

REVIEW ARTICLE

Advancing Language Education through Multimodality: Insights from a Bibliographic Analysis

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ABSTRACT

With the development of technologies and pedagogies, multimodality of language education is becoming increasingly important, especially in the context of the challenges posed by the COVID-19 pandemic. Through advanced multimodal theories and media, teachers could integrate multiple sensory and communicative modes in language teaching. This study uses bibliometric analysis to explore the multimodality in language education from both qualitative and quantitative aspects. We use tools such as VOSviewer, CiteSpace, and CitNetExplorer to visualize this topic's research evolution. The findings show that multimodal media and pedagogies evolve to boost student engagement and understanding in language learning, particularly in terms of video-mediated interaction and social media. Future research is recommended to assess the long-term influences of multimodal approaches and explore their integration with emerging educational technologies.

Keywords: Bibliometric analysis; Multimodality; Language education; VOSviewer; CiteSpace; CitNetExplorer

1. Introduction

In the changing education landscape, the integration of multimodal approaches has been greatly promoted by the rapid development of digital technologies and paradigm shifts in education (Jewitt, 2005). Multimodality in language education involves the

use of various semiotic modes, such as visual, audio, gesture, and text, addressing the multifaceted nature of communication and understanding in the modern world (García et al., 2017). This approach enriches the teaching experience and meets the contemporary need for diverse literacy practices that go beyond traditional oral and written forms. The demand for

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ARTICLE INFO

Received: 27 May 2024 | Revised: 21 June 2024 | Accepted: 28 June 2024 | Published Online: 20 July 2024

DOI: <https://doi.org/10.30564/fls.v6i3.6691>

CITATION

Li, Y., 2024. Advancing Language Education through Multimodality: Insights from a Bibliographic Analysis. *Forum for Linguistic Studies*. 6(3): 447–466. DOI: <https://doi.org/10.30564/fls.v6i3.6691>

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education to adapt to local diversity and global connectivity increases, especially in this era of digital platforms, with most educational systems disrupted by the COVID-19 pandemic (Z. Yu, 2022a).

Despite the growing research on multimodal language education, there are still large gaps in how to systematically explore these practices in different educational settings and levels. Current research suggests that multimodal resources could improve student engagement and literacy, but comprehensive review on unpacking the evolutionary nuances and shedding light on the emerging areas in that field is lacking. This study aims to map the development of research in multimodal language learning through bibliographic analysis. It seeks to identify key themes, emerging trends, seminal works, and the influence and collaboration networks among various countries, institutions, authors, and journals in this field. The analysis will also focus on examining the impact of specific multimodal strategies, such as video media interaction and social media use, on enhancing language learning processes and outcomes.

2. Literature review

2.1. Multimodality

Multimodality is defined as using multiple semiotic modes in creating a product or event and the specific way these modes are combined (Kress & Van Leeuwen, 2001). And modes are described as resources for meaning-making, such as image, gaze, gesture, music, speech and sound (Jewitt & Kress, 2003). Therefore, we can understand that language always involves multimodality, as effective communication often requires things like spoken and written words, visual images, gestures, movements, sounds, and even silence.

Multimodal research has had a significant influence on both society and education systems. Early research on multimodality in education reimagined literacy teaching, to adapt for societies that are both locally diverse and globally connected (Cope, 2006). Literacy represents a set of communicative and sociocultural practices shared across communities.

As society develops, so does literacy. Multimodal literacy attempted to use various media to represent the visual, auditory, and gestural dimensions of communication and has become a popular research field (Cope & Kalantzis, 2009). Empirical studies indicate that integrating digital technologies with traditional literacy learning can deepen students' understanding of texts, which enables them to unpack multimodal texts and grasp their information structures and knowledge organization even in social and affective dimensions (Danielsson & Selander, 2016). For multilingual and English as a second language (ESL) learners, multimodal literacies have been shown to provide powerful means for expressing literacy comprehension and exploring cultural identities through various text types (Toohey et al., 2015). It was also confirmed that digital multimodal composing such as digital story telling is effective in enhancing critical thinking skills among EFL majors (Balaman, 2018).

Multimodal pedagogy requires that different modes of representations, languages and discourses should be integrated in the classroom (Stein, 2007). Teachers can encourage students to use different meaning-making resource to perform ideas (Unsworth, 2010). Teachers can also encourage the acquisition of knowledge from the living world of students (The New London Group, 1996). Besides, researches proposed that the assessment should not only focus on linguistic performance, but also design features in other modes (Lim J. M., 2020). Through multimodal pedagogies, teachers craft cohesive learning experiences by skillfully integrating various forms of knowledge representation and selecting appropriate resources for meaning-making. However, students are often ahead of teachers in their competence and creativity in using the Internet, digital programs and mobile technologies, and teachers' expertise as text analysis and criticism should be improved in the 'new' text world (Ryan et al., 2010).

2.2 Video-mediated interaction

Based on the cognitive theory of multimedia learning (Mayer & Pilegard, 2014), presenting words in printed form alongside graphics may lead to an

overload of the visual channel. This is because both elements are initially processed visually, which can lead to a higher cognitive load. Learners may have difficulty navigating back and forth between text and graphics and may lose key information in fast-paced lessons. This effect, known as split attention, burdens the visual channel. However, when words are delivered by way of narrative, they are transferred from visual channels to verbal channels, thus reducing the load on visual channels and enhancing processing power. Meanwhile, it's worth noting that audiovisual materials have dual representations: visual components that convey the details of objects and their relationships, and linguistic components that convey the abstract meanings and specific properties of those details. Therefore, combining these two components can improve the learning effect (Schär et al., 1999; Hegarty et al., 2003). Based on it, teachers can add corresponding videos to the spoken lecture in language learning classroom (H. Lee & Mayer, 2015).

In an educational setting, videoconferencing is often used to facilitate lectures at different campuses or institutions. This method is preferred because it is easy and flexible to use, allowing learners to participate using their personal computer at home or work, regardless of their location or time (Wang, n.d., 2004). Online video conferencing with multiple modes can facilitate language learning to cater to learner preferences (Hampel & Stickler, 2012). Videoconferencing in language learning provides multiple modes of meaning-making that learners can use simultaneously to reinforce their strengths. Nowadays, short educational videos have developed rapidly in TikTok, which can deliver small learning units in a short timespan (less than 60 seconds). Based on nano-learning principles, how to condense and convey creative learning content should be further explored (Khlaif & Salha, 2021). Sora, capable of quickly and accurately transforming text into dynamic video content, can be used as a tool for language education. It can offer various learning modalities. However, to make good use of Sora, it's crucial to address ethical concerns (Adetayo et al., 2024). Further research is necessary to identify teachers'

specific skills and strategies and improve language education (Hampel & Stickler, 2005).

2.3 Social media influence

According to the social interactionism theory, 'other significant people' was considered a key element (Erikson, 1968). Furthermore, Vygotsky's (1981) concept of the Zone of Proximal Development (ZPD) highlighted the critical role of mediations in all aspects of human development, including learning. This suggests that learning also occurs in communities that are dynamically involved in the individual's internal learning process (Illeris, 2008). Consequently, language acquisition and learning are greatly influenced by the cultural and communicative environment around learners.

Social media such as vlogs, blogs and podcasts could simplify information sharing for individuals (Bonwell & Eison, 1991). These platforms improve communication, information exchange, and online social interactions. Social media can also make learning more engaging and interactive, potentially transforming learners' current cognitive states into reflective and applicable knowledge for new situations Mondahl et al., 2009). Research has demonstrated that interventions significantly impact student interest and achievement in language learning (Olagbaju & Popoola, 2020). Teacher should learn combine face-to-face instruction with online activities via social media in language education, trying to avoid its negative effects at the same time (Naghdi-pour & Eldridge, 2016, p. in).

2.4 Research questions

Multimodality plays an important role in language education and continues to evolve with the time. While previous studies have explored the influence of multimodal approaches on language education, there are still large gaps in understanding the comprehensive trends, key themes, and collaborative networks in this field. Additionally, there is a need to examine how various multimodal media, including video-mediated interaction and social media, have

evolved over time to influence language education. To address these gaps, we propose six Research Questions:

RQ1: What is the year-based trend of in publications and citations included?

RQ2: What are the heated topics and research fields related to multimodality in language education?

RQ3: What are the top 10 countries, organizations, authors, and journals among the studies on multimodality in language learning?

RQ4: How does multimodal pedagogy affect students' language learning?

RQ5: How does video-mediated interaction enhance language education?

RQ6: How do social media promote language education?

3. Materials and methods

3.1 Research materials

We conducted a literature search through the Web of Science Core Collection. We excluded two indexes “Current Chemical Reactions(CCR, 1985-present) and Index Chemicus (IC, 1993-present)” due to the irrelevance. Our search term was “multimodal*” (Topic) combined with “language learn*”, “language educat*”, or “language teach*” (Topic). “Analyze Results” function on Web of Science were then used to analyze publication trends.

3.2 Research methods

We exported the full records and the cited references of the search results for bibliographic analysis. We then processed the text files through various tools: VOSviewer (Van Eck & Waltman, 2010), CiteSpace (Chen, 2006) and CitNetExplorer (Van Eck & Waltman, 2014).

VOSviewer could display the influence and collaboration networks between authors, keywords, countries, institutions and journals. The software also generated lists ranking authors, keywords, countries, institutions, and journals by citations and occurrence-

es. We compiled the top 10 authors, countries, and institutions based on citation counts to highlight key contributors to the topic. Additionally, we selected the top 30 keywords based on occurrences to outline the prevalent research themes and elements associated with this topic.

CiteSpace could perform scientometric analysis, which utilizes several metrics, such as the H index, to assess the volume and impact of academic output from researchers and institutions. The degree metric in scientometric analysis indicates the level of communication and collaboration between authors, institutions, or countries. Intermediary centrality assesses the importance of nodes within the research cooperation network. Additionally, the half-life parameter reflects the persistence of research activity over time at an institution (Chen, 2006).

The CitNetExplorer could be used to analyze publications' citation networks. By the clustering function, closely connected studies were grouped into the same cluster. In addition, we used the “drilling down” function to identify the longest path of highly cited or recent studies. This longest path illustrates how subsequent researchers have cited a study, forming a citation network that propagates original ideas to contemporary research through multiple references. This function helps to explore the theoretical basis and development of the field. Compared with traditional bibliometric methods, these three software tools can complement each other and provide a more readable visual analysis of the scientific knowledge graphs. Key procedures and methods are summarized in **Figure 1**.

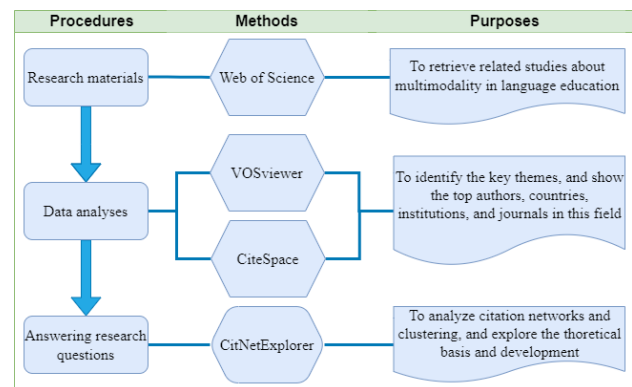


Figure 1. Key procedures and methods.

4. Results

4.1 RQ1: What is the year-based trend of in publications and citations included?

On March 26, 2024, we conducted a search of the Web of Science Core Collection using relevant indexes. The total results included 701 publications.

The Web of Science data showed a yearly trend in publications on multimodality in language education. As can be seen from **Figure 2**, except for 2016, the research on multimodality of language education

has shown an increasing trend since 2008. The number of the publications has increased dramatically since around 2017. The peak was recorded for 2022: 141 publications and 1575 citation networks. At that time, there was a global outbreak of COVID-19, and multimodality in long distance learning has attracted attention. In 2023, when the world enters the post-COVID-19 pandemic era, the number of publications declined slightly, but the number of citations continued to rise. As of 2024, there have been 19 publications recorded up to the data collection date.

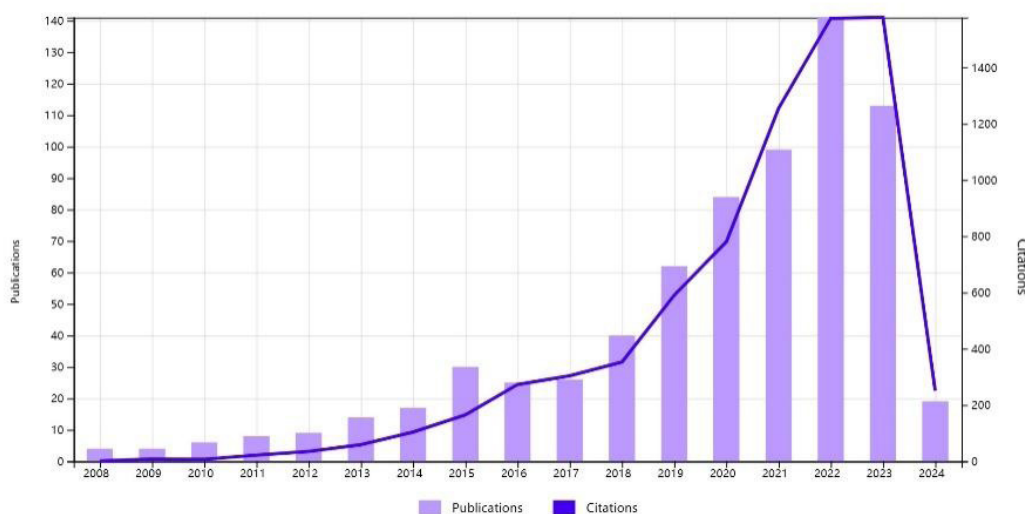


Figure 2. Trend of publications and citations per year.

Next, we examined the Web of Science categories associated with these results. The top ten published categories were Education Educational Research (N = 438, 62.482%), Linguistics (N = 370, 52.781%), Language Linguistics (N = 209, 29.815%), Psychology Experimental (N = 22, 3.138%), Neurosciences (N = 15, 2.140%), Psychology Multidisciplinary (N = 15, 2.140%), Humanities Multidisciplinary (N = 14, 1.997%), Computer Science Interdisciplinary Applications (N = 13, 1.854%), Social sciences Interdisciplinary (N = 13, 1.854%) and Computer Science Artificial Intelligence (N = 9, 1.284%). The predominance of studies in education and linguistics indicates the important position of multimodal approaches in language teaching and research. The involvement of fields such as Experimental Psychology and Neurosciences suggests researchers

are examining the effects of multimodal teaching on learners' psychology and brain functions from a cross-disciplinary perspective. Furthermore, the engagement with Computer Science, especially Artificial Intelligence, signals a future where multimodal language education might rely on advanced technologies for pedagogical innovation and quality enhancement to a greater extent.

4.2 RQ2: What are the heated topics and research fields related to multimodality in language education?

We then utilized VOSviewer's keyword co-occurrence function to identify the heated topics related to the study and determine which aspects to include. We imported the data, selected "co-occurrence" as the analysis type, "full counting" as the counting meth-

od, and “all keywords” as the unit of analysis. We set the minimum number of keyword occurrences to “eight”. As a result, 105 items met the threshold. The

author’s keyword co-occurrence visualization has a total of 5 clusters, with 1816 links and 3633 total link strength (**Figure 3**).

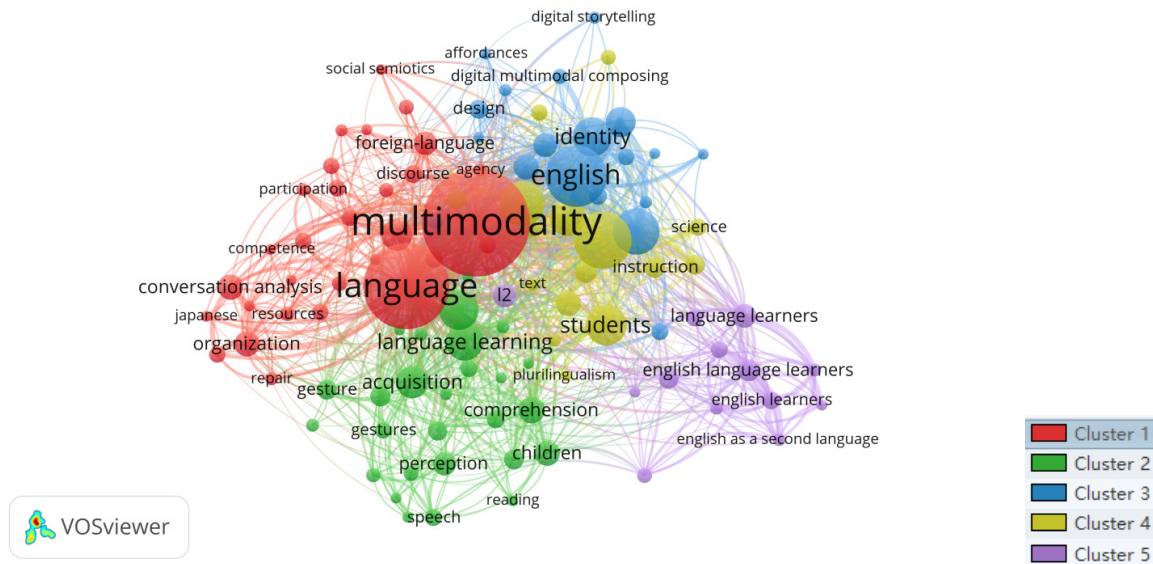


Figure 3. A clustering map of keywords.

The heated topics related to multimodality in language education, as identified through a bibliometric analysis using VOSviewer, are categorized into five clusters based on keyword co-occurrence from bibliographic data. Cluster 1 includes the keywords “multimodality”, “language” and “conversation analysis”, and focuses on the integration of multimodal approaches and their impact on language teaching. The second cluster concludes the keywords “language learning”, “acquisition” and “comprehension”, and deals with the cognitive processes involved in language learning, particularly among younger learners. Cluster 3 mainly includes the keyword “multiliteracies”, centers on the use of digital tools and the development of digital literacies. The focus of cluster 4 is on broader educational frameworks and the professional development of teachers, as we can see the keywords “education” and “instruction”. The final cluster mainly addresses aspects of learner engagement and assessment in language education. Each of these clusters reflects a different facet of how multimodality is influencing language education and is also a heated topic.

We then used the CiteSpace software to get other parameter indicators which exist for a specific evaluation, such as centrality, degree, and year of its earliest appearance. The most used keywords were “Multimodality” (156 publications), “Language” (116 publications), “English” (75 publications), “Literacy” (68 publications) and “Multiliteracies” (52 publications). **Table 1** shows the most the 30 most used keywords in the field of multimodality in language education.

In the field of multimodality in language education, seven keywords stand out with centrality values over 0.1 among the 30 most used keywords. They are “Language”, “English”, “Language learning”, “Acquisition”, “Children”, “Perception”, and “English language learners”. These 7 important keywords are closely connected with the phrase content of “multimodality in language education” and are also the basic elements of this research. Combined with its early appearance, high frequency, and large centrality, it can be inferred that these 7 keywords are the basic research fields of multimodal language education.

Table 1. The 30 most used keywords in the field of multimodality in language education.

Keyword	Frequency	Centrality	Degree	Total Link Strength	Year
Multimodality	156	0.01	13	490	2018
Language	116	0.14	51	429	2008
English	75	0.13	56	311	2008
Literacy	68	0.06	46	293	2008
Multiliteracies	52	0.02	28	223	2011
Education	50	0.07	46	209	2013
Students	44	0.07	54	220	2015
Learners	42	0.04	35	173	2016
Identity	41	0.06	39	164	2018
Language learning	39	0.14	57	134	2010
Acquisition	32	0.13	68	150	2009
Classroom	31	0.09	52	132	2008
Pedogagy	29	0.02	22	116	2009
Conprehension	25	0.07	58	124	2009
Knowledge	23	0.04	33	102	2011
Technology	23	0.03	28	98	2017
Organization	23	0.03	35	89	2018
Children	23	0.16	42	84	2014
Conversation analysis	23	0.02	30	82	2015
Language learners	22	0.06	43	141	2011
12	21	0.01	28	123	2019
Foreign language	21	0.05	45	93	2011
Perception	21	0.26	65	69	2010
English language learners	19	0.14	59	144	2011
English-language learners	19	0	9	88	2012
2nd-language	18	0.07	48	86	2015
Instruction	18	0.03	23	82	2009
Multilingualism	17	0	10	89	2019
Gesture	17	0.03	33	87	2014
Impact	17	0.01	14	87	2018

4.3 RQ3: What are the top 10 countries, organizations, authors, and journals among the studies on multimodality in language learning?

As shown in **Table 2**, we found that the United States, China, England, Spain, Australia, Canada, Brazil, Japan, France and Germany are the top ten countries in terms of the number of publications. The United States leads with approximately 27% of publications, followed by China with about 14%. These

countries not only dominate in publication volume but also show high levels of connectivity and centrality in the academic cooperation network, indicating active collaboration and communication in this research field. The half-life of research outputs from China is 13.5, suggesting that research contributions are relatively enduring; whereas Australia has the shortest half-life at 6.5, indicating a faster pace of research turnover.

Table 2. Top ten countries in the field of multimodality in language education.

Country	Publications(%)	Centrality	Degree	Half-Life
The United States	190(27.10%)	0.37	22	11.5
China	101(14.41%)	0.25	16	13.5
England	60(8.56%)	0.32	18	11.5
Spain	59(8.42%)	0.18	17	10.5
Australia	45(6.42%)	0.08	10	6.5
Canada	43(6.13%)	0.10	8	12.5
Brazil	29(4.14%)	0.00	2	10.5
Japan	21(3.00%)	0.00	6	7.5
France	17(2.43%)	0.06	6	9.5
Germany	16(2.28%)	0.03	18	9.5

With regard to the institutions (**Table 3**), we found the City University of Hong Kong, the University of Hong Kong, University College London, the University of British Columbia, and Macquarie University emerge as leaders in publication volume. Institutions like the Education University of Hong Kong and University College London show higher degrees of connectivity, suggesting their active roles in fostering academic exchanges and collaborations.

With regard to the authors (**Table 4**), we found that there isn't a highly established group of prolific

authors yet, as seen by the relatively small number of publications per author. The top authors, like Dooly M and Hafner CA, do have publications that are cited fairly often, indicating they have made notable contributions to the field. However, the overall picture shows low collaboration and weak connection strength among researchers, with most appearing to work independently. This can be reflected in the lower centrality and degree values, suggesting that the field may still be in the early stages of developing collaborative research networks.

Table 3. Top ten institutions in the field of multimodality in language education.

Category	Frequency	Centrality	Degree	Half-Life
City University of Hong Kong	14	0.01	2	7.5
University of Hong Kong	12	0.00	3	9.5
University College London	11	0.03	7	4.5
University of British Columbia	11	0.01	6	7.5
Macquarie University	11	0.01	3	7.5
New York University	10	0.02	6	7.5
University of Miami	10	0.02	2	0.5
Newcastle University	10	0.00	5	3.5
Education University of Hong Kong	9	0.03	11	2.5
Hong Kong Polytechnic University	9	0.01	10	4.5

Table 4. Top ten authors in the field of multimodality in language education.

Author	Number of Publications	Total Citations	Citation Average	Centrality	Degree
Dooly M	9	183	20.33	0.00	5
Grapin SE	9	54	6.00	0.00	2
Ho WYJ	8	68	8.50	0.00	1
Llosa L	7	51	7.29	0.00	2
Wigham CR	6	102	17.00	0.00	2
Satar M	5	33	6.60	0.00	1
Zheng D	5	140	28.00	0.00	5
Balaman U	5	13	2.60	0.00	5
Tai KWH	5	43	8.60	0.00	1
Hafner CA	5	459	91.80	0.00	3

As shown in **Table 5**, we also listed the top ten journal names. We can find all ten journals in the Scopus source list, and they have achieved high quartile rankings on Clarivate’s Master journal list for the year 2022. The results show that relevant studies are highly distributed in different publishing journals as the centrality of each journal is very low. What these journals have in common is their focus on the way languages are learned and taught, specifically integrating technical and psychological insights into educational practice.

These journals are distributed in different countries, but most are based in the UK and the US.

Figure 4 presents a bibliographic analysis of countries, organizations, authors and journals of studies on multimodality in language education. This visualization emphasizes the networking, collaboration, and interdisciplinary efforts of academic interaction that characterize the convergence of research in language teaching, technological integration, and pedagogical innovation.

Table 5. Top ten journals in the field of multimodality in language education.

Journal	Total Publications	Total Citations	Quartile	Impact Factor (2022)	Centrality	Country
System	37	534	Q1	6.00	0.00	United Kingdom
Language Learning and Technology	23	534	Q1	3.80	0.00	United States
Journal of the European Association for Computer Assisted Language Learning (ReCALL)	19	598	Q2	4.50	0.00	United Kingdom
TESOL Quarterly	19	480	Q2	3.20	0.00	United States
Computer Assisted Language Learning	17	297	Q1	7.00	0.00	United Kingdom
Modern Language Journal	17	146	Q2	4.90	0.00	United States
RELC Journal	14	100	Q1	3.00	0.00	United Kingdom
Linguistics and Education	12	127	Q4	1.60	0.00	Netherlands
Frontiers in Psychology	12	84	Q1	3.80	0.00	Switzerland
International Journal of Bilingual Education and Bilingualism	11	155	Q2	2.80	0.00	United Kingdom

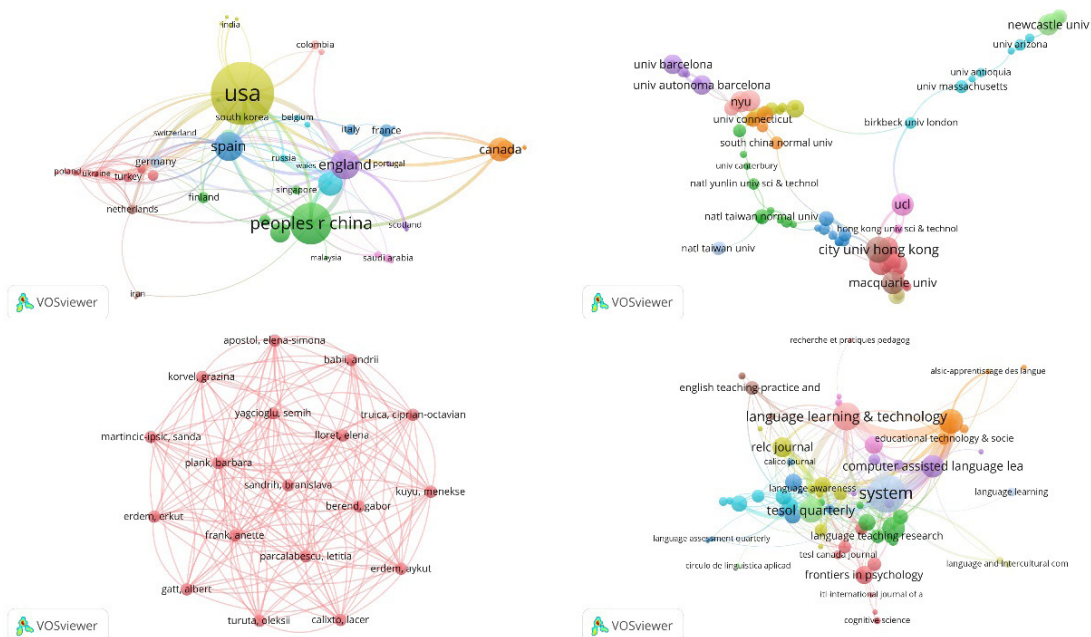


Figure 4. Connection between countries, organizations, authors and journals in this topic.

4.4 RQ4: How does multimodal pedagogy affect students' language learning?

We then used CiteNetExplorer's clustering function and grouped each publication within the citation network into several categories. To visually differentiate these groups, we assigned different colors to each and illustrated the connections between groups with colored lines. As shown in **Figure 4**, of the 701 publications and their references, we organized them into seven clusters. An additional 375 publications were not assigned to any cluster, as the threshold for forming a group was set at a minimum of ten publi-

cations. We choose the number of publications to be shown in the citation network as 100 (**Figure 5**).

Table 6 shows the citation network information of the seven major groups. The theme of Group 1 is multiple modes and pedagogies in language education. The theme of Group 2 is video-mediated interaction. The theme of Group 3 is multimodal input. The theme of Group 4 is multimodal approach to literacy teaching. The theme of Group 5 is practices in multiliteracy education. The theme of Group 6 is learner engagement and assessment. The theme of Group 7 is concerned with language learning across social media platforms.

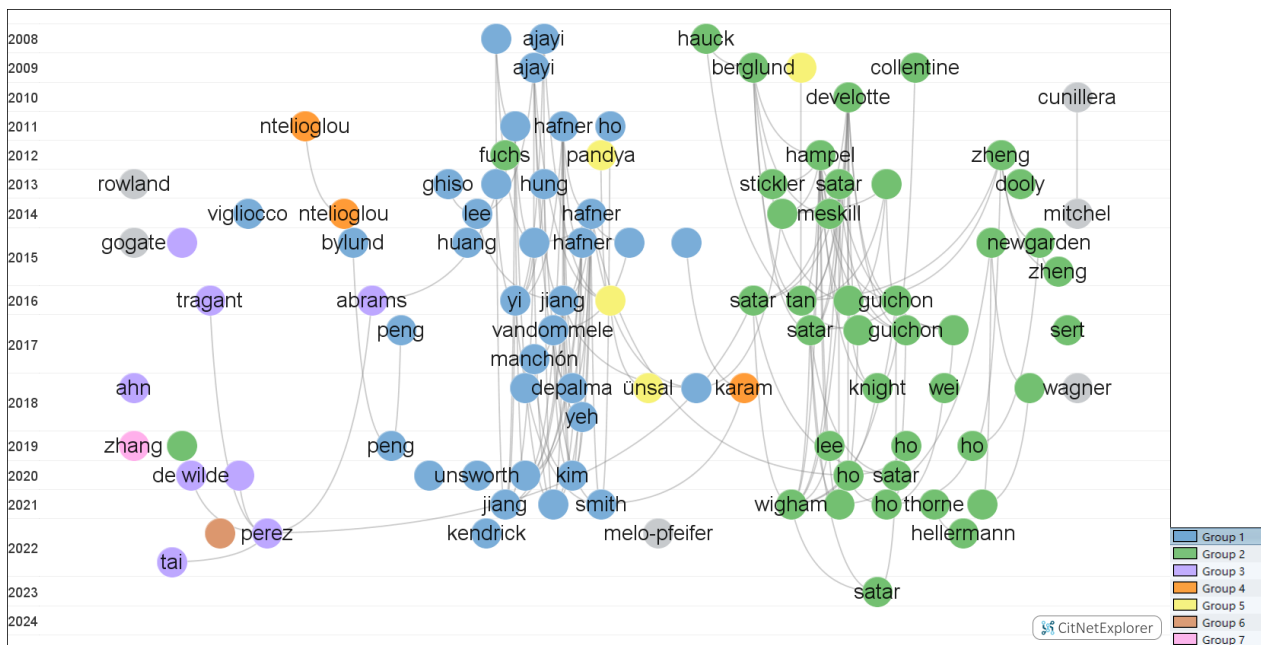


Figure 5. Citation network about multimodality in language education.

Table 6. Information about the seven major groups.

Group	Color	No. of Publications	No. of Citation Links	No. of Publications ≥ 4 Citations
1	Blue	134	334	23
2	Green	110	263	26
3	Purple	25	33	3
4	Orange	18	19	2
5	Yellow	17	20	2
6	Brown	12	14	0
7	Pink	10	9	1

We analyzed Group 1 and identified that the earliest author, Ajayi, led the longest citation path, with

all the publications discussing the influence of multi-modality on language education (**Figure 6**).

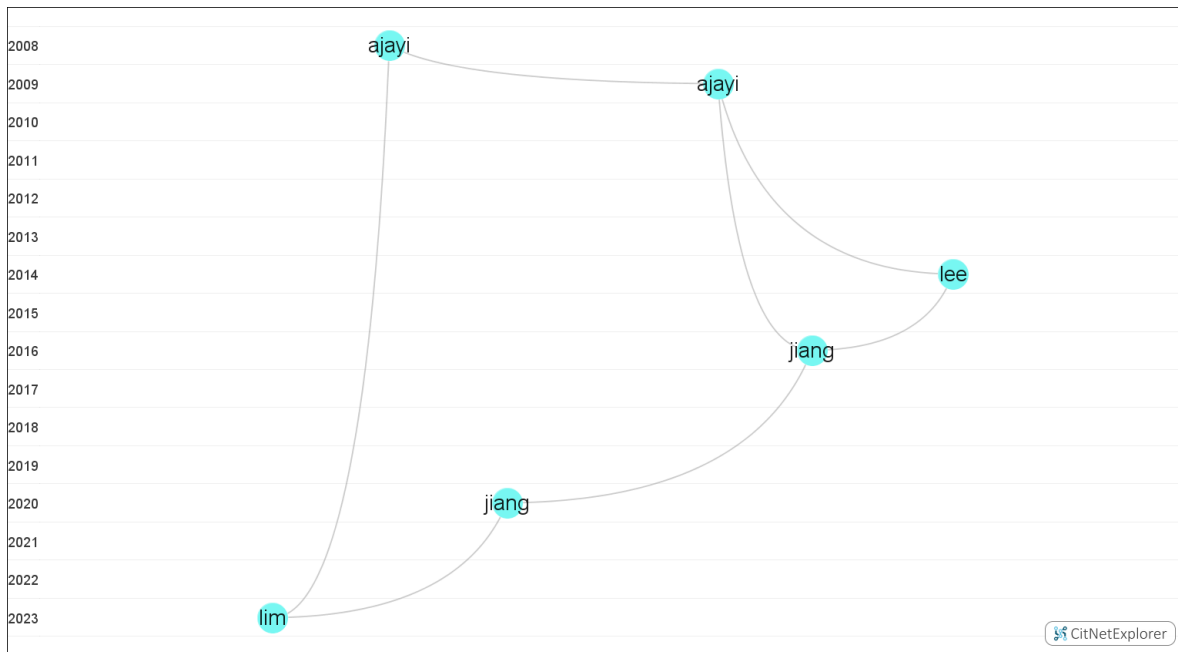


Figure 6. The longest path led by Ajayi in group1.

Ajayi proposed that high school language learners could use multimodal resources, such as texts, photographs, and video clips, to convey their identity and subjectivity in meaning-making engagements (Ajayi, 2008). Based on the social semiotic framework of Kress and van Leeuwen, Ajayi then analyzed and interpreted students’ annotated drawings for meaning. This analysis demonstrated that students can be given more chances for varied interpretations by multimodal texts (Ajayi, 2009). Further research showed that multimodal composing (MC), particularly in arts integration activities like online literature circles and digital storytelling, can inspire at-risk EFL students who lack confidence and motivation (H.-C. Lee, 2014). Jiang and Luk reported that the use of video essays in MC creates a motivating learning environment for contemporary language learners, allowing them to experience seven key factors: challenge, curiosity, control, fantasy, competition, cooperation, and recognition during learning process (Jiang & Luk, 2016). Additionally, it was highlighted that drawing on multiple modes from everyday media experiences can foster digital empathy, which is de-

scribed as the cognitive and emotional capacity to be reflective and socially responsive while effectively using digital media. This development helps students become more active and responsible online participants (Jiang & Gao, 2020). Lim et al. concluded that multimodal pedagogy involves bringing together a range of representations and comments and effectively using meaning creation resources to design student learning experiences (F. V. Lim et al., 2023).

The citation network highlights the influential role of the initial author, Ajayi, whose work is cited across all publications. This network also illustrates the relationships and interconnections among various authors, underscoring the impact that multimodal resources and pedagogies have on language education.

4.5 RQ5: How does video-mediated interaction enhance language education?

We drilled down Group 2 and found the second longest path led by the earliest authors Develotte et al. All the publications discussing the impact of video on language education (**Figure 7**).

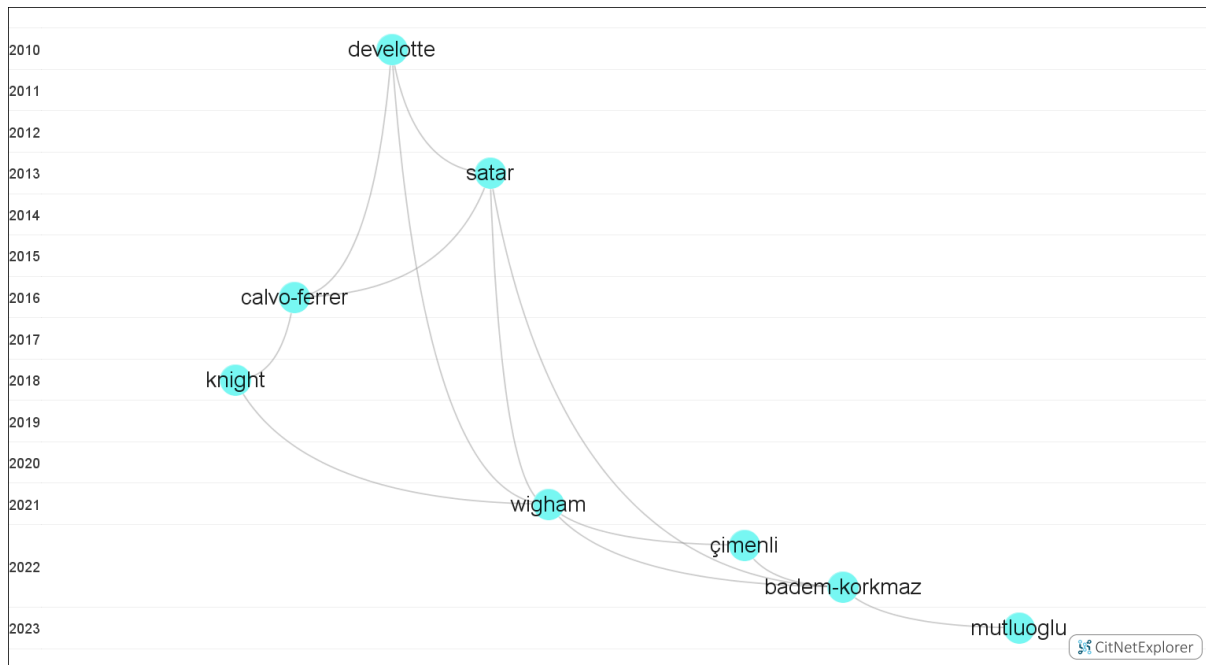


Figure 7. The longest path led by Develotte in group 2.

Develotte et al. proposed that a teacher must develop specific semio-pedagogical skills in video-conferencing (DVC) contexts. This means that the teacher should learn how to coordinate pedagogical actions across various means and tools. In the case of DVC, webcamming video can be used to create presence at a distance, and develop the quality of the pedagogical relationship (Develotte et al., 2010). To improve social presence and optimize learning experience, eye-contact in online communication (Satar, 2013) and navigational screen-based resources (Knight et al., 2018) was also highlighted. In addition, the print mode (resource sheets, text chat, URLs, online collaborative writing spaces) can be used for higher-level instructional actions in videoconferencing context, which requires teachers to manage these complexities and organize semio-pedagogical activities in synchronous online teaching (Wigham & Satar, 2021). An interactional device referred to as “rolling the ball back” (RBB) was proposed. This technique invites a co-participant to maintain the current topic of discussion by reciprocating a previously asked question in video-mediated virtual exchanges (Çimenli et al., 2022). In cases of lack of response following teacher questions in large, remote, syn-

chronous, video-mediated L2 classrooms, teachers should employ diverse interactional practices and screen-based multimodal resources to maintain the flow of the current activity (Badem-Korkmaz & Balaman, 2022). In addition, in video-mediated post-observation meetings for pre-service teachers’ online practicum teaching, the use of a digital observation tool (Video Enhanced Observation, VEO) was discussed. This tool aids teacher trainers in guiding reflective post-observation discussions with pre-service teachers, enhancing the feedback process and supporting professional development (Kanat Mutluoğlu & Balaman, 2023).

All publications highlight the critical role of video in facilitating multimodal language instruction, the need for teachers to adopt a series of semio-instructional skills and interactive strategies to effectively engage students in online language learning environments.

4.6 RQ6: How do social media promote language education?

We drilled down Group 7 and found all the publications discussing language learning across social media platforms. However, due to the recent research

age, small number of literatures, and scattered citation relationships, we failed to find the longest path containing more than 3 publications.

Social media platforms such as WeChat, TikTok, and MicroBlog make knowledge sharing easy and unobtrusive for individuals. By studying an Instagram online community where members share narratives, stories, memories, and experiences of learning a foreign language, researchers observed enhancements in learners' language skills (Gomes Junior, 2020). Additionally, several applications can be used by learners to enhance their speaking skills. These applications not only focus on speaking but also cover vocabulary, grammar, conversation, and more to support speaking practice (Kuning, 2020). Social media platforms also facilitate collaboration and knowledge sharing, which improves learning outcomes as students focus on solving problems that can be generalized to other tasks (Mondahl & Razmerita, 2014). In addition, social media can support the development of intercultural awareness, audience awareness, and particular literacies (Reinhardt, 2019a). Overall, using social networks help learners increase motivation, produce positive attitudes, and improve learning outcomes (Z. Yu, 2024). The researchers also recommend that educators approach multimodal composition as advocacy. Since all texts have advocacy elements, teachers should help students recognize their roles and teach them to craft texts effectively to become socially aware writers and communicators (Warren-Riley & Hurley, 2017). Additionally, teachers should encourage students to use their digital social platforms strategically to align with their interests and needs.

5. Discussion

5.1 Public trend

Since the COVID-19 pandemic, multimodal language education has become increasingly popular. Prior to 2017, there was limited use of multimodal research, but the pandemic gave a boost to distance learning, triggering a surge in research into digital multimodal resources to improve language educa-

tion. The shift reflects a broader trend in education toward more flexible and engaging approaches to learning. The use of various multimedia and interactive platforms has proved particularly effective in engaging students more deeply (*Zhonggen Yu & Yu, 2021). As evidenced by the peak in publications and citations in 2022, this growing field of study has expanded significantly, reflecting the global shift towards more integrated and technologically advanced teaching methods.

Current research on multimodal language education covers topics ranging from classroom technology applications to cognitive processes in language learning. These studies combine insights from education, linguistics, psychology and technology and are characterized by an interdisciplinary nature. In terms of geographical and institutional contributions, the United States and China lead the way in the number of publications, which highlights the global interest and collaborative efforts in this area of research. The participation of different countries and institutions in the multimodal study of language education demonstrates its relevance in different educational and cultural contexts. This trend points to a promising future for research and practice in the field, underscoring the need for continued innovation and collaboration. At the same, research shows educational approaches should be adapted to keep pace with the changing needs of learners and educators around the world, ensuring that education remains effective and engaging (Rapanta et al., 2020).

5.2 Digital multimodality in language learning

Video-mediated interaction and social media have created a comprehensive digital ecosystem that supports all aspects of language learning and acquisition. For example, educational video and video conferencing enhance the language experience by providing real-time visual and auditory stimuli (Z. Yu, 2022b). They are particularly useful for improving speaking and listening skills, but are often challenging in a purely online environment (Bailey & Rakushin Lee, 2020). In the future, sora, as an AI tool for video generation, can also be used by teachers and students

for multimodal writing in English classes. As a complement, social media platforms expand the learning space into more informal, everyday interactions and allow learners to practice and apply language skills in a variety of contexts (Reinhardt, 2019b). This not only helps to practice the language, but also deepens cultural understanding and intercultural communication skills (Yang et al., 2024).

The integration of these two multimodal media enables learners to receive structured instruction through video, while practicing and interacting in a richer social environment provided by social media. TikTok (social media based on making and sharing videos, which was popular during the COVID-19 pandemic), is recommended to be introduced into the curriculum as a teaching tool because of its positive educational potential (Escamilla-Fajardo et al., 2021). Such an approach aligns with Vygotsky's social constructivist theory (Vygotskij & Cole, 1981), emphasizing learning as a socially mediated activity. It supports learners' development within the Zone of Proximal Development (ZPD) by providing scaffolding when needed and allowing for independent, peer-mediated practice.

5.3 Multimodal pedagogies in language learning

Multimodal approaches in language education are based on the idea that different modes of information presentation can meet different learning preferences and needs, enhancing comprehension and memory by providing multiple ways of engaging content to accommodate visual, auditory, and kinesthetic learners (Ganapathy & Seetharam, 2016). This means that multimodal teaching assigns cognitive load to the linguistic and visual features associated with a particular text. Learners can allocate less ability to processing forms and more to the conceptual and contextual features of the information to be learned (Li, 2020). By integrating multicultural materials and contexts, multimodal pedagogies can also improve learners' ability to operate across different cultural norms and linguistic contexts, thereby preparing students for real-world interactions (F. V. Lim et al., 2022).

Teachers should constantly update their digital literacy skills to keep pace with technological advances. Research has shown that digital tools for multimodal teaching, such as interactive whiteboards, digital storytelling tools, can help improve the English proficiency of students, which should be widely used (Hur & Suh, 2012). At the same time, educators should also balance the use of various models to ensure that technology integration enhances learning outcomes and maintains high quality content in blended teaching so that technology integration truly contributes to instructional value (Skulmowski & Xu, 2022). Overall, to achieve the shift of student-centered learning, creative multimodal approaches that promote greater engagement and motivation should be valued (E. Lee & Hannafin, 2016). With regard to ethical issues, potential challenges such as the digital divide must be addressed to ensure that all students have equitable access to technology to prevent the education gap from widening (Azionya & Nhedzi, 2021). At the meanwhile, a collaborative teaching approach is critical, encouraging educators to share best practices within and across institutions and to innovate in multimodal language education.

6. Conclusion

6.1 Major Findings

This study explored the role of multimodality in language education through bibliometric analysis. Major findings include continued growth in multimodal research, driven by the need to adapt education systems as a result of the COVID-19 pandemic. Compared with traditional teaching methods, multimodality facilitates language learning by integrating multiple modes of media such as visual, audio, gestural, and spatial arrangements, thereby improving increasing learner comprehension and engagement. Among them, video media interaction and the use of social media are effective strategies to promote continuous interaction between learners, which is essential for language acquisition and learning.

We should leverage multimodal approaches to prepare students for the digital world. The findings

highlighted that educators should remain updated on the latest digital tools and methods, and focus on the issue of ethical technology use and online safety to ensure students are aware of their responsibilities and potential risks when using digital tools for learning. In addition, policymakers should invest in technological infrastructure and encourage experimentation with new teaching tools to support multimodal language education. Addressing the digital divide and providing subsidies to low-income families are also urgent issues.

6.2 Limitations

This study acknowledges several limitations. It included only publications from specific databases and may omit other relevant literature on multimodality in language education. Also, rapid advances in digital technology mean that the latest innovations may not be fully reflected in the review literature. It should also be considered that potential biases in the data sources and the fast-paced evolution of technology might affect the relevance of the findings over time.

6.3 Future Research Directions

Future research should conduct longitudinal studies to carefully assess the long-term effects of multimodal education on students' language acquisition and cognitive development. As theories and technologies continue to evolve, research should also explore new tools and platforms to improve multimodal language education and use advanced theories to guide teaching practice. At the same time, to promote educational equity, it is important to consider the ethical impact and accessibility of these theories and technologies.

Author contributions

Conceptualization, YL; data curation, YL; formal analysis, YL; funding acquisition, YL; investigation, YL; methodology, YL; resources, YL; software, YL; visualization, YL; writing—original draft, YL; writ-

ing—review and editing, YL.

Acknowledgment

The author would like to express deepest gratitude to everyone who assisted her throughout this journey.

Conflict of interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

References

- Adetayo, A.J., Enamudu, A.I., Lawal, F.M., et al., 2024. From text to video with AI: The rise and potential of Sora in education and libraries. *Library Hi Tech News*. ahead-of-print(ahead-of-print).
DOI: <https://doi.org/10.1108/LHTN-02-2024-0028>
- Ajayi, L., 2008. Meaning-making, multimodal representation, and transformative pedagogy: An exploration of meaning construction instructional practices in an ESL high school classroom. *Journal of Language, Identity & Education*. 7(3–4), 206–229.
DOI: <https://doi.org/10.1080/15348450802237822>
- Ajayi, L., 2009. English as a second language learners' exploration of multimodal texts in a junior high school. *Journal of Adolescent & Adult Literacy*. 52(7), 585–595.
DOI: <https://doi.org/10.1598/JAAL.52.7.4>
- Aziona, C.M., Nhedzi, A., 2021. The digital divide and higher education challenge with emergency online learning: Analysis of tweets in the wake of the COVID-19 lockdown. *Turkish Online Journal of Distance Education*. 22(4), 164–182.

- DOI: <https://doi.org/10.17718/tojde.1002822>
- Badem-Korkmaz, F., Balaman, U., 2022. Eliciting student participation in video-mediated EFL classroom interactions: Focus on teacher response-pursuit practices. *Computer Assisted Language Learning*.
- DOI: <https://doi.org/10.1080/09588221.2022.2127772>
- Baggett, P., 1984. Role of temporal overlap of visual and auditory material in forming dual media associations. *Journal of Educational Psychology*. 76(3), 408–417.
- DOI: <https://doi.org/10.1037/0022-0663.76.3.408>
- Bailey, D., Rakushin Lee, A., 2020. Learning from experience in the midst of COVID-19: Benefits, challenges, and strategies in online teaching. *CALL-EJ*. 21(2), 178–198.
- Balaman, S., 2018. Digital storytelling: A multimodal narrative writing genre. *Journal of Language and Linguistic Studies*. 14(3), 202–212.
- Benson, V., 2008. Is the digital generation ready for Web 2.0-based learning? The open knowledge society. A computer science and information systems manifesto. Springer: Berlin Heidelberg.
- DOI: https://doi.org/10.1007/978-3-540-87783-7_56
- Bonwell, C.C., Eison, J.A., 1991. Active learning: Creating excitement in the classroom. 1991 ASHE-ERIC Higher Education Reports. Office of Educational Research and Improvement: Washington, DC.
- Chen, C., 2006. CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*. 57(3), 359–377.
- DOI: <https://doi.org/10.1002/asi.20317>
- Çimenli, B., Sert, O., Jenks, C., 2022. Topic maintenance in video-mediated virtual exchanges: Rolling the ball back in L2 interactions. *System*. 108, 102834.
- DOI: <https://doi.org/10.1016/j.system.2022.102834>
- Cope, B., 2006. *Multiliteracies: Literacy learning and the design of social futures*. Routledge: London.
- Cope, B., Kalantzis, M., 2009. A grammar of multimodality. *International Journal of Learning*. 16(2), 361–426.
- DOI: <https://doi.org/10.18848/1447-9494/cgp/v16i02/46137>
- Danielsson, K., Selander, S., 2016. Reading multimodal texts for learning—A model for cultivating multimodal literacy. *Designs for Learning*. 8(1), 25–36.
- DOI: <https://doi.org/10.16993/df.72>
- Develotte, C., Guichon, N., Vincent, C., 2010. The use of the webcam for teaching a foreign language in a desktop videoconferencing environment. *ReCALL*. 22(3), 293–312.
- DOI: <https://doi.org/10.1017/S0958344010000170>
- Erikson, E.H., 1968. *Identity: Youth and crisis*. W. W. Norton & Company: New York.
- Escamilla-Fajardo, P., Alguacil, M., López-Carril, S., 2021. Incorporating TikTok in higher education: Pedagogical perspectives from a corporal expression sport sciences course. *Journal of Hospitality, Leisure, Sport & Tourism Education*. 28, 100302.
- DOI: <https://doi.org/10.1016/j.jhlste.2021.100302>
- Ganapathy, M., Seetharam, S.A., 2016. The effects of using multimodal approaches in meaning-making of 21st century literacy texts among ESL students in a private school in Malaysia. *Advances in Language and Literary Studies*. 7(2), 143–155.

- García, O., Flores, N., Spotti, M., 2017. *The Oxford handbook of language and society*. Oxford University Press: Oxford.
- Gomes Junior, R.C., 2020. Instanarratives: Stories of foreign language learning on Instagram. *System*. 94, 102330.
DOI: <https://doi.org/10.1016/j.system.2020.102330>
- Gruszczynska, A., Merchant, G., Pountney, R., 2013. “Digital Futures in Teacher Education”: Exploring open approaches towards digital literacy. *Electronic Journal of E-Learning*. 11(3), 193–206.
- Hampel, R., Stickler, U., 2005. New skills for new classrooms: Training tutors to teach languages online. *Computer Assisted Language Learning*. 18(4), 311–326.
DOI: <https://doi.org/10.1080/09588220500335455>
- Hampel, R., Stickler, U., 2012. The use of videoconferencing to support multimodal interaction in an online language classroom. *ReCALL*. 24(2), 116–137.
DOI: <https://doi.org/10.1017/S095834401200002X>
- Hegarty, M., Kriz, S., Cate, C., 2003. The roles of mental animations and external animations in understanding mechanical systems. *Cognition and Instruction*. 21(4), 209–249.
DOI: https://doi.org/10.1207/s1532690x-ci2104_1
- Hur, J.W., Suh, S., 2012. Making learning active with interactive whiteboards, podcasts, and digital storytelling in ELL classrooms. *Computers in the Schools*. 29(4), 320–338.
DOI: <https://doi.org/10.1080/07380569.2012.734275>
- Illeris, K., 2008. *How we learn: Learning and non-learning in school and beyond* (2nd. ed.). Routledge: London.
- Jewitt, C., 2005. Multimodality, “Reading”, and “Writing” for the 21st Century. *Discourse: Studies in the Cultural Politics of Education*. 26(3), 315–331.
DOI: <https://doi.org/10.1080/01596300500200011>
- Jewitt, C., Kress, G.R., 2003. *Multimodal literacy*. Peter Lang Group: Lausanne.
- Jiang, L., Gao, J., 2020. Fostering EFL learners’ digital empathy through multimodal composing. *RELC Journal*. 51(1), 70–85.
DOI: <https://doi.org/10.1177/0033688219898565>
- Jiang, L., Luk, J., 2016. Multimodal composing as a learning activity in English classrooms: Inquiring into the sources of its motivational capacity. *System*. 59, 1–11.
DOI: <https://doi.org/10.1016/j.system.2016.04.001>
- Kanat Mutluoğlu, A., Balaman, U., 2023. The use of video enhanced observation in video-mediated post-observation conversations on pre-service EFL teachers’ online practicum teaching. *System*, 118, 103151.
DOI: <https://doi.org/10.1016/j.system.2023.103151>
- Khlaif, Z.N., Salha, S., 2021. Using TikTok in education: A form of micro-learning or nano-learning? *Interdisciplinary Journal of Virtual Learning in Medical Sciences*. 12(3), 213–218.
DOI: <https://doi.org/10.30476/ijvlms.2021.90211.1087>
- Knight, J., Dooly, M., Barberà, E., 2018. Multimodal meaning making: Navigational acts in online speaking tasks. *System*. 78, 65–78.
DOI: <https://doi.org/10.1016/j.system.2018.07.007>
- Kress, G.R., Van Leeuwen, T., 2001. *Multimodal discourse: The modes and media of contemporary communication*. Oxford University Press:

- Oxford.
- Kuning, D.S., 2020. Applications of social media to learn speaking: Applications of social media to learn speaking. *Edukasi Lingua Sastra*. 18(1), 77–85.
DOI: <https://doi.org/10.47637/elsa.v18i1.227>
- Lee, H., Mayer, R.E., 2015. Visual aids to learning in a second language: Adding redundant video to an audio lecture. *Applied Cognitive Psychology*. 29(3), 445–454.
DOI: <https://doi.org/10.1002/acp.3123>
- Lee, H.C., 2014. Using an arts-integrated multimodal approach to promote english learning: A case study of two Taiwanese junior college students. *English Teaching: Practice and Critique*. 13(2), 55–75.
- Li, M., 2020. Multimodal pedagogy in TESOL teacher education: Students' perspectives. *System*. 94, 102337.
DOI: <https://doi.org/10.1016/j.system.2020.102337>
- Lim, F.V., Toh, W., Nguyen, T.T.H., 2022. Multimodality in the English language classroom: A systematic review of literature. *Linguistics and Education*. 69, 101048.
DOI: <https://doi.org/10.1016/j.linged.2022.101048>
- Lim, F.V., Towndrow, P.A., Min Tan, J., 2023. Unpacking the teachers' multimodal pedagogies in the primary English language classroom in Singapore. *RELC Journal*. 54(3), 729–743.
DOI: <https://doi.org/10.1177/00336882211011783>
- Lim, J.M., 2020. Language in multimodal writing processes and performance: Developing multimodal writing tasks for L2 learners. Michigan State University: Michigan.
- Mayer, R.E., 1999. The promise of educational psychology: Learning in the content areas. Merrill: New York.
- Mayer, R.E., 2009. *Multimedia learning* (2nd ed). Cambridge University Press: Cambridge.
- Mayer, R.E., Moreno, R., 2002. Animation as an aid to multimedia learning. *Educational Psychology Review*. 14(1), 87–99.
DOI: <https://doi.org/10.1023/A:1013184611077>
- Mayer, R.E., Pilegard, C., 2014. Principles for managing essential processing in multimedia learning: Segmenting, pre-training, and modality principles. *The Cambridge Handbook of Multimedia Learning* (2nd ed.). Cambridge University Press: Cambridge. pp. 316–344.
DOI: <https://doi.org/10.1017/CBO9781139547369.016>
- Mondahl, M., Rasmussen, J., Razmerita, L., 2009. Web 2.0 applications, collaboration and cognitive processes in case-based foreign language learning. *Visioning and engineering the knowledge society. A web science perspective*. Springer: Berlin. pp. 98–107.
DOI: https://doi.org/10.1007/978-3-642-04754-1_11
- Mondahl, M., Razmerita, L., 2014. Social media, collaboration and social learning a case-study of foreign language learning. *Electronic Journal of E-learning*. 12(4), 339–352.
- Naghdipour, B., Eldridge, N.H., 2016. Incorporating social networking sites into traditional pedagogy: A case of Facebook. *TechTrends*. 60(6), 591–597.
DOI: <https://doi.org/10.1007/s11528-016-0118-4>
- Olagbaju, O.O., Popoola, A.G., 2020. Effects of audio-visual social media resources-supported instruction on learning outcomes in reading. *International Journal of Technology in Education*. 3(2), 92–104.
- Rapanta, C., Botturi, L., Goodyear, P., et al., 2020. Online university teaching during and after the Covid-19 crisis: Refocusing teacher presence

- and learning activity. *Postdigital Science and Education*. 2(3), 923–945.
DOI: <https://doi.org/10.1007/s42438-020-00155-y>
- Razmerita, L., Kirchner, K., Sudzina, F., 2009. Personal knowledge management: The role of Web 2.0 tools for managing knowledge at individual and organisational levels. *Online Information Review*. 33(6), 1021–1039.
DOI: <https://doi.org/10.1108/14684520911010981>
- Reinhardt, J., 2019. Social media in second and foreign language teaching and learning: Blogs, wikis, and social networking. *Language Teaching*. 52(1), 1–39.
DOI: <https://doi.org/10.1017/S0261444818000356>
- Ryan, J., Scott, A., Walsh, M., 2010. Pedagogy in the multimodal classroom: An analysis of the challenges and opportunities for teachers. *Teachers and Teaching*. 16(4), 477–489.
DOI: <https://doi.org/10.1080/13540601003754871>
- Satar, H.M., 2013. Multimodal language learner interactions via desktop videoconferencing within a framework of social presence: Gaze. *ReCALL*. 25(1), 122–142.
DOI: <https://doi.org/10.1017/S0958344012000286>
- Schär, S.G., Kaiser, J., Krueger, H. (editors), 1999. *Multimedia: The effect of picture, voice & text for the learning of concepts and principles*. Proceedings of HCI International (the 8th International Conference on Human-Computer Interaction) on Human-Computer Interaction: Ergonomics and User Interfaces; 1999 Aug 22–26; Munich, Germany.
- Skulmowski, A., Xu, K.M., 2022. Understanding cognitive load in digital and online learning: A new perspective on extraneous cognitive load. *Educational Psychology Review*. 34(1), 171–196.
DOI: <https://doi.org/10.1007/s10648-021-09624-7>
- Stein, P., 2007. *Multimodal pedagogies in diverse classrooms: Representation, rights and resources*. Routledge: London.
DOI: <https://doi.org/10.4324/9780203935804>
- The New London Group, 1996. *A pedagogy of multiliteracies: Designing social futures*. *Harvard Educational Review*. 66(1), 60–93.
DOI: <https://doi.org/10.17763/haer.66.1.17370n67v22j160u>
- Toohey, K., Dagenais, D., Fodor, A., et al., 2015. “That Sounds So Coool”: Entanglements of children, digital tools, and literacy practices. *TESOL Quarterly*. 49(3), 461–485.
DOI: <https://doi.org/10.1002/tesq.236>
- Unsworth, L., 2010. Resourcing multimodal literacy pedagogy: Toward a description of the meaning-making resources of language–image interaction. In: Locke T. (ed.). *Beyond the Grammar Wars*. Routledge: London.
- Van Eck, N.J., Waltman, L., 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 84(2), 523–538.
DOI: <https://doi.org/10.1007/s11192-009-0146-3>
- Van Eck, N.J., Waltman, L., 2014. CitNetExplorer: A new software tool for analyzing and visualizing citation networks. *Journal of Informetrics*. 8(4), 802–823.
DOI: <https://doi.org/10.1016/j.joi.2014.07.006>
- Vygotskij, L.S., Cole, M., 1981. *Mind in society: The development of higher psychological processes*. Harvard University Press: Harvard.
- Wang, Y., 2004. *Supporting synchronous distance language learning with desktop videoconferencing*. Language Learning & Technology.
- Warren-Riley, S., Hurley, E.V., 2017. *Multimodal*

- pedagogical approaches to public writing: Digital media advocacy and mundane texts. *Composition Forum*. 36.
- Wigham, C.R., Satar, M., 2021. Multimodal (inter) action analysis of task instructions in language teaching via videoconferencing: A case study. *ReCALL*. 33(3), 195–213.
DOI: <https://doi.org/10.1017/S0958344021000070>
- Yang, S., Xu, W., Liu, R., et al., 2024. Influencing and moderating variables in informal digital learning of English through a structural equation model. *Computer Assisted Language Learning*.
DOI: <https://doi.org/10.1080/09588221.2023.2280645>
- Yu, Z., 2022a. A meta-analysis and bibliographic review of the effect of nine factors on online learning outcomes across the world. *Education and Information Technologies*. 27(2), 2457–2482.
DOI: <https://doi.org/10.1007/s10639-021-10720-y>
- Yu, Z., 2022b. The effect of teacher presence in videos on intrinsic cognitive loads and academic achievements. *Innovations in Education and Teaching International*. 59(5), 574–585.
DOI: <https://doi.org/10.1080/14703297.2021.1889394>
- Yu, Z., 2024. A systematic review of motivations, attitudes, learning outcomes, and parental involvement in social network sites in education across 15 years. *Behaviour & Information Technology*.
DOI: <https://doi.org/10.1080/0144929X.2023.2260893>
- Yu, Z., Yu, L., 2021. A meta-analysis of facebook-assisted learning outcomes and their gender differences. *International Journal of Mobile and Blended Learning (IJMBL)*. 13(4), 1–20.
DOI: <https://doi.org/10.4018/IJMBL.2021100104>