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Sensory and spatial adaptation for social inclusion in the educational model of higher education

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***Abstract*—**Currently, education in the Ecuadorian environment is conceived as a transcendental tool in human formation that includes social, cultural, economic and environmental aspects that make up a comprehensive personality and a character that promotes personal social development and for their peers. Social inclusion requires new ways of teaching, communicating and challenges students' abilities to deal with their own ways of knowing. The objective of this study is to provide methodological proposals that promote the inclusion of learning for people with disabilities in the higher education model, taking as a model the Faculty of Architecture and Urban Planning of the University of Guayaquil. A qualitative, deductive methodology is applied that analyzes divergent systems and types of learning environments to generate a tool with characteristics of sensory and spatial analysis that adapt to the context of higher education. The conclusion is that sensory adaptations comprehensively activate the cognitive and integrative part of users with physical disabilities, while spatial adaptations can provide comfort and relaxation to users with psychosocial deficiencies.

Keywords: Multimedia education, online learning, programmed teaching, social inclusion.

INTRODUCTION

Educational development among countries around the world varies unevenly depending on public policies, learning dynamics, school adaptations, and psychosocial factors. These factors largely generate a comprehensive inclusion in education, as a way of perceiving societies as equal to those who need learning environments that adapt to their conditions, which foster resilience within education.

Developing countries do not have a viable education model that meets the highest standards of the global market, but this should not diminish educators' efforts to establish themselves as a high-level educational model. The situation of educational institutions has deteriorated with the onslaught of the latest global pandemic, such as COVID-19, which caused some countries, already mired in poverty, to fall even further behind the development scale. Others found opportunities within digital, technological, and smart media production, which now make them visible to the world, as in the cases of Singapore and Iceland. Strategies based on a forward-looking look at the world's needs and where new buyers will be found at the height of globalization in the fourth industrial revolution

One of the emerging trends following COVID-19 has been digital initiatives to provide and obtain essential services such as education, food, and employment. This first approach has adopted new social policies in the creation of so-called virtual classrooms and how the power of technology has enabled a virtual teaching methodology called e-learning (Vivas et al., 2015), which has almost perfectly replaced traditional teaching using technologies. It is immersive, adaptive, and always seeks to create the most realistic and integrative experience possible.

Currently, education in Ecuador is conceived as a transcendental tool in human development, encompassing social, cultural, economic, and environmental aspects that shape a comprehensive personality and character that promotes personal and peer social development (Jácome et al., 2025).

At the national level, considerations regarding universal accessibility are almost non-existent, since less than 6% of establishments do not have architectural elements such as ramps, handrails, accessible floors, or adequate spatial conditions for the deployment of people with reduced mobility (Luck, 2022).

The ability to study ergonomics involves gaining important insights into human physiognomy to establish guidelines for architectural and spatial redesign (Colorado-Pastor et al., 2020). Previous studies show that technology applied to assist people with disabilities transforms them into autonomous elements within society (Estima & Carvalho, 2024), increasing their inclusion and improving their quality of life.

In Ecuador, educational proposals seeking integration at all levels are somewhat scarce and fragmented. According to reports from the Ministry of Education, only 45% of establishments provide access to people with disabilities, cognitive difficulties, or social and gender differences.

Educational proposals such must integrate these sensory and spatial (physical) aspects to generate true inclusion that contributes to society. This, to a certain extent, is not the case, especially in Latin American educational settings. Therefore, a comprehensive education approach must be the driving force that aligns knowledge toward the promulgation of shared sustainable development.

The divergences in today's education offer new possibilities for communication, collaboration, interaction, and authentic student-centered learning. Examining the potential impact of the new educational environment has become an important aspect of the efforts of educational researchers. Much of this research and literature on information and communication technologies (ICT) and learning has been conducted through the lens of sociocultural theories and theories of dialogism (Vila-Merino et al., 2024). Social inclusion requires new ways of teaching and communicating and challenges students' abilities to grapple with their own ways of knowing. The concept of teaching is defined as a specific form of communication that aims to provide students with the opportunity to learn and construct knowledge; however, this presents new challenges for both students and teachers. It represents an inherent complexity, partly within the system and partly within the system's environment. Therefore, educators must learn to manage both complexity and contingency. Recent literature provides insights into and implications of the ways in which complexity and contingency can affect teaching and learning. We call for continued research on communication and the conditions for learning in specific educational settings, including the development of learning resources and research projects focused on new media and their learning potential.

According to this background, education should not be managed as a particle or a cell without any connection (Choe & Kim, 2024), but a complex structure such as a divergent or diversified structure of societies, cultures, economies or environments should generate a programmatic order through an educational systems framework.

MATERIALS AND METHODS

a. FUNDAMENTALS OF SOCIAL INCLUSION FROM SPATIAL AND SENSORY PERSPECTIVE

The difficulties from a spatial and sensory analysis perspective are quite diverse, but in context, the focus is on two highly recognized classifications in science that recognize physical and mental disabilities (Spiegel et al., 2019). These classifications encompass sensory disabilities and the spectrum of syndromes with direct psychological impact, such as autism or Asperger's, that respond to the spatial and sensory quality of classrooms and their failure to accommodate students with diversity.

It has been possible to address these difficulties by analyzing educational models as divergent and inclusive systems, using trained classroom models that promote the physical design of better-equipped spaces, such as ramps, Braille writing, speakers, or spaces that use soothing colors and simulate an integrative space (Moreira & Gaibor, 2020).

From this theoretical background, it can be defined that there are foundations of social inclusion based on three basic pillars:

- Provide personalized support within the regular classroom to serve each student according to their specific needs.
- Recognize and respect individual differences, promoting an environment of harmonious coexistence among students.
- Encourage the active participation of all students in learning without connoting physical or mental differences.

b. DIVERGENT LEARNING SYSTEMS AND ENVIRONMENTS

For spatial adaptation, there are design methodologies that use so-called educational systems. These are characterized by an educational management design that uses the learning environment as a learning development module.

A system as such is an environment composed of mutually dependent elements. Therefore, a system interweaves knowledge for possible student validation. Therefore, employing a learning environment through the lens of inclusion creates a divergent learning environment that encourages the integration of knowledge based on the specificities of individuals.

Therefore, the starting point of the framework is a basic model of systems theory, consisting of a system and its environment (Brandel et al., 2024). Every system has a related environment that is specific to the system. Furthermore, the environment of a system is always more complex than the system itself, so each system constructs, so to speak, its environment due to the observation of the system.

Ultimately, the use of a system would generate a divergent environment by functioning as an operating system, being the conjugation of systems that are aligned with each other. Therefore, aspects such as society (and its diversity), culture (and its identities), the economy (and its strata), and the environment and its particularities can be integrated into comprehensive education (Silva Duarte et al., 2022).

c. PSYCHIC AND SOCIOCULTURAL SYSTEM

Sensory adaptation employs the methodology of psychic systems that operate and are maintained through conscious activities (e.g., thoughts, emotions, and intuitions). A particular user may or may not find a thought coherent, but in relation to them, it is not a superficial agreement. It is less possible to form a system from a set of different human beings (Lam, 2024).

A particular group likes to pass through agreements and conventions of thought, but the structure remains highly divergent if they encounter things they dislike; therefore, this discrepancy in thought generates a

personal psyche of nonacceptance, which leads to a lack of interaction among other distinctions. Generating a point of cohesion of thought would generate the integrative link to place the personal psyche in an environment of comfort, so proposing the psychic system with neural links of comfort would improve social and cultural integration.

Social systems influence communication as an articulating entity through dialogue. The concept of communication is defined as the synthesis of three selections: (1) the selection of information, (2) the selection of expression (selected by the sender, for example, the teacher), and (3) the selection of understanding (selected by the sender, for example, the teacher). by the recipient, for example, the student) (Hosseini & Bousbaci, 2024).

These elements comprise linear communication, but the management of divergent models includes a fourth element, which is multicultural communication (selected by the theme of new knowledge from each culture). This communicative dynamic would generate a permanent bond between different social and cultural figures.

Therefore, a minimum of two people (psychic systems) is needed to form a communication unit and therefore a social system. We can observe this statement, but not the third. The selection of the intellect is, so to speak, invisible; that is, they are internal operations of the specific psychic system (Urzúa, 2024). Of course, this has implications for the specific environment, designed for joint learning.

A key point is that communication can be successful if a horizon of expectations and agreements is established on both specific and indigenous topics, which can happen through practice or by establishing a plan in the academic classroom.

d. ANALYSIS OF A HIGHER EDUCATION UNIT

The Faculty of Architecture and Urban Planning at the University of Guayaquil, listed as one of the oldest educational faculties with over 62 years of experience, has maintained a linear educational model over the years; however, this landscape has gradually changed, highlighting new students with disabilities.

In recent years, the number of students with disabilities has grown by 3% (average data), which means that classrooms and faculty must address this new student population, opening a comprehensive and inclusive educational model that had not been conceived at the beginning of the faculty.

Table 1. Complex system through communication and evaluation parameters

Period	Faculty	Disability	Percentage of disability	State
2024-2025 IIC	Architecture and Urbanism	Psychosocial	38	Second registration
2024-2025 IIC	Architecture and Urbanism	Physic	51	First registration
2024-2025 IIC	Architecture and Urbanism	Auditory	40	Third registration
2024-2025 IIC	Architecture and Urbanism	Visual	81	First registration
2024-2025 IIC	Architecture and Urbanism	Auditory	45	Second registration

Note: FAU-UG Student Wellbeing Data (2024).

RESULTS

The following table shows the case of five students with disabilities enrolled in this second semester of the current year. The dropout rate or number of enrollments resulting from repeating the course is more consistent among this social stratum. This information made it possible to see that part of the educational structure does not provide support for people with disabilities, which is growing in importance with each university cycle.

a. PROPOSAL FOR PHYSICAL-SPATIAL ACCESSIBILITY

An educational model is proposed through a proposal for universal accessibility based on the needs of students identified in Table 1. It is evident that only one student has a physical disability. However, the spectrum of students with temporary physical disabilities arising from accidents or unrecognized congenital or future problems that cause these students to drop out is also widespread. Based on this information, a redesign of spaces will be proposed based on usability according to the size and design of ramps and stairs, and by improving formal aspects of the furniture (seating). Through this redesign, safety parameters will be established to reduce the number of injuries, ensuring the lowest comfort level. The design of the proposal must address users with visual disabilities, since the respondents in this type of sample do not have ergonomic criteria that aid their orientation and autonomy (see Figure 1).

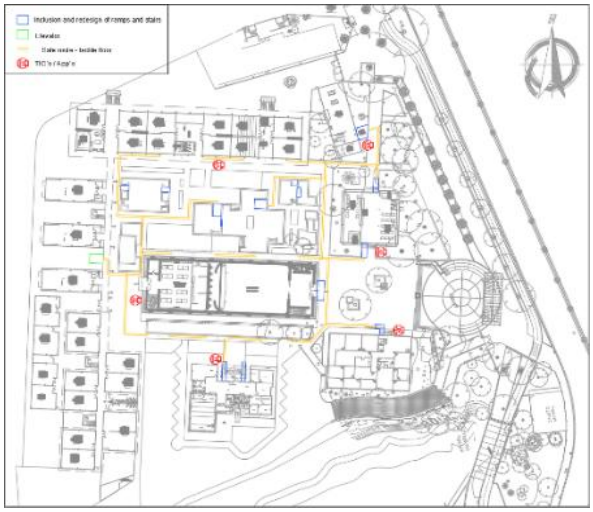

Fig. 1. Proposal for physical and spatial accessibility at the Faculty of Architecture and Urban Planning. Note: Prepared by the authors.

b. COMPLEX AND DIVERGENT SYSTEMS IN HIGHER EDUCATION

A complex system arises from particularities that make up a group of conglomerates that differ from one another. Therefore, the structure of a system is not so singular, but rather an operating system that links various objective functions, in this case the psyche, such as the motor function, the thinking function, and sociocultural functions, such as ethnicity, race, or identity.

In this complex system, it is vitally important to establish variable roles within the group of students, with the teacher as the moderator, who grants special powers to lower-level roles to maintain this diversity of action in terms of opinion. The condition of communication is established due to the specific function of this system. It is therefore the specialized form of communication that aims to change the mental structures that constitute this type of social system and is integrative.

At first, this may seem like a simple general model for key parameters and their relationships in a teaching environment. In this sense, communication must be developed by indicating the specific context of use, where, for example, the selected communication forum is made explicit, or by indicating that there are several roles and functions of teachers and students, thus indicating a complexity built into the system.

Figure 2 illustrates how a communication system influenced by diversity of thought should operate. In some cases, the parameters at stake are how to establish constant and fluid communication and how the educator can make decisions, since they must decide what to select and what to deselect in the specific context. And clearly, determining the specific context must be the fundamental decision when preparing, planning, and organizing learning environments.

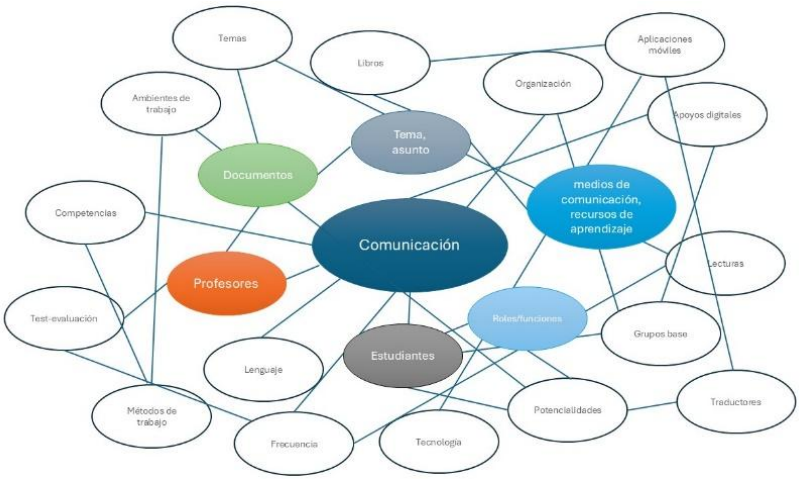

Fig. 2. Complex system through communication and evaluation parameters. Note: Adapted from "Learning models in the transition towards complexity as a challenge to simplicity" (Guaicha et al., 2024).

Proposing learning environments requires reflection on the particularities students face, such as differences in social contexts due to historical disputes or religious differences. Research on teacher development conceives the teaching of knowledge as highly contextualized and interpretive (Jácome et al., 2025; Yusof et al., 2024), based on the social contexts within which teaching takes place. This perspective is based on interpretations of situated situations in cognition in which the social context within which learning takes place is an integral part of the interpretation and application of that learning. Teacher learning involves addressing questions about practice, about students, and about their beliefs, conceived as traditions.

The proposed learning environment includes an environment where the physical space represents social neutrality without references or preferences; open conversations on topics safeguarding respect; Integration of weekly cultural and social topics and a structured approach to teaching that is equally accessible to all, such as openness to sign language and Braille, and the physical adaptation of furniture to the environment.

This proposal will generate an ideal level of inclusion, truly demonstrating a holistic learning classroom focused on a divergent learning environment that fosters strong social development and diverse thinking.

c. PSYCHIC-SENSORY TECHNOLOGICAL PROPOSAL

Since technological criteria through ICT promote this communication link compared to non-perceptible systems, that is, they are not easily located within the physical environment and generate a fragmentation of the educational system, it is therefore proposed to establish the dissemination of technological elements in the environment of the Faculty of Architecture and Urban Planning that support visual, auditory, and physical abilities with the use of tactile floors, signage, auditory elements, and access guides; these elements are proposed within the communication system. Regarding technological systems, an interconnection is established between the applications Google Talk, SpeakLiz, and Esaccesible. The objective is to establish a single application that shares these three functions to better integrate users and ensure that their physical spatial journey is autonomous, allowing the platform to interact with other internationally distributed applications.

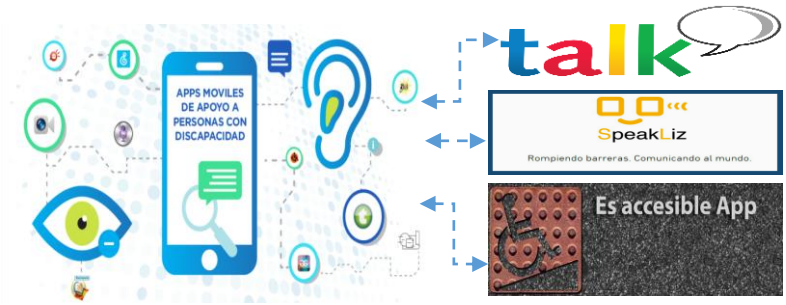

Fig. 3. Psycho-sensory technological proposal at the Faculty of Architecture and Urban Planning. Note: Adapted from "Proposal of a technological ergonomic model for people with disabilities in the public transport system in Guayaquil" (Colorado., 2020).

Addressing psychosocial disabilities from this technological structure, a correlation is adopted with the accessibility proposal, as they must be spatially and sensorially self-sustaining to achieve a hybrid model, considering four basic concepts of neuroarchitecture: color, shape, interaction with green areas, and social integration as the foundations for optimal treatment. Therefore, classrooms will be adapted to respond to this relaxing environment, relevant to psychosocial disabilities related to autism spectrum disorder.

d. CAPACITIES FOR CLASSROOMS – SOCIAL INCLUSION SPACE

To promote the development of communities and their differences, it is necessary to start from the academy as a link between innovation and technology. Therefore, educational training must align with current trends. Therefore, it is proposed to integrate Design Thinking into I-Labs to obtain the social contribution and economic incentive that each community desires through an initiative to create diverse environments and integrative work programs that embrace the best ideas for diversity. Therefore, a form of inclusion from the learning classroom is proposed, with the following initiative:

Capable Classroom

Starting from the question: What are the challenges for the economic and social inclusion of people with disabilities in Ecuador?

There were five objectives to be achieved:

- Awareness of the problem
- Empowering people with disabilities
- Give everyone a voice through technology
- Generate measurable evidence
- Larger-scale pilot projects

The proposal posits that knowledge of disabilities is fundamental to understanding them. Therefore, in a trained classroom, one disability is articulated per classroom or in a learning environment, where students will feel comfortable with their disability in an environment that respects their rights and supports their ideas. In the teacher-trained classroom, students (regardless of their social or physical differences) will engage in meetings to propose solutions to improve the quality of each facility based on an experiential study of how empowered disabilities are addressed in the "Trained Classroom."

DISCUSSION

The proposed educational model analyzes the interaction between architectural spatiality and the senses to integrate sociocultural aspects into the academic curriculum and pedagogical practices to create a more inclusive and equitable learning environment. By recognizing and valuing social diversity in higher education, taking into account the analysis conducted at the Faculty of Architecture and Urbanism at the University of

Guayaquil, Ecuador, the aim is to enhance the relevance of accessibility and improve the academic performance of all students with disabilities, thus contributing to the comprehensive development of society.

Including social diversity in the school curriculum is not only a necessity in contemporary education, but also brings multiple benefits. First, it allows students to develop a broader worldview, breaking down stereotypes and prejudices that limit their understanding of social and cultural complexities. Second, it fosters more meaningful and contextualized learning, where students can relate academic content to their own cultural experiences.

The document is based on theoretical approaches such as the Theory of Divergent Systems and Learning Environments by Mathiasen and Schrum (2010) that address the characteristics of special people and their equal considerations for communication and joint learning that is formulated as an integrative strategy. within the classrooms that supported by the technological and ergonomic aspects supported by the theories of Colorado-Pástor (2020) generate an association between the sensory and spatial analysis that educational centers should have, these theoretical foundations highlight social interaction and critical thinking as key tools for the construction of knowledge.

CONCLUSION

Education should be a liberating process that allows students to reflect on their sociocultural reality. On a practical level, the proposal includes collaborative activities, the use of inclusive teaching materials, and pedagogical strategies designed to encourage active and critical student participation. These activities include debates, cultural fairs, community dialogues, and the use of digital technologies to enrich the teaching-learning process.

Third, the proposal for social diversity through innovation and technology is a valuable pedagogical resource that, when properly integrated, improves both academic performance and the school climate, contributing to the development of more critical and culturally aware global citizens. The proposal emphasizes the importance of inclusion and mutual respect (Estima & Carvalho, 2024). The proposal also seeks to make cultural diversity an integral part of the academic curriculum, not as additional content, but as an essential component that reinforces the values of respect, inclusion, and solidarity (Moreira & Gaibor, 2020). This contributes to developing instilling in students a critical and multicultural awareness that will enable them to face the challenges of a globalized society.

This comparative approach reinforces the need to integrate pedagogical strategies that go beyond social recognition but rather promote an inclusive and transformative dialogue that fosters equity and mutual respect in learning environments (González & Cruz, 2022). Thus, the educational proposal not only responds to the need for greater inclusion in the classroom but also offers significant benefits for students' academic, personal, and social development, fostering a more critical and committed citizenship regarding diversity around disabilities.

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