers' attention. It was stated earlier that multimodal research has been applied in uncovering problems in the fields of science, law, medicine, and education with various implementation strategies.

In the field of education, multimodal research has also made significant progress. The pedagogic studies compiled so far have placed multimodality as an analytical framework for various theoretical-analytical problems because multimodality can integrate various sources of meaning to increase students' participation, activity, competence, and interaction during learning. Generally, researchers [49,51,52,55] view multimodality in relation to Halliday's social semiotics or the developmental form of it. Besides, the multimodal research developed has also greatly been assisted by a number of other linguistic analysis frameworks, such as Systemic Functional Linguistics (SFL) used by [45,61], Systemic Functional Multimodal Discourse Analysis (SFMDA) used by [44,46,62-63], and Multimodal Interaction Analysis (MIA) used by [64-65]. These multimodal studies have solved a number of problems of learning in the classroom, such as gestures [45], learning evaluation [52], and handling children with special needs [65]. Multimodal research is recommended by researchers because it has been successful in helping students and teachers to achieve quality learning that is more varied, adaptive to the context, and more egalitarian in placing subjects in the classroom.

It has been explained previously that multimodality derives from a view to integrate various sources of meaning with the aims of collecting and concluding meaning in a more comprehensive and holistic manner. In the previous research, especially the research related to the application of multimodal pedagogy in the classroom context, the researchers have tended to combine two to three sources of meaning, for example text and image [60] and a combination of text, image, sound, and video [66]. The integration of various sources of meaning is intended to mediate the teaching and learning process [67] so that learning participants can understand the meaning tried to be shared. Considering the studies gathered, the use of sources of meaning has not been carried out optimally. For example, the multimodal researchers in the classroom

have been too focused on verbal/lingual, visual, audio, and gestural aspects by utilizing the aid of technological devices and machines. The other multimodal aspect, like spatial aspect, has not received much attention of the researchers. The arrangement of classroom and the positioning of teacher and students in the classroom, or other topics seem to be interesting to be researched further in a multimodal research framework so that multimodal practice will be developed on a wider spectrum of semiotics.

The methodological approach applied has also developed significantly, both from quantitative and qualitative perspectives, although more classroom research has seen multimodality from the qualitative perspective. The multimodal quantitative approach has been primarily concerned with evaluation involving assessment/scores and learning outcomes. Meanwhile, the multimodal methodological approach with mixed method of quantitative and qualitative perspectives has not been seen yet. In fact, in research in the field of education, the mixed method is no longer an odd method to use.

#### AUTHORS' CONTRIBUTIONS

Author 1 and 2, author 2 and 3, and author 3 and 4 contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

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