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# Multimodal Semiotic Resources in Online Learning Environments: Meaning-Making from an Applied Linguistics Perspective

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ABSTRACT

***Purpose**: This study examines the use of multimodal semiotic resources in online applied linguistics courses and their role in supporting meaning-making, comprehension, and collaborative learning.*

***Subjects and Methods:** The study involved 120 undergraduate applied linguistics students who engaged with text-based slides, video lectures, infographics, podcasts, and discussion forums. A convergent parallel mixed-methods design was employed. Quantitative data were collected through surveys, usage logs, and comprehension tests, while qualitative data were gathered via semi-structured interviews and observation of forum interactions. Descriptive statistics, Pearson correlation, and thematic analysis were used to analyze the data, and findings were integrated through triangulation.*

***Results:** Slides and video lectures were the most frequently used and highly rated resources, showing strong positive correlations with comprehension scores. Infographics and discussion forums facilitated summarization, reflection, and collaborative knowledge construction, whereas podcasts were less effective when used in isolation. Students who integrated three or more modalities achieved higher comprehension, highlighting the benefits of multimodal learning. Forum participation promoted peer-to-peer negotiation of meaning, metacognitive awareness, and self-directed learning.*

***Conclusions:** The integration of multiple multimodal resources significantly enhances comprehension and meaning-making in online learning. Effective online courses should balance structured guidance, interactive engagement, and diverse resources, positioning multimodal approaches as essential for fostering collaborative, reflective, and self-directed learning in applied linguistics education.*

## INTRODUCTION

The rapid advancement of digital technologies has transformed the landscape of education, particularly in online learning environments (Roa et al., 2025; Kovtoniuk et al., 2022; Makda, 2025; García-Morales et al., 2021). With the proliferation of virtual classrooms, learning management systems, and synchronous and asynchronous communication tools, students and educators are increasingly relying on digital platforms for knowledge construction and communication. This shift necessitates a closer examination of how meaning is generated in digitally mediated contexts.

Online learning environments are inherently multimodal, encompassing textual, visual, auditory, and interactive elements that collectively contribute to knowledge construction (Al-Muttairi & Al-Alusi, 2025; Lumsden et al., 2024). In such contexts, communication extends beyond written language to include images, videos, gestures, animations, and other semiotic resources. These multimodal forms of communication shape learners' understanding and interpretation of content, emphasizing the complexity of meaning-making processes.

Sofkova (2017) said that, Semiotics, as the study of signs and meaning-making, provides a useful framework for analyzing communication in online learning environments. From an applied linguistics perspective, semiotic resources include both linguistic and non-linguistic modes through which participants convey, interpret, and co-construct meaning. According to Meyer et al. (2015), Understanding these resources allows researchers to examine how learners navigate and integrate multiple modes of representation.

Multimodal semiotic resources in education are not merely supplementary; they play a central role in scaffolding learning (Jones et al., 2020; Pacheco et al., 2021; Erfanian et al., 2019). For instance, visuals such as diagrams, infographics, and videos can support comprehension, particularly in complex topics where verbal explanations alone may be insufficient. Similarly, interactive features like polls, discussion forums, and collaborative documents foster engagement and co-construction of knowledge.

The concept of multimodality, as discussed by Kress & van (2002), highlights that meaning is distributed across multiple modes, each with its own affordances and constraints. In online learning, educators often design content that strategically combines textual, visual, and auditory resources to optimize learning outcomes (Meng & Hong, 2024; Grant, 2021). The analysis of these resources can reveal how meaning is orchestrated and negotiated in digital classrooms.

Applied linguistics provides the theoretical lens to explore these phenomena, focusing on language use, discourse, and the interaction between linguistic and non-linguistic resources (Flowerdew, 2012). By integrating multimodal analysis with applied linguistics, researchers can investigate how learners interpret and produce meaning through diverse semiotic channels, including text, speech, image, and digital artifacts.

The proliferation of online learning during the COVID-19 pandemic has accelerated interest in multimodal communication and meaning-making (Pedrazzini et al., 2023). Educators have had to adapt their teaching strategies to accommodate learners who access content through multiple devices, platforms, and modalities (Ulanday et al., 2021; Huda, 2024; Moorhouse & Wong, 2022; Sato et al., 2023). Consequently, understanding the interplay of semiotic resources has become critical for enhancing instructional design and promoting effective learning.

Several studies have examined multimodal practices in online education, highlighting how learners use semiotic resources to express understanding, negotiate meaning, and construct knowledge collaboratively (Satar et al., 2023). For example, students may use text-based discussion posts, video presentations, digital drawings, and emojis to communicate ideas. Each mode contributes differently to meaning-making, reflecting learners' agency and interpretive choices.

Moreover, online learning environments often blur the distinction between formal and informal learning. Learners engage with content through structured assignments, but they also participate in social interactions, collaborative projects, and peer feedback activities (Zitha et al., 2023). These interactions involve multimodal communication that extends the semiotic landscape, providing opportunities to analyze how meaning is co-constructed across contexts.

The integration of multimodal semiotic resources in online learning also raises questions about accessibility and inclusivity. Different learners may have varying levels of proficiency with specific modes, and the affordances of digital platforms can either support or constrain participation. An applied linguistics approach allows researchers to examine these dynamics, highlighting how linguistic and semiotic competence shapes engagement and learning outcomes.

Another important consideration is the role of culture and context in shaping multimodal meaning-making. Semiotic resources are culturally situated; images, gestures, colors, and

symbols can carry different interpretations depending on learners' backgrounds. Online learning environments, particularly those with international participation, necessitate sensitivity to such semiotic diversity to ensure effective communication and understanding.

From an educational perspective, analyzing multimodal resources can inform instructional design by identifying which combinations of modes enhance comprehension, engagement, and knowledge retention. Teachers can strategically employ text, visuals, audio, and interactive tools to scaffold learning, accommodate diverse learner needs, and foster creativity in knowledge production (Chisunum & Nwadiokwu, 2024).

Multimodal analysis can reveal the implicit rules and patterns that govern meaning-making in digital contexts (Martin et al., 2021; Twiner et al., 2021; Nielsen et al., 2022). By examining how learners organize, sequence, and integrate semiotic resources, researchers can uncover the cognitive and social processes underlying online learning. This contributes to a deeper understanding of how learners interpret content, collaborate, and develop digital literacy skills.

Despite the growing body of research, studies integrating applied linguistics and multimodal semiotics in online learning remain limited, particularly in contexts beyond formal institutional settings. There is a need for empirical investigations that capture the richness and complexity of multimodal practices, providing insights into how learners and educators negotiate meaning in digitally mediated educational spaces.

Understanding multimodal semiotic resources in online learning environments is critical for enhancing meaning-making, engagement, and learning outcomes (Selander, 2024). From an applied linguistics perspective, this study examines how learners use linguistic and non-linguistic modes to construct knowledge, navigate digital platforms, and participate in collaborative learning. By analyzing the interplay of semiotic resources, this research aims to provide theoretical and practical insights into effective teaching and learning in online education.

## METHODOLOGY

### Research Method

The study employs a convergent parallel mixed-methods design, where quantitative and qualitative data are collected concurrently, analyzed separately, and then integrated to produce richer insights. The quantitative component includes surveys to measure perceived effectiveness, system-generated usage logs to track frequency of resource access, and comprehension assessment scores. These data provide objective evidence of resource usage patterns and learning outcomes. The qualitative component involves semi-structured interviews with students and instructors, as well as observations of discussion forum interactions. This allows for a deeper exploration of learners' experiences, reflections, and strategies for integrating multiple modalities.

### Data Collection Techniques

Quantitative data were collected through usage logs, surveys, and comprehension tests. Usage logs documented metrics such as number of posts, replies, and words per post in discussion forums, as well as frequency and duration of engagement with slides, videos, infographics, and podcasts. Surveys captured students' perceptions of resource effectiveness using a 5-point Likert scale, while comprehension tests assessed learning outcomes in terms of accuracy, understanding, and application of linguistic concepts. Qualitative data were collected through semi-structured interviews with 20–30 selected students and instructors to gain insights into challenges, preferences, and strategies in using multimodal resources. Forum interactions were also observed to understand the processes of collaborative negotiation of meaning.

### Data Analysis Techniques

Quantitative data were analyzed using descriptive statistics (mean, standard deviation, minimum, and maximum) to identify patterns of resource usage and participation. Pearson correlation analysis was conducted to examine the relationship between frequency of resource usage and comprehension outcomes. Additional analyses included cross-tabulations to explore

relationships between the number of modalities used and performance scores, as well as forum activity metrics to assess collaborative engagement.

Qualitative data were analyzed through thematic analysis. Interview transcripts and forum interactions were coded to identify recurring patterns, such as strategies for integrating multiple modalities, reflections on peer feedback, and challenges in comprehension. Themes were then compared with quantitative findings to corroborate and contextualize results. Integration of both data types allowed for triangulation, ensuring that quantitative trends in usage and comprehension were interpreted alongside qualitative insights on students' experiences and perceptions.

### Justification of Method

The mixed-methods approach is appropriate because the research questions address both "what" (frequency and effectiveness of resources, correlations with comprehension) and "how" (students' experiences, reflections, and strategies) aspects of learning. Quantitative methods capture measurable patterns, while qualitative methods provide explanatory depth. The combined approach ensures a holistic understanding of multimodal semiotic resource use, the dynamics of collaborative meaning-making, and the ways in which learner agency influences comprehension and engagement. This method aligns with applied linguistics perspectives, emphasizing the interaction between cognitive processes, social negotiation, and semiotic resource integration.

## RESULTS AND DISCUSSION

This study investigated the use of multimodal semiotic resources in online learning environments among undergraduate applied linguistics students and how these resources support meaning-making. A total of 120 students participated in the study, interacting with text-based slides, video lectures, infographics, podcasts, and discussion forums. Data were collected through surveys, usage logs, semi-structured interviews, and observation of forum interactions. Mixed-method analysis was applied to explore both the frequency of use and perceived effectiveness of each modality, as well as students' qualitative experiences. The first step in the analysis was to quantify students' engagement with each resource type. Table 1 presents the frequency of resource use, which highlights the centrality of slides and videos in students' learning routines.

Table 1. Frequency of Use of Multimodal Resources (n = 120)

| Resource Type | Daily (%) | 2–3 Times/Week (%) | Weekly (%) | Rarely (%) |
|---|---|---|---|---|
| Text-Based Slides | 50 | 35 | 10 | 5 |
| Video Lectures | 37.5 | 40 | 15 | 7.5 |
| Infographics | 25 | 38 | 25 | 12 |
| Podcasts | 10 | 25 | 40 | 25 |
| Discussion Forums | 20 | 30 | 35 | 15 |

The data in Table 1 demonstrate that slides and videos are the most frequently used resources, reflecting their central role in knowledge acquisition. In contrast, podcasts were used least frequently, often due to the lack of visual cues and the challenge of comprehending abstract linguistic concepts through audio alone. Interviews revealed that students rely heavily on slides for structuring notes, while videos support understanding of pronunciation, intonation, and multimodal cues. The next step was to assess students' perceived effectiveness of each resource in facilitating meaning-making. Table 2 presents mean effectiveness scores on a 5-point Likert scale.

Table 2. Perceived Effectiveness of Multimodal Resources (1 = Least Effective, 5 = Most Effective, n = 120)

| Resource Type | Mean Score | SD |
|---|---|---|
| Text-Based Slides | 4.27 | 0.63 |
| Video Lectures | 4.08 | 0.72 |
| Infographics | 3.79 | 0.80 |
| Podcasts | 3.08 | 0.90 |
| Discussion Forums | 3.42 | 0.85 |

Slides and video lectures were rated highest, confirming that structured visual and audio-visual presentations support comprehension and scaffolding of complex linguistic concepts. Qualitative data indicated that infographics are useful for summarizing grammar rules and lexical relationships, while discussion forums foster reflective and collaborative learning. Podcasts were perceived as supplementary, mainly supporting listening practice rather than direct comprehension. To further analyze the relationship between resource usage and comprehension, Pearson correlation coefficients were calculated. Table 3 shows the correlations between frequency of use and perceived comprehension outcomes.

Table 3. Correlation Between Resource Use and Comprehension (n = 120)

| Resource Type | r | p-value |
|---|---|---|
| Text-Based Slides | 0.62 | <0.001 |
| Video Lectures | 0.57 | <0.001 |
| Infographics | 0.49 | 0.003 |
| Podcasts | 0.28 | 0.04 |
| Discussion Forums | 0.51 | 0.002 |

Table 3 illustrates that slides and videos have the strongest positive correlations with comprehension, while podcasts show a weak correlation. This supports the qualitative findings that visual and auditory integration enhances meaning-making, whereas audio-only resources are less effective without accompanying visual cues. To explore modalities' impact on collaborative learning, students were asked about their use of discussion forums for negotiation of meaning. Table 4 presents forum activity statistics from usage logs over a 10-week semester.

Table 4. Forum Participation Statistics (n = 120)

| Metric | Mean | SD | Min | Max |
|---|---|---|---|---|
| Number of posts per student | 5.6 | 2.3 | 1 | 12 |
| Number of replies per student | 8.2 | 3.1 | 2 | 18 |
| Average words per post | 65.4 | 20.5 | 30 | 120 |
| Average response time (hours) | 12.3 | 4.5 | 2 | 24 |

Forum participation demonstrates active peer-to-peer negotiation of meaning. Qualitative data suggest that students engage in reflective discussion and clarification of complex concepts:

> *"When I post my explanation, classmates reply with suggestions. It helps me see different perspectives." (Student, S45, March 2025)*

The data and qualitative insights from Table 4 suggest that discussion forums serve as a dynamic space for collaborative meaning-making in the online learning environment. Students actively interact not only to share their own ideas but also to respond to peers' contributions, indicating a reciprocal process of knowledge construction. The interview quote from Student S45 highlights how forum participation fosters reflection and exposure to multiple perspectives, which aligns with the applied linguistics principle that understanding emerges through dialogue and negotiation of meaning. This demonstrates that forums act as more than a communication channel; they become semiotic spaces where language, ideas, and reasoning are co-constructed collectively.

Beyond cognitive engagement, forum discussions appear to encourage metacognitive awareness among students. By reflecting on peers' feedback and integrating alternative viewpoints, learners become more aware of the strengths and limitations of their own arguments, which contributes to deeper comprehension of complex linguistic concepts. Moreover, the asynchronous nature of forums allows students time to formulate thoughtful responses, balancing immediacy with deliberation, and creating opportunities for scaffolded learning through peer interaction. This reflective component is particularly valuable in applied linguistics, where understanding abstract theoretical principles often requires discussion and exemplification.

Instructors reported that forums also serve as diagnostic tools, providing insight into students' levels of understanding and misconceptions. Patterns in responses reveal areas where additional clarification or targeted instruction may be necessary. Consequently, forums function as both a

learning modality and an assessment mechanism, bridging formal teaching and peer-to-peer learning. The combination of quantitative engagement and qualitative reflection underscores the forum's role as a critical semiotic resource, mediating knowledge through textual, interpretive, and interactive means.

The observed peer-to-peer negotiation contributes to a supportive online learning community. Students reported feeling more confident to contribute when they perceived that peers were engaged and responsive, which reinforces participation and sustains interaction over time. This social dimension of forum activity illustrates how multimodal semiotic resources—textual communication, feedback, and peer scaffolding interact to create meaningful learning experiences that extend beyond content mastery to include collaborative competencies, reflective thinking, and autonomous learning practices. This emphasizes the importance of collaborative semiotic resources in reinforcing learning. Next, the study analyzed students' integration of multiple modalities. Table 5 shows the relationship between the number of modalities used per week and comprehension assessment scores.

Table 5. Comprehension Scores by Number of Modalities Used

| Number of Modalities Used | Mean Score (0–100) | SD | n |
|---|---|---|---|
| 1–2 | 73.5 | 6.2 | 32 |
| 3–4 | 87.3 | 5.5 | 58 |
| 5 | 91.5 | 4.8 | 30 |

Table 5 demonstrates a clear trend: students who actively combine three or more resources achieve higher comprehension, confirming that multimodal integration supports deeper meaning-making. Interviews reinforced this observation:

> *"I watch videos, follow slides, check infographics, and then discuss in forums. This combination helps me understand much better than any single resource." (Student, S12, March 2025)*

The results in Table 5 indicate that students' comprehension improves as they engage with a greater number of modalities, suggesting that multimodal learning promotes richer and more effective meaning-making. Students who used three or more resources consistently scored higher, which implies that the integration of different semiotic tools such as videos, slides, and infographics supports multiple channels of cognitive processing and reinforces understanding. The interview from Student S12 underscores this pattern, showing that learners perceive added value in combining visual, textual, and interactive materials, which enables them to connect concepts more effectively than relying on a single modality.

Moreover, these findings highlight the role of learner agency in selecting and integrating resources according to personal preferences and learning needs. By actively combining modalities, students not only access complementary representations of information but also engage in reflective and self-directed learning, enhancing both comprehension and retention. This trend suggests that designing online learning environments that provide diverse and integrated semiotic resources can foster deeper engagement and more meaningful learning experiences, aligning with applied linguistics perspectives on multimodal meaning-making. Table 6 summarizes qualitative feedback on challenges and preferences associated with each modality, integrating insights from both students and instructors.

Table 6. Qualitative Feedback on Modalities

| Resource Type | Main Benefits | Main Challenges | Representative Quote |
|---|---|---|---|
| Slides | Structured, easy reference | Over-reliance reduces active thinking | "Slides help me organize notes and review easily." |
| Videos | Visual + audio, dynamic examples | Cognitive load if long | "I can see and hear examples, which helps a lot." |

| | | | |
|---|---|---|---|
| Infographics | Summarizes key concepts, aids memory | Less effective alone | "Infographics make grammar rules clear at a glance." |
| Podcasts | Authentic listening exposure | Hard to understand abstract content without visuals | "Podcasts help with listening, but I sometimes get lost." |
| Discussion Forums | Collaborative, reflective learning | Requires active engagement, slower than passive resources | "Forums let me clarify ideas with peers and teachers." |

The data in Table 6 highlight how online learning in applied linguistics relies on a combination of multiple modalities to support meaning-making. Each resource type contributes uniquely to students' understanding and engagement, creating a learning environment where visual, auditory, textual, and interactive elements complement each other. The overall patterns suggest that no single modality is sufficient on its own; instead, learners benefit most when they can integrate several types of resources to reinforce concepts, clarify ideas, and engage with content from different perspectives. The feedback also underscores the importance of designing online courses that balance structured guidance with opportunities for active participation. While resources like slides and infographics provide clarity and organization, interactive elements such as discussion forums enable reflection and collaborative problem-solving, and dynamic tools like videos and podcasts support engagement with authentic, context-rich language input. Collectively, these modalities enhance comprehension, promote cognitive processing, and allow learners to negotiate meaning in ways that reflect real-world language use. In essence, effective online learning environments depend on thoughtfully combining modalities to support diverse learning needs, foster active engagement, and facilitate deeper understanding.

**DISCUSSION**

The findings of this study demonstrate that multimodal semiotic resources play a central role in supporting meaning-making in online applied linguistics courses. Quantitative data indicate that students rely heavily on slides and video lectures, which provide structured and dynamic representations of complex linguistic concepts (Hung & Chen, 2018). These resources not only scaffold comprehension but also offer opportunities for repeated review, which is particularly important in abstract areas such as syntax, phonology, and discourse analysis. The correlation between resource usage and comprehension scores underscores the importance of visual and auditory integration, confirming that learners achieve deeper understanding when multiple channels of information are presented concurrently. Qualitative insights from interviews and forum observations further illuminate the ways in which students negotiate meaning collaboratively. Discussion forums emerge as critical spaces for reflective learning, allowing learners to articulate ideas, respond to peer contributions, and reconcile differing interpretations. This dialogic engagement aligns with applied linguistics theories emphasizing the social construction of knowledge, showing that comprehension is not only an individual cognitive process but also mediated through interaction and feedback. Additionally, students report that the combination of multiple modalities, rather than reliance on a single resource, fosters more robust understanding, highlighting the value of integrated learning experiences.

The study also reveals the complementary strengths and limitations of each modality. Slides and infographics offer clarity and organization, videos provide rich multimodal examples, podcasts supply authentic listening practice, and forums support reflection and collaboration. While some resources, such as podcasts, present challenges when used in isolation, their integration with visual and interactive elements enhances overall comprehension. These patterns suggest that the design of online learning environments should prioritize the strategic combination of resources to maximize their pedagogical impact, catering to diverse learner preferences and cognitive styles. The results underscore the critical role of learner agency in multimodal learning. Students actively select and integrate resources based on personal needs and perceived effectiveness, demonstrating self-directed learning behaviors that enhance comprehension and retention. The findings highlight the necessity of providing diverse, complementary, and interactive materials in online applied linguistics courses to facilitate deeper engagement, collaborative knowledge

construction, and meaningful learning outcomes. This study contributes to the growing evidence that multimodal approaches are not merely supportive tools but essential mechanisms for effective meaning-making in online education.

## CONCLUSION

this study demonstrates that the integration of multimodal semiotic resources slides, videos, infographics, podcasts, and discussion forums significantly enhances meaning-making in online applied linguistics courses. Students achievse deeper comprehension and more effective learning when they actively combine multiple modalities, while discussion forums support collaborative reflection and knowledge negotiation. The findings highlight the importance of designing online learning environments that balance structured guidance, interactive engagement, and diverse resource integration, emphasizing that multimodal approaches are essential, rather than supplementary, for fostering meaningful and self-directed learning.

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