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AI IMPACT AND SOCIAL BEHAVIOR IN LEARNING ENVIRONMENTS: A PROXEMICS-BASED APPROACH TO EDUCATION 5.0 (PAE 5.0)

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Purpose: The purpose of this paper is to theoretically consider how proxemics (Hall, 1966)—the study of interpersonal spatial relationships—can be applied as an analytical and design-oriented approach for structuring contemporary learning environments. The research addresses the growing need to integrate human-centered spatial design with adaptive technologies in line with the principles of Education 5.0.
Design/methodology/approach: The paper adopts a conceptual and design-informed research approach. It synthesizes architectural theory, environmental psychology, and proxemics theory, drawing on the works of Edward T. Hall, Bryan Lawson, and William H.
Whyte. Visual and behavioral analysis of archival material from pre-digital era *The Social Life of Small Urban Spaces* is combined with hypothetical spatial organization concept based on PAE 5.0 framework to develop a structured vision to educational environments redevelopment strategies. The framework is illustrated through a hypothetical and conceptual design model referred to as the Co-Learning Space.
Findings: The paper demonstrates that proxemics principles can be translated into measurable spatial parameters and recurring patterns that support interaction, observation, collaboration, and reflection (IOCR) in educational environments. It clarifies how spatial distance, visibility, and thresholds mediate social behavior and learning processes. These principles are illustrated through a conceptual case study—the Co-Learning Space—which integrates Education 5.0 spatial assumptions (PAE 5.0) with an AI-driven proxemics loop (AIPL) to enhance pedagogical outcomes.
Research limitations/implications: The research is conceptual and does not include empirical testing in implemented learning environments. The paper is intentionally framed as a conceptual and analytical contribution, aimed at developing a transferable framework rather than reporting results from an implemented project. Further research should involve pilot projects, longitudinal observation, and mixed-method evaluation, combining sensor data with qualitative methods or behavioral studies to assess learning and organizational outcomes.
Practical implications: The proposed proxemics approach provides decision-support guidance for architects, educational managers, and education planners. It can inform spatial programming, campus redevelopment strategies, and governance frameworks for adaptive learning environments, particularly where AI-supported systems are introduced.
Social implications: By reinforcing physical co-presence, observation, and collective engagement, the proxemics approach contributes to improved social cohesion, and inclusive

learning cultures. It supports responsible technology adoption by framing AI as an assistive rather than determinative component of educational space.
Originality/value: The paper contributes an original integration of proxemics theory with Education 5.0 and adaptive spatial systems, positioning proxemics as a strategic analytical approach relevant to architecture design, education space organisation, and management studies. Its value lies in bridging human-centered design, technological mediation, and organizational governance within learning environments.
Keywords: spatial communication; Education 5.0 environments design; proxemics; human-centered AI design; AI impact on sociability.
Category of the paper: Conceptual paper; Hypothetical Case Study.

1. Introduction

This paper examines spatial communication in educational environments through the lens of proxemics, focusing on how interpersonal distance, spatial configuration, and embodied perception influence social interaction and learning processes in AI-mediated contexts. Grounded in architectural theory and environmental psychology, the study positions proxemics as an analytical approach for interpreting human–space relations within contemporary educational settings shaped by adaptive and data-informed technologies. The paper addresses current challenges in designing educational environments that sustain collective presence, social empathy, and human-centered values while accommodating the increasing role of artificial intelligence in spatial mediation contexts. Sustaining sociability is one of the core principles of Education 5.0 and in wider context Society 5.0 (Government of Japan, 2016).

In contemporary learning environments, digital tools and adaptive technologies increasingly influence how space is used and managed. „The transition from Education 4.0 to Education 5.0 thus represents a move from digital to pedagogical transformation, from re-digitalizing education to re-humanizing it" (Komló, 2025). Education 5.0 foregrounds human flourishing, creative collaboration, and the purposeful integration of technological instruments in support of social and emotional development. Realizing these objectives extends beyond curricular reform and digital infrastructure; it necessitates a reconsideration of the spatial conditions that enable IOCR (interaction, observation, collaboration and reflection) to increase co-presence and collective engagement. „Education 5.0 contributes skilled, adaptable talent and innovation capacity (...)" (Chigbu, Makapela, 2025). Although human-centred values are emphasized in Education 5.0 discourse, learning environments are rarely analysed as spatial systems that structure interaction co-presence, and embodied learning (Komló, 2025; Bautista, López-Costa, 2025).

Architectural space functions as a system of relationships defined by distance, orientation, thresholds, and sensory cues that collectively structure social interaction (Lawson, 2001). These spatial relationships form a nonverbal language through which behaviour, perception, and communication are facilitated. Proxemics, introduced by Hall (1966), provides a structured means of interpreting this language by identifying interpersonal distance zones and their associated social functions.

A proxemics approach is proposed and examined through a conceptual case study to demonstrate its relevance for Education 5.0 and organizational management. Against this background, the article advances proxemics as a critical analytical approach for understanding and designing educational environments that sustain collective learning and social empathy, while situating artificial intelligence as a mediating rather than substitutive element of human interactions.

Prior to the pervasive mediation of digital technologies, public spaces frequently operated as informal learning environments, in which social knowledge was acquired through proximity, imitation, and shared attention. William H. Whyte's film *The Social Life of Small Urban Spaces* (1980) offers a systematic empirical record of such proxemics dynamics, providing a valuable point of reference for reassessing the spatial foundations of sociability and social cohesion in contemporary contexts. People observe and learn through social interactions. That is why the important role of William H. Whyte's *The Social Life of Small Urban Spaces* is justified as a **structured empirical observational dataset** form the pre-digital era, showing sociability, social learning process, human interactions in small and larger groups and human responsivity to environmental factors in public zones, rather than as an illustrative historical reference.

2. Proxemics and Spatial Communication in Learning Environments

2.1. Space as a communicative medium

Architectural form, layout, furniture, and circulation encode social norms and behavioural expectations (Rapoport, 1982). In learning environments, spatial configuration influences attention, interaction patterns, and cognitive load. Theories of embodied and situated cognition reinforce the premise that learning is inseparable from movement and social context, making spatial communication a pedagogically relevant concern.

2.2. Proxemics as behavioural structuring

Hall's(1966) classification of intimate, personal, social, and public distances can be translated into architectural parameters such as seating density, visibility, enclosure, and acoustic separation. While proxemics norms vary culturally, the underlying relationship between distance and social function remains consistent and applicable across educational contexts. Proxemics is a tool which could improve social interactions.

2.3. Observation and co-presence

Whyte's (1980) empirical observations demonstrate how micro-spatial features—edges, seating opportunities, sunlight, and focal elements—structure social density and informal interaction together with social learning. His work anticipates contemporary interest in behavioural analytics while underscoring the enduring value of visible co-presence for learning.

2.4. Human-centred design and adaptive systems

Human-centred design prioritizes empathy, participation, and user agency. Adaptive technologies and AI-supported systems offer data-informed responsiveness but introduce governance and ethical challenges if they override human judgment. A proxemics approach positions technology as a decision-support mechanism embedded within human oversight structures. Moreover, „universities are socially and digitally engaged institutions where the teaching methodologies will need to transform to the digital space. Educational technology enables adaptive learning programs, collaborative teaching, and personalized learning, which will be the new forms of education" (Shahidi Hamedani et al., 2024). Dedicated tools like digital twins, AI tutors, personalized learning software, and immersive technologies (VR/AR) enhance, not replace, human teaching and learning, keeping teachers and students „research&learning loop". Proxemics based approach to Education 5.0 can add the new layer to the design process in which the addaptive systems are already the part of architecture of educational environment (i.ex. through the intelligent building systems). Proxemics adds an extra human-centered value to the educational environments design methods amd helps reshaping spaces according to Education 5.0 principles.

Learning does not occur independently of physical environments. Architectural space operates as a communicative medium structured by distance, orientation, thresholds, and sensory cues that shape social interaction and behaviour. Although human-centred values are emphasized in Education 5.0 discourse, learning environments are rarely analysed as spatial systems that structure interaction and embodied learning (Komló, 2025; Koper et al., 2025).

3. Methodology: Circular Proxemics Approach to Education 5.0 (PAE 5.0) — human-centered foundations

3.1. Research approach

The study employs a conceptual research methodology integrating theoretical synthesis with design reasoning. Literature in proxemics, environmental psychology, and architectural theory is combined with visual analysis of archival film material (Whyte, 1980) as evidence of pre-digital proxemics practices. Literature review helps formulating "several questions for future research on the concept of the smart classroom and on how learning spaces can be improved and should be designed. For instance: (...) What are the design principles for creating inclusive and sustainable learning environments? How do learning spaces influence in segregation or coeducation? These and many other questions need to be addressed in the study of physical learning space design" (Bautista, López-Costa, 2025). Synthesis presented in this research informs a structured proxemics approach (PAE 5.0) organized around three analytical dimensions: sensory conditions, interaction patterns, and reflective use. The use of proxemics is clarified as an **analytical and design-oriented framework**, grounded in recognized theory and qualitative spatial research methods. Based on the literature research the Proxemics Approach to Education 5.0 (PAE 5.0) is derived. The proposed approach aims to be practical — providing architects with a set of spatial parameters and design moves — while remaining theoretically grounded. Visual–behavioral analysis is a recognized qualitative method in architectural and spatial research, particularly for studying proxemics, social density, and interaction patterns in situated environments (Groat, Wang, 2013; Müller, Richert, 2025).

3.2. Terms and definitions- theoretical approach

Education 5.0 is understood as a human-centred educational paradigm that emphasizes social cohesion, creativity, ethical responsibility, and the supportive integration of advanced technologies. It refers to the specific contextual conditions under consideration.

Proxemics Approach to Education 5.0 (PAE 5.0) refers to a spatial–analytical approach that applies proxemics theory to the design and evaluation of educational environments, focusing on interpersonal distance, spatial configuration, and patterns of co-presence. It describes an analytical approach grounded in spatial analysis.

The AI-Driven Proxemics Loop (AIPL) denotes an adaptive spatial management mechanism in which sensing, interpretation, and adjustment processes support proxemics conditions under human oversight. It describes adaptive technological mechanism.

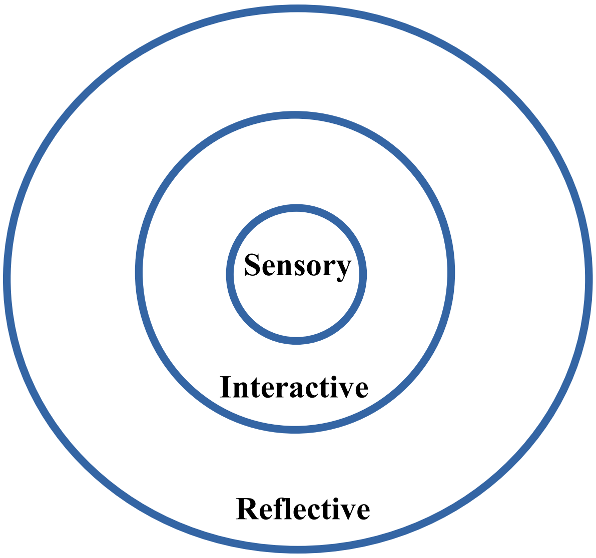
3.3. Rationale

In line with recent Education 5.0 scholarship relying on qualitative synthesis and systematic literature review rather than primary empirical experimentation (Shahidi Hamedani et al., 2024; Chigbu et al., 2025), this study adopts a conceptual, design-informed qualitative research methodology. While PAE 5.0 secures a human-centred baseline, the AI-Driven Proxemics Loop (AIPL) proposes how sensing and adaptation can enhance environmental responsiveness without supplanting empathic design intent. Adaptive Spatial management is important because of human oversight. Moreover the AI-Driven Proxemics Loop (AIPL) supports dynamic spatial communication. „This also implicitly tells us that the researchers who have addressed the subject up to this point needed the flexibility in data collection and analysis that qualitative research methods provide, allowing them to adapt their approaches based on emerging findings. (...) This may also provide insight into the methodological variations among the many academic disciplines, which, in turn, helps us gauge how comprehensively these disciplines have investigated the topic of this study. It is important to understand that methodological tools vary across disciplines, which has an impact on the types of questions that can be posed" (Shahidi Hamedani et al., 2024).

3.4. Circular Proxemics Approach to Education 5.0 (PAE 5.0) — human-centred foundations

Based on conducted research (Shahidi Hamedani et al., 2024; Komló, 2025), the circular PAE 5.0 frames proxemics relations as concentric layers radiating from the individual to culture established (Figure 1):

- **Sensory Layer:** immediate perceptual field, materials, microclimate, acoustic comfort — conditions for presence and attentional readiness.
- **Interactive Layer:** proxemics distances, seating clusters, orientation, visibility — supports dialogue, peer learning, workshops.
- **Reflective Layer:** identity, memory, belonging, ownership of space — supports reflection, mentoring, mental rest.



Sensory (centre), Interactive (middle ring), Reflective (outer ring).

Figure 1. Circular Proxemics Approach to Education 5.0 (PAE 5.0).

Source: D. Wiśniewska.

3.5. Visual analysis and archival evidence

Design operationalization involves mapping learning activities to proxemics zones, defining spatial affordances, and introducing transitional elements that support fluid movement between modes of learning. Whyte's film sequences were analysed to extract recurring proxemics patterns: clustering behaviour, micro-seating appropriation, edge occupation, and the role of natural elements. These patterns inform PAE 5.0 (Figure 1) suggested spatial moves, such as designing permeable edges and creating “sittable” informal surfaces.

Iterative observation and prototyping are proposed as evaluation mechanisms.

3.6. Structure of the AIPL - analytical framework

Adaptive spatial systems can support learning environments through non-intrusive sensing, pattern interpretation, and data-informed adjustment of environmental conditions such as lighting or acoustic modulation. The AIPL (Figure 2) comprises four iterative stages:

1. **Sensing:** occupancy, clustering metrics, noise, temperature, and light levels (via non-intrusive sensors).
2. **Interpreting:** machine learning models classify activities (discussion, presentation, quiet study) and proxemics patterns.
3. **Adapting:** the system proposes or executes adjustments (acoustic panels, dynamic lighting, signage suggestions, reconfigurable furniture prompts).
4. **Learning:** feedback loops refine interpretation models, guided by HCD constraints and manual overrides.

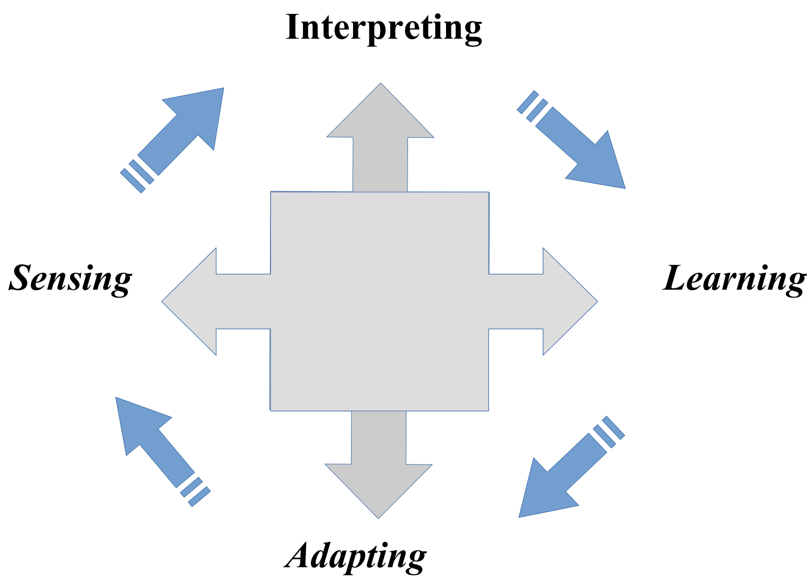


Figure 2. AI-Driven Proxemics Loop (AIPL).

Source: D. Wiśniewska.

3.7. Human-in-the-loop and ethics

Crucially, AIPL (Figure 2) must preserve human decision nodes: choices about privacy, data retention, aesthetic and ethical trade-offs are resolved through participatory protocols. AI provides suggestions and analytics but does not replace human judgment. This supports an aspirational design aim: **human-centered as inspiration for AI-driven design.**

Furthermore, these systems must operate within human-in-the-loop governance structures that define decision rights, privacy safeguards, and ethical boundaries. Technology informs spatial management but does not autonomously determine behavior.

4. Conceptual Design Theory: The Co-learning Space

4.1. Concept overview

The Co-*Learning Space* is presented as a conceptual design hypothesis illustrating how proxemics principles can inform architectural spatial organization in an Education 5.0 context. Because terms Education 5.0 and Work 5.0 are considered together in many research papers, the concept of co-learning space was analized according to existing co-working spaces. Conceptual and exploratory case studies are widely employed in architectural research to test theoretical frameworks and design logic prior to empirical implementation (Groat, Wang, 2013; Creswell, Poth, 2018). According to conceptual design hypothesis presented in this paper the educational environment is structured into interconnected (hybrid) *macro* and *microzones* corresponding to public, social, personal, and intimate distances (Hall, 1966). Design elements such as sittable edges, flexible furniture, and permeable visibility foster learning by observational, spontaneous collaboration, and reflective use. It is intentionally presented as a conceptual model — not an executed project — to demonstrate how PAE 5.0 and AIPL are translated into design moves. By enabling learners to modulate their level of social exposure, **the Co-Learning Space supports self-regulation and sustained engagement across varying learning modes** and stays in line with Education 5.0 principles.

4.2. Spatial program and proxemics mapping

Referring to pedagogical outcomes, when designed in accordance with proxemics and human-centered principles, the Co-Learning Space supports multiple modes of learning that extend beyond formal instruction.

Based on proxemics distances (Hall, 1966) presented below and the Education 5.0 principles, The Co-Learning Space is organized into interconnected *macrozones* (Agora and Collaboration Hub) and *microzones* (Mentoring Pod and Reflective Nooks):

- **Agora (Public Zone):** open square for lectures, exhibitions, and festivals — supports public distances (>3.6 m).
- **Collaboration Hubs (Social Zone):** movable worktables, shaded pergolas, small amphitheatres for 4-12 people (1.2-3.6 m).

- **Mentoring Pods (Personal Zone):** semi-enclosed alcoves for one-to-one feedback, tutoring, and focused small-group work (0.45-1.2 m).
- **Reflective Nooks (Intimate Zone):** secluded benches near vegetation and water features for contemplation and emotional reset (<0.45 m).

Those principles are helpful in space design process. Google offices design (Figure 3) i.ex. is the good exaple of implementation of Work 5.0 framework into space design process. Imlementing the conceptual design theory of Co-learning Space can result with better quality of educational environments.

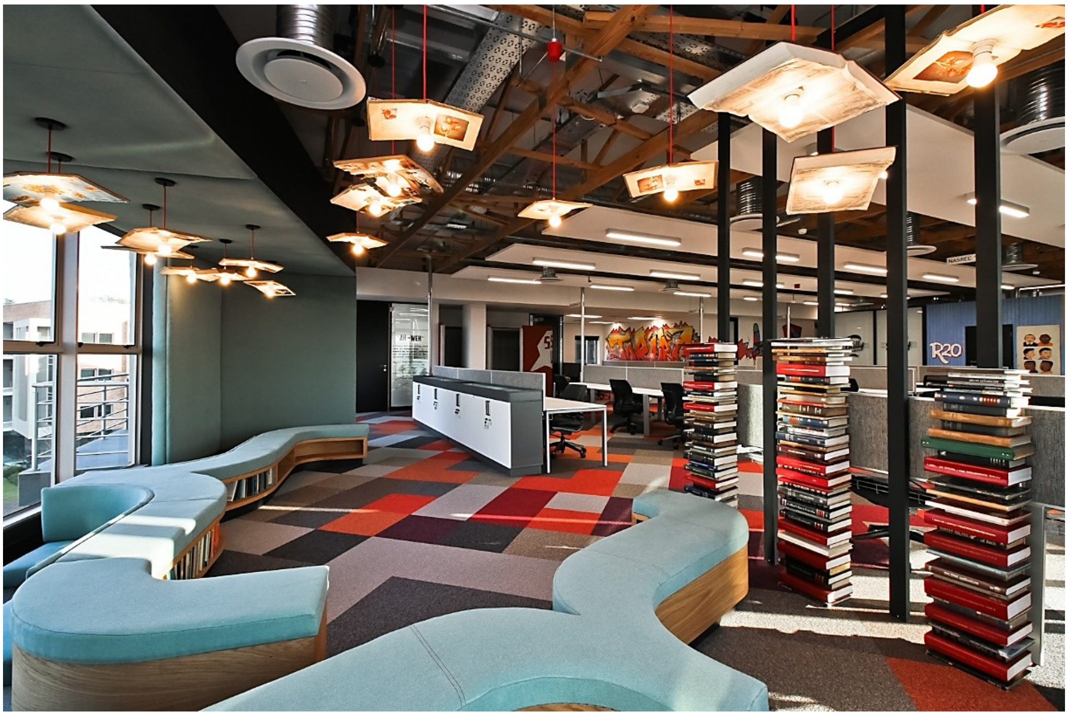


Figure 3. Google office design in Johannesburg.

Source: https://trendgroup.co.za/

4.3. Design moves inspired by Whyte

Adaptive systems are introduced as supportive mechanisms that provide feedback on occupancy and usage patterns while remaining subject to human interpretation based on Whyte’s (1980) findings which suggest several concrete moves:

- **Sittable edges and thresholds:** encourage informal seating and accidental grouping.
- **Focal attractors:** water, art, sunlight patches to generate social magnetism.
- **Flexible furniture:** clusters that can be reconfigured to shift proxemics relations.
- **Permeable visibility:** transparent partitions and sightlines that enable peripheral observation.

4.4. AIPL integration in the Co-Learning Space and its pedagogical outcomes

Referring to pedagogical outcomes, when designed in accordance with proxemics and human-centered principles, the Co-Learning Space supports: could:

- observational learning: students acquire knowledge through peripheral observation of peers engaged in practice,
- spontaneous collaboration: micro-interactions facilitate unplanned yet productive social exchange (compare Koper et al., 2025),
- emotional regulation: reflective zones contribute to stress reduction and improved cognitive readiness.

Furthermore within the Co-Learning Space, AIPL could:

- detect rising cluster density and suggest opening adjacent collaboration hubs via retractable partitions, or offer scheduling prompts,
- modulate localized lighting and acoustic attenuation during focused sessions,
- compile anonymized occupancy heat maps for designers to understand long-term spatial usage patterns.

4.5. Operationalizing PAE 5.0 for Co-learning Space

To translate the circular model into design, based on the conceptual design theory presented in this paper, practitioners can:

- Map typical activities and classify them by proxemics zone (intimate to public, compare Figure 4).
- Specify spatial affordances for each zone (furniture type, sight-lines, acoustic thresholds).
- Provide transitional elements (thresholds, gradients of enclosure) to allow fluid movement between zones.
- Test scenarios using small-scale observations and iterative prototyping.

Within the Co-Learning Space, the AI-Driven Proxemics Loop (AIPL) operates as an adaptive yet non-deterministic layer that supports spatial management while preserving human agency in design and use. Through non-intrusive sensing technologies, the system can detect variations in occupancy, clustering density, movement patterns, acoustic levels, and environmental comfort. When rising cluster density is identified in collaboration hubs or transitional zones, AIPL may suggest the temporary opening of adjacent spaces through retractable partitions, thereby redistributing activity and preventing spatial congestion. Alternatively, the system can generate scheduling prompts or spatial recommendations communicated to users or facility managers, enabling informed decision-making without enforcing behavioural outcomes.

During periods of focused or individual work, AIPL can modulate localised lighting conditions and acoustic attenuation to support concentration and reduce cognitive overload. Such adjustments are calibrated to proxemics conditions rather than purely functional metrics; for instance, lighting intensity and sound absorption may be adapted differently in personal versus social distance zones. Importantly, these adjustments remain reversible and transparent, reinforcing the principle that adaptive systems should augment, rather than replace, human perception and judgment.

Over longer temporal cycles, AIPL can compile anonymized occupancy heatmaps and behavioral trend visualizations. These datasets provide architects, educational managers, and institutional decision-makers with evidence-based insight into how spaces are appropriated, transformed, or avoided over time. Rather than serving as prescriptive optimization tools, these analytics function as reflective instruments that inform post-occupancy evaluation, iterative design refinement, and governance decisions related to spatial policy and resource allocation. In this sense, AIPL contributes to organizational learning by translating spatial use into intelligible patterns without reducing complex human behaviors to purely quantitative indicators.

One key postulated outcome, based on theoretical research is **observational learning**, whereby students acquire tacit knowledge through peripheral awareness of peers engaged in diverse activities. Visual permeability, layered sight-lines, and proxemics gradation enable learners to observe processes, gestures, and social interactions without direct participation. This aligns with theories of social and situated learning, in which knowledge emerges through exposure, imitation, and shared presence rather than exclusively through verbal instruction.

A second outcome is **spontaneous collaboration**, facilitated by spatial configurations that encourage micro-interactions at thresholds, edges, and transitional zones. Informal seating, shared surfaces, and semi-enclosed hubs enable brief encounters to develop into meaningful exchanges. Such interactions are often unplanned yet productive, fostering interdisciplinary dialogue, peer feedback, and collective problem-solving. The proxemics organization of the Co-Learning Space ensures that these encounters occur within socially comfortable distance ranges, reducing barriers to participation and supporting inclusive engagement (Figure 4).

A third pedagogical outcome concerns **emotional regulation and cognitive readiness**. Reflective zones—characterized by reduced sensory stimulation, proximity to natural elements, and greater spatial enclosure—provide opportunities for mental restoration and stress reduction. In high-density educational environments, the availability of such proxemically distinct spaces is critical for maintaining attention, motivation, and psychological comfort.

Figure 4. Macrozones at Bydgoszcz University of Science. Agora and Collaboration Hubs.
Source: D. Wiśniewska.

Collectively, these outcomes illustrate how spatial communication, informed by proxemics and supported by adaptive systems, contributes to learning as a holistic process encompassing cognitive, social, and emotional dimensions.

5. Discussion

This paper addresses this gap by proposing a proxemics-based analytical framework for Education 5.0 environments, positioning artificial intelligence as a supportive, non-deterministic layer embedded within human-in-the-loop governance structures. **Proxemics principles in educational environments can be described by measurable spatial parameters and recurring patterns that support interaction, observation, collaboration, and reflection (IOCR).** The proxemics approach provides a structured vocabulary for articulating how spatial arrangements influence learning behaviour and organizational culture. By integrating proxemics with adaptive systems under human oversight, learning environments can balance technological responsiveness with social presence. Cultural variability necessitates local calibration, and the conceptual nature of the study highlights the need for empirical validation. The paper is intentionally framed as a **conceptual and analytical contribution**, aimed at developing a transferable framework rather than reporting results from an implemented project. Conceptual case studies are widely accepted in architectural, educational, and organizational research as a means of testing theoretical coherence and design logic prior to empirical application. Implementing a full empirical case study would exceed the scope of the present work and is therefore proposed as a direction for future research. Theoretical conceptual design gives structured framework for further spatial analyses and behavioral studies of reshaped space. Well structured framework helps with more detailed synthesis of design decisssions.

The Co-Learning Space design concept demonstrates that educational environments can be designed as dynamic ecosystems in which architecture, pedagogy, and technology are mutually reinforcing. Within this framework, artificial intelligence functions not as an autonomous controller but as an assistive mechanism embedded within human-centered governance structures. Such positioning is consistent with Education 5.0 values, emphasizing ethical responsibility, and the cultivation of collective intelligence through spatial design.

While contemporary Education 5.0 literature extensively examines human–AI interaction, ethics, and workforce transformation (Shahidi Hamedani et al., 2024; Komló, 2025), spatial communication and proxemic structuring of learning environments remain marginal in current research. This study contributes by positioning proxemics as a strategic analytical layer linking architectural design, educational governance, and AI-mediated spatial design and management. The contribution of the paper is identifying the **lack of spatial and proxemics perspectives in literature describing human-ceneterd perspective in design guidelines for educational environments according to current Education 5.0 approach**. While contemporary Education 5.0 literature extensively examines human–AI interaction, ethics, and workforce transformation (Shahidi Hamedani et al., 2024; Komló, 2025), spatial communication and proxemic structuring of learning environments remain marginal in current research. This study contributes by positioning proxemics as a strategic analytical layer linking architectural design, educational governance, and AI supported spatial management.

6. Conclusion

Historically, public spaces functioned as informal learning environments where social learning occurred through observation and shared presence. This study demonstrates that spatial communication, interpreted through proxemics, offers a coherent and transferable approach to the design and evaluation of educational environments in relatively new AI-mediated contexts.

By foregrounding human sensory, social, and behavioral needs, the proxemics-based approach enables architects and decision-makers to articulate how spatial configurations support collective presence, interaction, and learning outcomes.

The proposed conceptual models illustrate how human-centered spatial principles based on proxemics could help develop educational environments inform without delegating agency to AI technology. In this sense, artificial intelligence functions as an enabling layer that supports evidence-informed decisions, spatial responsiveness, and organizational learning. By treating AI-supported systems as assistive mechanisms rather than autonomous agents, the proposed approach is in line with Education 5.0 values and responsible organizational management. By embedding artificial intelligence within human-in-the-loop governance structures, the proposed proxemic approach aligns with Society 5.0 principles emphasizing ethical responsibility, human agency, and sustainable development (De Villiers, 2024; Chigbu et al., 2025). Such positioning is particularly relevant for institutions seeking to balance innovation with ethical responsibility, user security and comfort, as well as long-term sustainability.

For policy makers, educational managers, and designers, the findings underline the value of integrating architectural knowledge into broader governance frameworks for learning environments. The final hypothesis presented in this article is: *Proxemics provides a shared language through which spatial quality, social interaction, and adaptive AI-driven technologies can be evaluated and aligned with Education 5.0 objectives***.** Proxemics offers a strategic tool for structuring learning environments that align architectural design, educational objectives, and adaptive technologies. The study contributes to interdisciplinary discourse across architecture, education, and management by reframing spatial design as a communicative and governable system. Furthermore, adaptive technological systems, when embedded within human oversight and governance mechanisms, can enhance responsive spatial management without undermining physical co-presence or social interaction.

Future research should test the proposed approach in implemented projects, combining spatial analytics with qualitative assessment to support informed management of educational space in increasingly complex institutional settings.

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