Where Space Meets Pedagogy: Advancing Technology Integration and Teacher–Learner Collaboration in Flexible Learning Spaces

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כשמרחב ופדגוגיה נפגשים: קידום שילוב טכנולוגיה ושיתופיות בין מורים ולומדים במרחבי למידה גמישים

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Abstract

This study examined the integration of technological tools and collaborative practices within Flexible Learning Spaces (FLS) designed to support innovative, learner-centered instruction. The research investigated the levels of technology integration achieved, and the occurrence of collaborative processes among educators and learners. A multiple case study approach, guided by the principles of the mixed-methods design, was employed. Data were collected through 15 semi-structured interviews and 7 non-participatory classroom observations conducted in various FLS. The e-CSAMR model was used to evaluate the level of technology integration (Substitution, Augmentation, Modification, or Redefinition) and the levels of collaborative teaching and learning processes (from information sharing to collaboration). Additionally, the Mindtools framework (Jonassen, 2020) was employed to examine which pedagogical approaches-learning from, with, or about technology-were supported through technology use in the FLS. Data analysis demonstrated that higher integration levels were prominent: Augmentation was most frequent, Modification appeared consistently in interviews and observations, and Redefinition emerged in the interviews. In Mindtools terms, technology use largely reflected "learning from technology," with considerable evidence of "learning with technology," enabling inquiry, creativity, and active knowledge construction. In parallel, multiple collaborative processes emerged among educators, including joint planning, co-teaching, and simultaneous support for several learner groups. Learner collaboration was highly evident across all levels of the e-CSAMR model, with frequent occurrences of high-level collaboration. This research enhances understanding of teaching and learning processes in FLS, highlighting their potential to support advanced technology integration and meaningful collaboration among teachers and learners.

Keywords: Flexible Learning Spaces, Technology integration, Collaborative learning, Teacher collaboration, e-CSAMR framework.

Introduction

The physical design of learning environments is recognized as an influential factor in teaching and learning, as research has found that spatial characteristics can shape instructional processes and contribute to pedagogical change (Correia & Cavadas, 2024). Accordingly, **Flexible Learning Spaces** (FLS) were developed to shape teaching and learning processes and to support pedagogical change (Obonyo & Thomas, 2025). These spaces aim to support the development of a broad range of skills including critical thinking, problem-solving, decision-making, communication, collaboration, logical reasoning, and creativity (Saur & Ulleberg, 2025). They are also designed to accommodate diverse teaching approaches and varied needs of students (Page et al., 2024).

FLS vary widely in their physical layouts and architectural configurations, enabling diverse teaching and learning approaches. They are typically characterized by adaptable structures for different activities and group sizes, large open areas that allow simultaneous work by multiple teachers and learner groups, and movable or transparent partitions connecting adjacent zones. Furniture typically provides varied seating and multiple learning focal points through boards, screens, projectors, and collaborative tables (Connor et al., 2023; Halidane et al., 2024). Many FLS also incorporate diverse technological resources, including interactive touchscreens, large displays, augmented-reality objects, virtual-reality headsets, and immersive projection systems (Hu et al., 2025).

This study examines the **types and levels of technology integration**, and the **levels of collaboration between teachers and learners** within FLS, as conceptualized through the frameworks of the e-CSAMR, and Mindtools, which are described later in the paper.

Literature Review

Previous studies have found that FLS can promote **collaborative learning processes** (Halidane et al., 2024). The flexibility of the furniture and the availability of multiple learning zones enable easy reorganization of the classroom and convenient group division, thereby encouraging teachers to integrate collaborative activities (Sánchez-López et al., 2025). In addition, open, spacious layouts and round or large tables facilitate joint task completion and group discussions by allowing learners to move freely and work together comfortably (Aga, 2024). Furthermore, designated small-group areas enable focused work without distractions, while meeting rooms and presentation spaces enhance communication and cooperation among learners (Saur & Ulleberg, 2025; Yesil & Aras, 2024). Finally, informal seating options-such as sofas, beanbags, and collaborative tables-further promote spontaneous learner collaboration (Jalal, 2024).

Moreover, existing research further demonstrates that FLS support **teacher collaboration**. Such collaboration includes joint lesson planning, co-teaching, and shared support for students during lessons taught to one or several classes (Alakoski et al., 2025). Specifically, when multiple classes work simultaneously in the same space with several teachers present, collaborative practices are reinforced (Fletcher et al., 2023). Additionally, the open, spacious layout facilitates flexible grouping of students, allowing each teacher to assist a specific group without distractions (Colton et al., 2024). This collaboration helps address diverse learner needs and enables teachers to learn innovative instructional approaches from one another, inspiring the adoption of new pedagogical practices (Alakoski et al., 2024; Liu & Sun, 2025).

Furthermore, **technology-rich FLS** help teachers become familiar with digital tools, strengthen their techno-pedagogical skills, and design creative lessons. The diversity of tools supports varied instructional programs, encourages adjustments in teaching approaches, and improves instructional efficiency (Hu et al., 2025). This shift moves teaching from traditional instruction to active, technology-enhanced learning and reinforces learner-centered pedagogy that develops twenty-first-century skills (Correia & Cavadas, 2024; Sitthiworachart et al., 2022).

At the same time, interactive audiovisual technologies-such as virtual and augmented reality-enable students to view content from multiple perspectives and organize knowledge more effectively, particularly with abstract concepts. These tools enhance learning outcomes and self-efficacy while increasing students' motivation and interest (Hu et al., 2025; Papaioannou et al., 2023). Moreover, they support collaborative learning by allowing shared outputs to be viewed simultaneously across multiple displays and by providing group screens that facilitate equitable participation (Dehdary et al., 2024; Yesil & Aras, 2024). However, FLS alone do not generate meaningful pedagogical change (Sánchez-López et al., 2025); effective integration still relies on teachers' techno-pedagogical knowledge to use these tools appropriately (Dehdary et al., 2024).

Theoretical Frameworks

To address the research aims, this study employed several theoretical frameworks. The study applied the **e-CSAMR model** (Shamir-Inbal & Blau, 2021), which evaluates both the level of technology use and the level of technology-supported collaboration in teaching and learning. Following the SAMR framework (Puentedura, 2014), technology integration is described across four levels: *Substitution*-digital replacement without change; *Augmentation*-adding functional improvements to the existing task; *Modification*-redesigning the task in a meaningful way with the support of technology, and *Redefinition*- creation of tasks impossible without technology. In parallel, the model defines three levels of collaborative learning (Blau, 2011; Salmons, 2008): *Information sharing*- exchanging ideas or knowledge; *Cooperation*- dividing roles to produce a shared outcome, and *Collaboration* -joint work on both process and outcome.

As a complement, to clarify the pedagogical rationale behind the use of these tools, the study applied Jonassen's **Mindtools framework** (Jonassen, 2020), which identifies three approaches: *learning from technology* -practice tasks, guided exercises, or content delivered through the tool, *learning about technology* -understanding how digital tools operate, and *learning with technology* using technology as a partner for exploration and knowledge construction.

To reach the study aims, we explored the following **research questions**:

1. What is the **level of technology integration** within FLS according to the e-CSAMR framework in this context? Which **pedagogical approaches** are reflected in these environments according to Mindtools framework?

2. According to the e-CSAMR model, what are the **levels of collaboration among pedagogical teams**, if any, in these FLS? Do these environments encourage the highest level of teamwork between educators?

3. According to the e-CSAMR model, what are the **levels of collaboration among learners**, if any, in these FLS? Do these environments promote the highest level of teamwork between learners?

Methodology

The study employed a **multiple case study** approach (Yin, 2018), guided by the principles of the **mixed-methods** design (Creswell, 2021). Data collection included triangulation between 15 **semi-structured interviews** and 7 **non-participatory observations** of lessons conducted in FLS. **Participants** were teachers who taught several lessons, or taught regularly, within an FLS. They included homeroom teachers and subject teachers such as mathematics and English as a second language, with varied years of teaching experience. **The learning spaces** were diverse in layout and equipment. Some included fully mobile furniture, while others had fixed arrangements. Seating options were diverse, ranging from high, low, and focus chairs to more uniform arrangements. Configurations included transparent walls, movable partitions, built-in amphitheater seating, and quiet rooms. In addition, furniture elements such as large round collaborative tables, sofas,

beanbags, presentation stages, carpets, and movable boards supported flexible use. Furthermore, technological resources were varied and included a 3D printer, VR headsets, immersive walls and an Active Floor system.

In the interviews, teachers described the teaching and learning processes they implemented in the FLS, including technology integration and collaborative activities. The observations provided direct insight into these processes and highlighted challenges associated with instruction in such environments. The interviews were audio-recorded and transcribed for analysis. The *unit of analysis* in the interviews was the statement, rather than the participant. In the observations, the unit of analysis was a field note recorded during the lesson, rather than the lesson as a whole. Data were coded using two complementary approaches:(1) **bottom-up coding**- using thematic analysis (Braun & Clarke, 2006, 2019) to identify emergent themes and develop analytical categories. (2**) top-down coding**-aligning the data with predefined theoretical frameworks: the e-CSAMR model (Shamir-Inbal & Blau, 2021) and the Mindtools framework (Jonassen, 2020). To ensure inter-rater reliability 25% of the interview and observation data were independently recoded by a second rater. Cohen's kappa indicated high agreement across the coding dimensions (κ = 0.72-0.91).

Findings

Integration of Technological Tools in Teaching and Learning Processes in FLS

The **first research question** examined the **level of technology integration within the FLS, and the pedagogical approach** underlying its use. Tables 1–2 present the findings from the interviews and observations: Table 1 displays integration levels according to the e-CSAMR framework (Shamir-Inbal & Blau, 2021) and Table 2 illustrates the pedagogical approach according to Jonassen's (2020) model. Each table includes the number and percentage of statements in each subcategory, as well as representative quotes.

Table 1.   Levels of Technology Integration (interviews=104; observations=13)

Level of Technology Integration	Representative Quote
Substitution Interviews: N=9 (9%) Observations: N=2 (15%)	Observation: "The lesson began with the teacher explaining an assignment presented in a slideshow, which the students were asked to complete independently on their computers."(D2)
Augmentation Interviews: N=42 (40%) Observations: N=7 (54%)	Observation: "The English teacher divided the class into two groups. The English-proficient students worked independently on leveled online tasks in an English-learning platform, including educational games and practice activities, across different learning spaces outside the classroom. Meanwhile, the rest of the class remained with her for direct instruction." (R)

Level of Technology Integration	Representative Quote
Modification Interviews: N=29 (28%) Observations: N=4 (31%)	Interview: "At the end of each school day, there is a half-hour period in which students select an activity for that day. On one occasion, they prepared a presentation on a topic of their choice, including information, images, and an explanation of their interest, which they developed during free work periods within classroom work cycles. Throughout the year, they take turns presenting their work during this time." (D3)
Redefinition Interviews: N=24 (23%) Observations: N=0	Interview: "One of the things I'm working on with them this year is using AI. We are learning about Israel's borders over time, and as part of the lesson I asked them to check what AI "thinks" about it. They came back with the answers they received, and we discussed what those responses meant." (E)

Analysis of the data indicated a meaningful presence of higher integration levels across both sources. Specifically, Augmentation emerged as the most common level, with Modification clearly evident in both the interviews and the observations. However, the Redefinition level appeared only in the interviews. Substitution was least common, suggesting that technology was generally applied beyond simple replacement of traditional tools.

Table 2.   Types of Technology Integration (interviews=104; observations=13)

Type of Technology Integration	Representative Quote
Learning from technology Interviews: N=51 (49%) Observations: N=9 (69%)	Observation: "The teacher uses a behavior-management software called Class Dojo, in which the students collect points based on their behavior. She used the software several times during the lesson-to reward a student for positive actions or to warn them about losing points." (L)
Learning about technology Interviews: N=7 (7%) Observations: N=0	Interview:" In science, the students learn to build a 3D cell. We work with an external organization that teaches them how to construct the cell and design it gradually, step by step." (D1)
Learning with technology Interviews: N=46 (44%) Observations: N=4 (31%)	Interview: "I allow them to express their thoughts on a current topic in a creative format of their choice. They can record a podcast reflecting their ideas, create a short video, or express themselves through a drawing. As each student has a laptop, this work takes place independently across the learning spaces." (H)

The results demonstrated that technology use in the FLS was largely characterized by learning from technology, reflected in practices where digital tools delivered content or structured activities. At the same time, learning with technology appeared consistently and meaningfully, enabling students to generate ideas and express knowledge through inquiry tasks and creative digital products. By contrast, learning about technology appeared only in limited instances and was reported solely in the interviews.

Collaboration Between Educators and among Learners

The **second research question** examined whether **collaboration occurred among educators** during teaching and learning in FLS, and at what levels, based on the e-CSAMR model. Table 3 presents the number and percentage of statements for each level of educator collaboration, along with representative quotes from interviews and observations.

Table 3.   Levels of Collaboration among Educators (interviews=50; observations=6)

Level of Collaboration	Representative Quote
Information Sharing Interviews: N=4 (8%) Observations: N=0	Interview: "This year, my co-homeroom teacher is new and unfamiliar with the Montessori method, so I am mentoring her. I am teaching her how to work according to this approach-for example, how to write a "work cycle" " (V)
Cooperation Interviews: N=21 (42%) Observations: N=1 (17%)	Interview: "We always have at least two teachers in the lesson, but we don't always stay in the same room. Sometimes one teacher takes a group to another room for instruction, while I stay to support the students working independently." (A)
Collaboration Interviews: N=25 (50%) Observations: N=5 (83%)	Observation: "The math lesson was taught jointly by two teachers: the homeroom teacher and a specialist in remedial instruction. They taught the new topic together, with each contributing her expertise so that all students could clearly understand the new content." (L&A)

The findings indicate that collaboration among educators was a consistent and meaningful feature of the FLS. The most frequent form of collaboration identified was the highest level-Collaboration-in which teachers planned lessons together and even co-taught in the same learning space. Lower levels of collaboration were also present, although far less frequently, while information sharing did not appear in the observations at all.

The **third research question** examined whether **collaboration occurred among learners** during teaching and learning in FLS, and at what levels, in accordance with the e-CSAMR framework. Table 4 presents the number and percentage of statements for each level of learner collaboration, along with a representative quote.

Table 4. Levels of Collaboration among Learners (interviews=133; observations=19)

Level of Collaboration	Representative Quotation
Information Sharing Interviews: N=50 (38%) Observations: N=1 (5%)	Interview: "When a student finishes early, we review their work briefly and tell them, "You're a young teacher." They then help teach their classmates, since peers often explain concepts to each other in a clearer, more relatable way." (G)
Cooperation Interviews: N=20 (15%) Observations: N=3 (16%)	Interview: "We have classroom roles because I teach them responsibility. One of the roles is "Computer Monitor," and their job at the end of each day is to make sure all the laptops are charging and to roll up the computer mice so they don't get damaged." (A)
Collaboration Interviews: N=63 (47%) Observations: N=15 (79%)	Observation: "The teacher let the students choose whether to work on the assignment in the different learning spaces in pairs or alone. Most of them formed pairs or groups of three and worked together on the tasks." (D2)

The results demonstrated that learner collaboration was highly prominent in the FLS. The most common form observed was Collaboration, the highest level, in which students worked together on tasks, responded to one another's ideas, and jointly shaped their learning processes. Information sharing also appeared meaningfully, evident in peer discussions, concept explanations, and the presentation of shared products

Discussion

This study highlights the contribution of FLS to both advanced technology integration and meaningful collaboration in school-based instruction.

Integration of Technological Tools in Teaching and Learning Processes in FLS

Analysis of **technology integration** shows that the availability of technological tools in the FLS encouraged teachers to engage with them more actively. Prior research similarly found that technology-rich environments motivate teachers to explore new instructional methods, experiment with unfamiliar tools, and adopt innovative practices (Hu et al., 2025; Sitthiworachart et al., 2022). In this study, teachers integrated technology at advanced levels, including Modification and even Redefinition according to the e-CSAMR model**.** The findings further suggest that the spatial design of the FLS, which favors independent and parallel work over frontal instruction, shaped the level and nature of technology integration**.** These findings align with earlier studies showing that technology integration in FLS can transform teaching and learning, shifting them toward active, learner-centered pedagogies (Correia & Cavadas, 2024).

Moreover, insights from the Mindtools framework analysis (Jonassen, 2020) reinforced this pattern, indicating that integration in the FLS frequently reflected "learning with technology," a constructivist-oriented approach that supports active knowledge construction. In this context, the availability of multiple learning zones and the ease of transitioning between learning configurations

supported this mode of integration, enabling students to use digital tools for inquiry, creation, and expression rather than for content consumption alone. This is consistent with studies demonstrating that technology-rich FLS promote learner-centered engagement, critical thinking, and creative thinking processes (Correia & Cavadas, 2024; Yesil & Aras, 2024).

Collaboration Between Educators and among Learners

The findings revealed that the unique characteristics of the FLS environment enabled and encouraged **collaborative interaction among teachers**. The open, spacious layout allowed teachers to communicate easily, consult one another, and share professional insights in real time. In addition, the multiple learning zones-such as quiet rooms and soft-seating areas-supported flexible grouping and enabled simultaneous instruction for different student groups within the same area. Moreover, moving classes into the larger open space for independent work allowed teachers to support several groups at once, providing more immediate and individualized assistance. Taken together, these findings align with previous research showing that expansive, flexible environments with multiple learning zones enhance teacher collaboration and enable more responsive support for diverse learner needs (Alakoski et al., 2024; Fletcher et al., 2023).

   Learner collaboration also emerged as a prominent feature within the FLS. The space design-with furniture arranged to support group work, including small-group rooms, mobile whiteboards, and large shared tables-encouraged teachers to incorporate collaborative tasks and enabled students to engage in them smoothly. Similarly, round and shared tables supported visual contact and idea exchange, while areas such as classroom stages and amphitheater-style seating created natural settings for peer interaction. Additionally, informal seating options, including beanbags, sofas, and carpets, contributed to a relaxed atmosphere that further supported collaboration. These observations align with research showing that flexible layouts, movable furniture, and dedicated collaborative zones in FLS promote teacher-initiated collaborative learning and facilitate meaningful student participation (Aga, 2024; Halidane et al., 2024; Sánchez-López et al., 2025).

Conclusion

This study demonstrates that FLS **support advanced technology integration and collaborative practices**. The availability of technological tools encouraged teachers to experiment with technology, and to design learning activities that incorporated technology in ways that enriched pedagogy and supported active learning. The flexible spatial design further enhanced these processes by enabling high-level integration that shifted instruction toward learner-centered and inquiry-based approaches. In addition, the open areas, multiple learning zones, and collaborative furniture facilitated continuous interaction among teachers, promoting joint lesson planning, co-teaching, and reciprocal professional learning. These spatial features also supported high levels of learner collaboration, as students engaged in shared tasks, exchanged perspectives, and collectively constructed knowledge within flexible, technology-enhanced environments. Overall, these findings highlight the pedagogical value of FLS as environments that enable meaningful, technology-enhanced, and collaborative learning experiences.

*Artificial intelligence tool (ChatGPT version 5.2) was used for language editing purposes.

References

Aga, K. (2024). Comfort in active learning spaces – students' perceptions and preferences. European Journal of Engineering Education, 49(4), 785–806. https://doi.org/10.1080/03043797.2024.2341756

Alakoski, R., Laine, A., & Hannula, M. S. (2024). Teaching mathematics in innovative learning environments—The entangled tensions between the learning environment and pedagogy. European Journal of Education, 59(3). https://doi.org/10.1111/ejed.12661

Alakoski, R., Laine, A., & Hannula, M. S. (2025). Interaction and collective emotional climate in innovative learning environments in mathematics lessons: a third- and fourth-grade students' perspective. Learning Environments Research. https://doi.org/10.1007/s10984-025-09530-7

Blau, I. (2011). E-collaboration within, between, and without institutions: Towards better functioning of online groups through networks. International Journal of e-Collaboration (IJeC), 7(4), 22-36. http://doi.org/ 10.4018/jec.2011100102

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. Qualitative Research in Sport, Exercise and Health, 11(4), 589–597. https://doi.org/10.1080/2159676x.2019.1628806

Colton, J., O'Keeffe, L., Barry, G., White, B., & White, J. (2024). Teacher's perceptions of pedagogical practices in innovative learning spaces. Pedagogy Culture and Society, 32(3), 675–697. https://doi.org/10.1080/14681366.2022.2073605

Connor, L. (2023). Possibilities, Perceptions and Practices: Visibilising the impact of flexible learning spaces. Video Journal of Education and Pedagogy, 8(1), 1–14. https://doi.org/10.1163/23644583-bja10045

Correia, M., & Cavadas, B. (2024). Innovative learning environments: a learning experience with in-service teachers. Educational Media International, 61(1–2), 146–160. https://doi.org/10.1080/09523987.2024.2358652

Creswell, J. W. (2021). A concise introduction to mixed methods research. Thousand Oaks, CA,USA: SAGE. http://doc1.lbfl.li/acc/flmf044361.pdf

Dehdary, N., Allmark, N., Nadabi, Z. A., & Hurmuzy, S. A. (2024). Using a Technology-Enhanced active Learning classroom to teach English: a help or hindrance? Journal of Language Teaching and Research, 15(5), 1455–1466. https://doi.org/10.17507/jltr.1505.07

Desimone, L. M. (2009). Improving Impact Studies of Teachers' Professional Development: Toward better conceptualizations and Measures. Educational Researcher, 38(3), 181–199. https://doi.org/10.3102/0013189x08331140

Fletcher, J., Everatt, J., Subramaniam, Y. D. B., & Ma, T. (2023). Perceptions about innovative and traditional learning spaces: Teachers and students in New Zealand primary schools. New Zealand Journal of Educational Studies, 58(1), 133-151. https://doi.org/10.1007/s40841-023-00280-9

Halidane, C., Bluteau, J., Pillarella, S., & Kirakoya, F. (2024). Impact of flexible seating on the quality of teacher-student interactions with coping to stress adaptation and mental health of elementary students in Quebec. International Journal of Health Promotion and Education, 62(4), 325–338. https://doi.org/10.1080/14635240.2023.2212373

Hu, L., Zhang, W., & Lin, P. (2025). Can the utilization of technology-enhanced learning spaces lead to improved learning outcomes? A meta-analysis based on 39 experimental and quasi-experimental studies. Interactive Learning Environments, 1–21. https://doi.org/10.1080/10494820.2024.2436943

Jalal, S., Norman, H., Zaini, H., Hamdan, F., & Zakaria, N. Y. K. (2024). Transformation of challenge-based learning spaces in higher education. International Journal of Academic Research in Business and Social Sciences, 14(5). https://doi.org/10.6007/ijarbss/v14-i5/21591

Jonassen, D. H., & Carr, C. S. (2020). Mindtools: Affording multiple knowledge representations for learning. In Computers as cognitive tools (pp. 165-196). Routledge.

Liu, Q., & Sun, Y. (2025). The impact of collaborative atmosphere on innovative work behavior of college teachers, North China. Frontiers in Psychology, 15. https://doi.org/10.3389/fpsyg.2024.1497503

Obonyo, C., & Thomas, G. (2025). Bridging the gap: Strategies for preparing student teachers for 'Real-World' innovative learning environments in Aotearoa New Zealand. New Zealand Journal of Educational Studies. https://doi.org/10.1007/s40841-025-00401-6

Page, A., Anderson, J., & Charteris, J. (2024). Innovative Learning Environments and spaces of belonging for students with disability in mainstream settings. Cambridge Journal of Education, 1–20. https://doi.org/10.1080/0305764x.2024.2397398

Papaioannou, G., Volakaki, M. G., Kokolakis, S., & Vouyioukas, D. (2023). Learning spaces in higher education: a state-of-the-art review. Trends in Higher Education, 2(3), 526-545. https://doi.org/10.3390/higheredu2030032

Puentedura, R. (2014). Building transformation: An introduction to the SAMR model [Blog post]. TechTrends, 60, 433-441. https://did.li/gvATY

Salmons, J. (2008). Expect Originality! Using Taxonomies to Structure Assignments that Support Original Work. In IGI Global eBooks (pp. 208–227). https://doi.org/10.4018/978-1-59904-801-7.ch014

Sánchez-López, M., Violero-Mellado, J., Martínez-Vizcaíno, V., Laukkanen, A., Sääkslahti, A., & Visier-Alfonso, M. E. (2025). Impact and perceptions of Active Learning Classrooms on reducing sedentary behaviour and improving physical and mental health and academic indicators in children and adolescents: A scoping review. PloS one, 20(2), e0317973. https://doi.org/10.1371/journal.pone.0317973

Saur, E., & Ulleberg, H. P. (2025). Space, place and safety: user experiences of new school buildings. Educational Research, 67(1), 117-134. https://doi.org/10.1080/00131881.2024.2443141

Sitthiworachart, J., Joy, M., King, E., Sinclair, J., & Foss, J. (2022). Technology-Supported active learning in a flexible teaching space. Education Sciences, 12(9), 634. https://doi.org/10.3390/educsci12090634

Shamir-Inbal, T., & Blau, I. (2021). Characteristics of pedagogical change in integrating digital collaborative learning and their sustainability in a school culture: e-CSAMR framework. Journal of Computer Assisted Learning, 37–3, 825–838. https://doi.org/10.1111/jcal.12526

Yesil, L. B., & Aras, İ. S. (2024). The significance of flexible learning spaces and student-centred pedagogies in school settings: A comparative case study. International Education Journal: Comparative Perspectives, 23(1), 1-24. https://eric.ed.gov/?ff1=locGermany&id=EJ1434902&q=cases

Yin, R. K. (2018). Case study research and applications: Design and methods (6th ed.). Sage