AG EDITOR

REVIEW

Multisensory Design in Educational Environments: The Influence of Architecture in Enhancing the Learning Experience.

Diseño Multisensorial en Entornos Educativos: La Influencia de la Arquitectura en la Potenciación de la Experiencia de Aprendizaje

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ABSTRACT

Objective: to explore the existing scientific literature on sensory architectural training in education, in order to establish an approach that enhances the learning experience and recommend the effective implementation of multisensory architecture in educational environments.
Method: exhaustive narrative review of scientific literature, consulting databases such as Scopus, Scielo and Scispace, with a search conducted between March and April 2024. Terms related to architecture, design, multisensoriality and education were used, filtering an initial total of 86 articles to obtain a final corpus of 26 articles relevant to the review.
Results: traditional architectural design has mostly privileged visual perception, relegating other senses such as touch, hearing and smell, although multisensory architecture seeks to stimulate all senses to generate full and enriching emotional experiences, in addition, it is highlighted that multisensory architecture in educational settings should go beyond simple structures, transforming spaces into dynamic landscapes that invite exploration and learning, promoting creativity and concentration,.
Conclusions: the integration of multisensory stimuli in educational architecture is fundamental to empower students and redefine the educational landscape, captivating all senses and stimulating more active and enriching learning.

Keywords: Multisensory Design; Educational Environments; Architecture; Learning Experience.

RESUMEN

Objetivo: explorar la literatura científica existente sobre la formación arquitectónica sensorial en educación, con el fin de establecer un enfoque que mejore la experiencia de aprendizaje y recomendar la implementación efectiva de la arquitectura multisensorial en entornos educativos.
Método: revisión narrativa exhaustiva de la literatura científica, consultando bases de datos como Scopus, Scielo y Scispace, con búsqueda realizada entre marzo y abril de 2024. Se emplearon términos relacionados con arquitectura, diseño, multisensorialidad y educación, filtrando un total inicial de 86 artículos hasta obtener un corpus final de 26 artículos relevantes para la revisión.
Resultados: el diseño arquitectónico tradicional ha privilegiado mayormente la percepción visual, relegando otros sentidos como el tacto, el oído y el olfato, aunque la arquitectura multisensorial busca estimular todos los

sentidos para generar experiencias emocionales plenas y enriquecedoras, además, se destaca que la arquitectura multisensorial en ámbitos educativos debe ir más allá de estructuras simples, transformando los espacios en paisajes dinámicos que invitan a explorar y aprender, promoviendo la creatividad y la concentración,.

Conclusiones: la integración de estímulos multisensoriales en la arquitectura educativa es fundamental para empoderar a los estudiantes y redefinir el paisaje educativo, cautivando todos los sentidos y estimulando un aprendizaje más activo y enriquecedor.

Palabras clave: Diseño Multisensorial; Entornos Educativos; Arquitectura; Experiencia de Aprendizaje.

INTRODUCTION

In contemporary architecture, a trend has developed that transcends traditional approaches focused solely on aesthetics and functionality, incorporating a variety of sensory stimuli that enrich the spatial experience and strengthen the relationship between the user and the built environment.[1] Historically, architectural design has been dominated by sociocentrism, privileging sight as the primary sense in the perception and creation of space, a phenomenon described in a visually oriented society.[2] However, the evolution towards a Multisensory Architecture (MA) implies a rethinking that involves multiple senses for a deeper understanding and interaction with space, integrating natural and sensory qualities through a conscious and holistic design.[3]

From this perspective, it is pointed out that architectural design should facilitate sensory experiences that mobilize both the creator and the user, proposing AM as a discipline that generates meta-sensory experiences in users through evoking emotions and sensations.[4] Pallasmaa reinforces this idea by stating that the true richness of architecture lies in its ability to activate all the senses - sight, touch, smell, hearing, among others - transforming spatial interaction into a holistic and emotionally meaningful experience.[5] In this sense, architecture ceases to be a mere set of visual forms and becomes an artistic expression involving textures, lights, aromas, and sounds designed to provoke profound sensory experiences.

In education, the application of AM transforms learning spaces into immersive environments where each spatial element takes on a narrative meaning, generating a sensory journey that stimulates curiosity and discovery.[4] Classrooms are described as dynamic scenarios where light, sound, and matter interact to create atmospheres that enhance knowledge and motivation.[6] It is emphasized that AM modifies the spatial appearance and triggers a sensory symphony capable of evoking emotions through tactile materials, light games, and sound environments, enriching the experience of living and learning.[7]

The evolution of AM in educational contexts represents a paradigm shift in the design of learning environments, integrating multisensory stimuli to encourage engagement, exploration, and the holistic development of students.[8] This transformation is not unrelated to cultural and contextual influences, as evidenced by studies that examine educational architecture from its historical roots to its current manifestations, where sensory and symbolic elements converge to create meaningful spaces.[9]

For example, in Egypt, it is suggested that design should take advantage of abundant natural light by incorporating large windows and interior courtyards. At the same time, it is proposed that AM applied to education in Egypt can enhance well-being and academic performance by incorporating local cultural references.[6,10] In China, AM reflects traditional architectural heritage through courtyards and curved roofs, integrated with technologies and sustainability, resulting in spaces that connect history and modernity.[11,12] In Latin America, cultural richness is manifested through ancestral materials and techniques, such as thatched roofs and adobe walls, which bring identity and meaning to educational architecture.[13,14]

The present analysis seeks to synthesize the empirical and theoretical production of MA in the educational context, highlighting how this approach can foster an emotional and spiritual connection between users and spaces through multisensory perception.[15] Understanding these processes is vital, as architecture not only stimulates the senses but also significantly impacts the well-being and attitude of those who inhabit the space, promoting everything from relaxation to creativity and concentration.

Finally, an MA in education is not limited to the creation of functional structures but is configured as an artistic practice that transforms learning environments into dynamic landscapes, inviting exploration and discovery through holistic sensory experiences. Thus, it redefines educational design to empower students through the stimulation of all their senses.

METHOD

A narrative review was conducted to explore and synthesize current scientific literature related to multisensory architecture in educational contexts. For this purpose, the databases Scopus, Scielo, and Scispace, selected for their interdisciplinary coverage and focus on applied sciences and architecture, were consulted.

The search strategy was designed using key terms in Spanish and English, including: 'architecture,' 'design,' 'multisensory,' 'education,' 'architecture,' 'design,' "sensory," and 'education.' Boolean operators (AND, OR) were applied to optimize the precision and breadth of the results, allowing the combination of concepts relevant to the topic of study.

The search period was from March to April 2024. It was limited to publications between 2020 and 2024, with no language restriction to ensure the inclusion of international perspectives. Case reports, interviews, letters to the editor, and theses were excluded due to their non-empirical nature or their specific focus that did not fit the objectives of the review.

The initial search process generated a total of 86 papers. Of these, 63 focused on multisensory architecture, educational architecture, multisensory applied to education, emotional architecture, multisensory spaces for education, history of pedagogical architecture, and sensory architecture in academic contexts. Two duplicate papers associated explicitly with neuroarchitecture were eliminated. Subsequently, 23 articles were discarded for not aligning with the research objective, and 12 more did not meet the inclusion criteria, mainly because they dealt with psychology-related topics. The final corpus consisted of 26 articles relevant to the analysis and discussion.

This procedure allowed us to obtain a representative and specific documentary sample to address the current state and emerging trends in multisensory architecture applied to education.

RESULTS
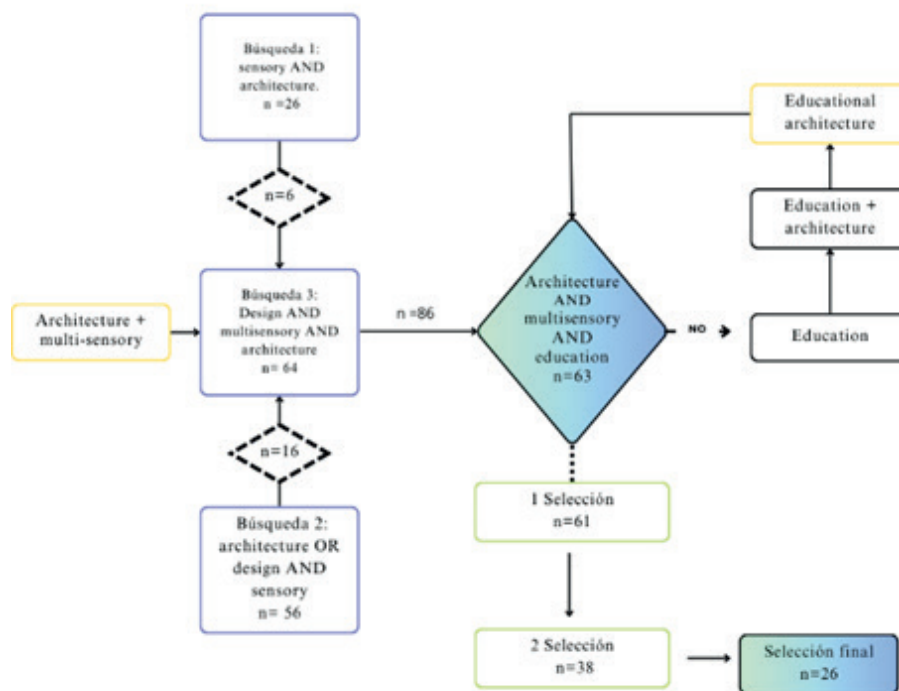
Figure 2. Diagram for study selection

Table 1. Results of architectural design literature review

Author, year	Article type/Design	Target	Result
Pallasmaa, Juhani	Observation	To provide an experiential contribution of art and architecture that engages all the senses simultaneously and stimulates our sense of identity with the experience of the world..	The architectural environments of our time tend to leave us without perception, without the emotional involvement of natural and historical environments.
Ana Sánchez Fúnez[2]	Research	Convey and demonstrate that architecture can be perceived in our world in relation to history, culture and nature.	The design of architecture created by a person is capable of making full use of all the senses; however, over the course of time, the hegemony of sight has increased.

Author	Method	Objective	Conclusion
Zayats, Inna[16]	Research	To demonstrate that the utilitarian elements of construction are an important part of architectural creation.	Architects resort to abstract and unified forms, leaving architectural creativity aside, and it is these elements that can embellish any building.
Sanchez, Ana Callejón, Maria Dolores[7]		To seek an architecture that excites, being more sensorial.	It is necessary to establish guidelines in sensorial design that allow for the creation of architectural spaces that excite; to this end, spaces that are in contact with nature, that are capable of activating memories and that excite their occupants through the activation of the senses must be studied.
Martinez-Molina, Antonio[17]	quantitative and qualitative	Conduct a subjective assessment of thermal comfort with the pedagogical support of teachers based on measurements and questionnaires, both for the educational community.	Providing a roadmap for the improvement of the thermal quality of a building, as an important initiative to provide indoor thermal comfort, but it is necessary to take into account the historical importance of the building.
Ng, Veronica[18]		The exploration of spatial recreation that aims to celebrate local identity as a key driver of architectural production, supported by collaboration between students, architects and designers.	It has the propensity to find a starting point towards an inclusive architectural education, which provides a real, experiential and engaging learning environment.
Singh, Manoj Kumar[19]		Draw conclusions on the best ways forward in the challenge of designing teaching and learning spaces.	Renovate existing spaces that need a set of guidelines with separate standards, for comfort and design standards.
Cattaneo, Daniela[9]	phenomenological	To reflect on school architecture as a subject of innovation, starting from the fact that school architecture has become a subject of research and that in recent years the number of works on this subject has multiplied.	The socialisation of the study environment enables its collaborative construction and is fundamental to establish individual or collective partnerships, to advance in networks around school architecture as an object of study.
Bianchi, Pablo[20]	phenomenological	Incorporate knowledge related to sensory aspects in architecture, during the development of academic subjects.	To incorporate sensorial aspects into the development of the architectural project problem, stimulating creativity and the search for answers, addressing innovative paths through a method that can be perfected.
Ramdan, Anwar Subhi[8]		Highlight the importance of the academic identity of schools of architecture in strengthening the identity of architecture associated with space and time, through the local nature of building materials and construction graphics in architecture.	There is an improvement in the resources of courses in subjects centred on the identity of the approach to modern technologies in building materials and construction and architectural graphics.
Bakir, Dina[4]		contribute to the understanding of the relationship between spatial qualities and the multisensory perception of the built environment.	Description of the central environments: tense environment and vibrant environment. Where the findings are discussed in relation to the multi-sensory spatial qualities that have stimulated the senses.
Galimullina, Albina[21]		Interpret the adaptation of school buildings as a developing environment outside a traditional approach and that the design focuses on the learning process itself.	In assessing the accessibility of a school building, several key elements are proposed as fundamental criteria. These elements are identity, acoustic and lighting comfort, proportionality and clear navigation.
Pachta, Vasiliki[22]		Define the historical, architectural and constructive characteristics of the stone schools in the area, as well as detect their state of conservation.	The more thorough evaluation of documentation and identification as heritage structures, in order to pass on tangible and intangible values to the next generations.

Töpper, Daniel[23]	Show how in the larger cities the initial one-room schools developed into multi-room buildings, taking their final form in 'big school buildings'.	the importance of the academic identity of schools in architecture, the strengthening of identity and architecture associated with space and time in the era of globalisation, through nature.
Helmy Almaz, Amira[6]	To describe the importance of studying and analysing the interior design of educational spaces for students with special abilities and skills to enable them to integrate into society and to study the impact of design through sensory perception.	The use of architectural spaces to have the same capacity of understanding in another sense by providing qualified spaces, functionality and design that the different senses of the students can perceive.
Aldana, Karen Pesantes[13]	Describe the importance of materials for the expression of an architecture that must transmit sensations as a unique, personal and intimate experience, which is achieved through a relationship between the individual and the architectural work.	1. Materiality is important to stimulate the senses, because it enhances the quality of architecture, where sensory stimulation is the basis for the development of architectural design. 2. The design of the
Chen, Xing[12]	To investigate the internal relationship between the evolution of the network of religious buildings and urban development, and to characterise the value of religious buildings to the historic city of China.	The protection of religious architectural heritage and urban characteristics brought about by religious factors and emphasising the use of religious architectural heritage as a potential avenue for cultural and economic regeneration.
Paramita, Kristanti Dewi[3]	To explore the process of measuring, interpreting, tracing and constructing spatial elements and spatial processes driven by sensory stimulants, leading to different projections of space.	Create multiple possibilities for sensory design goals that transcend contexts, practices and users, significantly expanding the discourse of sensory architecture.
Córdova Ramírez, Miguel[14] qualitative approach	To reveal the formal qualities - visually identified in the façades - that influenced the willingness to empathise with the streets, as a first approximation of the complex empathic processes with the city.	The experience of walking around the façades is a multi-sensory activity, visually allowing us to find patterns, which by influence have allowed us to better understand our interaction with the city.
Rosén Rasmussen, Lisa	To explore the changing empirical and theoretical conceptions of the relationship between school architecture, in terms of the architect's pen and pedagogical architecture.	reveal deep and meaningful connections that influence the educational experience and the learning environment.
Kalinkina, N. [24]	To characterise the perception of colour and form by children of different ages, considering the specificity of the influence of these means of architectural expression in various spheres of children's activity.	Colours that have a positive effect on the psycho-emotional state of children and colour combinations to avoid have been identified, which determines the percentage of primary and secondary colours in the interior design of educational organisations.
Ahmed Shaaban, Dina Ezzat[10]	Deliver smart city designs that can ensure the creation of inclusive environments that motivate people's well-being.	Demonstrates the latent powers of architectural design, through an authentic experiment, highlighting the increased decision making in physiological and psychological states.
Shahhoseini, Habib[25]	To assess how multisensoriality may affect visitors' 'visual principals' by means of textual and photographic questionnaires.	Urban and landscape planners, with regard to the relationship between the senses and their practical implications, promote the visual principals.
Li, Huahua[1]	Establish a macro-meso-micro-analysis framework, to explore the relationships between sensory experiences and spatial features of the environment from the macro-data.	This research went beyond the conventional framework of the five senses to include a sixth sense: interoception, showing that the spatial distribution and relationships between sensory experiences generate a new sense.

| Zou, Minglan[11] | Identify the sense of place of sacred spaces through the structure, components and material characteristics and architecture of wooden temples offering a new perspective that focuses on architectural emotions.. | They were able to identify that wooden temples offer not only new emotions towards architectural perspectives, but also perceived their potential to improve people's health and spiritual well-being. |

CONCLUSIONS

This review confirms that, historically, traditional architectural design contemplated stimulating all human senses as an integral part of the spatial experience, as stated in.[2] However, over time, the primacy of visual perception has prevailed, shaping a trend that has emphasized the optical dimension to the detriment of the other senses - touch, hearing, smell, and taste - thus relegating the sensory and multisensory richness that architecture can offer. This visual predominance has limited the complexity and depth of the architectural experience, conditioning the way users interact with the built space.

Accordingly, Shahhoseini[16] shows how urban and landscape design has focused excessively on visual aesthetic qualities, prioritizing the image perceived through sight to the detriment of a holistic sensory experience. This one-dimensional vision restricts perceptual diversity and spatial complexity, limiting the capacity of the built environment to activate the other sensory dimensions that enrich the knowledge and understanding of space.

However, authors such as Sánchez and Callejón[7] propose a design paradigm based on multisensoriality, where architecture is configured as a generator of emotions and deep sensations, establishing emotional links between users and spaces. Simultaneously activating senses such as sight, touch, smell, hearing, and taste, spatial experiences that transcend mere functionality and aesthetics are promoted, fostering well-being, belonging, and joy. This is especially significant in educational settings, where sensory stimulation can enhance learning and memory through emotional evocation.

Furthermore, according to Galimullina and Korotkova[17] and Cattaneo and Espinoza[9] the consolidation of multisensory school architecture requires a collaborative and multidisciplinary approach that fosters research, design, and implementation networks, facilitating the generation of innovative and contextualized solutions.

In this sense, architecture must be conceived as an active agent that encourages everything from relaxation and meditation to creativity and concentration, transcending the static function of space to transform it into a dynamic system of continuous stimuli. This transformation is key in education, where multisensory environments should not only respond to functional or aesthetic criteria. Still, it should be designed as dynamic landscapes that invite exploration, experimentation, and multisensory learning. Thus, multisensory architecture redefines the educational landscape, empowering new generations through spatial experiences that captivate and stimulate all the senses and go beyond the conventional imagination, contributing significant value to the educational process and the user's integral development.

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CONFLICT OF INTEREST
The author declares that there is no conflict of interest.

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