

INNOVATIVE LEARNING ENVIRONMENTS
STUDENT EXPERIENCE: THE SCOPING STUDY

GLOBAL CROSS-SECTOR THINKING ON GAPS IN LEARNING SPACE RESEARCH: RESULTS OF THE ILE+SE WORKSHOP 1

01



Global cross-sector thinking on gaps in learning space research:
Results of the ILE+SE Workshop 1

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Visit <https://ilesescopingstudy.com.au/> to learn more about this
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WORKSHOP 1

TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
BACKGROUND	6
ANALYSIS OF QUESTION A	8
What ILE research do we know and use at present?	
ANALYSIS OF QUESTION B	10
What are the perceived research gaps?	
ANALYSIS OF QUESTION C	20
How should such research be designed?	
APPENDIX	22

EXECUTIVE SUMMARY

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The first ILE+SE Scoping Study workshop sought comment from 217 leading learning space practitioners in 21 countries equally representing three 'sectors' (academe, industry and education) to answer 'What ILE research exists, and what is needed'?

It found the international field draws sparingly from existing research; a wide scope of projects, publications and experts were cited, but most only once or twice. The exceptions were some large projects, suggesting their large scale produces a capacity to create comprehensive and cohesive outputs that meet a variety of needs.

Analysis based on frequency of citations identified twenty critical gaps on a robust hierarchical scale. This hierarchy remained stable when the data was analysed according to sector; academe, industry and education agree on the highest priority and lowest priority ILE research gaps that currently exist.

When analysed according to geographies, greater variation was found. In terms of which gaps rate as 'top five' priority for each country, the top three are consistent with frequency and sector analyses. The remaining identification of critical gaps vary widely across the geographies, indicating a range of subsidiary priorities.

This analysis found the issues of evaluation of the impact of learning spaces, the nature of ILE design qualities, and issues concerning inclusiveness hold international priority in terms of needed research. Geographically, further priorities differ widely, suggesting while a predominant agenda exists, research must accommodate quite diverse regional needs and circumstances.



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BACKGROUND

The Innovative Learning Environments and Student Experience Scoping Study (hereafter referred to as ILESE) is a one-year exploratory study leveraged off more than a decade of findings from a suite of research by the host group (LEaRN) and other key centres, industry R&Ds, and individual researchers around the world. That research has built a body of knowledge concerning the architectural and pedagogic design of innovative learning spaces, how to evaluate their effectiveness, and how to assist teachers to utilize those spaces for positive impact on student learning.

Results from those projects indicate the next logical step is gathering quality data around students' actual experiences in these spaces. However, this assumption requires testing; if we are to continue to build a logical, comprehensive research base that supports ILE design and effective use, the next project must have international relevance, must encompass the needs of education and allied industries, and must create data that directly informs infrastructure development and best practices in learning spaces. This report summarises the analysis from the first workshop for the study.

A total of 217 individuals participated in Workshop 1, across 21 teams from 19 countries. The three sectors were proportionately represented (Academe 31%, Industry 32%, Educators 37%). In terms of geographical representation, 58% of participants were from Australia/SE Asia/ New Zealand, 18% from the Americas, 24% from Europe and South Africa. Workshop 1 created a total of 1,616 comments in the online whiteboard tool, Miro, each of which were coded and are represented in this analysis summary.

In terms of focus, Workshop 1 was designed to address ILE+SE's three guiding questions:

*Where has existing international ILE research led us?
What is the critical research that now must be done?
How should such research be designed?*

This was our first research event, and a refined version of the questions was used to gather 'entry level' data:

- A. What research do we know and use at present?
- B. What are the perceived 'gaps' in this research?
- C. How should we address these gaps?

Analysis was conducted on excerpts from the Miro boards, and where possible, each excerpt was tagged with the individual's sector (academe, industry, education) and geographical location (country).

As some of the Miro post-it note excerpts were not tagged, an additional 17 Miro boards were imported into the analysis software as 'Unknown' boards, which allowed us to analyse these data without applying the tagging information. Consequently, a total of 234 Miro boards were coded by the research team.

The analysis used a qualitative method. First, the data were inductively coded to look for common issues. Next, the frequency of each code was identified to create a hierarchy of key research used and research gaps. This analysis has some limitations:

- It only represents material that was elicited via the workshop, whereas wider opinions may exist.

- A citation may be negative as well as positive. Sector representation within each workshop might bias types of responses. Coding of the citations can be seen to be largely subjective.

These limitations were adequately addressed within the workshop's methodological approach:

- All workshop participants were asked the same questions, using the same prompts. Responses were summarised by an external moderator and subjected to member checking during the workshops.
- Nearly all the workshops had representation from each of the three sectors, and the overall representation was proportionate.
- Coding of specific sections of each workshop was done by one individual, with two other coder independently checking for accuracy and consistency.



ANALYSIS OF QUESTION A

WHAT ILE RESEARCH DO WE KNOW AND USE AT PRESENT?

The short answer is that while there exists a wide scope of 'familiar' research, most are only cited once or twice. A conclusion is that while existing research informs various activities, we are missing a genre of research that drives cross-sector, multi-focused ILE activity. However, the (limited) exception were some large-scale projects; possibly because these had the capacity to produce a comprehensive and cohesive range of outputs that met a variety of needs.

Three categories of existing research were identified during coding; research which:

1. Named an individual or organisation (e.g., LEaRN) but with no specific publication or reference listed,

2. Named a project or paper (e.g., ILETC) that could be traced, or
3. Named a topic of ILE research where a body of work is evident.

A total of 909 citations were provided by participants; these are summarised by sector on the following page.

Table 1: Citations of research known or used by topics participants; by authors, project/papers, and topics

	Education (n = 79)	Academe (n = 68)	Industry (n = 70)
Author	38	77	52
Actual project or paper	75	50	37
Topic	325	103	152
	438 (48%)	230 (25%)	241 (27%)

From within these citations, 95 authors (or authoring organisations) were listed. The top three most referenced were:

- Twelve citations each for John Hattie, OECD's CELE, and Steelcase,
- Six citations each for the ILETC project, and for Stephen Heppell, and
- Five citations each for David Thornburg and Byers et al.

One hundred and forty four discrete projects or papers were cited. These were categorised by lead author or by organisation, depending on the level of detail provided. The top three most cited were:

- Eight citations for Peter Barrett's Clever Classrooms material,
- Six citations for ILETC's fact sheets, technical reports and conference proceedings, and
- Four citations for the Ministry of Education New Zealand's The Impact of Physical Design on Student Outcomes report and Designing Flexible Learning Spaces materials.

Eight general topics were identified by the Teams, the top three being:

- Design: All topics relating to the design of a school (e.g., affordances, comfort and use, IEQ, indoor/outdoor),
- School: All topics relating to the structure and running of the school, its educational programs and its community (e.g., collaboration, community, curriculum, inclusion, professional learning), and
- Students and learning: All topics relating to student experiences in the school and their learning (e.g, achievement).

COMMENTS

The analysis team makes the following observations in terms of what research is known/used:

- There was no dominant author, project, or topic. The most referenced still only constituted 1.5% of citations.
- There were many single-cited papers/projects and topics, and these came from all sectors, suggesting a good range of materials but a lack of significant impact.
- For all sectors, research is providing some general support, but the wide range of papers and projects being cited (and most at a very low number) suggests research is being 'touched on' but not necessarily used to closely support specific activities. Put another way, existing research is informing but not driving ILE activity across the sectors in most cases.
- Educators were noticeably confident in naming ILE research topics; two to three times more so than academics or industry professionals, suggesting some good dissemination of research to educational practitioners.
- Larger projects/organisations (such as the OECD, the NZ Ministry, the ILETC project) had the greatest visibility.

ANALYSIS OF QUESTION B

WHAT ARE THE PERCEIVED RESEARCH GAPS?

The short answer is there are twenty key issues, with citation numbers clearly identifying a linear hierarchy. This hierarchy of frequencies remains consistent when analysed by the three sectors. Academe, industry, and education agree about the highest priority (and lowest priority) research gaps that currently exist.

There is wider variation when research gaps were analysed by countries; their three highest priority gaps mirror the sector analysis, but wide variability exists after that. These findings create a mandate for a global project structured around evaluation of impact, inclusivity issues and impact of specific design qualities; however, the design of that project must also accommodate a range of local priorities.

The overall number of citations attached to each key issue was used to generate a hierarchical list of most to least cited key issues; presented below as (1) the frequency analysis of gaps. This list was then used to see how each were ranked by sector; this is (2) the sector analysis of gaps. A third list was generated – the top five key issues cited by each country; this was (3) the geographies analysis.



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ANALYSIS ACCORDING TO FREQUENCIES

Based on frequency of citations, workshop 1 participants identified twenty research gaps (key issues), with multiple sub-issues in each. Each key issue contained several sub-issues. The frequency counts and details of sub-issues are summarised in Table 5, located in the Appendix due to its size. Below is a sample of the first two key issues listed in Table 5.

	Key issues	Description	Sub-issues	Total (A + E + I)
1	Evaluation of Learning Environments	<i>Evaluation relates to both design/use of current spaces; includes comments about research not being measurable (i.e., not enough research specific to a context or reliable to apply across contexts).</i>	<ul style="list-style-type: none"> • Affordances • Antecedent research/knowledge • Change and change management • Communities • Dissemination • Evaluating designs • Learning outcomes • Non-traditional ILEs • Scale, scope, focus • Social emotional and physical well-being • Students and learning • Targeted evaluations • Teachers and pedagogies 	113 (20,57,36)
2	Design of ILE spaces	<i>Relates to design aspects such as size, colour, accessibility, acoustics; as well as aspects of the design process</i>	<ul style="list-style-type: none"> • Aesthetics, ambience • Affordances • Design and design process • Designing for well-being • Evaluation of designs • Impact on students 	109 (15,46,48)

Analysis categorised these twenty key issues into four clusters (design, teaching/learning, health/wellbeing, and education systems).

DESIGN ISSUES

We need more research that evaluates learning environment use. What empirical evidence informs how these spaces operate? This needs to be finer grained than previously, to be applicable to specific contexts. *A selection from the identified sub-issues includes the impact of specific designs on teaching approaches and learning outcomes, the effect of a range of affordances on teaching and learning, social emotional and physical wellbeing facilitated by designs, and the impact of non-traditional spaces on teaching and learning.*

We need more research that builds evidence of the efficacy of ILE designs. What strategies produce tangible benefits? It relates to the physical design itself, as well as aspects of the design process. *A selection from the identified topics includes IEQ, aesthetics and ambience, the concept of affordances, participatory design, inclusive design, alternative learning spaces, and 'design' relationships with educational and local-school systems.*

We need more research on indoor/outdoor spaces. How do we design and use spaces that make the most of our environment? *A selection from the identified topics includes defining what is a learning space, and biophilic design.*

TEACHING AND LEARNING ISSUES

We need more research on ILEs and academic learning outcomes. How do we measure the impact of ILE designs on quantifiable learning outcomes? This differs to affective outcomes from schooling, such as the 4Cs – communication and collaboration skills, creative and critical thinking. *A selection from the identified topics includes how particular designs impact specific learning outcomes, who benefits and who are disadvantaged, and what happens to outcomes over time.*

We need more research on ILEs and affective learning outcomes. This relates to a design's impact on student knowledge, skills and attitudes considered necessary for immersion into a 'knowledge economy'. *A selection from the identified topics includes a design's impact on building student and teacher collaboration capacities, facilitating entrepreneurship, developing critical and creative thinking, developing interpersonal 'soft' skills, and a variety of learner capabilities or learning dispositions.*

We need more research on how ILEs impact teaching. What evidence can be built about their effect on teacher identity, practices, and beliefs? This needs to include teachers and teacher training. *A selection from the identified topics includes how good teachers align pedagogies and space, what pathways are followed during transition, what change and change management strategies work, and issues of ownership of spaces and professional risk.*

We need more research on ILEs and hybrid learning. How do ILEs support blended learning and teaching? This relates to digital/real-time, synchronous/asynchronous, and on-campus/at home educational approaches. *A selection from the identified topics includes designing and evaluating non-traditional spaces, the home as an ILE, and utilising non-traditional spaces.*

We need more research on ILEs and specialist subjects. How do the spatial needs of ILEs differ according to discipline of study? *A selection from the identified topics includes the special needs of STEM/STEAM/GLAM, universal design principles, and cross-school sharing of spaces.*

We need more research on ILEs and child development theories. What is the relationship between the learning environment and how children learn? *A selection from the identified topics includes neuro-cognitive development and ILEs, ILEs and learning attributes, and life-long learning.*

HEALTH AND WELLBEING ISSUES

We need more research into ILEs, physical behaviour and safety. How do ILE spaces positively impact student behaviour, provide for their physical safety, protection from bullying, and security? *A selection from the identified topics includes impact of lockdowns, how to provide privacy, and engender a sense of well-being.*

We need more research on the impact of ILEs on student engagement. What measurements can be made about the way ILE designs influence student motivation, involvement in the learning process, their interest and enthusiasm? *A selection from the identified topics includes the impact of design on students' behavioural, social and emotional engagement, and design 'engagement' factors that improve learning outcomes.*

We need more research on ILEs and student agency. How does design empower student participation and ownership? This includes agentic learning and student voice, rights to participation in school design and use. *A selection from the identified topics includes students having agency over what and where they learn, collaborative and cooperative design, student needs, and the uniqueness of student experiences in ILEs.*

We need more research how ILEs impact users' health and wellbeing. Evidence is required about the role of ILEs in facilitating good mental health, and positive socio-emotional wellbeing. *A selection from the identified topics includes how ILEs might protect the interests of those with disabilities special needs and of disadvantage, engender student and teacher agency, provide desired private versus communal learning environments, and support the development of healthy relationships.*

We need more research on ILEs and inclusivity. What impact do ILEs have on full student participation? This encompasses physical and neurological disabilities, individual student needs, culture, faith, belonging, and gender. *A selection from the identified topics includes ILEs accommodation of Indigenous and minority cultures, facilitating equity, supporting identities, and creating nurturing environments.*

We need more research regarding ILEs and COVID. What was COVID's impact on learning and the use of spaces, and how might this inform future practices? *A selection from the identified topics includes how one measures such impact, 'alternative' spaces and well-being, and the relationship between home and school learning spaces.*

EDUCATION AND SCHOOL SYSTEM ISSUES

We need more research on ILEs and school systems. Specifically, collecting data that informs how policies and school management facilitate or hinder effective design and use of ILEs. This must embrace policy and large-scale reform, through to localised school practices. *A selection from the identified topics includes how ILEs can assist cultural plurality, educational vision (what schools 'should be'), post-schooling pathways, and transition issues.*

We need more research on schools at a local level. How does school-based administration and leadership support the development and best use of ILEs? *A selection from the identified topics includes effective school leadership and managing change, timetabling, managing expectations of parents/students, engaging with external organisations, leadership of school staff/practices, and building community.*

We need more research on ILEs and technologies. This encompasses how ILEs support the use of mobile and installed digital equipment to enrich the learning experience. *A selection from the identified topics includes designing spaces for flexible technologies, their impact on engagement and learning in this environment, and how teachers and students 'organise' their use of technologies in ILEs.*

We need more research on the sustainability of ILEs. What environmental considerations do ILEs accommodate, such as material usage, durability in design, and systemic sustainability as in future proofing? *A selection from the identified topics includes how ILEs reflect students desired ecological impact, maintenance, and ongoing quality of infrastructure.*

We need more research on informal learning environments. What do these look like, how do they operate, and what is their impact on student experiences? *A selection from the identified topics includes aligning such spaces to learning tasks, the concept of 'alternative' learning, and familiarity and freedom issues.*



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Of the four categories, the content of two (*design issues*, and *teaching and learning issues*) tended to focus predominately on effect – measurable outcomes that create a picture of what is the current situation; while two (*school systems issues* and health and *wellbeing issues*) tended to focus predominately on affective phenomenon – seeking to understand why this is occurring.

The frequency of citations indicated three groupings of key issues – gaps of significant importance (119 to 50 citations); medium importance (47-25 citations); and low importance (22 to 10 citations).

ANALYSIS ACCORDING TO SECTORS

The ranking of key issues by sector is presented in Table 2. It illustrates that the hierarchical ranking of key issues, as shown in Table 5, is consistent with the order of those rankings by sector (with only minor deviation). The number of citations is presented in parentheses after each research gap.

ANALYSIS OF QUESTION B

Table 2: Ranking (and citation numbers) of key issues by sector

	Academe	Education	Industry
1	Eval learning environments (20)	Eval learning environments (57)	Design of ILE spaces (48)
2	Design of ILE spaces (15)	Inclusiveness (49)	Eval learning environments (36)
3	Inclusiveness (12)	Design of ILE spaces (46)	Inclusiveness (27)
4	School systems (11)	School systems (31)	Health and wellbeing (16)
5	Teaching (11)	Impact on student engag. (30)	Impact on student engag. (14)
6	Impact on student engag. (9)	Teaching (28)	Teaching (14)
7	Health and wellbeing (7)	Student agency/voice (25)	Sustainability (10)
8	Affective learning (6)	Health and wellbeing (24)	Academic learning outcomes (9)
9	Physical behaviour & safety (6)	School – local level issues (19)	COVID (9)
10	Student agency/voice (6)	Acad. learning outcomes (16)	Hybrid learning models (9)
11	Academic learning outcomes (5)	Affective learning (13)	Student agency/voice (9)
12	School – local level issues (5)	Technologies (13)	School – local level issues (8)
13	Sustainability (5)	Hybrid learning models (10)	School systems (8)
14	Indoor/outdoor (4)	Sustainability (7)	Technologies (8)
15	Subject specific design (4)	Indoor/outdoor (6)	Affective learning (7)
16	Technologies (4)	Informal learning spaces (6)	Child dev. theory & space (7)
17	Hybrid learning models (2)	Physical behaviour & safety (5)	Indoor/outdoor (7)
18	Informal learning spaces (2)	COVID (4)	Informal learning spaces (6)
19	COVID (1)	Subject specific design (4)	Physical behaviour & safety (5)
20	Child dev. theory & space (1)	Child dev. theory & space (2)	Subject specific rdesign(3)



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ANALYSIS ACCORDING TO GEOGRAPHIES

The project has 21 teams with representatives across 19 countries. A small number of Teams have members who come from a different region to the majority. To clarify this for analysis, a schedule of countries was generated (see Table 3).

Table 3: Schedule of 'countries' codes used for analysis

Country code used for analysis	Country/countries included	Teams represented
Africa	South Africa	Mzansi South Africa
Australia	Australia	LEA Australasia, Queensland Education, CEO Parramatta, Beparta Furniture and Associates, Anon, DoE WA
Brazil	Brazil	Team Brazil
Canada	Canada	Team Canada
Europe +	England, France, Germany, Italy, Russia, Wales	Steelcase Europe, A4LE Europe Action Research Team
New Zealand	New Zealand	Grow Waitaha, EBOSS and Partners
Nordic	Denmark, Finland, Iceland, Norway, Sweden	Nordic Association
Scotland	Scotland	Scottish Alliance
South East Asia	Singapore, China, Hong Kong	Singapore American School, China Regional Team, Steelcase APAC
USA	USA	Steelcase USA, DLR Group

Countries were grouped according to how Teams have self-identified during the project in terms of the voice they represent.

Frequency analysis of key issue citations against this countries list produced a diverse distribution. However, as can be seen in Table 4 below, this analysis produced the same result as overall frequency and sector analyses in terms of clearly preferencing three key issues (evaluation of learning environments, design of ILE spaces, inclusivity issues - hereafter called evaluation, design, inclusiveness).

What differed from the previous two analyses is the extent of diversity of priorities after that. The 'top five' key issues produced no global consistency for the remaining items. Three research gaps did not make any country's 'top five' issues - impact on student engagement, COVID, and child development theories. In fact, there were quite diverse distributions of favoured issues in terms of how countries ranked the issues. The 'which countries' column in Table 4 is of particular interest because it stresses that not all countries are the same and have the same research needs.

Overall, a large count of seventeen of the twenty issues appeared in the countries' top five lists, but seven of these issues appeared in only one country's top five, indicating a wide variety of local needs after evaluation, design and inclusiveness. These diverse top five lists reflect countries' differing circumstances (such as 'security/safety' in places currently experiencing some social discord, and 'sustainability' reflecting a country's strong climate change culture).

Table 4: Top five key issues as cited by countries

Key Issue	Top five ranking (for 10 countries)	Which countries?
Evaluation	9	All except Africa
Inclusiveness	8	All except Brazil and Canada
Design	6	All except Africa, Brazil, Nordics, USA
Teaching	4	Only Australia, Europe+, Scotland, USA
Student agency and voice	3	Only Europe+, Nordics, Scotland
21st Century Learning	3	Only Brazil, Nordics, USA
School systems	3	Only Africa, Australia, Scotland
Health and well-being	3	Only Africa, NZ, SE Asia
Technology	2	Only Africa, Canada
Academic learning outcomes	2	Only Canada, Nordics
Sustainability	1	Only NZ
School – local issues	1	Only USA
Indoor/outdoor	1	Only Brazil
Informal learning environ.	1	Only Brazil
Subject specific design	1	Only Brazil
Hybrid learning	1	Only Canada
Physical behaviour and safety	1	Only Africa
Impact on student engagement	0	No country saw this as a ‘top five’ priority
COVID	0	No country saw this as a ‘top five’ priority
Child development theories & ILE	0	No country saw this as a ‘top five’ priority

COMMENTS

The analysis team make the following observations in terms of perceived gaps:

- Twenty key issues can be identified, with three predominating - evaluation, design, and inclusivity issues. At the other end of the scale participants do not feel issues such as ILEs and COVID, developmental theories, and subject-specific needs, are a high research priority. Further analysis clusters all twenty issues into four categories of *design issues*, *teaching and learning issues*, *health and well-being issues*, and *education and school system issues*.
- There was noteworthy consistency in this ranking when analysed by sectors. A linear trend was identified where, with only minor deviation, academe, education and industry participants ranked all twenty issues consistently.
- In terms of how countries ranked the issues, gap analysis points to strong global priorities. International consistency was found for the top three issues (evaluation, design, and inclusiveness). However, greater diversity was found after that. Overall, a large count of seventeen of the twenty issues appeared in the countries' top five lists, but seven of these appeared in only one country's top five. This indicates a wide variety of local needs and reflects countries' differing circumstances.

-
- Geographical analysis supports the possibility of a global project covering three specific issues but acknowledges that research must have scope to service geographically isolated needs. This analysis, calling for a two-pronged approach, informs the ILE+SE Scoping Study's third research question, 'How should such research be designed?'
 - It was noteworthy that ILE impact on student engagement rated highly in terms of overall citation analysis, but did not make it into the top five for any country. It was consistently spoken about but did not rate as a priority.

ANALYSIS OF QUESTION C

HOW SHOULD SUCH RESEARCH BE DESIGNED?

This question laid a foundation for the Scoping Study's final task – conceptualising and possibly designing the next generation of ILE research studies. Workshop 1's initial thinking generated several potential research ideas and questions; these will be reviewed against data provided by workshop 2 and Delphi surveys. This is an emergent task that will culminate in the designing of the Roundtable tasks later this year. For that reason, analysis of this Workshop 1 question will not be released at present.

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APPENDIX

A hierarchical analysis of participant responses to perceived gaps in current research was conducted by ranking the above mentioned 'issues' according to frequencies, presented in the table below. This ranking provided the platform for analysis according to (1) sectors – Education, Academe, and Industry; and (2) ranking according to geographical regions. These were then subjected to comparison analysis to determine commonalities in rankings, producing a profile of which issues were deemed most important across all sectors and geographical regions. The obvious benefit is allowing us to organise the rich array of sub-issues identified by the 217 participants, finding a clear international cross-sector agenda for future research – a primary aim of ILE+SE Scoping Study.

Table 5: Hierarchy of identified issues, organised by frequencies (descending order)

	Key issues	Description	Sub-issues	Total (A + E + I)
1	Evaluation of Learning Environments	<i>Evaluation relates to both design/ use of current spaces; includes comments about research not being measurable (i.e., not enough research specific to a context or reliable to apply across contexts).</i>	<ul style="list-style-type: none"> • Affordances • Antecedent research/knowledge • Change and change management • Communities • Dissemination • Evaluating designs • Learning outcomes • Non-traditional ILEs • Scale, scope, focus • Social emotional and physical well-being • Students and learning • Targeted evaluations • Teachers and pedagogies 	113 (20,57,36)
2	Design of ILE spaces	<i>Relates to design aspects such as size, colour, accessibility, acoustics; as well as aspects of the design process</i>	<ul style="list-style-type: none"> • Aesthetics, ambience • Affordances • Design and design process • Designing for well-being • Evaluation of designs • Impact on students • Inclusion • Non-traditional learning environment • Pedagogies and space • School systems • Student-friendly spaces • Teachers and teaching • Technology/digital 	109 (15,46,48)
3	Inclusiveness	<i>Broad category encompassing disability, individual student needs, culture, faith, belonging, gender.</i>	<ul style="list-style-type: none"> • Cultures • Equity • Evaluating inclusivity and space • Identity • Indigenous • Nurturing environments • Recognising diversity of needs • Special needs 	88 (12,49,27)

4	Teaching	<i>Impact of ILEs on identity, theory, practice, beliefs of teachers. Also includes how teachers are prepared for change/transition to ILEs (including pre-service teachers).</i>	<ul style="list-style-type: none"> Align pedagogies and space Change and leadership ILEs and teaching Ownership Teacher and student preparation Pre-service teacher training 	53 (11,28,14)
5	Impact on Student Engagement	<i>Relates to the role of ILE design on motivation, student involvement in the learning process, their interest and enthusiasm.</i>	<ul style="list-style-type: none"> Behavioural Design factors Emotional Learning outcomes Measurement Motivation Social\Student agency 	53 (9,30,14)
6	School Systems	<i>Broad category of issues that are sector wide. Relates to policy, large-scale reform, and equity (e.g., are cultural responsiveness/cultural identity/migration, SES factors, remote vs. metro schools, policy/compliance frameworks). Also includes statements about what school is and what school 'might be' in the future (e.g., alignment between what is 'being valued' at school vs. post-school).</i>	<ul style="list-style-type: none"> Equity Transition from early years to primary to secondary 	50 (11,31,8)
7	Health and Wellbeing	<i>Broad category looking at the concept of wellness and health aspects (e.g. belonging, school-based services, privacy, physical activity, mental health, social-emotional wellbeing).</i>	<ul style="list-style-type: none"> Assisting disabilities Design affordances and health/well-being Impact on relationships Space impact on well-being Student spaces and engagement/achievement Student ownership of spaces Teacher health and well being 	47 (7,24,16)
8	Student Agency/Voice	<i>Relating to initiatives to understand student perspective (e.g., as part of the design process or within learning design). Also includes students having agency over a space and their learning.</i>	<ul style="list-style-type: none"> Cooperative development of ILEs Ownership Student needs Uniqueness of student experiences 	40 (6,25,9)
9	School – Local Level Issues	<i>School-based administration and leadership issues, including timetable, managing expectations of parents/students, engaging with external organisations, leadership of school staff/practices.</i>	<ul style="list-style-type: none"> Leadership School community 	32 (5,19,8)
10	Academic Learning Outcomes and Assessment	<i>Related to learning outcomes or academic achievement, and how we measure these. Sometimes in conjunction with 21st century skills.</i>	<ul style="list-style-type: none"> Design impact on learning Evaluating ILE impact on learning ILE, curriculum, and achievement Longitudinal evaluations Student/staff well being Child development theory and environment 	30 (5,16,9)
11	21st Century Learning (Affective learning outcomes)	<i>Relates broadly to knowledge, skills and attitudes considered relevant for students to be learning at school, including collaboration, entrepreneurship, critical thinking etc. Also referred to as soft skills, learner capabilities or learning dispositions.</i>	<ul style="list-style-type: none"> Changing thinking/behaviours Collaboration Communication Core knowledge Creative thinking Critical thinking Evaluating design and the 5 C's 'Soft' skills Student agency 	26 (6,13,7)

12	Technology	<i>Use of digital devices to support the learning experience.</i>	<ul style="list-style-type: none"> • Designing for technologies • Engagement • Impact on learning • Teaching, learning and technologies • Teaching, learning and technologies 	25 (4,13,8)
13	Sustainability	<i>Relates to environmental considerations such as material usage and durability in design. Also includes systemic sustainability as in future proofing.</i>	<ul style="list-style-type: none"> • ILEs relevant to 'life' • Maintenance • Sustaining ILE benefits 	22 (5,7,10)
14	Hybrid Learning Models	<i>Relates to the space/time, online and on campus, often in relation to optimising opportunities afforded through both together.</i>	<ul style="list-style-type: none"> • Designing non-traditional spaces • Evaluating non-traditional ILEs • Home/remote as an ILE? • Using non-traditional spaces 	21 (2,10,9)
15	Indoor/Outdoor	<i>Relates to outside learning environments, and connections with indoor/ outdoor learning and activity. Includes biophilia, indoor/ outdoor flow.</i>	<ul style="list-style-type: none"> • Alternative/non-traditional spaces and learning • Biophilic 	17 (4,6,7)
16	Physical Behaviour and Safety	<i>Effect of space on student behaviour, space to create physical safety, bullying, security.</i>	<ul style="list-style-type: none"> • Impact on learning • Lockdowns • Privacy • Well being • Bullying, emotional safety 	16 (6,5,5)
17	Informal Learning Environments	<i>Associated with 'other spaces' (i.e., not classrooms).</i>	<ul style="list-style-type: none"> • Aligning space to task • Alternative learning • Familiarity • Student freedom 	14 (2,6,6)
18	COVID	<i>Impact of COVID on learning, and the value of the physical/digital space.</i>	<ul style="list-style-type: none"> • Evaluation of COVID impact • Health and well being • Home learning • Impact on ILE trends 	14 (1,4,9)
19	Subject Discipline Specific Research	<i>Research needed on a specific discipline, including STEAM/STEM, GLAM vs specialist spaces, sharing specialist subjects across schools (i.e., using each other's labs and resources).</i>	<ul style="list-style-type: none"> • Efficacy • Evaluation • Making ILEs relevant • Specialist subject needs 	11 (4,4,3)
20	Child-Development Theory and Environment	<i>Relates to the relationship between the environment and how children learn (e.g., neuro-cognitive development and environment connection).</i>	<ul style="list-style-type: none"> • ILEs and learning attributes • Life-long learning • Spatial design and well-being • Student voice/agency 	10 (1,2,7)





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