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CRISIS OF ACCESS TO MODERN EDUCATIONAL COMPLEXES: EXPOSING THE GAPS

The article explores deficiencies in educational complexes impacting student engagement, learning, and accessibility. It proposes an architectural framework addressing outdated infrastructure, social spaces, technology, and sustainability. Using case studies and research, it identifies key design elements for future-ready institutions.

Keywords: *academic hub, student engagement, accessibility, learning environment, sustainability, architectural design.*

Statement of the problem

Modern education is not just about academics; it encompasses a holistic experience that includes accessibility, comfort, and engagement. However, many students hesitate to enroll in educational institutions due to deficiencies in infrastructure, limited amenities, and a lack of well-rounded learning environments. Educational complexes often suffer from inadequate classroom designs, insufficient social and recreational spaces, outdated technology, poor accessibility, and a lack of integration between academic and non-academic facilities [1,2,3].

One of the most critical issues is the lack of flexible and adaptive learning spaces. Many institutions still rely on rigid classroom layouts that do not support collaborative or active learning approaches [4]. This outdated model hinders engagement and innovation, making learning environments less dynamic and interactive. Additionally, a lack of recreational and social spaces affects students' mental well-being. Without areas for relaxation, informal learning, and social interaction, students may feel disconnected from campus life, reducing their motivation and overall academic performance [5]. Another prevalent challenge is the shortage of technological integration in educational complexes. As digital learning becomes increasingly important, many institutions struggle with outdated infrastructures that fail to support smart classrooms, online learning platforms, and research-based education [6]. The absence of modern digital tools puts students at a disadvantage, preventing them from accessing high-quality learning resources efficiently [7].

Accessibility and inclusivity issues also present significant barriers. Poor campus planning often neglects the needs of students with disabilities, making navigation difficult due to the lack of ramps, elevators, and accessible learning materials. Furthermore, insufficient accommodation facilities can lead to student overcrowding, negatively impacting both academic success and overall well-being.

Finally, environmental sustainability and energy efficiency are often overlooked in older educational complexes. Many institutions continue to rely on inefficient energy consumption models, outdated ventilation systems, and poorly designed green spaces, which not only affect student comfort but also contribute to higher maintenance costs and environmental impact.

A well-designed, modern educational complex should address these challenges by providing an environment that supports intellectual and social growth. Ensuring an educational space that integrates learning, entertainment, and well-being can bridge this gap and create an inclusive, engaging academic setting.

Analysis of recent research and publications

Numerous studies highlight the impact of educational infrastructure on student engagement. Research suggests that students perform better when they have access to well-equipped, comfortable, and engaging learning spaces. Additionally, the perception of an educational environment plays a key role in student retention and satisfaction.

Studies of Cannon Design, VS Furniture, and Bruce Mau Design [8] and Seymour Papert [9] have explored the relationship between architecture and student well-being. Research suggests that classrooms with ample natural lighting, ventilation, and ergonomic furniture contribute to improved focus and productivity. Schools and universities that integrate flexible learning spaces allow students to transition between independent study, group work, and interactive sessions seamlessly, making education more adaptable to different learning styles.

Further studies by John Hattie and A.W. (Tony) emphasize the role of communal areas in educational complexes [10]. The presence of libraries, study lounges, and recreational zones is directly correlated with increased academic performance and student satisfaction. Green spaces within campuses contribute to

relaxation and stress reduction, creating a balanced environment that supports both learning and well-being.

The aforementioned studies highlight the profound impact of educational infrastructure, architectural design, communal spaces and technology on student engagement and academic performance. As learning environments continue to evolve, institutions must prioritize innovative and adaptable designs that cater to diverse student needs. By integrating well-structured physical spaces with advanced technological tools, schools and universities can foster a more engaging, inclusive, and effective educational experience. Future research should further explore the intersection of design, pedagogy and digital advancements to ensure that learning environments continue to support student success in an ever-changing world.

Formulation of the goal of the article

The primary goal of this research is to address the deficiencies of accessibility in existing educational complexes by proposing a comprehensive architectural framework that enhances student engagement, accessibility, and learning outcomes. The study will focus on the following key objectives:

1. Defining the problem and identifying key factors contributing to the crisis via analysis of five schools and five universities around the world based on reviews from Google Maps, supplemented by spatial design analysis.

2. Analyzing the cases of modern educational institutions from urban and rural settings across different countries. A comparative approach was applied, using analysis to understand strengths, weaknesses, opportunities, and threats. Spatial analysis was employed to examine the geographic distribution, accessibility, and infrastructure of schools and universities, assessing how location impacts educational outcomes and resource allocation.

3. Making recommendations for educational institutions to enhance infrastructure, improve curriculum design, promote equitable access to education, and implement data-driven policies that support both students and educators.

The data collected from case studies, reviews, and spatial assessments were analyzed using a combination of statistical methods and qualitative thematic analysis. Quantitative data from surveys were processed through descriptive and inferential statistical methods.

Presentation of the main material

Access to modern educational complexes is a fundamental requirement for equitable and high-quality education. However, a significant crisis persists, characterized by disparities in infrastructure, resources, and technological integration. While some institutions boast state of the art facilities, others, particularly in rural or underprivileged areas, struggle with outdated buildings, insufficient learning tools, and limited digital access. These disparities create an uneven educational landscape, hindering student performance, engagement, and overall academic success.

This study adopts a mixed-methods approach, combining qualitative and quantitative methodologies to ensure a comprehensive understanding of the deficiencies in existing educational complexes and the strategies required for their improvement.

The study analyses the cases of leading universities and educational complexes that have successfully implemented innovative architectural, technological, and sustainability-driven solutions. Institutions such as Altschool in San Francisco ,United States, Green School Bali in Bali, Indonesia, High Tech High School in San diego, United States, Waldorf School in Stuttgart,Germany University of Hamburg in Germany, FST in Fez, Morocco, Al Akhawayn University in Ifran, Morocco, OSACEA in Odessa, Ukraine, NUOMA in Odessa, Ukraine serve as examples due to their well-integrated campus designs, advanced learning environments, and focus on student engagement. The research examines how these institutions utilize adaptive learning spaces, smart classrooms, recreational zones, and green infrastructure to enhance the academic experience.

A spatial analysis of selected educational complexes is conducted to assess their layout efficiency, accessibility features, and integration of social and academic spaces.

To gather empirical data, a comprehensive content analysis was conducted on the base of reviews on 10 educational institutions published on Google Maps by students and interested parties. The surveys focus on students' perceptions of campus facilities, engagement levels, and the challenges they face within their learning environments. The reviews (Fig.1-9) can provide the architects and university planners with data for implementing design strategies that contribute to creating inclusive, technology-driven, and sustainable educational spaces.

Qualitative responses from reviews on educational institutions were categorized into thematic areas such as learning environment quality, accessibility, technological integration, and sustainability etc. The content analysis measures the numbers of mentions of specific qualities in reviews according to this areas. For the analysis of schools, the mentions of following qualities were measured: **innovative learning environment**, **technological integration**, **flexibility of learning spaces**, **personalized learning**, **sustainability** and **green design**. For the analysis of universities, the measured qualities are **sustainability**, **integration of traditional and modern learning**, **aesthetic appeal**,

technological advancements, **functionality & accessibility**.

The analysis was conducted on the basis of 100 reviews on 4 schools and 5 universities each. The statistical reliability of the content analysis results was checked using the split-half reliability method.

The analysis of the five schools reveals distinct educational approaches, each with its strengths and areas for improvement, a spatial analysis also of these selected educational complexes is conducted to assess their layout efficiency, accessibility features, and integration of social and academic spaces.

These schools represent diverse educational models, each with unique spatial considerations.

Green School Bali's in Bali, Indonesia. Its spatial design is a direct reflection of its sustainability-focused educational philosophy, integrating eco-friendly architecture, open learning environments, and nature-based classrooms. Spatial analysis of the school highlights how its physical layout enhances both environmental consciousness and student engagement. The campus is designed with bamboo structures, open-air classrooms, and minimal environmental footprint, blending seamlessly with the natural surroundings. Instead of rigid buildings, learning spaces are fluid and adaptable, allowing students to move between indoor and outdoor areas, fostering experiential and project-based learning. The school's strategic use of natural ventilation, daylight, and renewable energy sources reduces reliance on artificial resources, creating a sustainable and self-sufficient campus. Additionally, communal spaces such as organic gardens, water filtration systems, and permaculture farms serve as interactive learning hubs. While Green School Bali excels in sustainability and innovation, its lower emphasis on technology means digital tools are used selectively rather than being central to learning spaces. Overall, spatial analysis reveals that Green School Bali's design is not just an aesthetic choice but a functional, immersive, and sustainable approach to education, where the environment itself becomes a teacher.Excels too in sustainability and green design (92.3%), reflecting its core environmental mission, while also emphasizing innovation (76.9%) and flexibility in learning spaces (69.2%). However, its integration of technology (57.1%) is less emphasized (Fig. 1).

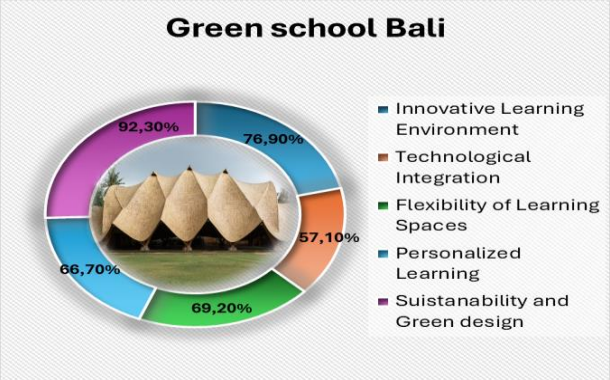


Fig. 1 – Diagram of total mentions of qualititive reviews of the Green School Bali in Bali, Indonesia (own work, using the photo from [13]).

AltSchool's in San Francisco, United States. Micro-schools leverage spatial design to create flexible, technology-driven learning environments in urban settings. Their strategic locations ensure accessibility, integrating seamlessly into city life with easy transportation options. Unlike traditional schools, AltSchool utilizes modular layouts with movable furniture, open spaces, and digital tools to personalize learning experiences. Sensor based analysis helps optimize classroom configurations, ensuring students have access to quiet study zones, collaborative hubs, and interactive areas tailored to different learning styles. By replacing rigid structures with adaptable, student-centered designs, AltSchool enhances engagement, fosters community-driven education, and bridges the gap between physical space and personalized learning,focuses heavily on innovation (75%) and personalized learning (41.07%), with moderate technological integration (71.4%) and flexibility (66.7%), but it could benefit from stronger sustainability practices (Fig. 2).

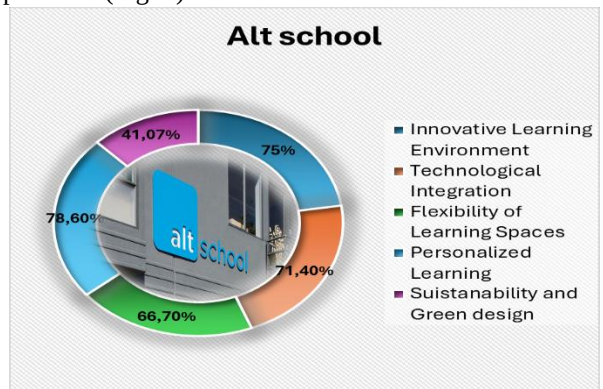


Fig. 2 – Diagram of total mentions of qualititive reviews of the AltSchool in San Francisco, United States (own work, using the photo from [14]).

High Tech High School in San Diego, United states. Its spatial design is built around innovation, collaboration, and flexibility, aligning with its project-

based learning philosophy. Spatial analysis of the school reveals a deliberate departure from traditional classroom structures, favoring open, adaptable spaces that encourage interdisciplinary learning and student engagement. The layout includes glass-walled classrooms, common work areas, and shared maker spaces, fostering transparency and interaction between students and teachers. Instead of isolated classrooms, High Tech High features flexible, studio-like environments where students can seamlessly transition between independent study, group projects, and hands-on learning activities. The school's integration of technology is embedded in its spatial design, with access to digital fabrication labs, robotics workshops, and media production studios that support STEM education. Additionally, hallways and communal areas double as exhibition spaces, allowing students to display their work and engage in peer-to-peer learning. The emphasis on collaborative workspaces over rigid seating arrangements reflects the school's commitment to creativity and real-world problem-solving. Overall, High Tech High's spatial design promotes an open, technology-driven, and student-centered learning environment, where the physical space itself reinforces innovation and active engagement. In addition, it demonstrates exceptional technological integration (86.7%) and personalized learning (88.9%), along with strong flexibility in learning spaces (80%) and an innovative environment (77.8%). However, its sustainability efforts (36.96%) are minimal (Fig. 3).

Fig. 3 – Diagram of total mentions of qualititive reviews of the High Tech High School in San Diego, United States (own work, using the photo from [15]).

Waldorf School in Stuttgart, Germany. Its spatial design is intentionally crafted to support its holistic, arts-integrated, and developmentally aligned educational philosophy. Spatial analysis reveals that this school prioritize warm, organic, and sensory-rich environments that foster creativity, imagination, and emotional well-being. Architecture and classroom design often feature natural materials like wood, wool, and clay, soft lighting, and curved walls to create a calming, home-like atmosphere. The absence of harsh, industrial elements reinforces a sense of warmth and security. Flexible, multi-purpose spaces encourage movement-based learning, artistic expression, and hands-on activities, aligning with Waldorf's emphasis on experiential education.The layout of classrooms is intentionally uncluttered and rhythmically structured, reflecting the developmental needs of students at different stages. Younger children learn in play-based environments with open-ended materials, while older students transition to classrooms that support more structured academic work, yet still emphasize aesthetics and creativity. Outdoor spaces are essential in Waldorf schools, with gardens, nature trails, and open play areas serving as extensions of the classroom, encouraging a deep connection with nature and seasonal rhythms. Unlike many modern schools, technology is de-emphasized in early years, with a focus instead on tactile, social, and artistic experiences.

Overall, Waldorf schools' spatial design reflects their commitment to nurturing the whole child—intellectually, emotionally, and physically—through carefully crafted environments that balance structure with creativity, indoor learning with outdoor exploration, and academic rigor with artistic and practical skills.

Further it emphasize creative and innovative learning environments (59.5%), flexibility of learning spaces (63.2%) and personalized learning (73.7%), with a lower focus on technology (35.3%) and sustainability (57.75%), highlighting a more traditional, nature-based educational approach (Fig. 4).

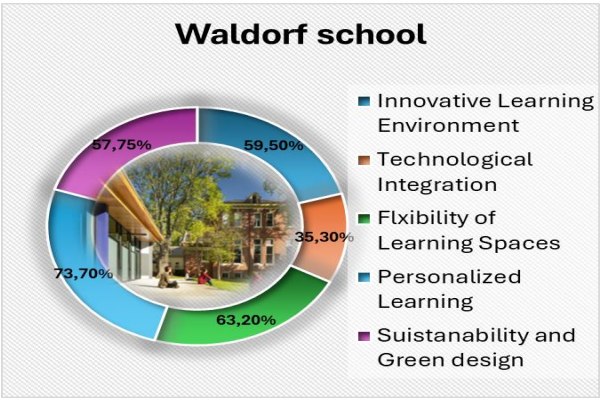


Fig. 4 – Diagram of total mentions of qualititive reviews of the Waldorf School in Stuttgart, Germany (own work, using the photo from [16]).

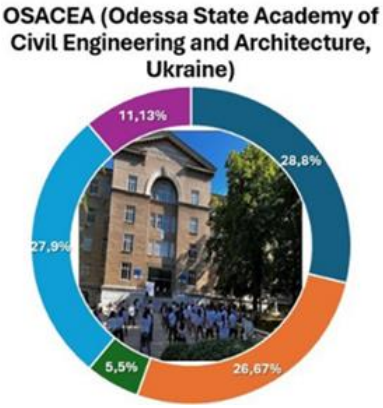
Finally, Waldorf School and Green School Bali both prioritize innovative learning and creativity, but the more tech-forward schools like High Tech High and AltSchool focus on technological integration to create a modern, adaptable, and personalized education. Each school offers valuable insights into how education can be shaped around the needs of students, blending creativity, sustainability, and technology with varying degrees of emphasis.

The comparative analysis of modern universities

reveals distinct approaches to technological innovation in design.

The spatial design of **Odessa State Academy of Civil Engineering and Architecture (OSACEA)** reflects its focus on architecture, urban planning, and engineering through a blend of traditional academic spaces, modern research facilities, and hands-on learning environments. Located in Odessa, Ukraine, the campus integrates lecture halls, design studios, fabrication labs, and material testing centers, fostering a balance between theoretical education and practical application. Collaborative workshops and computational labs support advanced architectural modeling and BIM technology, while outdoor courtyards and green spaces enhance student interaction. The city itself serves as an extended classroom, providing opportunities for real-world urban planning and restoration projects. OSACEA's infrastructure promotes sustainability, innovation, and engagement with historical and contemporary architectural trends, making it a dynamic hub for engineering and design education.

The diagram for the Odessa State Academy of Civil Engineering and Architecture (OSACEA) Ukraine (Fig. 5) shows that Sustainability received the highest total mentions at 26%, followed by Technological Advancements at 25% and Integration of Traditional & Modern at 24%, while Functionality & Accessibility and Aesthetic Appeal lagged behind with 10% and 5%, respectively. In terms of positive reviews, Sustainability leads with 22%, followed by Technological Advancements at 21% and Integration of Traditional & Modern at 20%, while Aesthetic Appeal and Functionality & Accessibility received 7% and 6%, respectively. Negative reviews were highest for Functionality & Accessibility at 10%, while Technological Advancements had 5%, and Sustainability, Integration of Traditional & Modern, and Aesthetic Appeal each had 4% or less. The percentage of mentions remained consistent across the top three categories, with Sustainability and Technological Advancements both at 28% and Integration of Traditional & Modern close behind at 27%, while Aesthetic Appeal again had the lowest share at 5%.



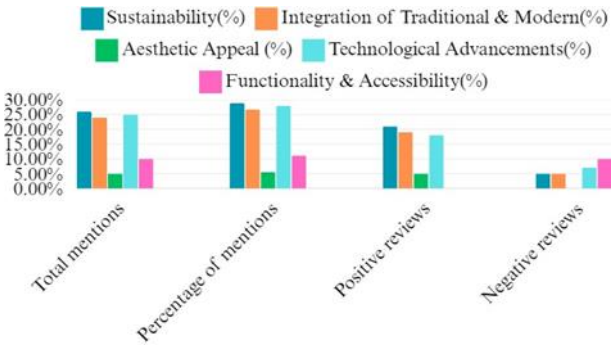


Fig. 5 – Range of mentions of different categories of OSACEA University in Odessa, Ukraine (own work, using the photo from [17]).

The National University Odessa Maritime Academy (NUOMA) in Ukraine features a spatial design tailored to maritime education, integrating specialized training facilities, simulation centers, and practical learning environments. Located in Odessa, a major port city, the campus is strategically positioned to provide direct access to maritime infrastructure, including shipyards, docks, and the Black Sea coastline. The university's spatial organization includes nautical simulation labs, engine room replicas, navigation bridges, and hydrodynamic research facilities, ensuring hands-on training for cadets. Large lecture halls and seminar rooms support theoretical instruction, while on-campus dormitories, recreational areas, and maritime museums contribute to student life. NUOMA also incorporates outdoor training zones, lifeboat drills, and emergency response practice areas, reinforcing real-world preparedness. The integration of advanced maritime technology, interactive simulators, and sustainable naval engineering spaces reflects the institution's commitment to producing skilled maritime professionals. Overall, NUOMA spatial design fosters an immersive learning environment that seamlessly connects academic, practical, and industrial maritime education.

The diagram for the National University Odessa Maritime Academy (NUOMA), Ukraine (Fig. 6) shows that Sustainability and Integration of Traditional & Modern received the highest total mentions, both around 25%, followed by Technological Advancements at 21%. Aesthetic Appeal and Functionality & Accessibility were lower, at approximately 20% and 10%, respectively. In terms of the Percentage of Mentions, Integration of Traditional & Modern leads with about 27%, followed by Sustainability with 24%, and Technological Advancements with 20%. When looking at positive reviews, Sustainability and Integration of Traditional & Modern both received 15%, while Technological Advancements and Aesthetic Appeal were close, at 13%

and 14%. For negative reviews, Functionality & Accessibility and Integration of Traditional & Modern had the highest rates, both close to 10%, while Sustainability, Technological Advancements, and Aesthetic Appeal each had slightly lower negative feedback, around 8–9%.

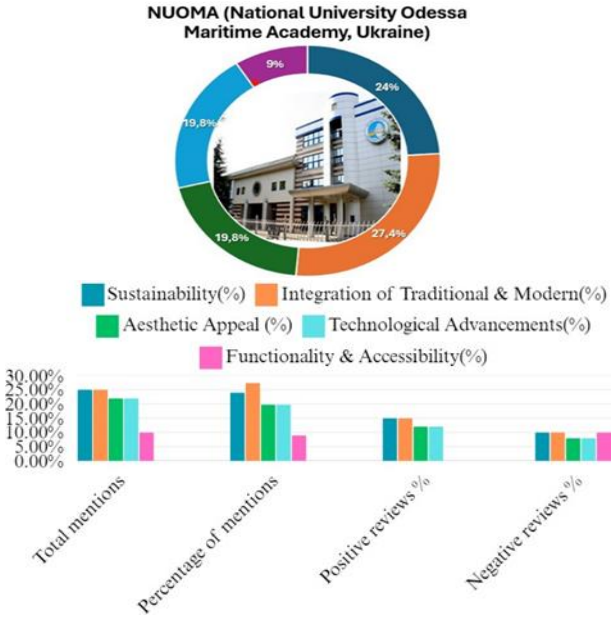


Fig. 6 – Range of mentions of different categories of NUOMA University in Odessa, Ukraine (own work, using the photo from [18]).

The University of Hamburg features a spatial design that reflects its role as a major research and academic hub in Germany, integrating historic and modern architecture across an urban campus. Located in the heart of Hamburg, the university is spread across multiple sites, with its main campus in the Rotherbaum district, allowing for seamless interaction between academic institutions, research centers, and the city's cultural and economic infrastructure. The spatial organization includes large lecture halls, seminar rooms, libraries, and specialized research institutes, fostering interdisciplinary collaboration. The Central Library and the University Main Building serve as key academic hubs, while green spaces like Planten un Blomen Park provide areas for relaxation and informal learning. The university integrates cutting-edge research facilities, digital learning spaces, and sustainable architecture, including energy-efficient buildings and smart classrooms. Additionally, the university's proximity to Hamburg's port and industrial zones enhances applied research opportunities, particularly in fields like climate science, economics, and logistics. The blend of historic buildings, modern infrastructure, and urban connectivity makes the University of Hamburg a dynamic and accessible learning environment that fosters innovation, academic excellence, and community engagement.

The diagram for the University of Hamburg Germany (Fig. 7) shows that Sustainability leads with the highest Total Mentions at approximately 34%, followed by Functionality & Accessibility at 25%, Aesthetic Appeal at 20%, Integration of Traditional & Modern at 14%, and Technological Advancements at 11%. In terms of the Percentage of Mentions, Sustainability remains dominant at around 30%, with Functionality & Accessibility at 25%, Aesthetic Appeal at 18%, Integration of Traditional & Modern at 13%, and Technological Advancements at 10%.

For positive reviews, Sustainability again leads with 30%, while Functionality & Accessibility and Aesthetic Appeal are close, both around 20%, followed by Integration of Traditional & Modern at 10% and Technological Advancements at 5%. Regarding negative reviews, Technological Advancements has the highest proportion at about 7%, while Sustainability, Integration of Traditional & Modern, and Functionality & Accessibility all stay below 5%.

Overall, the University of Hamburg receives the most attention for Sustainability, while Technological Advancements and Integration of Traditional & Modern appear to be less emphasized across the metrics.

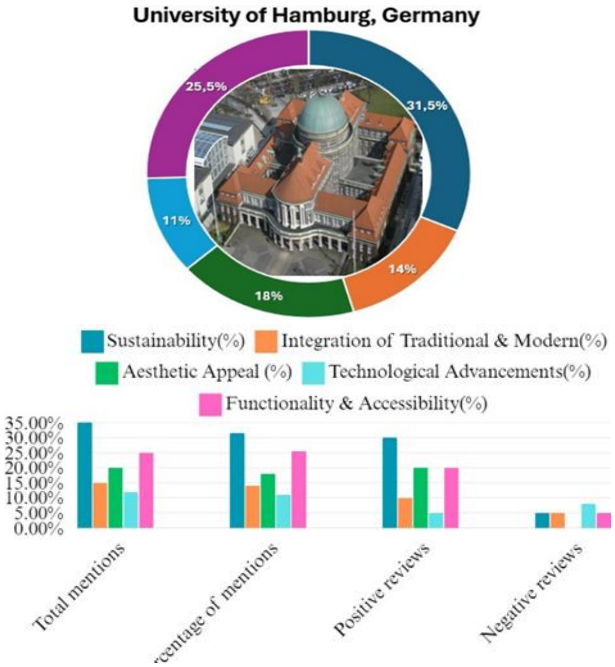


Fig. 7 – Range of mentions of different categories of University of Hamburg in Germany (own work, using the photo from [19]).

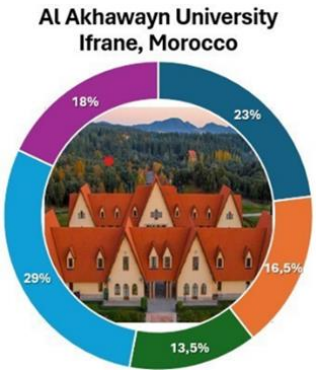
The spatial design of **Al Akhawayn University in Ifrane (AUI), Morocco** reflects a unique blend of modern educational infrastructure and traditional Moroccan-Andalusian architectural influences, creating a distinctive learning environment. Located in the scenic Middle Atlas Mountains, the campus is characterized by red-tiled rooftops, white-washed buildings, and spacious green landscapes, designed to harmonize with the alpine climate of Ifrane. The university's spatial organization

includes well-equipped lecture halls, research centers, and collaborative learning spaces, fostering interdisciplinary interaction. The library, student center, and on-campus housing are centrally positioned, enhancing accessibility and student engagement. AUI also integrates technology-driven classrooms, digital learning resources, and sustainability initiatives, such as energy-efficient buildings and water conservation systems. The outdoor spaces, sports complexes, and pedestrian-friendly campus layout promote a balanced academic and social experience. The university's strategic location in Ifrane, away from major urban distractions, creates a focused academic atmosphere while maintaining connectivity to Morocco's economic and political hubs. Overall, Al Akhawayn University's spatial design supports academic excellence, cultural identity, and environmental sustainability, making it a model for modern higher education in North Africa.

The diagram for Al Akhawayn University in Ifrane, Morocco (Fig. 8) shows that Technological Advancements lead in Total Mentions with approximately 30%, followed by Sustainability at 25%, Functionality & Accessibility at 20%, Integration of Traditional & Modern at 16%, and Aesthetic Appeal at 10%.

In the Percentage of Mentions, Technological Advancements again stands out at 28%, followed by Sustainability at 23%, Functionality & Accessibility at 18%, Integration of Traditional & Modern at 15%, and Aesthetic Appeal at 14%. For positive reviews, Technological Advancements leads with 20%, followed by Sustainability at 18%, Aesthetic Appeal at 10%, while Integration of Traditional & Modern and Functionality & Accessibility are both around 10%. Regarding negative reviews, Technological Advancements and Functionality & Accessibility are the highest, both at about 10%, while Sustainability, Integration of Traditional & Modern, and Aesthetic Appeal hover around 6%.

Overall, Technological Advancements receive the most attention, both in mentions and positive reviews, while Aesthetic Appeal remains the least emphasized aspect across the metrics.



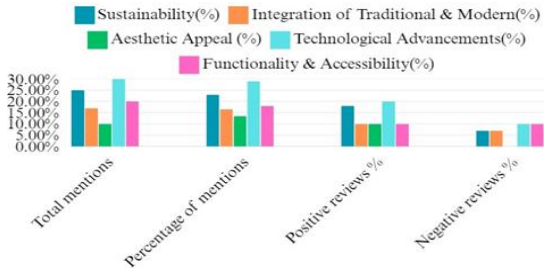
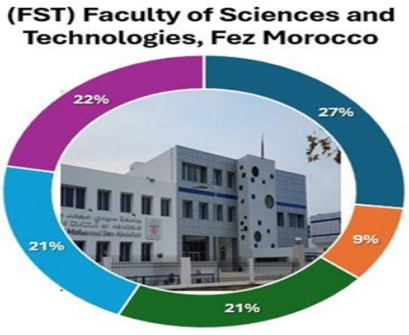


Fig. 8 – Range of mentions of different categories of Al Akhawayn University **(**own work, using the photo from [20]).

The Faculty of Sciences and Technologies (FST) in Fez, Morocco features a functional and technology-driven spatial design tailored to scientific research, engineering, and applied sciences. Located in Fez, a historic academic and cultural center, the campus integrates modern laboratories, lecture halls, and research facilities to support advanced studies in fields like engineering, physics, chemistry, and computer science. The spatial organization prioritizes efficient movement and accessibility, with interconnected academic buildings, specialized research centers, and student workspaces designed to foster collaboration. The campus layout includes well-equipped laboratories, computer rooms, and experimental workshops, ensuring hands-on learning experiences. Green spaces, open courtyards, and recreational zones enhance the academic environment, providing areas for relaxation and informal discussions. Additionally, the faculty integrates digital learning technologies and sustainable infrastructure, such as energy-efficient buildings and eco-friendly campus initiatives. Proximity to industrial and technological zones in Fez strengthens partnerships between academia and industry, offering students opportunities for internships and applied research. Overall, the spatial design of FST Fez promotes scientific innovation, practical learning, and interdisciplinary collaboration, reinforcing its role as a key institution for technological advancement in Morocco.

The diagram for the Faculty of Sciences and Technologies (FST) in Fez, Morocco (Fig. 9) reveals that Sustainability has the highest Total Mentions at 30%, followed by Functionality & Accessibility and Aesthetic Appeal, both around 22%, and Technological Advancements at 20%, while Integration of Traditional & Modern is the least mentioned with 10%.



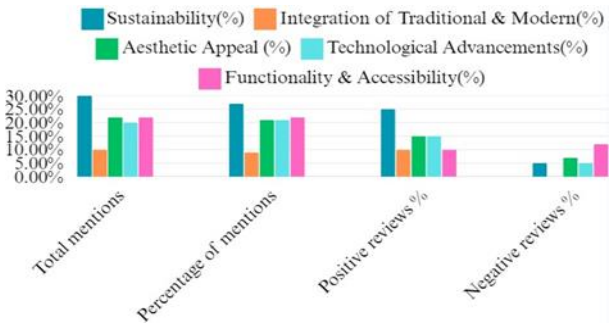


Fig. 9 – Range of mentions of different categories of FST University, own work ,using the photo from[21].

In the percentage of mentions, Sustainability again leads with about 27%, followed by Functionality & Accessibility and Aesthetic Appeal at 20% each, and Technological Advancements also at 20%, while Integration of Traditional & Modern lags behind with 9%. For positive reviews, Sustainability maintains its lead with 25%, while Aesthetic Appeal and Technological Advancements share 18%, followed by Functionality & Accessibility at 10% and Integration of Traditional & Modern with 10%. Regarding negative reviews, Functionality & Accessibility has the highest share at 12%, followed by Aesthetic Appeal at 7%, Technological Advancements at 5%, Sustainability at 5%, and Integration of Traditional & Modern with the lowest at 4%.

Overall, Sustainability consistently dominates across categories, while Integration of Traditional & Modern remains the least emphasized aspect throughout the diagram.

The analysis of the diagrams from the five universities—National University Odessa Maritime Academy (Ukraine), University of Hamburg (Germany), Al Akhawayn University in Ifrane (Morocco), and Faculty of Sciences and Technologies (FST) in Fez, Morocco)—reveals distinct trends in the perception of key aspects like sustainability, integration of traditional and modern elements, aesthetic appeal, technological advancements, and functionality & accessibility.

Sustainability consistently emerges as a dominant theme across all universities, with the University of Hamburg standing out with the highest mentions (around 35%), followed closely by FST Fez and Al Akhawayn University. Technological advancements also receive considerable attention, particularly at Al Akhawayn University, which leads with around 30% in total mentions. In contrast, Integration of Traditional & Modern tends to receive lower recognition across most institutions, except for Odessa Maritime Academy, where it is relatively prominent.

When it comes to positive reviews, sustainability consistently performs well across the board, especially in Hamburg and Fez, reflecting a shared global emphasis on environmentally conscious practices. Functionality & Accessibility and Aesthetic Appeal also receive substantial positive feedback in Hamburg and Odessa, indicating a balance between usability and visual appeal.

Regarding negative reviews, FST Fez records the highest percentage, primarily for Functionality & Accessibility, while Hamburg University maintains the lowest negative sentiment, suggesting a strong overall performance.

In short, while each institution shows strengths in different areas, Sustainability emerges as a universally valued attribute, followed by Technological Advancements. Odessa Maritime Academy shows a notable focus on blending traditional and modern elements, while Hamburg University excels in both positive reviews and overall balance across all categories. Moroccan institutions display a stronger emphasis on Technological Advancements, with Al Akhawayn University particularly standing out in that regard.

Each institution adopts technology uniquely—OSACEA and NUOMA prioritize academic resources, while Al Akhawayn University and FST focus on sustainable design elements. Patterns indicate that tech-driven spaces foster greater engagement, collaboration, and comfort among users. Surveys reflect high satisfaction with tech-enhanced environments, with users favoring spaces that balance technology with comfort and accessibility.

Architectural characteristics also vary based on regional needs and institutional priorities. OSACEA and the University of Hamburg are recognized for their innovative designs that blend traditional and modern architectural themes with a strong emphasis on sustainability. NUOMA and Al Akhawayn University excel in heritage preservation, demonstrating architectural respect for historical elements while fulfilling contemporary academic requirements. FST Fez stands out for its technology integration and commitment to sustainability, adopting a practical architectural style focused on functionality.

Overall, the analysis underscores how educational institutions around the world design their spaces to reflect regional cultural values, environmental concerns, and technological advancements. Institutions that successfully balance traditional aesthetics with modern functionality tend to receive more positive reviews across various categories. In contrast, challenges often arise when innovation or sustainability efforts conflict with heritage preservation or practical functionality.

Conclusions

The crisis of access to modern educational complexes stems from architectural barriers that limit inclusivity, adaptability, and functionality. Many institutions suffer from rigid layouts, insufficient ramps,

inefficient circulation spaces, and a lack of universally accessible facilities, which create obstacles for students with disabilities and hinder overall accessibility. These challenges are compounded by outdated building designs that do not accommodate evolving pedagogical methods, technological advancements, or the diverse needs of contemporary students. The failure to integrate accessibility-focused architecture results in educational environments that are restrictive rather than supportive, limiting opportunities for learning, collaboration, and personal development.

To overcome these challenges, educational architecture must integrate flexible and adaptive learning spaces that allow for modular, multifunctional designs supporting diverse teaching methods, collaboration, and technological advancements. Institutions should prioritize classroom layouts that can be easily reconfigured, allowing for individual, small group, and large group interactions while maintaining accessibility for all students. Universal design principles should be emphasized, incorporating step-free access, widened corridors, automated doors, ergonomic furniture, and assistive technologies such as braille signage, voice-command systems, and hearing loop installations to ensure inclusivity for students with disabilities. The need for architectural inclusivity extends beyond classrooms to libraries, auditoriums, sports facilities, dormitories, and common areas, ensuring that every space within an educational complex is designed with accessibility in mind. Additionally, the integration of green and open spaces can significantly enhance student well-being, providing alternative learning environments that foster creativity, relaxation, and social interaction. Thoughtfully designed outdoor spaces, including sensory gardens, shaded courtyards, and multi-use recreational zones, promote mental health and encourage informal learning experiences. Smart campus solutions, such as sensor-based navigation, digital wayfinding, and intelligent classroom management systems, can further bridge accessibility gaps, ensuring seamless movement and personalized learning experiences. These technologies can assist students with mobility impairments by offering real-time navigation assistance and automated scheduling systems to optimize space usage.

Furthermore, sustainability must be a core consideration, with architectural strategies emphasizing natural lighting, passive ventilation, energy-efficient infrastructure, and the incorporation of renewable energy sources such as solar panels and green roofs to reduce operational costs and promote environmental responsibility. Sustainable materials and energy-efficient building designs not only contribute to lower carbon footprints but also improve indoor air quality, thermal comfort, and overall user experience.

By embracing these architectural interventions, educational institutions can transform their spaces into inclusive, engaging, and future-ready environments that accommodate diverse student needs, foster academic success, and promote holistic development. An effective educational complex should function as more than just a collection of classrooms – it should be a dynamic, interactive, and supportive ecosystem that encourages innovation, creativity, and social interaction while ensuring that modern education is accessible to all individuals regardless of physical, economic, or geographical constraints. Only through a comprehensive and thoughtful architectural approach can educational institutions bridge the accessibility gap and create truly equitable learning environments that empower students to reach their full potential.

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КРИЗА ДОСТУПУ ДО СУЧАСНИХ ОСВІТНІХ КОМПЛЕКСІВ: ВИЯВЛЕННЯ ПРОГАЛИН

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Сучасна освіта виходить за межі традиційного навчального процесу, включаючи такі аспекти, як комфорт, доступність та інтеграція цифрових технологій. Однак освітні комплекси часто стикаються з проблемами застарілої інфраструктури, недостатньої кількості соціальних та рекреаційних просторів, а також слабкої інтеграції сучасних технологій, що негативно впливає на рівень залученості студентів та якість навчального процесу. Крім того, невідповідність освітніх просторів сучасним потребам студентів та викладачів створює перешкоди для ефективного навчання та взаємодії.

У статті аналізуються основні проблеми, що перешкоджають ефективному функціонуванню навчальних закладів. Використовуючи змішану методологію, що містить контент-аналіз відгуків студентів, просторовий аналіз навчальних закладів та вивчення передових архітектурних і технологічних рішень у школах та університетах різних країн, автори досліджують, які фактори найбільше впливають на доступність та ефективність освітніх просторів. Особливу увагу приділено інтеграції екологічно сталих рішень, що сприяють зменшенню негативного впливу будівель на довкілля, а також ролі цифрових технологій у покращенні навчального процесу.

Дослідження охоплює аналіз таких навчальних закладів, як Green School Bali, AltSchool, High Tech High та Waldorf School, які демонструють успішні архітектурні й технологічні інновації. Крім того, розглядаються університети, включаючи Гамбурзький університет, Університет Аль-Ахавайн, Одеську державну академію будівництва та архітектури та Національний університет «Одеська морська академія», що дозволяє оцінити значущість екологічної стійкості, цифрових рішень та доступності у створенні сучасного навчального простору. Дослідження також показує, що університетські кампуси, які включають спільні простори для неформального навчання, сприяють підвищенню рівня взаємодії між студентами, що позитивно впливає на їхню академічну успішність.

Результати дослідження підтверджують, що адаптивні навчальні простори, інтеграція «розумних» технологій, створення спільних зон та використання зеленої інфраструктури значно покращують академічні досягнення та добробут студентів. Окрему увагу приділено питанням інклюзивності та архітектурної

доступності, які забезпечують рівні можливості для всіх категорій студентів, включаючи осіб з обмеженими фізичними можливостями. Такі освітні простори допомагають створити комфортне середовище, що сприяє як академічному розвитку, так і психологічному благополуччю студентів.

У підсумку, запропонована архітектурна концепція сприяє розробці навчального середовища, що базується на принципах стійкого розвитку, просторової ефективності та студенто-орієнтованих технологіях. Впровадження цих підходів дозволить подолати розрив у доступі до освіти та створити більш залучене, справедливе й ефективне академічне середовище майбутнього. Застосування передових рішень у сфері освітньої архітектури допоможе не лише підвищити якість навчання, а й сприятиме формуванню нового покоління спеціалістів, які працюватимуть у комфортних та сучасних умовах.

Ключові слова: *академічний центр, залучення студентів, доступність, навчальне середовище, стійкість, архітектурне проектування*.