


# Multisensory strategies to foster autonomous language learning through digital landscapes

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## ABSTRACT

This research explores the integration of multisensory strategies in digital learning landscapes to enhance autonomous language learning. Drawing on theoretical foundations such as multisensory integration, learning strategies, and autonomy, the study investigates how digital platforms that engage multiple senses can address the challenges of autonomous online learning, particularly for English language learners. The research focuses on English teachers in the Pedagogical Praxis module of a master's program, examining their experiences with a multisensory digital landscape designed to foster self-directed learning. The study employed a quantitative research approach, collecting data via surveys to evaluate the impact of multisensory design on learner engagement, language proficiency, and autonomy. Findings indicate that participants experienced higher levels of engagement, improved comprehension, and increased motivation through the multisensory digital landscape. While the majority of respondents reported positive outcomes, minor challenges related to self-management and technical difficulties were noted. Overall, the study highlights the potential of multisensory digital learning landscapes to support autonomous language learners and offers insights into how these strategies can be further refined to maximize educational impact.

**Keywords:** autonomy, digital landscapes, language learning, multisensory

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## INTRODUCTION

Setting and achieving learning objectives is crucial for having motivated and responsible students. Autonomy is key in virtual education, as it leverages students' motivation when interacting with different technological gadgets. Specifically in online English learning, autonomy makes learners the focus, requiring them to understand their needs and interests. Building confidence, motivation, collaborative support, and learning skills is essential for productive learning (Olaya & Mora, 2022). Yet, autonomous language learning carries multiple challenges in this educational setting. Learners often struggle with maintaining motivation, finding suitable resources, and effectively managing their learning process without the structure provided by a traditional classroom environment.

Moreover, in virtual scenarios, these challenges can become even more pronounced as learners navigate the complexities of online platforms, often feeling isolated and unsupported. These difficulties can lead to frustration and a lack of progress, or simply a stagnation of the training process, making it essential to find innovative approaches that can support self-directed learning. In that sense, a mitigating proposal is the integration of multisensory learning strategies, which engage various senses to enhance comprehension, attention, retention and overall engagement.

As a mitigation process of these previous challenges. Recent reviews and empirical research indicate that digital technologies significantly enhance autonomous language learning. These technologies can assist students improve their competencies and achievement levels, by shifting language pedagogy from teacher-centered to student-centered, and by also offering materials for independent study outside the classroom. Digital technology is recognized as a powerful tool for promoting autonomous learning, enabling teachers to act as facilitators, while learners are encouraged to take responsibility for their education, actively engage in the learning process, and assess their progress (Pratiwi & Waluyo, 2023).

In that sense, digital learning landscapes have emerged as powerful educational resources that can be addressed to these challenges. According to Hernando (2015), in a learning landscape, the teacher designs experiences that outline the objectives to be achieved, the evaluation tools, and the products for each activity. However, the teacher grants students the autonomy to choose their own learning path, sharing daily educational decisions in the classroom. So, digital landscapes can result in important resources to offer diverse and engaging learning experiences, through a structure and support that autonomous learners need. These spaces can create opportunities for immersive and interactive learning, allowing students to practice language skills in dynamic and contextually rich environments.

Multisensory learning, which involves using visual, auditory, tactile, and kinesthetic stimuli to enhance the learning experience, is particularly relevant in the context of digital learning landscapes since it aids students in gaining diverse perspectives on a single topic by exploring it in various forms, while also necessitating the integration of these fragmented pieces of knowledge into a coherent whole. Based on Fadeev and Milyakina (2021), the digital environment enables the incorporation of nearly limitless amounts of verbal, audiovisual, and other sensory information. In addition, this multisensory approach is a result of ongoing research and experiments in educational technology aimed at enhancing the teaching-learning process and its outcomes (Aja et al., 2017). In other words, by leveraging the capabilities of modern technology, these landscapes can create rich, multisensory environments that motivate learners, help them retain information more effectively, and ultimately lead to greater language proficiency.

This paper explores the theoretical foundations of multisensory learning and its practical implementations within a digital learning landscape, examining the impact on autonomous language learners. The research was conducted as part of the Pedagogical Praxis module in the master's program in education, with a special emphasis on English learning. The study involved a population of English teachers who face challenges with virtual learning environments as part of the modality of the master's program, and they need to continuously practice and develop their English language skills. By incorporating multisensory approaches, the digital learning landscape aims to address these challenges and support the teachers in fostering their autonomy during the process and enhancing their language proficiency.

## THEORETICAL FRAMEWORK

The theoretical framework for this study draws upon several key concepts that inform the development and effectiveness of digital learning landscapes. These conceptualizations provide a comprehensive basis for understanding how learners interact with multisensory environments and how these environments can support language acquisition. By integrating established theories on learning strategies, autonomy, and digital educational tools, this framework seeks to explore how various approaches can be combined to enhance learner engagement, motivation, and independence. These theoretical underpinnings guide the analysis and offer valuable insights into the potential of innovative learning methodologies in the context of language education.

### Multisensory Integration and Learning Strategies

Multisensory integration refers to the process by which the brain combines information from different sensory modalities to form a coherent and comprehensive understanding of the environment. Since teaching involves creating optimal conditions for learning, then, employing a multisensory approach introduces multiple ways for information to enter students' cognitive systems by engaging their hearing, vision, touch, speech, taste, and movement. This method helps students connect new information with their existing knowledge and comprehend the relationships between concepts (Feitosa et al., 2022).

According to Main (2021), research indicates that a multisensory approach generates more beneficial brain responses compared to using a single sense, by training the brain to react to various inputs, leading to improved overall learning. Also, stimulating multiple senses

simultaneously can make learning more enjoyable and significantly boost recall and retention.

Hence, multisensory learning strategies involve engaging multiple senses simultaneously to enhance the learning experience. This approach focuses on the understanding that information is better retained and understood when presented through various sensory channels. Common strategies include the use of visual aids such as images and videos, auditory stimuli like recordings and music, and tactile experiences such as hands-on activities and interactive simulations.

In the modern digital era, data is produced and consumed in numerous formats, including text, images, and sound. As technology progresses, the distinctions between these different modalities are becoming less clear. As a consequence, cross-modal learning has emerged as an effective approach to connect these diverse data forms by means of the implementation of strategies which integrate effective multiple sensory inputs (Thakran, 2023). For instance, interactive e-books that combine text with audio narration and visual animations can cater to different learning styles and preferences. These strategies not only make learning more enjoyable but also help learners to make connections between different types of information, thereby enhancing their overall understanding and retention.

In digital language learning landscapes, multisensory integration can be effectively leveraged through the use of multimedia resources that simultaneously present information in various formats. For example, a platform might present new vocabulary words through a combination of spoken pronunciation, written text, and illustrative images. This simultaneous presentation engages multiple sensory pathways, making it easier for learners to internalize and recall the information. Furthermore, linguistic landscapes provide a rich source of language input, increasing both the amount of input learners receive and the frequency of their exposure (Kieu, 2023). By incorporating these elements, digital learning landscapes enhance the quantity and frequency of language input, which are critical for effective language learning.

### Autonomous Learning

Autonomous learning, often referred to as self-directed or independent learning, emphasizes the learner's ability to take control of their educational journey. Key concepts within this framework include self-regulated learning, intrinsic motivation, and learner autonomy. Self-regulated learning involves active management of one's learning processes, including goal setting, self-monitoring, and self-assessment. Learners plan their learning activities, track their progress, and adjust strategies as needed to achieve their goals. Intrinsic motivation, another critical concept, refers to the internal drive to learn that stems from personal interest, curiosity, or the inherent enjoyment of the learning process. When learners are intrinsically motivated, they are more likely to engage deeply with the material and persist through challenges. Learner autonomy, the capacity to make decisions about one's learning, encompasses both self-regulated learning and intrinsic motivation, allowing learners to exercise choice and take responsibility for their learning outcomes.

Based on Khairallah et al. (2020), in language teaching, autonomy is fundamental to learner-centered approaches where students actively engage in their learning process. They work together on task-based activities such as simulations, develop their own language learning

strategies, use technology and digital tools to take charge of their learning paths, and critically reflect on their progress through self-assessment. The teacher's role shifts from being an authoritative source of information to acting as a facilitator and guide. Additionally, autonomous learning allows for personalized pacing, enabling learners to progress at a speed that suits their individual needs and learning styles. This flexibility helps to accommodate different proficiency levels and learning rates, making the acquisition process more effective and less stressful.

### Multisensory Learning and Autonomy in Digital Learning Landscapes

Multisensory learning strategies, when integrated into digital learning landscapes, can significantly enhance the benefits of autonomous language learning. Digital learning landscapes offer diverse resources and activities, fostering a journey-like experience. Motivation is driven by both the designers, who create these stimulating environments, and the users, who benefit from organized and meaningful learning sequences. Participants play a key role, being autonomous and generating their own learning experiences (Hernández-Silvera & Ghilardelli, 2022).

By providing a variety of sensory inputs—such as visual, auditory, and tactile stimuli—digital learning landscapes cater to different learning preferences and styles, making it easier for learners to engage with the material on their terms. This multisensory approach not only aids in memory retention and comprehension but also supports self-regulated learning by offering diverse and interactive resources that learners can access independently. The combination of multisensory strategies and digital autonomy creates a rich, engaging, and flexible learning environment that empowers learners to take charge of their language acquisition journey.

## METHODOLOGICAL FRAMEWORK

This research is based on a quantitative research approach, utilizing a survey to gather comprehensive data on the effectiveness of the multisensory digital learning landscape. This method has been chosen because it allows for the systematic collection and analysis of numerical data, providing a clear and objective measure of participants' perceptions and experiences. The research was carried out in three stages to ensure a comprehensive evaluation of the multisensory digital learning landscape for autonomous learning. The first stage involved the design of the learning landscape, incorporating various multisensory elements such as visual, auditory, and kinesthetic stimuli to support autonomous learning. The second stage focused on the implementation of the learning landscape within the Pedagogical Praxis module of the master's program in education, emphasizing English learning. The final stage involved the application of a survey to gather data on the effectiveness of the learning landscape.

### Design of a Multisensory Digital Learning Landscape for Autonomous Learning

The design of the multisensory digital learning landscape was created using Genially, a platform that facilitates the development of interactive and visually engaging learning environments. Its interface allows for the design of a navigation structure that supports autonomous exploration by learners. Additionally, the platform enables the integration of various multisensory elements.



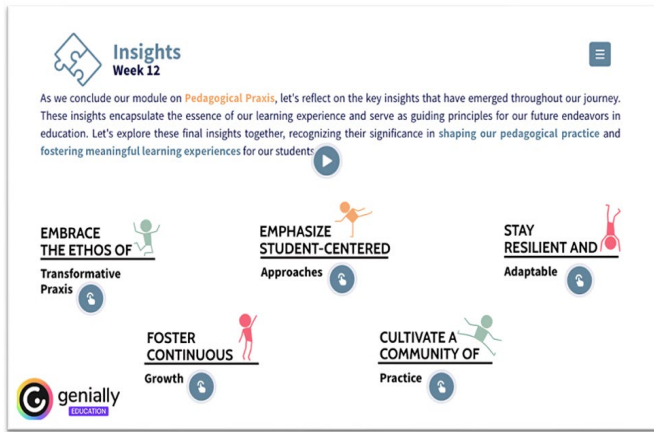
**Figure 1.** Homepage (Own creation with Genially [virtual platform] and Freepik free resource [photograph], 2024)

Indeed, Genially's capabilities for incorporating multimedia elements, animations, and interactivity align with the focus on engaging and dynamic learning experiences. These features are essential in the digital era, as Papadakis et al. (2023) emphasize the increasing importance of leveraging innovative, technologically advanced tools to transform traditional educational practices. The use of smart technologies, as discussed in their study, correlates how Genially fosters an immersive and engaging environment that encourages learners to actively interact with content, thereby enhancing comprehension and retention.

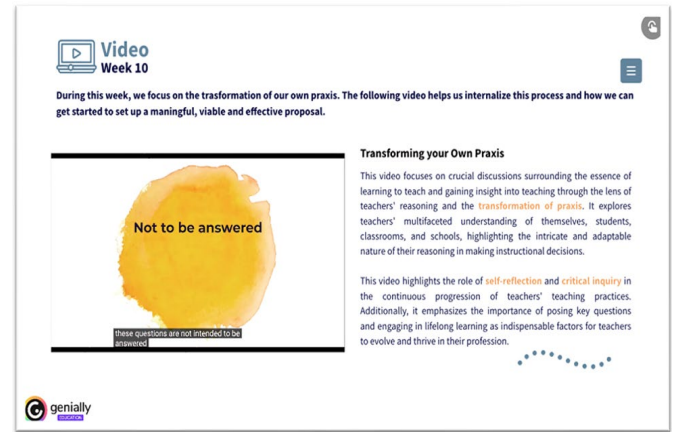
The design of the multisensory digital learning landscape was structured as a twelve-week site, with each week represented by a distinct route. These twelve routes were carefully planned to align with specific learning objectives and content relevant to the module. While each route addressed particular topics and goals, the instructional design and layout were consistently maintained across all of them. This uniformity ensured a coherent learning experience, allowing participants to navigate seamlessly while focusing on the weekly themes. The standardized structure included interactive activities, multimedia elements, and opportunities for reflection, fostering engagement and supporting the achievement of the intended outcomes.

The design process also incorporated a cohesive graphic design, featuring a carefully selected color palette to ensure visual consistency throughout the various paths of the learning landscape. This unified aesthetic not only enhanced the platform's appeal but also supported intuitive navigation and a seamless learning experience for participants. **Figure 1** illustrates the homepage of the learning landscape, showcasing the 12 weekly paths and highlighting the visual consistency achieved through the applied color palette.

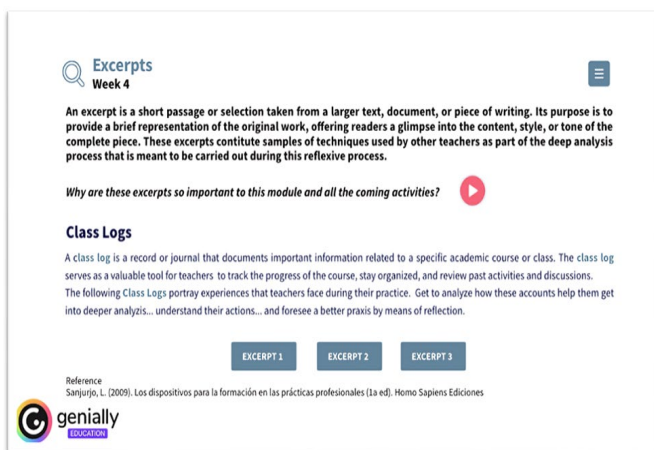
To enhance visual learning and support independent study, the design incorporates a variety of visual stimuli. Videos and animations are used to demonstrate language usage in different contexts, helping learners visualize conversations and scenarios. Images and infographics provide visual representations of vocabulary and grammar concepts, making abstract ideas more concrete. Color-coded text highlights different parts of speech and grammatical structures, aiding in the recognition and retention of language patterns. These visual elements create a visually rich environment that caters to visual learners and enhances overall comprehension. **Figure 2** shows the use of color-coded text to emphasize key messages, icons to provide visual stimuli,



**Figure 2.** Integration of visual and auditory elements in the learning landscape (Own creation with Genially [virtual platform], 2024)



**Figure 4.** Cross-modal video support for multisensory learning (Own creation with Genially [virtual platform], 2024)



**Figure 3.** Auditory support for listening and pronunciation practice (Own creation with Genially [virtual platform], 2024)

and audio-text supported messages to enhance comprehension and engagement.

Auditory stimuli are integrated to support listening and pronunciation practice. Audio recordings of native speakers provide examples of correct pronunciation and intonation, helping learners develop their listening skills. Music and sound effects are used to create an immersive learning atmosphere, making the language experience more engaging and enjoyable. This auditory input is crucial for developing listening and speaking skills, which are essential components of language proficiency.

**Figure 3** demonstrates the integration of audio support to enhance listening skills, featuring play icons for audio playback and automatic audio activation in pop-up windows.

Cross-modal learning combines different sensory inputs to create a rich, multisensory learning experience. For example, videos with subtitles provide both visual and auditory input, enhancing comprehension through multiple channels. Interactive audio sections, where learners can listen to a dialogue and follow along with a transcript, integrate auditory and visual stimuli. These cross-modal activities ensure that learners engage with the language through multiple senses, reinforcing learning and aiding retention.

**Figure 4** presents the use of colorful, subtitled, and text-audio videos to provide cross-modal support for content comprehension, integrating visual and auditory stimuli to enhance learning.

### Implementation of the Multisensory Digital Learning Landscape for Autonomous Learning

The implementation of the multisensory digital learning landscape was carried out within the pedagogical praxis module of the master's program in education, with a special emphasis on English learning. The study included a cohort of ten students, all of whom are practicing English teachers. While the sample size may be considered small and less diverse, it represents the total enrollment for this module at the time, making it the only group available for this research. Despite these limitations, the homogeneity of the cohort provided valuable insights into the practical applications of the multisensory approach, particularly in contexts where participants share similar professional and linguistic backgrounds. All participants are native Spanish speakers, with most demonstrating B2–C1 English language proficiency according to the common European framework of reference for languages, which further enriched the findings by aligning with the study's focus on English language teaching.

During the initial interaction with the multisensory digital learning landscape, a few participants encountered minor challenges, primarily related to navigating the platform. These challenges were promptly addressed by providing additional instructions and personalized support from the facilitator via email. This helped to overcome any initial difficulties, ensuring a smooth and effective learning experience for all participants as they progressed through the landscape.

Later on, throughout the twelve-week module, all participants engaged with the digital learning landscape independently, exploring the various multisensory activities and resources. They were encouraged to set their own learning goals, track their progress, and reflect on their experiences. The implementation focused on fostering autonomous learning by providing a flexible, self-directed environment where teachers could tailor their learning experiences to their individual needs and preferences.

### Application of Survey

Feedback and data were collected through a survey to evaluate the impact of the multisensory approach on language learning after the

**Table 1.** Evaluation of the effectiveness of the multisensory digital learning landscape in supporting autonomous language learning

| Criteria                     | Overall result | Perception level       |
|------------------------------|----------------|------------------------|
| Language proficiency support | 70%            | Moderately supported   |
| Comprehension and retention  | 80%            | Effective              |
| Engagement and motivation    | 100%           | Very engaging          |
| Autonomous learning          | 100%           | Significantly impacted |
| Usability                    | 100%           | Very user-friendly     |
| Visual elements              | 100%           | Very effective         |
| Auditory elements            | 100%           | Very effective         |
| Cross-modal elements         | 100%           | Very effective         |
| Overall satisfaction         | 100%           | Very satisfied         |
| Challenges                   | 80%            | No                     |

implementation phase of the learning landscape. The teachers' experiences and outcomes were analyzed to determine the effectiveness of the design and identify areas for improvement. This practical implementation not only contributed to the research but also provided valuable professional development for the participating teachers, enhancing their skills and knowledge in language teaching.

To gather comprehensive data on the effectiveness of the multisensory digital learning landscape, a survey was utilized. In accordance with ethical research guidelines, participants were fully informed about the purpose of the research, their role in the study, and their right to withdraw at any time without consequence. To ensure confidentiality, all data were anonymized and stored securely, with access limited to the researcher. These ethical practices were integral in safeguarding participants' rights and enhancing the credibility of the study.

The survey consisted of a series of structured questions designed to assess various aspects of the learning experience, including engagement, perceived effectiveness, and ease of use. Participants were asked to rate their experiences and provide feedback on specific components of the multisensory activities. This quantitative data provided a broad overview of the learners' perceptions and highlighted key areas for further exploration.

## RESULTS AND DISCUSSION

The survey aimed to evaluate the effectiveness of the multisensory digital learning landscape in supporting autonomous language learning among English teachers who are native Spanish speakers. The survey focused on various aspects, including language proficiency, comprehension and retention, engagement and motivation, autonomous learning, usability, visual and auditory elements, cross-modal learning, overall satisfaction, and challenges faced by the participants. **Table 1** provides a summary of the results of the survey.

The results revealed that 70% of respondents perceived that the multisensory digital learning landscape moderately supported their language proficiency, while 80% found it effective for comprehension and retention of new linguistic elements. This aligns with the concept that linguistic landscapes offer genuine contextual input in natural settings, providing learners with crucial language input that helps form their understanding of the target language. Items within a language learning landscape typically serve informational and symbolic purposes, representing various communicative contexts in which these items are created and displayed (Kieu, 2023).

All participants (100%) reported high engagement and significant enhancement in their ability to learn independently. The interface and navigation were considered very user-friendly by all, with only one participant mentioning initial difficulties. Visual and auditory elements, as well as cross-modal combinations, were unanimously deemed very effective. Overall, 100% of the participants were very satisfied with their experience, though 10% faced challenges in managing their learning process and another 10% encountered technical issues, only at the very beginning of the interaction process. According to Myréen (2017), multisensory elements enhance classroom engagement and motivate students in language learning by promoting interaction. A multisensory space provides a comfortable environment for foreign language learners, using auditory, visual, and cross-modal elements to stimulate the brain and improve recall. This positive atmosphere encourages students to confidently use the foreign language.

The 100% satisfaction ratings for both auditory and visual elements reinforce the importance of integrating diverse sensory elements to achieve a deeper level of engagement and support autonomy in learning. These findings highlight how sensory diversity enhances the learning experience by using multiple senses, which is essential for creating immersive and interactive educational environments. This approach not only boosts learners' motivation and retention but also facilitates a more personalized learning journey, allowing students to explore content at their own pace and according to their preferences. These outcomes align with the key principles advocated in the broader development of open, technology-driven education, as emphasized by Papadakis (2023), underscoring the significance of flexible, learner-centered platforms that adapt to the diverse needs of learners.

Overall, participants in this study expressed a positive perception of the multisensory digital learning landscape, attributing their engagement to its user-friendly design and practical utility. The clear navigation pathways, intuitive interface, and integration of multisensory elements, such as visuals, audio, and interactive activities, were particularly noted as enhancing their overall experience. This matches the findings of Lavidas et al. (2024), who emphasized that perceived ease of use and usefulness are critical determinants influencing students' intentions to adopt technological tools for academic purposes. In both contexts, the ability of technology to simplify complex tasks and provide benefits to the learning process emerged as key points to its acceptance. To that effect, when educators design digital tools that are both functional and accessible.

It is clearly evidenced that the multisensory digital learning landscape fosters greater accessibility and autonomy, allowing learners to navigate the content at their own pace and according to their individual needs. This aligns with Papadakis et al. (2023), highlighting the role of cloud-based smart technologies [such as Genially] in supporting open learning environments, and underscoring the importance of flexible, technology-driven spaces that can be tailored to diverse learner needs. Thus, the design of the learning landscape in this study incorporates features that allow for personalized exploration, empowering learners to take control of their educational experience. By integrating multimedia elements and interactivity, the landscape provides an adaptable environment that encourages learners to engage actively with the module's goal and contents.

Lastly, the survey results reveal that the multisensory digital learning landscape had a highly positive impact on key general aspects of learning, including engagement, motivation, and autonomous

learning, with participants rating these areas as 100% effective or significantly impacted. Papadakis (2023) in his previous research asserts moving into more accessible and engaging learning environments, such as MOOCs. As they continue to adapt and expand, incorporating elements such as those also found in Genially can support the growing demand for open and personalized learning experiences.

These findings underscore the potential of multisensory digital learning landscapes in enhancing autonomous language learning. The high levels of satisfaction and perceived effectiveness across various dimensions highlight the benefits of integrating multisensory approaches in digital learning environments. Addressing the minor challenges reported can further optimize the learning experience, ensuring that all learners can fully benefit from the rich, interactive, and self-directed nature of multisensory digital learning landscapes.

## CONCLUSIONS

Language learning is a continuous process that occurs at every stage of life, including for teachers who are already in service or undergoing training. This study underscores the importance of providing ongoing learning opportunities for educators, allowing them to refine their skills and stay updated with the latest pedagogical advancements. Teachers, as lifelong learners, benefit from engaging in autonomous language learning as it enables them to experience the challenges and rewards of language acquisition firsthand. This experiential learning helps them better understand their students' needs and enhances their teaching practices.

The cognitive benefits of multisensory learning for autonomous language learning are substantial. By engaging multiple senses, learners can create stronger and more diverse neural connections, leading to better retention and recall of information. Multisensory approaches cater to various learning styles, ensuring that each learner can engage with the material in a way that suits them best.

Learning landscapes also play a pivotal role in supporting autonomous language learning. These digital environments provide a structured yet flexible platform where learners can access a wide range of resources and activities tailored to their individual needs. By incorporating multisensory elements, learning landscapes create immersive and interactive experiences that keep learners engaged and motivated. So, as a recommendation to this research, these multisensory approaches can be enhanced by incorporating kinesthetic learning through virtual reality (VR) applications. VR enables learners to engage with immersive, contextually rich environments, providing movement-based activities that reinforce content and language skills.

In addition, future research could aim to address the limitations of small and homogeneous sample sizes by including larger and more diverse populations. Expanding the study to involve participants from different linguistic backgrounds, varying teaching experiences, and a wider range of educational contexts could provide a more comprehensive understanding of the effectiveness of multisensory digital learning landscapes. Also, incorporating participants from multiple programs would enhance the generalizability of the findings and allow for comparative analyses of how such multisensory learning landscapes function in diverse educational environments.

To address technical challenges in future learning landscapes, strategies include providing clear instructions and tutorials, offering

technical support, and designing intuitive interfaces. Regular feedback collection and preparing contingency plans may help identify and resolve issues quickly. Furthermore, fostering a supportive learning community where participants assist each other with technical problems can also enhance overall experience, ensuring a more effective learning process.

In conclusion, the integration of multisensory strategies within digital learning landscapes presents a powerful method for enhancing autonomous language learning. Even when learning landscapes remain a relatively underexplored area of study, yet they present significant potential for enhancing educational contexts; and its implementation facilitates effective practices that promote educational inclusion and foster the development of various skills and competencies through technology (García-Tudela, 2021). By engaging in multiple senses, these approaches not only improve cognitive outcomes but also address common challenges faced by autonomous learners. For teachers, engaging in such learning experiences provides valuable professional development, equipping them with firsthand insights into the process of language acquisition.

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**Declaration of interest:** The author declares no competing interest.

**Data availability:** Data generated or analyzed during this study are available from the author on request.

## REFERENCES

- Aja, S. N., Eze, P. I., Igba, D. I., Igba, E. C., Nwafor, C. C., & Nnamani, S. C. (2017). Using multi-sensory instruction in managing classroom for effective teaching and learning. *International Journal of Applied Engineering Research*, 12(24), 15112–15118. [https://www.ripublication.com/ijaer17/ijaerv12n24\\_163.pdf](https://www.ripublication.com/ijaer17/ijaerv12n24_163.pdf)
- Fadeev, A., & Milyakina, A. (2021). Multisensory learning environments. *SHS Web of Conferences*, 130, Article 02003. <https://doi.org/10.1051/shsconf/202113002003>
- Feitosa, G., Miyahara, R., & Alves, V. (2022). Multisensory integration approach, cognitive domains, meaningful learning: Reflections for undergraduate nursing education. *Revista da Escola de Enfermagem da USP*, (56), Article e20210381. <https://doi.org/10.1590/1980-220x-reeusp-2021-0381>
- Freepik. (2024). Multicultural and interracial community. Amigos de ángulo bajo en sillas con burbujas de chat [photograph]. <https://www.freepik.es/serie/5965437/2>
- García-Tudela, P. (2021). Los paisajes de aprendizaje como una herramienta para atender a la diversidad: Análisis cualitativo de propuestas didácticas [Learning landscapes as a tool to address diversity: Qualitative analysis of teaching proposals]. In A. B. Barragán, M. M. Molero, A. Martos, M. M. Simón, J. J. Gázquez, & M. C. Pérez-Fuentes (Eds.), *Innovación docente e Investigación en educación: Nuevos enfoques en la metodología docente* (pp. 549–557). Dykinson. <https://doi.org/10.2307/j.ctv2gz3vbd.52>

- Hernández-Silvera, D. I., & Ghilardelli, M. A. (2022). Paisajes digitales de aprendizaje en la universidad huellas vivenciales e inserción comunitaria [Digital learning landscapes at the university: experiential traces and community insertion]. *Revista Panamericana de Pedagogía*, (35), 135–151. <https://doi.org/10.21555/rpp.vi35.2727>
- Hernando, A. (2015). *Viaje a la escuela del siglo XXI. Así trabajan los colegios más innovadores del mundo* [A trip to the school of the 21<sup>st</sup> century. This is how the most innovative schools in the world work]. Fundación Telefónica. <https://www.fundaciontelefonica.com/noticias/record-descargas-viaje-escuela-siglo-21-alfredo-hernando/>
- Khairallah, M., Fleonova, O., & Nicolas, M. O. (2020). Understanding students' resistance to autonomous learning in an L2 English language course at a University in Lebanon. (2020). *European Journal of Education*, 3(1), 20–38. <https://doi.org/10.26417/ejed.v3i1.p18-30>
- Kieu, C. Y. (2023). Harnessing linguistic landscapes for language learning: A comprehensive guide (5 key areas of 25 awesome tips). *Language Educators Assemble*. <https://www.languageeducatorsassemble.com/linguistic-landscapes/>
- Lavidas, K., Voulgari, I., Papadakis, S., Athanassopoulos, S., Anastasiou, A., Filippidi, A., Komis, V., & Karacapilidis, N. (2024). Determinants of humanities and social sciences students' intentions to use artificial intelligence applications for academic purposes. *Information*, 15(6), Article 314. <https://doi.org/10.3390/info15060314>
- Main, P. (2021). Multisensory learning in the classroom: A teacher's guide. *Structural Learning*. <https://www.structural-learning.com/post/multisensory-learning-in-the-classroom-a-teachers-guide>
- Myréen, S. (2017). Evaluating the role of multisensory elements in foreign language acquisition. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 11(2), 375–378. <https://www.theseus.fi/handle/10024/123817>
- Olaya, M., & Mora, W. (2022). Exploring autonomous language learning behaviors through video sharing and online discussions in higher education. *Colombian Applied Linguistics Journal*, 24(2), 187–202. <https://doi.org/10.14483/22487085.17827>
- Papadakis, S. (2023). MOOCs 2012–2022: An overview. *Advances in Mobile Learning Educational Research*, 3(1), 682–693. <https://doi.org/10.25082/AMLER.2023.01.017>
- Papadakis, S., Kiv, A. E., Kravtsov, H. M., Osadchyi, V. V., Marienko, M. V., Pinchuk, O. P., Shyshkina, M. P., Sokolyuk, O. M., Mintii, I. S., Vakailuk, T. A., Striuk, A. M., & Semerikov, S. O. (2023). Revolutionizing education: Using computer simulation and cloud-based smart technology to facilitate successful open learning. In *Proceedings of the 10<sup>th</sup> Illia O. Teplytskyi Workshop on Computer Simulation in Education, and Workshop on Cloud-based Smart Technologies for Open Education* (pp. 1–19). <https://doi.org/10.31812/123456789/7375>
- Pratiwi, D. I., & Waluyo, B. (2023). Autonomous learning and the use of digital technologies in online English classrooms in higher education. *Contemporary Educational Technology*, 15(2), Article ep423. <https://doi.org/10.30935/cedtech/13094>
- Thakran, D. (2023). Integrating text, image, and sound with cross-modal learning. *Medium*. <https://medium.com/@thakrandisharth/integrating-text-image-and-sound-with-cross-modal-learning-266e2b65e6ce>