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Accessibility and Environmental Comfort in Brazilian Architecture and Urbanism Schools: User Perceptions Assessment

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Abstract: Schools of Architecture and Urbanism have unique spatial requirements shaped by their distinct pedagogical strategies. Beyond serving as educational spaces, these buildings play a fundamental role in students' initial encounters with architecture, influencing their professional development. This study examined user perceptions of accessibility in two Architecture and Urbanism school buildings in São Paulo, Brazil: FAU-USP and FAU-Mackenzie. The research's methodology combined literature and document reviews with Post-Occupancy Evaluation (POE) methods, including walkthrough analyses and user perception surveys on accessibility. The findings revealed both strengths and weaknesses in the buildings' accessibility from the perspectives of users and the researcher. Despite modifications to their original designs, critical issues persist, particularly concerning vertical mobility safety and the absence of effective wayfinding systems, which may affect occupants' autonomy. Additionally, problems related to the classrooms' acoustics and thermal conditions were identified, potentially impairing students' ability to hear, communicate, and engage during lectures. Based on these insights, the study proposed recommendations for future architectural adaptations aligned with the norm NBR 9050 – Accessibility to Buildings, Equipment, and the Urban Environment (Brazilian Standard) and the Americans with Disabilities Act (ADA) to enhance inclusivity and usability within these academic environments.

Keywords: Accessibility: User perspective: Post-Occupancy Evaluation: Schools of Architecture and Urbanism

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Introduction

Architecture and Urbanism (AU) schools are more than just educational facilities; they act as formative spaces that reflect and influence students' understanding of architecture. Their physical structures support pedagogical strategies and provide some of the first opportunities for students to critically engage with the built environment (Preiser, Nasar, & Fisher, 2018).

In Brazil, many AU school buildings were designed in the mid-twentieth century, before accessibility standards were established. Consequently, these buildings often face difficulties in meeting current requirements for accessible learning environments (Costa, 2023). These issues underscore the importance of assessing built environments for inclusivity and user well-being.

The idea of accessibility goes beyond the provision of ramps and lifts; it includes cognitive, sensory, and communicational factors that affect users' independence, especially in complex academic settings. Inclusive architectural and universal design principles must address a wide range of user needs by enhancing spatial clarity, sensory conditions, and equitable usability (Steinfeld & Maisel, 2012; Imrie, 2012; Preiser & Ostroff, 2001). In educational settings, these measures influence participation, concentration, and academic performance (Black et al., 2014).

Parameters such as indoor air quality, thermal comfort, acoustics, and lighting play a critical role in cognitive function, memory retention, and academic outcomes (Brink et al., 2021; Frontczak & Wargocki, 2011; Minelli, Puglisi, & Astolfi, 2022). Poor environmental conditions can cause fatigue, decrease attention spans, and lead to higher absenteeism among students and staff (Imms, Cleveland, & Fisher, 2016). Therefore, creating a balanced sensory environment is essential to support diverse learning profiles and promote equity in educational opportunities.

In this context, user perception serves as a tool for assessing accessibility conditions. Post-Occupancy Evaluation (POE) methodological instruments enable researchers to capture users' lived experiences and identify potential improvements in building performance and inclusivity (Ono et al., 2018).

This article investigated how users perceive accessibility through a POE approach in two AU schools in São Paulo, Brazil: The Faculty of Architecture, Urbanism, and Design of the University of São Paulo (FAU-USP) and the Faculty of Architecture and Urbanism of Mackenzie Presbyterian University (FAU-Mackenzie).

Based on the findings, architectural adjustments were developed to align with the norm NBR 9050 – Accessibility to Buildings, Equipment, and the Urban Environment - Brazilian Standard (ABNT, 2020) and the Americans with Disabilities Act – ADA (United States Department of Justice, 2010), aiming to enhance inclusion and functionality in the academic spaces of the case studies.

Case studies

The selection of FAU-USP and FAU-Mackenzie was based on their historical importance and architectural significance. Both are in São Paulo, Brazil, but differ in their urban context, spatial layouts, and design conception, allowing for comparative analysis.

The Faculty of Architecture, Urbanism, and Design of the University of São Paulo (FAU-USP) is a public institution founded in 1948, with its current main building completed in 1969 (Figure 1). It is situated within the university campus and benefits from a spacious, green urban context, yet remains relatively isolated from the city's everyday dynamics. It was designed by architects Professor João Batista Vilanova Artigas and Carlos Cascaldi, considered a landmark of Brazilian modernism, characterised by exposed reinforced concrete, large open studio spaces, skylights, and a central connecting area (Buzzar, 2014; Barossi, 2016).

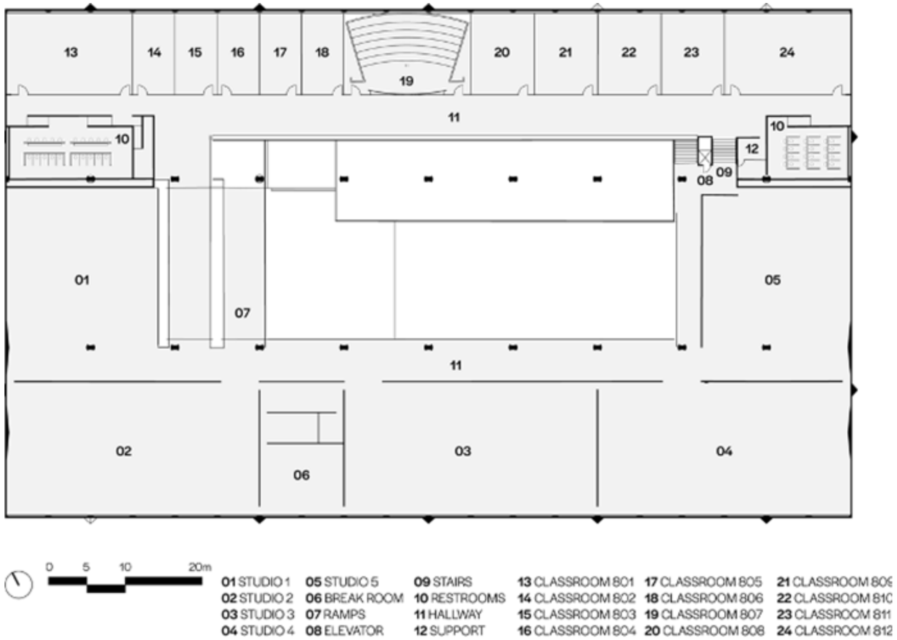
Figure 1

FAU-USP façade (Source: Fernando Stankuns, 2010)

The main FAU-USP building covers 21,263 square meters, spread over 8 half-stories. There are 12 classrooms on the 8th floor and 5 studios on the 7th floor (Figure 2).

Figure 2

FAU-USP 7th and 8th floors plan



The Faculty of Architecture and Urbanism at Mackenzie Presbyterian University (FAU-Mackenzie) is a private institution founded in 1947, with its current main building completed in 1961 (Figure 3). Located in a more central part of São Paulo, the school is within a denser urban environment. It was designed by architects Eduardo Corona, Takeshi Suzuki, and Jun Okamoto, who were also faculty members. Architecturally, the structure features a more traditional layout, with distributed floors and segmented rooms (Alvim, Abascal & Abrunhosa, 2017).

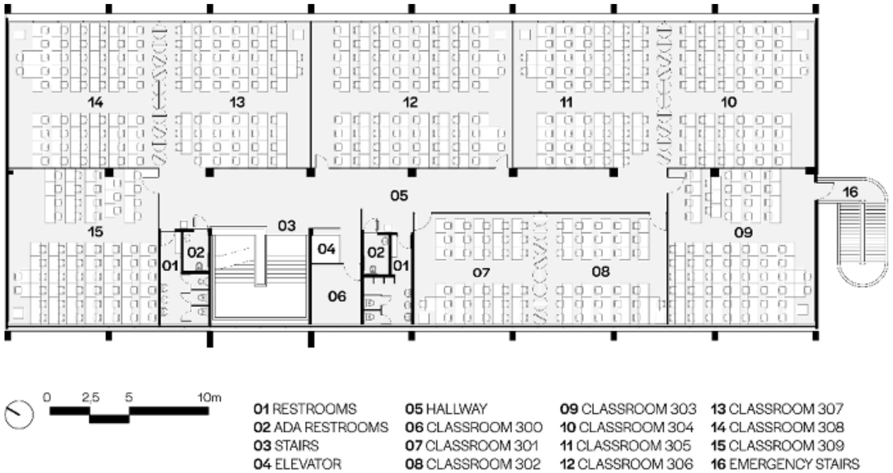
Figure 3

FAU-Mackenzie façade (Source: Alvim, Abascal & Abrunhosa, 2017)

The FAU-Mackenzie building covers 5,902 square meters and has 5 floors. The 28 classrooms are spread similarly over the 1st, 2nd, and 3rd floors (Figure 4).

Figure 4

FAU-Mackenzie 3rd floor plan



Both buildings have undergone recent renovations over the past decade to improve and modernise their original structures.

Methodology

This study employed a qualitative and exploratory Post-Occupancy Evaluation (POE) methodology (Preiser, Rabinowitz, & White, 2016; Ono et al., 2018), which prioritises user experience and perception when assessing the performance of built environments. The following methodological instruments were used: (1) a walkthrough analysis conducted by the researcher to identify qualitative aspects of spaces, and (2) the distribution of perception surveys to students, staff, and faculty at both institutions.

The questionnaires aimed to capture user perceptions of accessibility, vertical mobility, signage, and environmental comfort conditions in learning spaces.

Ethical Considerations

All research procedures involving human participants adhered to the ethical protocols established by Brazilian research protocols. The study was submitted to Plataforma Brasil and approved by the Research Ethics Committee of the School of Arts, Sciences and Humanities at the University of São Paulo (CEP-EACH) on 24 September 2021, under the Certificate of Ethical Review Submission (CAAE) no. 51134221.8.0000.5390 and approval protocol no. 4.996.912. Participants were informed about the research objectives and voluntarily signed informed consent forms before participating in the surveys.

Results and discussion

The study was conducted between 2020 and 2022, during a period marked by COVID-19 distancing protocols. Therefore, health restrictions affected the logistics of data collection, with digital surveys and adjusted site visits ensuring compliance with safety guidelines. The FAU-USP and FAU-Mackenzie surveys received 79 responses, respectively.

The FAU-USP and FAU-Mackenzie questionnaires were completed primarily by students, representing 82% and 57% of participants, respectively (Figures 5 and 6).

Figure 5

FAU-USP user responses to "What role do you have in the building?"

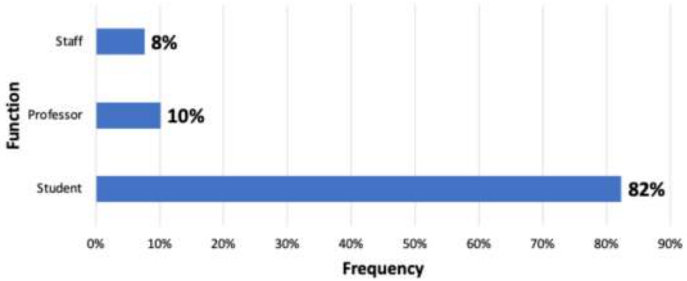
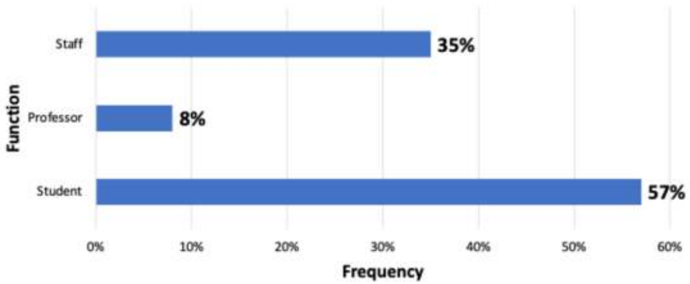


Figure 6

FAU-Mackenzie user responses to "What role do you have in the building?"



One question asked whether the respondent would like to declare any type of disability: physical, auditory, visual, intellectual, and/or mental/psychosocial. In the FAU-USP surveys, only one respondent indicated a visual impairment, while at FAU-Mackenzie, none of the respondents stated any type of disability.

Vertical circulation and wayfinding

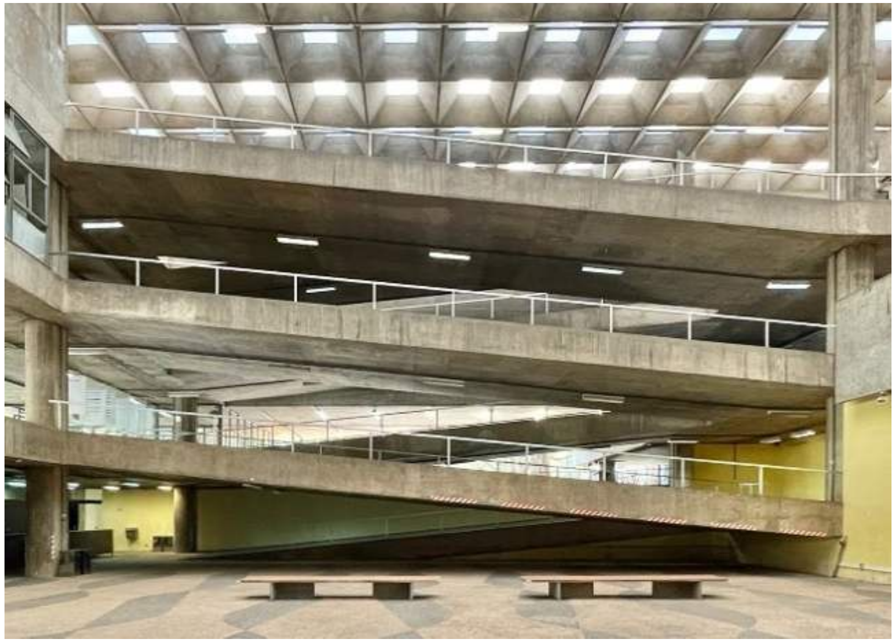
All classrooms and studios in the FAU-USP building are located on the top floors, so users rely on the vertical circulation provided by ramps, staircases, or elevator.

The FAU-USP iconic ramp is 6 metres wide, which complies with the minimum width required by both NBR 9050 and the ADA; however, its inclination of 9.74% exceeds the maximum allowed by both standards (maximum of 8.33%). The ramp surface is finished with rubber flooring, which may enhance slip resistance and tactile feedback, aligning partially with both standards' requirements for non-slip materials in circulation areas. However, there is no tactile paving at the beginning, end, or along the body of the ramp, as prescribed by NBR 9050 to aid orientation for visually impaired users.

Both sides of the ramp are equipped with handrails; nevertheless, they consist of a single square-profile bar, which does not conform to the specifications of NBR 9050 or the ADA, both of which recommend a circular section (typically 3 to 5 cm in diameter) to ensure ergonomic grip. These deviations may compromise safety and accessibility for users of manual wheelchairs who require physical propulsion and braking. The lack of guardrails along the ramp edges increases the risk of lateral falls as the ramp borders an open void (Figure 7).

Figure 7

FAU-USP ramp



The staircases within the FAU-USP building are 3 metres wide, complying with the minimum width requirement of NBR 9050 for accessible circulation routes. The steps are coated with epoxy flooring and include anti-slip strips at the edge of each tread, which is consistent with safety recommendations in both NBR 9050 and the ADA Standards. These materials contribute to surface traction and may reduce the likelihood of slips and falls.

Like the ramps, the staircases are equipped with squared-profile handrails on both sides, which do not meet the standards. The staircases' laterals are walls, which serve as protective barriers and eliminate the need for additional guardrails. While this feature enhances safety by preventing lateral falls, the lack of tactile warning surfaces at the top and bottom of the stairs (Figure 8) remains a possible navigation problem for visually impaired users who rely on such cues to identify changes in floor level.

Figure 8

FAU-USP stairs and elevator

The elevator in the FAU-USP building has approximate internal dimensions of 1.60 by 1.80 metres, which meet the minimum spatial requirements established by both NBR 9050 and the ADA Standards for wheelchair manoeuvrability. However, the lift is equipped with a manual pull door, which does not comply with the guidelines of both standards, which require doors to open automatically or with minimal effort to accommodate users with limited upper limb strength or mobility.

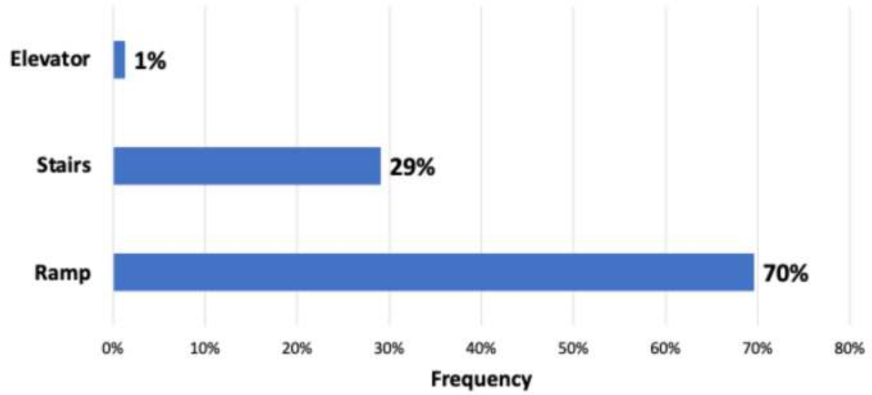
Moreover, the elevator does not include an internal mirror, which is an element mandated by NBR 9050 to assist wheelchair users in reversing safely when there is insufficient turning space. The elevator also serves only the even-numbered floors of the building, which may pose an additional challenge for users with mobility impairments, requiring them to rely on alternative routes to access certain areas of the building, such as the studios level.

No wayfinding signage was identified that could assist users in navigating the building. This absence conflicts with both NBR 9050 and ADA Standards, which require accessible signage to support autonomous navigation for people with disabilities.

Survey results revealed that 70% of FAU-USP respondents reported a preference for using the ramps for vertical circulation, while only 1% indicated regular use of the elevator (Figure 9). Despite the accessibility barriers presented, the choice of ramps over other means of vertical circulation may be justified by their visual prominence for users entering the building. The elevator may have been the least chosen option as it does not offer efficient circulation between all the building's floors.

Figure 9

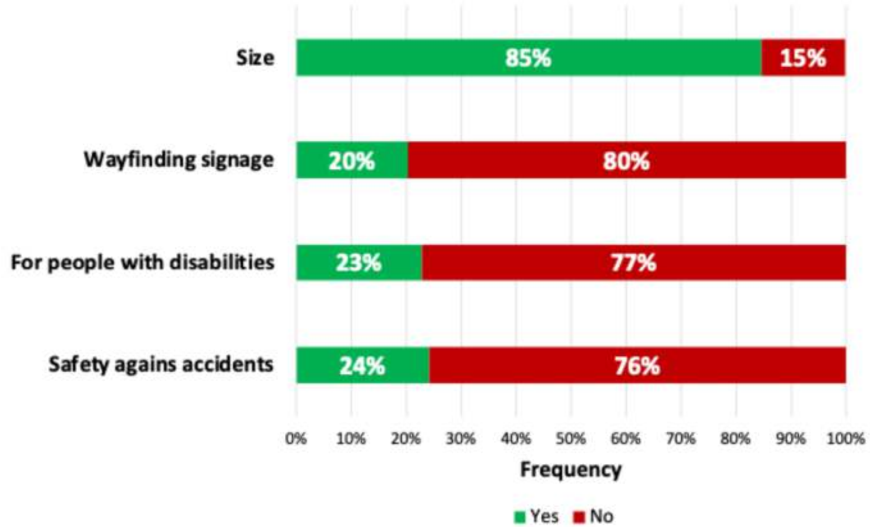
FAU-USP user responses to "How do you circulate the building most?"



Aligned with the researcher's analysis, most respondents indicated that they considered the chosen mean of vertical circulation to be accessible in terms of size, but not for people with disabilities, in terms of wayfinding signage and safety against accidents (Figure 10).

Figure 10

FAU-USP user responses to "Do you consider the previously chosen circulation space accessible in terms of...?"



Similarly, access to FAU-Mackenzie classrooms requires the use of stairs or an elevator. The stairs in the FAU-Mackenzie building are approximately 2.50 metres wide, which exceeds the minimum width required by both NBR 9050 and the ADA Standards. The stairs are equipped with guardrails featuring protective bars and dual handrails on both sides. These handrails have a rounded profile, aligning with both standards' recommendations for ergonomic grip.

The stair treads are made of granilite, a polished material, and include visual step markers (Figure 11). The absence of anti-slip treatment on the surface demonstrates that the stairs do not fully comply with the safety provisions outlined in either standard, which may pose a risk of falls.

Figure 11

FAU-Mackenzie stairs

The elevator at FAU-Mackenzie measures approximately 1.80 by 1.70 metres, meeting the space requirements set by both NBR 9050 and the ADA. It features an automatic door, allowing for independent use and compliance with both standards. A tactile floor surface at the entrance warns visually impaired users of the change in level (Figure 12), as required by NBR 9050. Inside, a mirror is provided to help wheelchair users when reversing, also in line with Brazilian regulations.

Figure 12

FAU-Mackenzie elevator

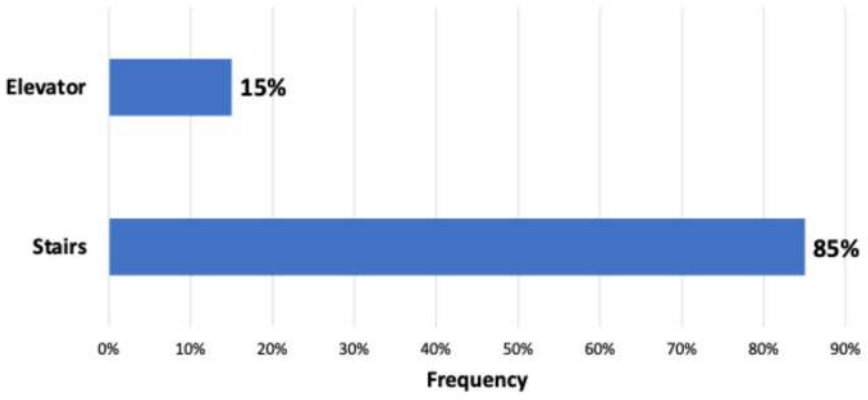
There was also no wayfinding signage found that could help navigation within the building, which does not comply with either of the accessibility standards.

Most users who responded to the survey indicated that they prefer using the stairs (85%) over the elevator (15%) (Figure 13). Similar to FAU-

USP, the stairs may be the preferred option as they offer greater visibility to users entering the building than the elevator.

Figure 13

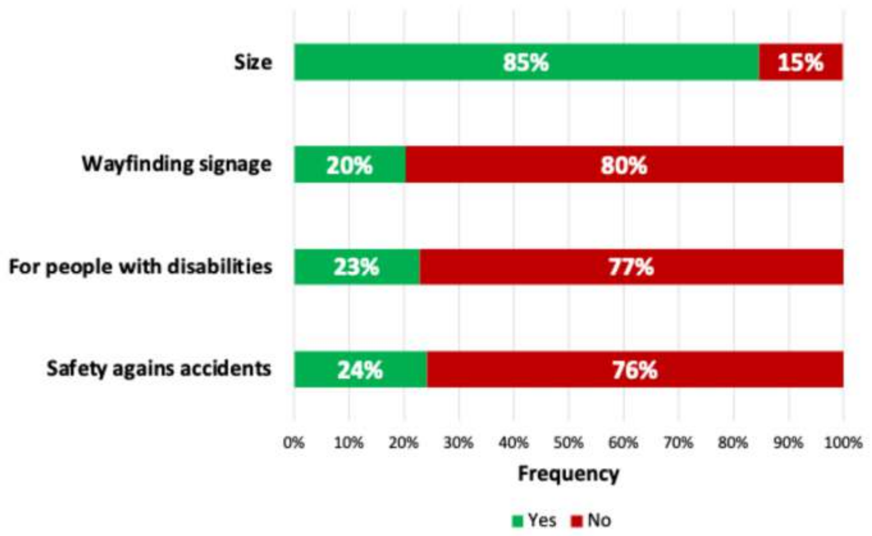
FAU-Mackenzie user responses to "How do you circulate the building most?"



The survey results also indicate that users perceive the chosen means of vertical circulation as accessible in relation to size, safety against accidents, and wayfinding signage, even though the researcher did not identify any signage in this regard. On the other hand, users do not perceive the vertical circulation accessible to people with disabilities (Figure 14).

Figure 14

FAU-Mackenzie user responses to "Do you consider the previously chosen circulation space accessible in terms of...?"



Overall, the vertical circulation at FAU-Mackenzie demonstrated greater adherence to accessibility regulations than at FAU-USP. Even so, both buildings lack wayfinding signage.

Ergonomics and Environmental Comfort

FAU-USP has two primary types of learning environments: conventional classrooms equipped with chairs and tables for lectures, and studios featuring wider tables suitable for design development classes.

The conventional classrooms at FAU-USP have either a flat floor or a tiered layout, like an auditorium. In some of the tiered classrooms, the furniture is fixed, and there is no designated space for wheelchair users. This configuration fails to comply with both NBR 9050 and ADA Standards, which require at least one accessible seating space in each room, with a clear floor area for frontal or lateral wheelchair approach. The absence of adaptable or removable seats in these tiered layouts may reinforce segregation and limit participation.

In both conventional classrooms and studios, daylight is provided by skylights. In classrooms, skylights positioned closer to the board have lower light transmission, thereby reducing the glare on the content. However, on sunnier days, there may be excessive illumination over the students' tables, which can hinder students' visibility.

The acoustics conditions of the studios were identified as critical: the partitions in these spaces are formed by half-walls, and there are no doors, which can allow external noise to enter these spaces. Furthermore, the surface materials are predominantly reflective, and the ceilings are double height, which can affect reverberation time and, consequently, speech intelligibility in this space.

For thermal-related features, users can open the facade's natural ventilation system; however, this system was found to have signs of dirt accumulation, indicating a lack of cleaning and proper maintenance. Additionally, the building does not provide artificial cooling or heating systems. As a result, users may experience thermal discomfort.

According to user responses in the survey, the most concerning issues identified in FAU-USP classrooms relate to thermal conditions, with discomfort reported during both winter and summer seasons. Respondents also rated the acoustic environment negatively, in terms of speech audibility and the presence of external noise. Additionally, accessibility was mainly perceived as “Bad” (Figure 15).

Figure 15

FAU-USP user responses to "How do you consider classrooms in terms of...?"

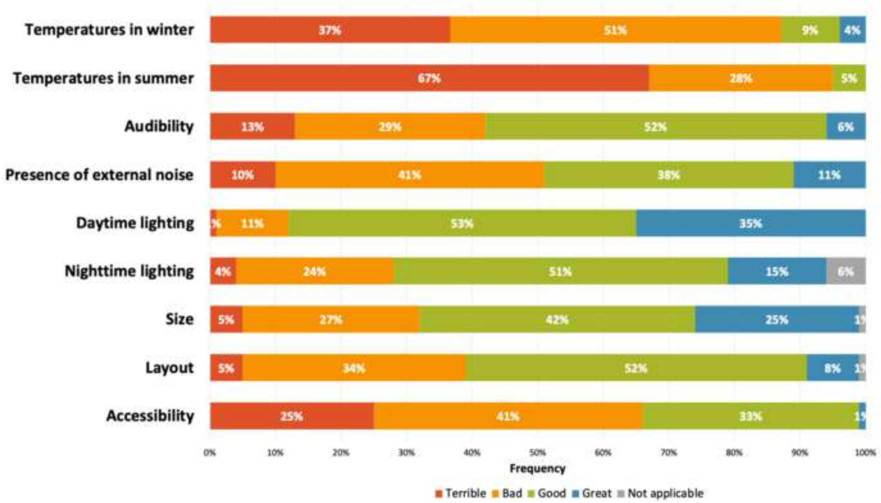
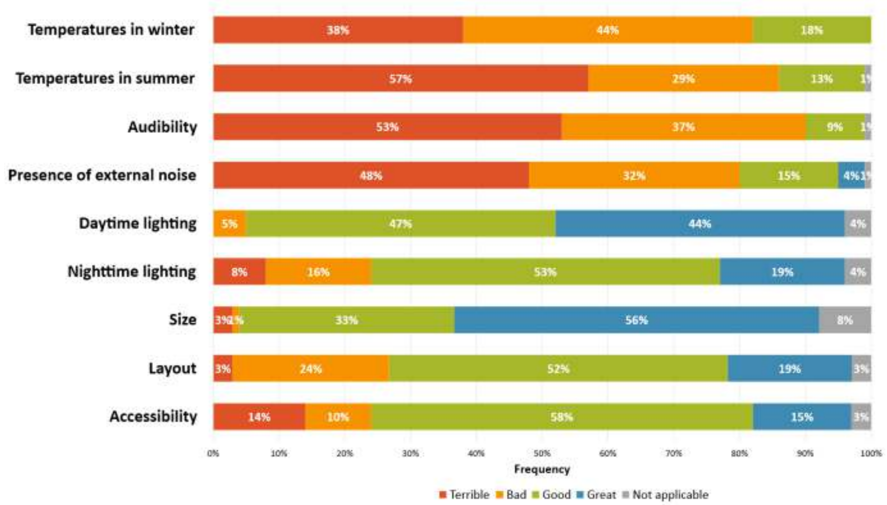


Figure 16

FAU-USP user responses to "How do you consider studios in terms of...?"



User perceptions were even more critical in relation to the studios, where temperatures during both winter and summer, combined with audibility and presence of external noise, were perceived mostly as "Terrible" (Figure 16). These conditions may further compromise concentration, communication, and overall usability in spaces intended for prolonged academic activities.

At FAU-Mackenzie, classroom furniture is flexible and includes designated spaces for wheelchair users, in alignment with accessibility guidelines. Natural lighting is provided through side windows, and interior operable curtains allow users to control glare and excessive daylight when needed, enhancing visual comfort during lectures.

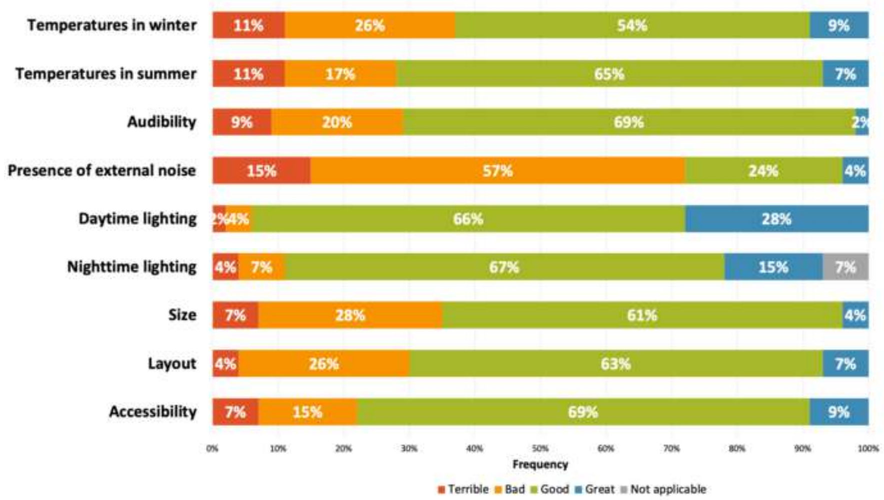
Given its urban context, the FAU-Mackenzie building is more exposed to external noise sources such as road traffic. However, classrooms are smaller in volume compared to those at FAU-USP, and the presence of curtains may help reduce reverberation time, contributing modestly to acoustic comfort.

For thermal comfort, windows can be opened to allow natural ventilation during warmer periods, and individual air conditioning units with thermostats are available in each classroom. Nonetheless, there are no passive or active systems in place to mitigate cold discomfort during the winter months, which may potentially affect concentration on colder days.

FAU-Mackenzie users generally reported positive perceptions regarding ergonomic and environmental comfort aspects within the classrooms (Figure 17). However, one aspect of concern was the presence of external noise, which was predominantly rated as "Bad," indicating potential interference with concentration and verbal communication during academic activities.

Figure 17

FAU-Mackenzie user responses to "How do you consider classrooms in terms of...?"



Recommendations

Based on the findings of this study, it is evident that both the FAU-USP and the FAU-Mackenzie buildings present limitations in terms of accessibility and inclusive usability. While architectural preservation concerns may restrict some improvements, it is still possible to propose targeted, non-invasive interventions that align with accessibility standards (NBR 9050 and ADA) without compromising the buildings' conceptual or historical integrity.

Wayfinding improvements should be prioritised in both institutions. The absence of directional signage and tactile guidance systems undermines autonomous circulation for users with visual impairments. The implementation of high-contrast visual signs, tactile floor indicators, Braille signage, and pictograms is recommended, as outlined in ABNT NBR 9050 and ADA Standards, to support orientation and safe navigation.

At FAU-USP, several aspects of vertical circulation require intervention. Installing floor tactile indicators, guardrails at a height of 1.10 m, and replacing the square-profile handrails with circular-section double handrails (3–5 cm in diameter) would improve safety and user autonomy without requiring structural alterations. The staircases should also be enhanced with similar ergonomic handrails, non-slip treads, and tactile hazard indicators at the top and bottom of each flight. The elevator could be modernised with the installation of an automatic door and a mirror, as required by NBR 9050.

Tiered classrooms present in FAU-USP should incorporate designated spaces for wheelchair users within the main seating layout to prevent segregation and ensure accessibility. Additionally, flexible furniture layouts that allow for rearrangement can facilitate equitable participation.

To enhance acoustic and visual comfort at FAU-USP, solutions such as modular acoustic panels, absorbent curtains, and light-diffusing films on skylights are recommended. These adjustments can reduce reverberation and glare in both conventional and studio environments. Regarding thermal comfort, improving the maintenance of the natural ventilation system and considering the provision of fans and/or HVAC systems could help mitigate potential thermal discomfort.

Although FAU-Mackenzie demonstrates greater compliance with accessibility norms, some aspects still require attention. The installation of anti-slip strips on stair treads, improved acoustic insulation in classrooms, and signage systems for orientation would further enhance user safety and inclusion.

In summary, these recommendations aim to reconcile the need for architectural conservation with the imperative of accessible and inclusive educational environments. By adopting technical, cost-effective, and reversible measures, it is possible to enhance comfort, autonomy, and equitable use for all students, faculty, and visitors.

Conclusion

This study highlighted how physical and sensory accessibility remains a challenge in Brazilian Architecture and Urbanism schools. Through the Post-Occupancy Evaluation methodologies, it was possible to identify how spatial limitations, such as inadequate ramps, a lack of wayfinding systems, and poor acoustic or thermal comfort, may affect the autonomy and well-being of diverse users. While FAU-Mackenzie demonstrates better alignment with accessibility standards than FAU-USP, both institutions still present critical gaps, especially in signage, safety features, and inclusive classroom design. By proposing targeted, reversible improvements grounded in the NBR 9050 and ADA Standards, this research aimed at user-centred adaptations that preserve architectural integrity. Ensuring inclusive learning environments in schools of Architecture and Urbanism is a legal and ethical responsibility that also plays an important role in shaping the awareness and practice of future professionals.

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