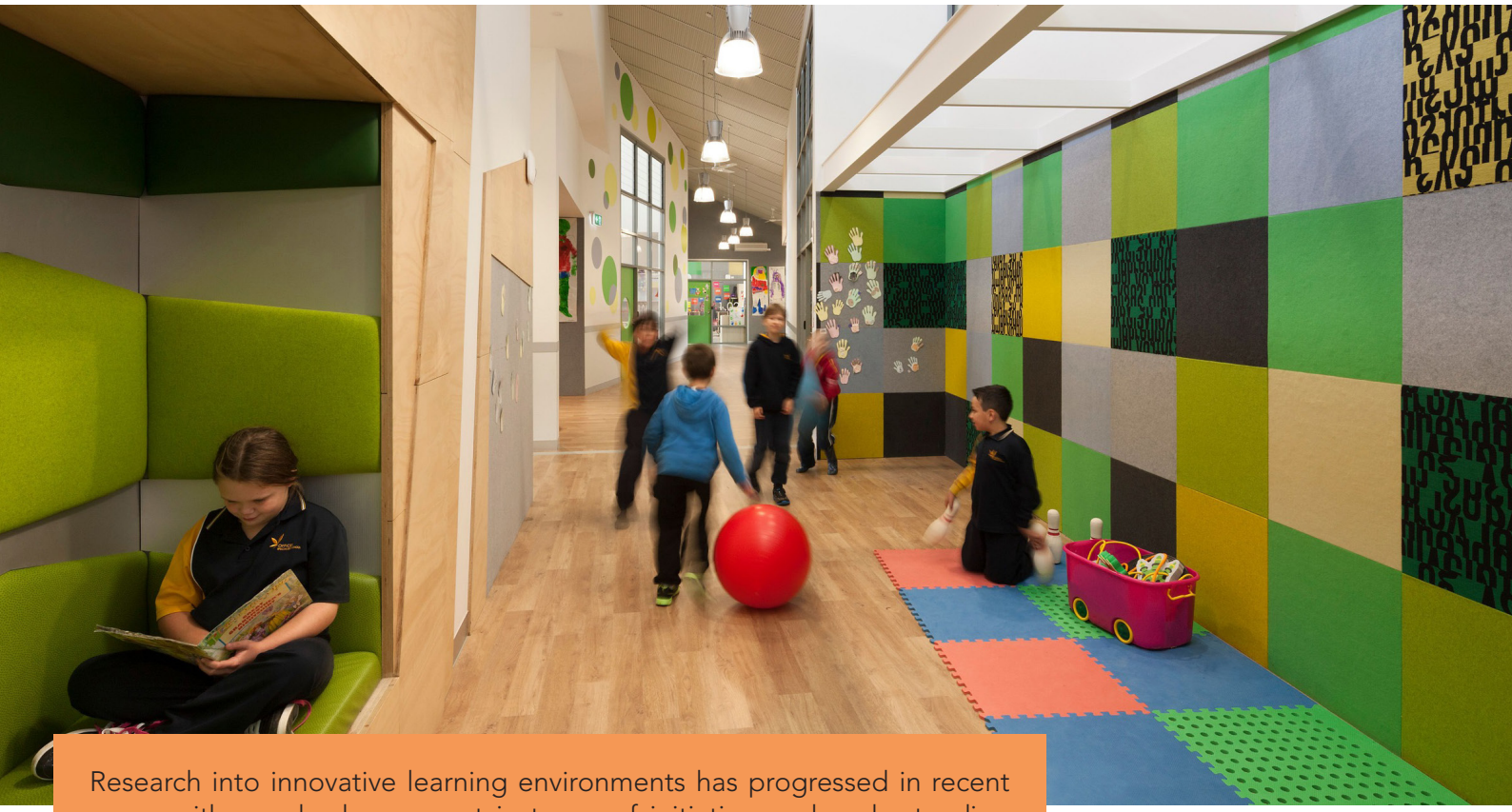
What should be the focus of next generation learning spaces research? An international cross-sector response

White Paper from the Innovative Learning Environments and Student Experience Scoping Study

February 2023



Research into innovative learning environments has progressed in recent years, with good advancement in terms of initiating and understanding design innovations, developing more sophisticated evaluation techniques, and exploring the role of the teacher in using spaces well.

However, one could argue that the field stands at a threshold. It lacks cohesion internationally, it recognises but does not necessarily service well the input and need of sectors other than education, and despite excellent smaller scale studies, it has yet to really understand the experiences of students of all abilities in these spaces.

What do the industries, the schools, and academics say is missing in current research? And of the gaps – which should be the priority for a new decade of learning spaces research.

ile+se
INNOVATIVE LEARNING ENVIRONMENTS AND STUDENT EXPERIENCE: THE SCOPING STUDY

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Authorship

What should be the focus of next generation learning spaces research? An international cross-sector response? The ILESE Scoping Study White Paper.

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Visit https://ilesescopingstudy.com.au/ to learn more about this project.

Acknowledgements

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INNOVATIVE LEARNING ENVIRONMENTS AND STUDENT EXPERIENCE: THE SCOPING STUDY

CONTENTS

THE CHALLENGE

"ILE research lacks the maturity of established discourse"

The four-year *Innovative Learning Environments and Teacher Change* (ILETC[1]) project found that innovative learning environments outperformed traditional classroom designs in terms of desired learning and teaching characteristics, that teachers were proving adept at using ILEs, and that there existed correlation between ILEs, student deep learning and measures of quality teaching.

These findings added to and supported decades of ILE development coming through the OECD, Australian Research Council Linkage Grants, EU Erasmus projects and small-group academic studies in many countries. It was logical, then, to assume these efforts culminated in a research agenda that supported the development and use of ILEs internationally. It could be assumed these findings built on each other to create a pyramid of knowledge, one that provided a robust and coherent rationale for the design, use and evaluation of the impact of such spaces.

However, that did not seem to be the case. While significant and high-quality work had been produced it seemed to be regional in its influence, lacked a true cross-sector voice, lacked coordination (by frequently duplicating key aspects of research done elsewhere), and tended toward the anecdotal – that is, did not consistently provide demonstrably empirical outcomes.

These issues culminate in a suite of challenges - how to maximise past and current quality work to drive the next generation of ILE research? Associated with this was how to do so internationally? And how to decide the priorities - what were the most pressing needs? And finally, how to meet the needs of all agents in ILE development – academic researchers, education policy groups and school practitioners, and the mass of allied industries contributing to the ongoing development of quality ILEs?

The scoping study addressed this range of challenges. It used an on-line and hybrid research approach that brought together a significant number of co-researchers comprising ILE expert designers, academics, and education policy and practitioners from 19 countries. It ran a parallel, validating Delphi Study of world leading experts. It challenged these skilled members to identify existing research gaps, to create a list of needed research, and to prioritise this list to create the next decade's agenda of effective research. It synthesised the results into a proposal for immediate research, an initiative of unprecedented ambition and scope within ILE scholarship and practice. Driving this were the key questions:

Where has existing international ILE research led us, what is the critical research that now must be done, and how should such research be designed?

1 Imms, W., et al (2017). Imms, W., et al (2021). Mahat & Imms (2021).

ORGANISING INTERNATIONAL CROSS-SECTOR VOICES

"The scoping study plan was ambitious. It made the most of the COVID affected years to bring together through largely on-line methods an international consortium of leading ILE practitioners"

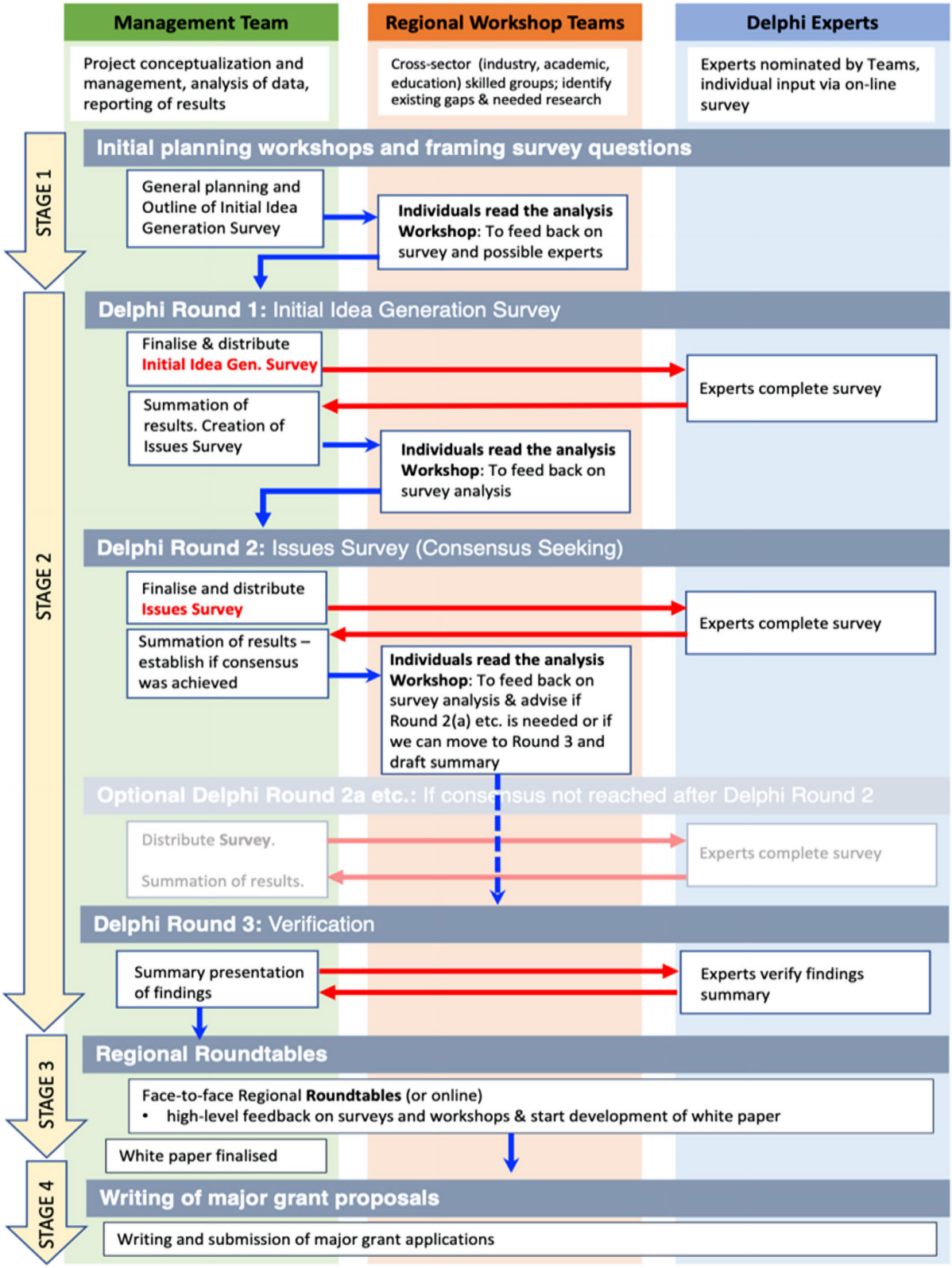
The logical strategy was to use a Delphi study approach, widely accepted as the best way to elicit and reach expert consensus on a given topic. A limitation, however, was Delphi's procedural difficulty when drawing on large samples of experts.

The solution was to run two parallel but separated studies, each comprising approximately equal numbers of industry, academic and education experts – what we would call our three 'sectors'.

The two studies would cover the same material, the first through a workshop design, the second a Delphi survey. Comparing the independent results from these two cross-sector groups would provide (if consensus existed) compelling evidence of future research agendas. This solution allowed for 217 experts across 19 countries to provide detailed opinion through workshops; meanwhile, Delphists were selected by this high-ranking group as 'exemplars' to participate in a quarantined, smaller Delphi group of 37. In each of the studies the three sectors were approximately equally represented.

The method for this project is summarised in the figure on the following page. The left column (Management Team) organised the workshops, analysed data, and used these to structure the Delphi surveys. They wrote reports and disseminated outputs. The middle column (Regional Workshop Teams) participated in on-line events to provide first-level data on the research questions and to validate Management Team analyses. The right column (Delphi Experts) independently addressed the same questions as workshop members. They differed, however, in being asked to revisit their rankings until they agreed on the priorities (Rounds 2a, 2b etc).

There were four stages. Workshop 1 and Delphi study 1 created a list of perceived gaps. Workshop 2 and then Delphi study 2 ranked these gaps to create a hierarchy of priorities. The Delphi's continued this ranking until consensus was reached. Annotations explained choices. Finally, after analysis a draft of this White Paper was discussed, modified, and approved by Teams at two face-to-face Roundtables (Copenhagen and Melbourne).



Infographic designed by Alastair Blyth, University of Westminster

THE GAPS

The identified list of gaps was surprisingly consistent across sectors and geographies in terms of the most and least important gaps.

A gaps analysis highlights the following points.

"An agreed set of gaps in ILE research can be identified"

Frequency of citations provides a list of 20 gaps in past and current ILE research. Citation numbers suggest three were common to all sectors and geographies (evaluation, design, and inclusiveness).

The implication?
There exists a clear set of gaps that arguably constitute an immediate ILE research agenda.

"There was a linear trend in this list of gaps"

The top five and bottom five were consistently rated as such across all sectors and all geographies. There was greater variation in the mid-range gaps.

The implication?
We can be confident we know what to prioritise and what to not invest too heavily in.

"The areas of research 'need' may be smaller than we think"

The Delphi experts added no new gaps; in fact, they reduced those of importance to a small number compared to workshop members.

The implication?
Experts arguably are less distracted by periphery issues.

"There is a lack of ILE factual evidence"

Across each of the three sectors, and across every one of the geographies, the most commented on gap was a lack of solid evidence about the impact of ILEs.

The implication?
It is hard to make a case for ILEs if evidence of their impact is lacking

"This lack of evidence is ubiquitous"

The comment 'we need more evidence about…' applied to nearly all the areas identified in the scoping study.

The implication?
We are underperforming in terms of gathering empirical evidence about nearly all facets of ILEs.

"Geographical regions do have differing needs"

The diversity in 'mid-range' gaps shows that while clear priorities exist, nuances of need differ country by country.

The implication?
Any large-scale research must accommodate specialist foci.

"What we talk about matches what we want to do"

The frequencies analysis correlates strongly with our ranking of the priorities.

The implication?
The scoping study's analysis of priorities is robust.

Additional to specific 'gaps' issues, the following was observed from this round of data collection

"Size does matter: The most, 'useable' research was limited to outputs from larger-scale initiatives"

'Useable' research, those topics, and actual projects most highly cited, was limited to outputs from larger-scale initiatives. Individual research outputs were cited only once or twice

The implication?
Experts are more selective than practitioners about what is 'useable' research; there is a limited pool of effective ILE research output.

"Quality ILE research is concentrated"

Delphi participants (the designated experts) identified a much lower number of 'useful' research topics and projects, but the citations for these were higher.

The implication?
High-impact ILE research outputs require a level of support and dissemination not readily available to solo or small team researchers.

"ILE research is diverse"

Topics vary widely, and there is no one 'driver' that attracts a number of teams.

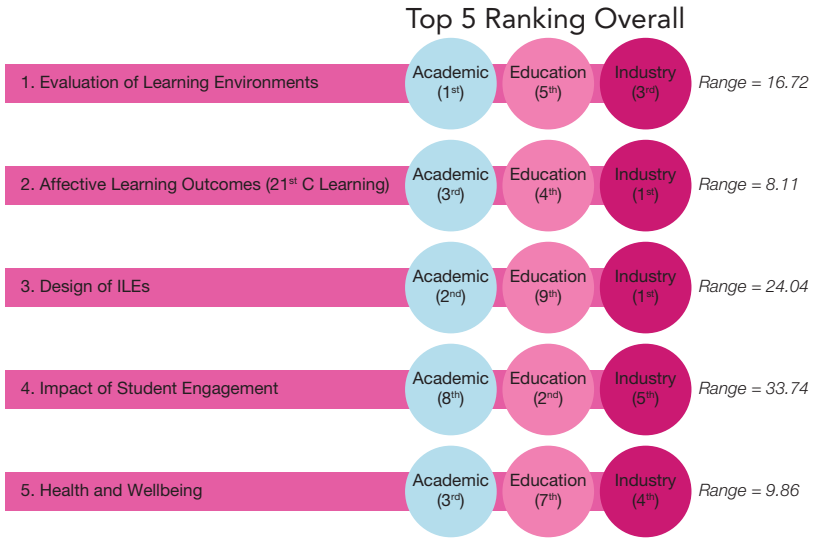
The implication?
Without a 'core' topic or set of topics, ILE research will not gain the maturity of other discourses.

Stonefields School, New Zealand.

THE PRIORITIES

Quantitative analysis found consensus in terms of prioritising the gaps. Some items rated highly across all sectors and geographies

The 'top five' ranking analysis (below) highlighted three issues. First, results were surprisingly consistent with Workshop 1 data (the 'gaps' analysis), which suggested internal robustness. Second, while consensus was found, the 'range' calculation showed that on some topics one sector ranked a topic lower than the other two. Third, two quite different foci emerged. The first (evaluation and design impact) sought measures of effectiveness. The other three (21st century learning outcomes, student engagement and health and well-being) sought understanding of harder to quantify student focused issues.



To fully understand this ranking analysis, we needed to explore the reasons why members made the rankings they did.

Comments explaining members' ranking choices argue that two equal, but different foci exist; one asks for more evidence, the other for understanding of experiences.

"We need more evaluation to support ILE growth"

(*Academic*) If we want to convince people to build ILEs, we need to be able to show evidence on how they work.

(*Industry*) Architects are interested in hard data on what ILE configurations and features facilitate innovative teaching, and deep learning.

(*Industry*) We need to minimize 'randomness' and the occurrence of superficial trends.

(*Educator*) We need a better picture of what is happening in ILEs; spatial types and pedagogies; and student evaluation of spaces is essential

(*Educator*) It is critical to have appropriate evidence for policy makers: randomised, double-blinded multiple trials that are peer reviewed for robustness.

These and a further +50 comments articulated a wish for evidence about how ILEs contribute to attainment of education improvement goals. These included for example, designers to be more evidence-informed and for everyone to have greater accessibility to reliable tools for evaluation. Evaluation was frequently seen as an 'umbrella' concept under which most priorities fall, to some degree.

"What we need to know is not always easy to measure"

(***Educator***) 21st century skills are what are needed to thrive in a dynamic and ever-changing world, but how do we measure these in an ILE context?

(***Academic***) How do we understand if developing affective skills is supported (or not) by ILEs?

(***Academic***) We need a more holistic understanding of the impact of space on human developmental experiences; this would shake up long-standing reliance on only academic achievement scores.

These and a further +60 comments articulated strong agreement that the need to look at issues such as 21st century learning skills is significant. In essence these concerned a better understanding of how ILEs might lead to improved so-called affective learning outcomes, as they occur in actual practice. There was recognition that while desirable, these were challenging to measure.

"A great unknown is how ILEs can empower student participation"

(***Education***) Our theory of action assumes ILEs are 'enablers' in the transforming of teaching and improving engagement practices; but we now need research to test that assumption.

(***Industry***) After COVID, knowing how ILEs impact student engagement is a bigger need than ever.

(***Industry***) Engagement has widespread positive impacts, from academics to health and well-being. If we can link qualities of ILEs to engagement many issues faced by schools would be addressed.

(***Academic***) Engagement provides robust metrics on the effect of various spaces.

These and a further +60 comments focused on the relationship between engagement and space, the degree to which ILEs could positively impact engagement, and the resulting relationship between engagement and well-being. They saw inclusion, health and well-being as foundational to student engagement.

"Originally, the Delphi was considered our primary source of information. But the Teams provided such rich data and gave such clear direction, their voices raised to the fore…"

A PROPOSAL FOR RESEARCH

It is evident a clear research mandate exists. It is evident that the cross-sector 'field' has a surprisingly consistent opinion what that research should address. It is evident that there is international agreement on the top three priorities.

The scoping study found that size does matter, we need a large-scale project to have the required impact.

It found that a clear set of gaps can be identified, and that these are surprisingly common across sectors and geographies.

It found the identified gaps and priorities constituted two areas of research (evidence generation and assessment of impact on users), each requiring differing methodologies.

It found a large-scale, international, cross-sector project was required to build a robust evidence base and bring cohesion and direction to future ILE development.

It emphasised, again, the critical need for having genuine voice from industry, education and academe equally represented in any meaningful evaluation of the impact of ILEs.

In summary, the future of ILE development would be best serviced through a consortium-led, cross-sector research program on a scale large enough to generate convincing evidence across multiple issues across multiple sites. Its design must be sophisticated, needing to provide its funders with the data specific to their individual needs.

The Management Team proposes the collegial development of a four-year program of research.

This program would provide the evidence needed for the three sectors to argue the importance of ILEs and lay an evidence-based foundation for accelerated development of ILE products and knowledge. It would be unprecedented in scale and scope, providing robustness thorough large samples across many countries. It would lay the foundation for the benchmarking of goals and allow comparison against similar circumstances internationally.

A unique moment

The Scoping Study emphasised we stand at a threshold. A rare opportunity exists to collect convincing evidence about how students are impacted by school designs.

This rarity comes from a confluence of events. We have significant research that provides a strong baseline from the ILETC and ILE+SE Scoping Study projects. We have an established international network of industry, education, and academic leaders in this field. We have refined our international cross-sector collaboration methods through the Scoping Study. We have built a body of proof that now requires expansion. We own intellectual property on effective measurement tools to do this. It is unlikely a similar opportunity will again arise.

Student voice and agency

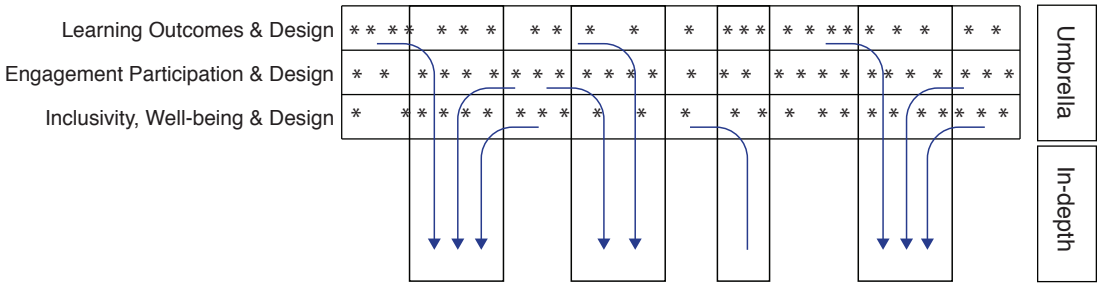
Implicit in all aspects of the following research proposal is the central focus on student opinion and action. Research has consistently shown that understanding of what students do, think and how they act are often meaningless if they are not driven by the perspectives of the students themselves. In this regard, parent and teacher voices are also acknowledged; however, this study focuses exclusively on the student - teacher perspectives about inhabiting ILEs have been well addressed in previous studies. Having said this, the opinions of these two key stakeholder groups is important in assisting to build a comprehensive understanding about how student use these spaces and for what purposes.

ORGANISATION

The Management Team recommends a two-tiered approach.

The first tier constitutes an 'umbrella' of evidence-gathering projects (years 1 to 3), with a common purpose: gather proof using multiple measurements (the asterisks) of ILE impact on students in terms of learning outcomes, engagement, inclusivity, and health and well-being.

The second tier comprises a suite of 'in depth' studies (years 2 to 4) that use umbrella data as a foundation (the arrows) for understanding the lived experience of students in their learning spaces.



The umbrella program is about 'evidence'; it contains three projects.

The intention is to use a set of common measurement tools (surveys, and some observations) plus desk-top analysis. The table below describes the scope of each of the three projects, with some possible outcomes that will be refined through the Development Phase of the next project.

We want to understand	We need good data on	As a result, we will
Learning outcomes and design	What academic and 'affective' learning outcomes are achieved in what type of spaces.	• Determine how academic learning outcomes are impacted by design and use of space • Have evidence of what affective outcomes are impacted by space • Develop a nuanced understanding of the relationship between academic and affective learning outcomes and space • Have capacity to understand how engagement is impacted by space, and if this relates to learning outcomes • Determine how aspects of design support inclusivity and well-being • Determine relationships that exist between design, student outcomes, engagement, and inclusion • Get evidence that links ILE characteristics/ uses to customised academic, industry and education needs Most importantly, we will have unprecedented data on how student perceptions of their experiences in ILEs inform these issues.
Participation, engagement, and design	Student perceptions of their opportunities to excel as a learner through the design and use of learning spaces.	
Inclusivity, well-being and design	Student perceptions of how school spaces assist or impede inclusiveness, and affect health and well-being.	

These address the top priorities identified within the scoping study, and will open the door to quality in-depth studies that provide needed knowledge across sectors and geographies. These three projects directly reference the needs of infrastructure providers and designers, education practitioners and leaders, those building new knowledge etc. to support decision-making that directly impacts students.

These projects would be run by Teams in a manner like the scoping study, the difference being they would be smaller, and would include a member with research experience.

The 'in-depth' studies focus on lived experience in ILEs, through the lens of 'local' issues.

It is envisaged these would constitute research hubs, a few in number (perhaps 3-6), and embedded within a university or an industry with good research capacity.

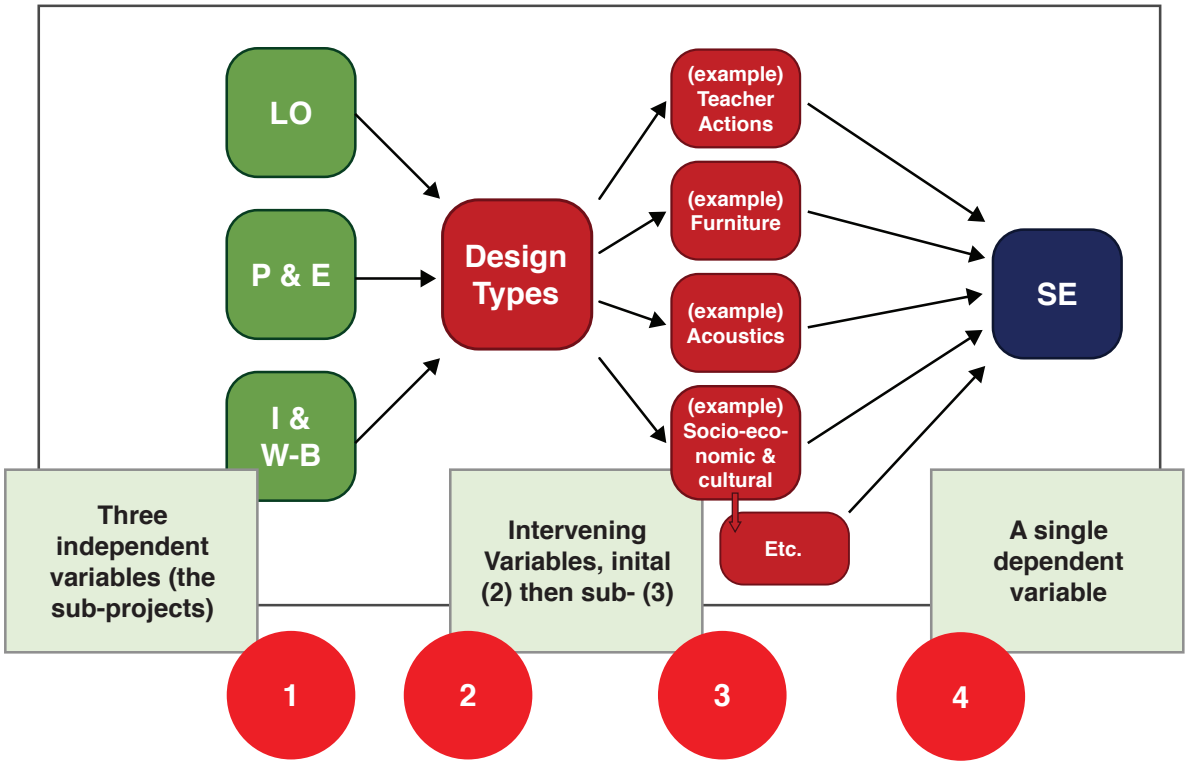
Their task would be to unpack emerging 'umbrella' evidence in terms of explaining those data.

What do these trends mean for the students who inhabit these spaces?

The hubs would be regionally focused, using the specific learning environment issues as a lens to better understand localised ILE issues.

Process

As shown in the following diagram, the three projects (1) would operate independently but would analyse data against one initial design intervening variable (2), the types of spaces being used by students. However, another set of analyses (3) would then analyse findings against a second range of intervening variables directed by the consortium members. For example, these could be social issues, schooling types, or perhaps a range of design factors such as furniture, outdoor spaces. All analyses would then be compared to student experiences. It is student experiences in ILEs that is the core focus of the overall study.



Note: A dependent variable is the phenomenon a project wishes to understand, its focus. Independent variables are the things that are manipulated, studied or adjusted, to see what influence they have on the dependent variable. Intervening variables 'unpack' the independent

The Management Team recognises large-scale projects like these have, in the past, been hindered by limited funding.

A critical issue is how such an ambitious project would be funded. This primarily refers to the umbrella sub-projects, as the in-depth studies would be funded locally through competitive grants – something active researchers on the teams would be familiar with. The in-depth projects would meet criteria guidelines for external funding through competitive national grant competitions such as ARC Linkages (for Australia), SSHRCs (for Canada), KK Grants (for Sweden), and various sources such as Horizons, or Erasmus (for Scotland).

To be implemented, the umbrella sub-projects would need considerable work in terms of soliciting costs – a consortium approach. These funds should come from the organisations and institutions which gain direct commercial and practice advantage from the project's unique outputs. However, as a direct benefit to these funders, the design of the sub-projects allows for considerable input by them in terms of what specialist data should be gathered regarding specific issues of concern to them; the second layer of intervening variables, shown as '3' in the diagram above.

The large overall cost would be somewhat softened by payments annually across the three years.

OTHER IMPORTANT FACTORS

Scale and Scope

It is stressed that any extended study must recognise and work with the small (for example one-room modest experimentations) as well as large (full-scale architectural) developments. Each offer valuable evidence to the effect of ILEs on students' experiences.

Dissemination, impact, and partner growth

A core ambition will be for the project to facilitate maximum impact. This takes many forms. For examle, its design will allow a two-way benefit for schools. Providing them the evidence to inform future development of how they adjust, use, and teach within their spaces. The project will significantly inform future decision making and product development for industries and education groups. For academics, good dissemination of findings may mean assisting the refinement of new theories about spatial innovation, or assist smaller research findings to 'push through' and expand their impact and growth. For universities, it will facilitate improved training of new teachers.

Networking

The project offers unprecedented opportunity to expand what is already a significant global research community. A task will be to grow through collaboration the unique networking this project builds and supports. Built into this is the opportunity for professional growth – the cross disciplinary challenge of learning from each sector, and of building and using research skills in an applied way to improve all aspects of student learning in schools.

Cultural and Indigenous

The study will need to be co-designed, to ensure local voices inform its design. In particular, this must drive the accommodation of localised issues regarding cultural and Indigenous needs to ensure they are appropriately built into the measurement and analysis tools.

Part of a wider learning ecology

Despite its scale and scope, the study is limited by parameters to ensure its feasibility. For example, it cannot assume to embrace all aspects of student experience in schools and must recognise its foci form only one part of a much wider ecology of learning.

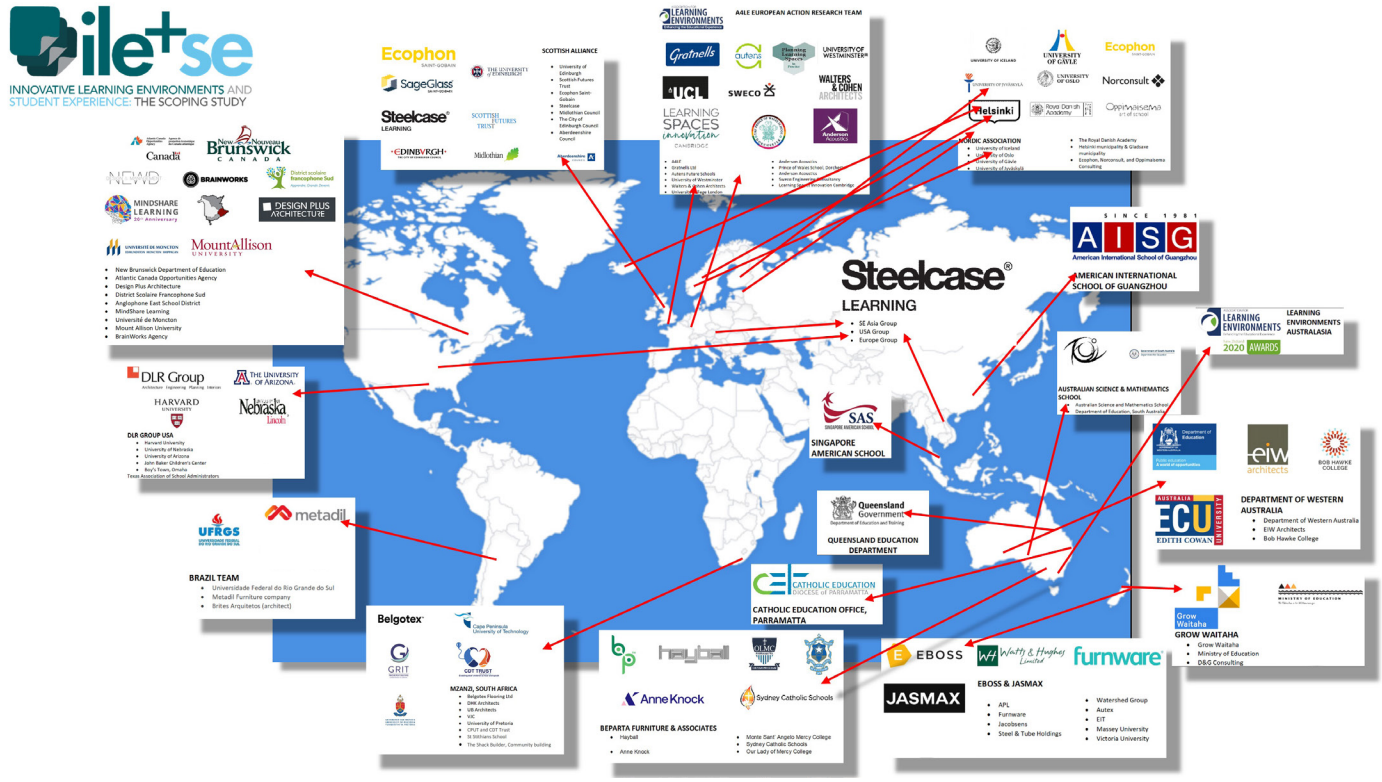
Stonefields School, New Zealand. Alex de Freitas photography.

DEFINITIONS

This White Paper uses terms that require clear definitions. The list below was agreed upon during Workshop 1. It should be noted, however, that some terms used in this White Paper carry quite different meanings across geographies – for example, in many Southern Hemisphere regions, 'didactic' refers to teacher-directed teaching methods, direct instruction with little feedback. In contrast, in many Northern Hemisphere regions the same word refers to the act of teaching (which, to again add confusion, is called 'pedagogy' elsewhere). Feedback from Roundtables stressed a need in any large upcoming project to refine and define meanings to create a consistent set of meanings. For that reason, the definitions listed here – while agreed by the teams as being adequate for the scoping study – will need to be expanded for any larger project; suggestions included refining the difference between affective and effective, what is exactly meant by 'learning outcomes' and the nature of 'pedagogy'.

Student experience	For this study, *student experience* is defined as the social, emotional, and academic effect of individuals 'being at school'. The study acknowledges no two students enjoy the same experience and are influenced by policies, structures and practices that limit or provide opportunity for equal and equitable participation.
Innovative Learning Environments	An innovative learning environment is what emerges when spatial designs are intentionally used as a pedagogic tool to improve student learning. This environment is the sum of the space and the practices within, the product created by specifically designing spaces to add new value to existing practices.
Research	We define research as creating significant new knowledge. Often this uses what is already known to bring into practice new ideas, theories, and methodologies.
Expert	A person acknowledged by peers and from his/her accomplishments to have made a significant contribution to a specific field of inquiry or practice.
Inductive data analysis	While deductive analysis occurs within the tight parameters of a defined framework, *analysis of data becomes inductive* when unstipulated concepts and findings are developed from the data themselves.

ILESE TEAMS/ PARTICIPATING ORGANISATIONS



This graphic is for illustration only, showing the scale of the Scoping Study. An accurate list of participating organisations is below.

A4LE Europe Action Research Team

Participating organisations:

- A4LE Europe (England and Denmark)
- Gratnell Ltd
- Autens
- Anderson Acoustics
- Sweco Architecture and Engineering Consultancy
- Prince of Wales School, Dorchester
- Walters and Cohen Architects
- Learning Spaces Innovation, Cambridge
- Planning Learning Spaces
- School of Architecture and the Cities, University of Westminster
- Edunovaspace

American International School Guangzhou

Participating organisations:

- American International School Guangzhou
- Southern University of Science and Technology in Shenzhen
- Shekou International School
- University of Hong Kong

Australian Science and Mathematics School

Participating organisations:

- Australian Science and Mathematics School
- Department for Education, South Australia

Beparta and Associates
Participating organisations:
- Hayball
- Beparta
- Anne Knock Consultancy
- Monte Saint Angelo Mercy College
- Our Lady of Mercy College
- Sydney Catholic Schools

Catholic Education Office, Parramatta
Participating organisations:
- Catholic Education Office, Parramatta

Department of Education, Western Australia
Participating organisations:
- Department of Education, Western Australia
- EIW Architects
- TRCB
- Bob Hawke College

DLR Group
Participating organisations:
- DLR Group
- Harvard University (Department of Graduate School of Education)
- University of Arizona (Office of School Engagement)
- University of Nebraska – Lincoln, College of Education and Human Sciences (Architecture and Education)
- John Baker Children's Center
- Texas Association of School Administrators

EBOSS and Partners
Participating organisations:
- EBOSS
- Jasmax
- APL
- Furnware
- Jacobsens
- Steel & Tube Holdings
- Watershed Group
- Autex
- Eastern Institute of Technology
- Massey University
- Victoria University

Grow Waitaha
Participating organisations:
- Grow Waitaha
- Ministry of Education, New Zealand
- D & G Consulting

LEA Australasia
Participating organisations:
- Learning Environments Australasia
- Howff Design
- Department for Education, South Australia
- Urbis
- Parry and Rosenthal Architects

Mzanzi South Africa
Participating organisations:
- Belgotex
- UB Architects
- Grit
- DHK Architects
- VJC
- University of Pretoria, Department of Architecture
- CPUT and CDT Trust
- St Stithians School
- The Shack Builder

Nordic Association
Participating organisations:
- The Royal Danish Academy
- University of Jyväskylä
- University of Iceland
- University of Oslo
- Norconsult
- University of Gävle
- City of Helsinki
- Oppimaisema
- Gladsaxe Municipality
- Ecophon Finland

Scottish Alliance
Participating organisations:

- University of Edinburgh
- Newbattle High School & Midlothian Digital Inclusion & Learning Team
- Corstorphine Primary School
- City of Edinburgh Council
- Scottish Futures Trust
- Steelcase
- Sage Glass & UOM
- Ecophon
- NORR Architecture
- Aberdeenshire Council & Northern Alliance Improvement Collaborative

Singapore American School
Participating organisations:

- Singapore American School
- Fielding International

Steelcase APAC
Contributing organisations:

- Steelcase HK
- Steelcase USA
- Pure Living
- MKSA
- Depo for Innovation in Pedagogy for ICN Business School
- Politecnico di Milano
- HEC, Real Estate Director
- Aalto University
- University of Glasgow
- Dulwich College Beijing
- Nord Anglia/BISS Shanghai
- University of Nottingham Ningbo
- Delhom Acoustics Shanghai
- JLL Education
- University of Edinburgh

Team Brazil
Contributing organisations:

- Universidade Federal do Rio Grande do Sul
- Universidade Federal Fluminense
- Metadil
- Athié Wohnrath

Team Canada
(New Brunswick Department of Education)
Participating organisations:

- New Brunswick Department of Education
- Atlantic Canada Opportunities Agency
- Design Plus Architecture
- District Scolaire Francophone Sud
- Anglophone East School District
- MindShare Learning
- NEWD Design and Management
- Université de Moncton
- Mount Allison University
- BrainWorks Agency

Queensland Department of Education
Participating organisations:

- Queensland Department of Education
- Novum Architects
- Anglican Church Grammar School

APPENDIX 1

ILE+SE RESEARCH GAPS

Based on frequency of citations, workshop 1 participants and Delphi experts identified twenty research gaps (key issues), with multiple sub-issues in each. 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 (Evaluation of learning environments). 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 (Design of ILE spaces). 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 ambiance, 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 (21st century learning). 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 (Inclusiveness). 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 (School – local level issues). 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 (Technology). 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.