

Ambient Learning Environment: An Integrative Review of Students' Learning Experience and Engagement

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ABSTRACT

In recent years, many educational institutions have sought to enhance student engagement through the improvement of learning spaces, leading to a growing interest in learning space design. However, while various studies have explored technological and environmental factors that shape the learning experience, the specific influence of lighting and spatial design on student learning remains not fully understood. This study examines how ambient learning environment engages student learning by synthesizing research conducted from 2021-2025. It explores how ambient learning environments influence students' experiences, with a specific focus on lighting and spatial elements. This integrative review analyzed ten peer-reviewed articles that were systematically selected based on established inclusion and exclusion criteria, and the findings were synthesized through thematic analysis. The findings show that five major themes of experience emerged, namely lighting effects, spatial design, motivation & engagement, co-design & flexibility, and learning outcomes & satisfaction. The findings suggest that a balance of natural and artificial lighting positively influences students' psychological state and cognitive abilities. Finally, this study proposes a framework for a multimedia-enhanced ambient learning environment, grounded in the principles of Embodied Cognition Theory. The framework consolidates the key findings of this review and illustrates how embodiment concepts underpin its structure. It is anticipated that this learning framework will enhance students' experiences, engagement, and creativity, ultimately contributing to improved academic performance.

Keywords: Ambient Learning Environment, Light and Spatial Design, Integrative Review, Multimedia-Enhanced Learning, Embodied Cognition Theory

INTRODUCTION

The concept of ambient learning environments has garnered increasing scholarly attention in recent years, particularly in the context of learner-centered and experiential education. An ambient learning environment is an educational space, both physically and psychologically, using the optimization of space design elements such as lighting and spatial arrangements to improve student learning outcomes. It involves the deliberate arrangement of light and learning spaces to maximize the integrated effects on students' learning, engagement, and comfort (Shahidi et al., 2021).

Light and spatial attributes are key elements in cultivating effective ambient learning environments. The integration of lighting and spatial design elements into learning facilities requires careful planning and preparatory work and may incur additional costs for educational institutions beyond the investment in the existing learning

facilities (Schweder et al. 2024). However, these elements can be explored with low-cost design with some creativity applied, through multimedia, digital lighting, and extended space design through digital display (Cayubit, 2022).

The 10-10 MYSTIE Framework, developed by the Malaysian Ministry of Science, Technology, and Innovation (MOSTI), promotes innovative learning environments by encouraging collaboration and the integration of best practices to enhance student learning outcomes (Academy of Science Malaysia, 2020). In line with this, a gap has been identified where there is insufficient research exploring the co-existence and interaction between different categories of learning environments (Valtonen et al., 2021). A review of literature on students' experiences is needed to develop and facilitate a functional environment in the learning space, which could guide and enhance students' motivation and satisfaction in their learning process (Mazloum Yar et al. 2023). Research indicates that adopting best practices can facilitate the development of effective learning spaces in higher education, enabling educators to support and leverage ambient environments more effectively (Cayubit, 2022).

Literature has identified that students in higher education require informal learning spaces and resources to enhance engagement, which helps in developing effective learning environments for diverse students (Valtonen et al., 2021). A neutral rating analysis based on students' perceptions identified several characteristics that they believe could enhance the effectiveness of learning environments by incorporating different creative ideas (Valtonen et al., 2021). Conversely, another study points out that ineffective classroom layouts can limit opportunities for collaboration and contribute to student isolation (Nwokedi, 2023). Therefore, research in this area could provide recommendations for educators and policymakers to reimagine classroom or learning environments that better support diverse learning needs (Nwokedi, 2023).

Research Objectives

This integrative review aims to examine studies published between 2021- 2025 that explore students' experiences in ambient learning environments, with a specific focus on the influence of lighting and spatial arrangements. The review also seeks to generate insights from existing literature to inform the design of effective ambient learning environments. The objectives of the review are:

1. To explore how light and spatial design elements in an ambient learning environment influence students' learning experience.
2. To investigate how light and spatial design elements influence students' learning engagement

Definition of Key Concepts

- **Student Experiences:** Students' interactions, emotions, perceptions, and activities that they go through during their education. In this review, student experiences refer to their educational journey, including their interactions with faculty, peers, and the learning environment (Wong, 2015).
- **Learning environment:** The atmosphere experienced by students within a safe, functional, and inspiring physical space. It encompasses the context and culture in various settings and is designed to support both learning and overall student well-being (Cayubit, 2022).
- **Light and Space:** The relationship between lighting and spatial design in shaping the ambience of a learning environment. In this review, particular attention is given to how light, used both functionally and metaphorically, helps define space, create an effective learning atmosphere, and promote interaction and connection among students (Lindh, 2012).
- **Integrated Review:** A method for researchers to synthesize existing knowledge, critically evaluate studies, and propose new frameworks, thereby advancing understanding within their fields (Torraco, 2016).
- **Multimedia-Enhanced Learning:** Multimedia-Enhanced Learning refers to the use of various media elements such as text, images, audio, video, and animation to create a more engaging and effective learning experience. It supports students' understanding by combining visual and auditory information, making the learning process more interactive, stimulating, and meaningful (Lehrman, 2025).
- **Embodied Cognition Theory:** The Embodied Cognition Theory posits that learning and thinking are fundamentally shaped by bodily movements, sensory experiences, and interactions with the surrounding environment. It emphasizes that cognition is not confined to the mind alone but is deeply influenced by physical actions such as doing, seeing, touching, and moving within one's learning context (Lakoff et al. 1999).

METHODS

This study employed an integrative review approach, guided by established methodologies for synthesizing diverse types of research. This method was chosen to allow a comprehensive analysis of existing literature on ambient learning environments, focusing on how lighting and spatial elements impact the learning environment

(Torraco, 2016). The outcome of such a review is to propose new frameworks and perspectives on the topic.

LITERATURE REVIEW USING PREDETERMINED CRITERIA

The research articles included in this review, spanning the period of 2021-2025, were obtained via electronic databases, Google Scholar, and education journals. The search terms included: “students experience”, “ambient learning environment”, “light and spatial”, “integrated review” as indicated in the topic. Other terms included “influence of learning space”, “students’ engagement”, “motivation in classroom”, “social behavior” and “holistic learning space”.

Specific inclusion and exclusion criteria were applied to ensure the relevance and quality of the selected studies. Studies were selected based on the following criteria: (a) scholarly works published in peer-reviewed journals; (b) written in English; (c) occurred in the timeframe between 2021-2025; (d) study participants were students in schools and higher education learning, and (e) included the search term or keywords.

Table 1. Summary of review of the included articles

No.	Author(s) / Year	Purpose	Method	Environment Factor (Light / Space)	Key Findings	Implications
11	Shahidi et al. (2021)	Explore how light affects mood and perception.	Mixed method	Light and Color	Light and color influence mood, perception, and performance	Design pleasant, well-lit environments.
22	Markkanen & Herneoja (2024)	Study co-design’s effect on satisfaction.	Mixed method	Spatial Atmosphere	Design changes have improved workplace satisfaction.	Use co-design in workspace planning.
33	Peng et al. (2022)	Study spatial attributes in ALCs.	Quantitative	Natural/Artificial Light, Space	Environment impacts engagement & experience.	Creating flexible, sustainable classrooms
44	Kamble & Pande (2024)	Design lighting and ventilation in fashion institutes.	Mixed method	Daylight, Ventilation	Lighting and air boost creativity and comfort.	Improve educational space planning.
55	Firman & Sandiarsa (2024)	Link learning environment with motivation.	Qualitative	Light and Layout	Design affects motivation and engagement.	Flexible design boosts student focus.
66	Nwokedi (2023)	Study classroom impact on English learning.	Mixed method	Lighting, Layout, Acoustics	Good design supports language communication.	Enhance layout for better results.
77	Schweder & Raufelder (2024)	Explore SDL vs TDI on motivation.	Quantitative	Space, Light, Learning Model	SDL improves motivation and needs satisfaction.	Support SDL through thoughtful design.
88	Mazloum Yar & Shaheedzoozy (2023)	Impact of light and space on learning.	Qualitative	Lighting, Size, Layout	Better design boosts engagement.	Design to improve interest and satisfaction.

9	Valtonen et al. (2021)	Understand student preferences in environments.	Mixed method	Physical Space	Students prefer flexible, informal setups.	Use cozy, adaptable spaces.
10	Cayubit (2022)	Examine learning space and motivation.	Quantitative	Space, Light Quality	Good settings support motivation and strategy.	Design with socio-emotional support.

In addition, the studies should directly examine the influence of ambient learning environmental factors, with a particular emphasis on lighting and spatial design, on students' motivation, engagement, academic performance, or well-being. Exclusion criteria, on the other hand, excluded studies published outside the specified timeframe, those not available in full text, and research that did not focus on environmental factors related to educational settings.

Overall, 30 articles have been identified, and a total of 10 research articles met the inclusion criteria for this integrative review. The studies were selected based on the scope relevant to the core theme: (a) the influence of ambient learning environment factors (lighting and spatial design), (b) students' academic motivation, engagement, and performance. The studies were all published between 2021-2025, used qualitative, quantitative, and mixed-method approaches, and focused on educational settings ranging from classrooms to studio space learning environments. **Error! Reference source not found.** shows the summary of articles that were used in this study.

Articles that examined general educational outcomes that lacked a direct focus on ambient learning environmental factors, such as lighting, space, or environmental design were excluded. Studies on digital tools, curriculum design, or teacher pedagogical styles without linking these to physical environmental variables were considered out of scope. Additionally, papers published prior to 2021, those not available in full-text or peer-reviewed format, and research lacking in empirical evidence were excluded.

Critical Appraisal of Selected Research

All selected articles were critically appraised and assigned scores to ensure alignment with the objectives of the review. This scoring framework allowed reviewers to assess each study's methodology, relevance to the review topic, practical applicability, and novelty. The evaluation was carried out by independent reviewers with expertise in educational design and architectural design. Each study was assessed based on five key criteria, with a maximum possible score of 20 points. The scoring criteria consist of (i) Relevance to topic, (ii) Methodological Rigor, (iii) Clarity of findings, (iv) Implication of Practice, (v) Innovation and originality. This evaluation helped determine the strength of evidence and each study's overall contribution to the integrative review.

No.	Author(s)/ Year	Relevance	Rigor	Clarity	Implication	Innovation	TOTAL
1	Shahidi et al. (2021)	4	4	4	3	3	18
2	Markkanen & Herneoja (2024)	4	4	4	4	4	20
3	Peng et al. (2022)	4	3	4	4	3	18
4	Kamble & Pande (2024)	4	3	3	4	3	17
5	Firman & Sandiarsa (2024)	3	3	4	3	2	15
6	Nwokedi (2023)	4	3	3	3	3	16
7	Schweder & Raufelder (2024)	4	4	3	4	4	19

8	Mazloum Yar & Shaheedzooy (2023)	3	3	3	3	2	14
9	Valtonen et al. (2021)	3	3	3	3	3	15
10	Cayubit (2022)	4	4	4	4	3	19

presents the scoring system for evaluating the included studies. Each criterion is connected to questions based on the included articles. (i) Relevance to Topic: Does the study directly address light or spatial factors in learning environments? (ii) Methodological Rigor: Is the research design aligns with the study's aim? (iii) Clarity of Findings: Are the results clearly presented and supported by evidence? (iv) Implication of Practice: Does the research offer practical or theoretical insights for learning environments? (v) Innovation and Originality: Does the research introduce novel perspectives or approaches to learning environments?

Analysis of the 10 studies indicated that the highest-scoring articles were (Markkanen et al. 2024), which scored 19 out of 20, reflecting high relevance, rigorous design, practical implications, and clear findings. The strong studies were (Peng et al., 2022; Schweder et al. 2024; Shahidi et al., 2021) 19, showing strong alignment with the review's aims and well-structured methodological quality. Meanwhile (Firman et al. 2024; Mazloum Yar et al. 2023; Nwokedi, 2023; Valtonen et al., 2021)

Scored between 15 and 16, indicating satisfactory quality but also revealing limitations in terms of innovation and methodological rigor.

Most studies show that light and spatial factors influence educational settings. However, a few studies lacked originality or methodological depth, suggesting that future research could be strengthened in these areas.

Table 2: Summary of scoring of the selected studies

No.	Author(s)/ Year	Relevance	Rigor	Clarity	Implication	Innovation	TOTAL
1	Shahidi et al. (2021)	4	4	4	3	3	18
2	Markkanen & Herneoja (2024)	4	4	4	4	4	20
3	Peng et al. (2022)	4	3	4	4	3	18
4	Kamble & Pande (2024)	4	3	3	4	3	17
5	Firman & Sandiarsa (2024)	3	3	4	3	2	15
6	Nwokedi (2023)	4	3	3	3	3	16
7	Schweder & Raufelder (2024)	4	4	3	4	4	19
8	Mazloum Yar & Shaheedzooy (2023)	3	3	3	3	2	14
9	Valtonen et al. (2021)	3	3	3	3	3	15
10	Cayubit (2022)	4	4	4	4	3	19

FINDINGS

After the selection and scoring process, thematic analysis was performed to identify key themes and patterns within the reviewed literature. The analysis revealed five key themes that provide clarity to the overall findings.

The studies were systematically synthesized into thematic categories and subcategories relevant to learning environments, in alignment with the review's aim, which is to examine how light and spatial design elements within ambient learning environments affect students' learning experience and engagement. **Error! Reference source not found.** presents the five major themes, along with supporting research evidence and synthesized key studies. The identified themes are: Lighting Effects, Spatial Design, Motivation & Engagement, Co-design & Flexibility, and Learning Outcomes & Satisfaction.

Table 3. Themes and sub-categories of the integrative review

Theme	Major Themes	Sub-categories/ Key Focus Areas	1:
	1. Lighting Effects	<ul style="list-style-type: none"> • Natural vs. Artificial Light Balance • Color Temperature & Mood • LED Lighting for Mental Well-being • Light Quality & Visual Comfort 	
	2. Spatial Design	<ul style="list-style-type: none"> • Classroom Size & Layout • Ergonomic Furniture • Acoustic Environment • Spatial Atmosphere 	
	3. Motivation & Engagement	<ul style="list-style-type: none"> • Cognitive Engagement • Emotional Well-being • Behavioral Participation • Psychological Needs Fulfillment 	
	4. Co-design & Flexibility	<ul style="list-style-type: none"> • User-Centered Design Process • Adaptable Learning Spaces • Self-Directed Learning Support • Collaborative Environments 	
	5. Learning Outcomes & Satisfaction	<ul style="list-style-type: none"> • Enhanced Academic Performance • Increased Student Motivation • Improved Learning Strategies • Better Psychological Well-being • Greater Learning Environment • Satisfaction 	

Lighting Effects

Balancing natural and artificial light, managing colour temperature, and utilizing LED lighting are critical factors in fostering mental well-being. Students reported feeling a sense of 'wow' or fascination when interacting with peers in environments illuminated by dim and ambient lighting. This theme is prominently evident in studies (Cayubit, 2022; Kamble et al. 2024; Mazloun Yar et al. 2023; Nwokedi, 2023; Shahidi et al., 2021) which demonstrate that such lighting elements effectively enhance both emotional well-being and cognitive performance.

Theme 2: Spatial Design

Most studies (Kamble et al. 2024; Mazloun Yar et al. 2023; Nwokedi, 2023; Peng et al., 2022; Valtonen et al., 2021) revealed that the spatial design elements, classroom size & layout, ergonomic interior, acoustic environment, spatial atmosphere, shape learning comfort, and students' engagement were significant factors influencing students' perceptions and learning outcomes. "I need to spend more time here, I felt comfortable", declared by a student after their lesson (Valtonen et al., 2021). These elements contribute to creating a conducive learning environment that fosters collaboration, engagement, and overall well-being. Yet, further research is needed to explore the optimal configuration and integration of these spatial design elements to maximize their impact on student learning experiences (Kamble et al. 2024).

Theme 3: Motivation & Engagement

Researchers indicated that a well-designed physical setting can significantly boost motivation, while self-directed learning settings have been shown to improve psychological needs, creating a more positive and engaging learning environment (Cayubit, 2022; Firman et al. 2024; Nwokedi, 2023; Schweder et al. 2024). This evidence suggests that students feel motivated and emotionally comfortable in well-designed learning spaces. Moreover, students expressed a willingness to contribute to the development of best practices for creating and maintaining such environments in higher education settings (Schweder et al. 2024).

Theme 4: Co-Design & Flexibility

Recent studies have emphasized that engaging students in the design process and providing adaptable learning spaces can substantially enhance their satisfaction, sense of belonging, and ownership of the learning environment (Schweder et al. 2024; Valtonen et al., 2021). This theme underscores the importance of student input in shaping

effective learning environments. Adaptable spaces, i.e., those that can be easily reconfigured to accommodate various learning activities, further contribute to a dynamic and responsive educational setting that supports student engagement and well-being.

Theme 5: Learning Outcomes & Satisfaction

The findings suggested that better-designed environments result in improved academic performance and satisfaction. These findings align with the broader literature on the impact of physical learning spaces on student outcomes, emphasizing the need for further research and investment in creating optimal learning environments (Cayubit, 2022; Firman et al. 2024; Gul Mazloum Yar et al. 2023; Shahidi et al., 2021).

Drawing from the synthesized themes, this review proposes the Light-Spatial-Learning Framework, a research-based model aimed at optimizing the design and effectiveness of ambient learning environments. The literature consistently demonstrates that lighting and spatial configurations have a substantial impact on students' psychological well-being, motivation, engagement, and academic outcomes. As such, ambient learning environments should be reconceptualized as dynamic, student-centered ecosystems that are intentionally designed to foster meaningful and sustained learning experiences.

Ambient Environments Mediated by Multimedia Technologies

The current review of ambient learning environments highlights how the integration of educational multimedia technologies has transformed traditional learning spaces into dynamic ecosystems (Shahidi et al., 2021). This integration allows for the convergence of light, space, sound, and digital media, which are multimodal and worth further exploration. Specifically, multimedia tools such as smart LED systems and interactive projection mapping transcend conventional lighting functions by creating immersive environments that can be synchronized with both creative and instructional content delivery. More importantly, these technologies contribute to the activation of cognitive states such as mood, focus, and memory among students (Kamble et al. 2024; Shahidi et al., 2021).

The integration of digital whiteboards, holographic displays, and immersive soundscapes enhances spatial design, allowing classrooms to have a seamless transition from traditional learning space to enhanced learning experiences. We believe that this adaptable space design and layouts can foster creativity and engagement in the classrooms (Markkanen et al. 2024; Peng et al., 2022). Multimedia applications such as augmented reality can provide multisensory experiences with augmented contents and interactivity to support the exploration of abstract concepts and interactive contents. The above-mentioned media technologies can sustain motivation and reinforce learning through embodied experiential engagement (Cayubit, 2022; Schweder et al. 2024). Additionally, student-controlled multimedia dashboards or interactive boards allow learners to actively participate in the design of their own learning environments by adjusting features such as lighting, visuals, and space. For instance, through smart classroom interfaces, students can dim or brighten lights to improve concentration, select calming background sounds to reduce anxiety. This can foster students' ownership and flexibility for optimal learning within their control (Mazloum Yar et al. 2023; Valtonen et al., 2021). Multimedia technologies used to augment space creations such as ambient learning environment can create the emotional and foster satisfaction in learning, and therefore strengthening student connections to their surroundings, and ultimately to improve their academic outcome.

Theory of Embodied Cognition in Ambient Learning Environment

Embodied Cognition Theory explains that our thinking and memory are shaped by the way our bodies interact with the environment. What we see, hear, and feel in our environment helps shape how we understand and remember things (Lakoff et al. 1999). Lakoff and Johnson (1999) emphasized that *"the mind is inherently embodied"* (p. 4), which means that human thought cannot be separated from the body and the senses. This perspective is reflected in research on ambient learning environment, which shows that sensory elements such as lighting and spatial design strongly influence learners' focus, mood, and memory (Peng et al., 2022; Shahidi et al., 2021). In this context, the surrounding environment actively contributes to the learning process rather than merely serving as a passive setting.

The benefits of applying embodied cognition in educational settings are numerous. Firstly, this approach can lead to significantly improved memory retention and a deeper understanding of complex concepts. Su's research (2023), shows that embodied teaching positively affects memory performance. Additionally, physical engagement accommodates varied learning styles, fostering inclusivity and an enriched emotional learning environment (Su, 2023).

The implementation of embodied cognition is notably enhanced by technological advancements like virtual and augmented reality. The study reveals that virtual learning environments provide a more accessible and effective solution for hands-on learners (Padilla Perez & Keleş, 2025). The integration of embodied elements within virtual learning environment sessions notably enhanced efficiency, resulting in a reduction of task completion time for learners (Padilla Perez & Keleş, 2025). Researchers observed that virtual reality technology significantly improves

student learning, engagement, and enthusiasm, thereby yielding superior educational outcomes (Padilla Perez & Keleş, 2025). From this perspective, technology mediates the embodied connection between learners and their surroundings, creating sensory-rich spaces that improve attention, emotional engagement, and memory retention.

Framework: Embodied Cognition in Multimedia-Enhanced Ambient Environment

Figure 1 presents the framework illustrating how embodied cognition theory forms the foundation for understanding the dynamic relationship between learners and their environments (Lakoff et al. 1999). Adapted from Johnson-Glenberg (2014), the framework demonstrates that when full-body interaction is aligned with learning content, it can strengthen creative collaboration, problem-solving, and spatial awareness, particularly in art and design education. Building on this idea, the framework integrates multimedia-enhanced ambient learning environments with embodied learning principles to show how sensory and physical engagement deepen understanding. Previous studies emphasize that students achieve better learning outcomes when realistic movement and interaction support active thinking and hands-on experiences, reinforcing the value of embodied approaches in technology-supported learning spaces (Wilson, 2002).

The EC theory suggests that cognition is shaped by bodily and sensory interaction, providing the foundation for understanding the role of ambient environment in learning (Lakoff et al. 1999; Padilla Perez et al. 2025). Elements such as lighting and spatial design serve as cognitive mediators, actively influencing focus, memory, and emotional engagement (Peng et al., 2022; Shahidi et al., 2021). These ambient features are further enhanced through multimedia technologies, including virtual and augmented reality, projection mapping, holographic displays, which create adaptive and sensory-rich experiences (Kamble et al. 2024; Peng et al., 2022). The final stage of the framework highlights the learning outcomes made possible by this mediation, including improved engagement, satisfaction, and conceptual understanding (Markkanen et al. 2024; Padilla Perez et al. 2025). Together, the framework conceptualizes how embodied cognition, mediated by environment and technology, leads to meaningful and sustainable learning outcomes.

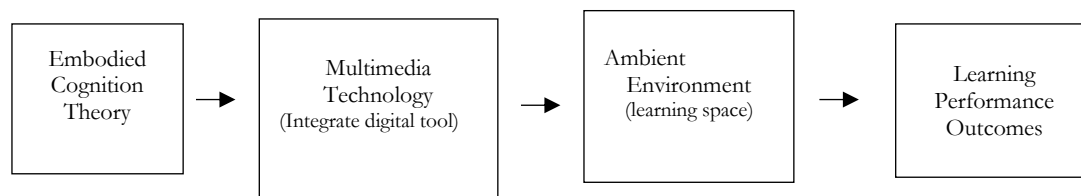


Figure 4. Framework of embodied cognition in multimedia-enhanced ambient learning environments

DISCUSSION AND LIMITATION

This integrative review highlights that ambient learning environments which are shaped by lighting, spatial design, and supported by emerging multimedia technologies play a significant role in shaping students' experiences. According to the reviewed studies, the integration of light and space was consistently shown to influence motivation, engagement, emotional well-being, and academic outcomes (Markkanen et al. 2024; Peng et al., 2022; Shahidi et al., 2021). When these environmental factors were mediated through technology such as interactive dashboards, projection mapping, and AR/VR tools, classrooms evolved from static spaces into dynamic ecosystems that foster collaboration, flexibility, and personalization. These findings align with embodied Cognition Theory and further underscore the role of sensory and spatial experiences in mediating cognitive processing (Lakoff et al. 1999).

Despite this, some limitations must be acknowledged. First, most reviewed studies focused on higher education contexts, with limited exploration of primary or secondary school environments, reducing the generalizability of findings (Valtonen et al., 2021). Second, many studies measured short-term outcomes such as satisfaction, focus, or engagement, while long-term impacts on academic performance and psychological well-being remain underexplored (Mazloum Yar et al. 2023). Third, the wide variety of research methods, from small case studies to experimental trials, makes it difficult to compare results. Finally, given the rapid advancements in technology, particularly in areas like AI and metaverse platforms, some research findings may quickly become outdated, thus requiring ongoing updates and new investigations.

CONCLUSION

This review concludes that ambient learning environments, when enhanced with educational multimedia technologies, hold strong potential to transform traditional classrooms into adaptive, student-centered ecosystems. By strategically combining light, space, and sound with interactive tools, educators can create environments that foster motivation, autonomy, collaboration, and deeper engagement. Grounded in Embodied Cognition Theory, this perspective emphasizes how sensory-rich interactions anchor knowledge in embodied experience. Collectively, the findings suggest that ambient learning is not merely about enhancing the physical atmosphere but also about reshaping pedagogy, fostering emotional resonance, and supporting meaningful learning outcomes.

Future research should extend to diverse educational settings, examine long-term learning outcomes, and explore the integration of emerging technologies such as artificial intelligence, adaptive lighting, and digital platform technologies. By doing so, educators, designers, and policymakers can ensure that learning spaces continue to evolve as holistic, engaging, and human-centered environments capable of supporting learners' cognitive, emotional, and social development.

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