TRANSITIONS

INHABITING INNOVATIVE LEARNING ENVIRONMENTS

SYMPOSIUM PROCEEDINGS

EUROPE 2017

WHAT IS NEEDED TO HELP TEACHERS BETTER UTILIZE SPACE AS ONE OF THEIR PEDAGOGIC TOOLS?

ILETC INNOVATIVE LEARNING ENVIRONMENTS AND TEACHER CHANGE

TRANSITIONS 2017: EUROPE

What is needed to help teachers better utilize space as one of their pedagogic tools?
An international symposium for graduate and early career researchers.

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THE UNIVERSITY OF MELBOURNE

Melbourne Graduate
School of Education

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EUROPE 2017

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Contents

Teachers' transition into Innovative Learning Environments: Acknowledging change 7
Dr. Marian Mahat and Associate Professor Wesley Imms
University of Melbourne - Australia

Keynote address I: Children as our educational imperative 11
Professor Stephen Heppell
Universidad Camilo José Cela, Spain; Bournemouth University, UK.

Keynote address II: Developing and adapting learning spaces 15
Diana Bannister
University of Wolverhampton, UK.

Session one: Inhabiting design 19

Using Fällman's Interaction Design Research Triangle as a methodological tool for research into school design 21
Emma Dyer
University of Cambridge - UK

The mobility of people, not furniture, leads to collaboration 27
Mie Guldbaek Broens
LOOP.bz - Denmark

Innovative Learning Environments, are they inclusive? Why evaluating the speaking and listening potential of the space matters 33
Leanne Rose-Munro
The University of Melbourne - Australia

Session two: Teacher Practices 43

Hack the school: A creative toolkit to transform school spaces 45
Sílvia Sasot[1] and Esther Belvis[2]
1: Universitat Ramon Llull - Spain
2: Universitat Autònoma de Barcelona - Spain

Where is the White Space for Learning? 51
S. J. Hall[1] and J. Leskela[2]
1 Staffordshire University - England
2 Tampere University of Applied Sciences - Finland

Pedarchitecture: Which learning environments for the personalisation of teaching and learning? An educational architecture for the schools of the future 59
Mariagrazia Marcarini
University of Bergamo - Italy

Session three: Change and risk 69

International comparative study of innovative physical learning spaces 71
John Augeri
Paris Ile-de-France Digital University - France, & Kyoto University - Japan

Creating a space for creative learning: The importance of engaging management and teachers in the design process 79
Bodil Bøjer
The Royal Danish Academy of Fine Arts Schools of Architecture, Art and Conservation and Rune Fjord Studio, Copenhagen - Denmark

Constructing a framework for the exploration of the relationship between the psychosocial and the physical learning environment 87
S. Baars[1,2,3], P. den Brok[2], S. Krishnamurthy[1], J.P. Joore[3,4] P.J.V. van Wesemael[1]
1 Eindhoven University of Technology - The Netherlands
2 Wageningen University & Research - The Netherlands
3 NHL Stenden University of Applied Sciences - The Netherlands
4 Delft University of Technology - The Netherlands

Session four: Measuring impact 97

Design with knowledge – Light in learning environments 99
Imke Wies van Mil[1,2], Olga Popovic Larsen[1], Karina Mose[1], Anne Iversen[2]
1: The Royal Danish Academy of Fine Arts - Denmark
2: Henning Larsen Architects - Denmark

A framework of factors for learning environments evaluation 107
Graeme Oliver
University of Melbourne - Australia

Teachers' transition into Innovative Learning Environments: Acknowledging change

Dr. Marian Mahat and Associate Professor Wesley Imms
University of Melbourne - Australia

In 2017, the Symposium explored the overarching theme of Inhabiting *Innovative Learning Environments*. The symposium was held in three cities: Melbourne, Australia; London, UK; and Grand Rapids, Michigan, USA. In collaboration with our project partner, Ecophon, the European symposium brought together contributors, who addressed the simple question: *'How are teachers making the transition into innovative learning spaces, and how does evidence of success inform future best practices?'*

While the provision of innovative learning environments, or ILEs, in many countries around the world is an exciting and overdue development, they are also presenting a number of new challenges. In particular, anecdotal evidence suggests that many teachers are resisting the need to adapt their proven 'traditional classroom' pedagogies to maximize the learning opportunities provided by such spaces. Transitions provided the opportunity for our graduate and early career researchers, often working in isolation, to come together through three international symposia, to be part of this quality discussion, and to be represented in a unique international publication celebrating this research. Through the careful sequencing of papers, and input after each paper by expert interlocutors, Transitions explored how well teachers are making this transition—are these spaces facilitating any improvement in teaching practices? What evidence exists that these spaces are improving student experiences and learning? What is needed to help teachers better utilize space as one of their pedagogic tools? Transitions was a working symposium, with new knowledge being generated from the exchanges of ideas occurring around each presentation.

The papers were grouped into four themes of Inhabiting Design, Teacher Practices, Change and Risk, and Measuring Impact. Participants presented an 8-minute synopsis of their research. There were no concurrent sessions—all participants listened to every presentation. At the end of the presentations in each theme, expert interlocutors discussed key themes that had emerged, drew inferences, and then elicited audience discussion on issues pertinent to each theme. Audience participation was encouraged and robust, drawing perspectives from various sectors including fellow higher degree researchers, industry representatives from design, building and ICT, academics working in this field, and those embedded in implementing new classrooms at a policy level. The day was an intense and highly informative exchange of ideas.

The papers included in this volume, Transitions Europe, were selected for presentation through double blind peer-review. The symposium took place on Thursday, 7 September 2017, at the Regent's University London. Sxity-five participants from industry, policy, schools and academia attended the symposium. Each paper was reviewed and the comments sent to authors in order to help them prepare a revised version to strengthen the continuity and congruence of the proceedings. The result of this revision process is the backbone of this volume and represents what we consider to be a stimulating and careful set of analyses about how teachers transition into innovative learning spaces.

Three sets of proceedings are planned for papers from each of the symposia. A selection of these papers will be invited to be re-worked and published in the peer-reviewed book, Teacher Transition into Innovative Learning Environment, edited by Associate Professor Wesley Imms and Professor Tom Kvan, scheduled to be published by Springer in late 2018.

TRANSITIONS EUROPE

Following welcome remarks from Colin Campbell from Ecophon and Associate Professor Wesley Imms from the University of Melbourne, Michal Cohen of Walters and Cohen set the scene and context for Europe. In her presentation, she provided case study examples as well as tools for engaging whole school community in school design.

Professor Stephen Heppell provided the first keynote address. Building on three decades of knowledge and expertise, Stephen reiterated the need to focus on learners at the heart of our research and practices. These children are our educational imperative—this is why we need to be relentless in identifying, sharing and validating new and old practices.

Diana Bannister offered further insights in the second keynote for the day. She urged the audience to go beyond the physical appearance—space is so much more than what can be captured in the photograph. The future landscape of education needs to be built upon the expertise of the community—architects, teachers, school leaders, researchers, and above all students can and should collaborate to ensure that the learning environments we inhabit continue to be innovative.

Julie Velissaratou of the Organisation for Economic Cooperation and Development (OECD) also provided reflections during the day about the organization's work in evaluating learning environments. The Learning Environments Evaluation Programme (LEEP) produces instruments and analyses that inform school stakeholders about how learning environments can most effectively support the pedagogies, curriculum, assessment and organisational forms necessary to develop students' capacities for the 21st century.

INHABITING DESIGN

Led by Terry White, Executive Director for the Association for Learning Environments in the United Kingdom, this session focussed on teachers' and students' experiences inhabiting new ILEs. In order to explore the concept of inhabiting design, Terry asked that we look deeper into the learning process. This should invariably focus on the approaches to learning and teaching that allow us to inform and understand the design process that we are all involved in. This, he believed, needed to be a learning-led design process.

Four distinctive presentations structured this session, but also linked together in many ways. Presentations focused on the design and implementation of the 'reading nook', teacher collaboration, the use of space for student with hearing difficulties and teachers' rationale about the design and furnishings in a classroom.

Amidst a national movement to build schools 'cheaper and faster', Dyer provoked critical dialogue about teachers' and students' environmental competencies and spatial practices as well as the effect on curriculum and assessment practices for reading. Adapting Fällman's (2008) research framework, a design artefact—a fully-realised prototype of a reading nook—becomes an element of the research project.

Guldbaek-Broens investigated teacher collaboration in relation to physical space. In her study, she found that flexible environments become an obstacle for collaboration as teachers would rearrange the furniture to mimic their team teacher, thus reducing the diversity and subsequently the teaching and learning possibilities in the classroom.

Rose-Munro investigated how students with suboptimal hearing, occupy and function in innovative spaces. Through a mixed methods design, sound deficient areas and noisy spaces that prevent students from accessing instructions were identified. Drawing on the interplay between design affordances, technology, spatial attributes and pedagogy, instances were found that enabled opportunity for inclusion of students with hearing difficulties.

Stavem sought to answer the question, 'What role does the physical environment including furnishing and design of the classroom play for teaching?' To investigate the relationship between the physical layout of classrooms and its effects on pedagogical practices, interviews with teachers in four Norwegian schools were undertaken. The aim was to provide a broad picture of teachers' reasoning and thinking about the design and furnishings of the Norwegian classroom.

TEACHER PRACTICES

The panel on teacher practices was chaired by Alastair Blyth, a senior lecturer at the University of Westminster and former policy analyst at the OECD. Discussion centred on the challenges for encouraging change in teacher practices. Some of the issues identified include teachers' mind sets and acknowledgement for the need for change, and the risk and fear of change.

Ibanez and Belvis established seven principles for a toolkit to foster the transformation of school environments. 'Hack the School' is a co-creative approach that focuses on school communities and the architect to facilitate the transition from traditional uses of space to innovative ones.

Hall introduced the concept of 'White Space' for learning as an approach that deliberately builds space into learning activities for learners to think, imagine and shape their own ideas. He maintained that white space is essential to encourage learners to take greater responsibility for their own learning, and provided some strategies for teachers in their teaching and learning practices.

Macarini highlighted the link between pedagogy and architecture—'pedarchitecture' to explore the teachers' pedagogical adaptations to different affordances and the impact of space on teachers and students. Using case study schools in three different educational contexts, she investigated the concept of teacher collaboration, team teaching and technology to create more active learning environments.

CHANGE AND RISK

The session on Change and Risk was led by Knud Nordentoft, a learning consultant and former Head Teacher of Hellerup School in Denmark. Knud reiterated the importance of the learning process. He captured the essence of the session with the notion that today's school must prepare the children for tomorrow's workplace.

Augeri led a comparative investigation of innovative physical learning spaces in universities across the world. His presentation highlighted some of the similarities and differences of learning spaces across various criteria such as ICT, governance, design and evaluation. He concluded that the main challenge for universities is to continuously enhance the student experience through innovative teaching & learning practices.

Bojer advanced the notion that for an ILE to function as it is intended, organisational structures (management) and educators using these learning spaces need to be included in the design process. She proposed a final 'delivery' or 'activation' phase to be included at the end of the design process in order for users to be informed of the intentions of the space and translate these into actions.

The final presentation in this section shifted the focus of the lens towards the learner. Baars conceptualised the relationship between the psychosocial environment and the physical learning environment in order to better understand the transitions between these components. He proposed a conceptual framework, which provided a balanced representation of both components, but maintained that further development and empirical testing is necessary to demonstrate the validity, usability and reliability of the framework.

MEASURING IMPACT

Emeritus Professor Peter Barrett of the University of Salford led the last session on measuring impact. Four presentations structured the final session, which relate to issues of sound, light and movement, as well as evaluation of learning spaces. He touched briefly on the importance of measurement—while you may get what you measure, it is not necessarily what you want or need.

Szynalska advanced a tablet application designed to explore the relationship between students' engagement in learning and spatial affordances. Drawing on quantitative and qualitative data from three distinctive case studies, she investigated participants' thoughts, actions and behaviour as they occur within the environment they are in.

Wies van Mil investigated the impact of artificial lighting in learning environments on students' academic performance. Drawing on data from eight Danish primary schools, preliminary findings found that high spatial contrast, created by focussed, local light distribution might lower average student noise, increase environmental satisfaction by both educators and students, and lenghten periods of concentration amongst students.

Karjalainen explored the effects of an intervention program with an 'action-reflection-learning approach' that targets strategies for enhanced communication such as non-verbal methods and vocal exercises for primary school teachers. The findings revealed that ensuring teacher support and understanding were crucial in actualising these communicative methods in the classroom.

Finally, Oliver developed a framework, which could be used to create a situational profile to evaluate innovative education practices in ILEs. Using an expert elicitation method, the profile emphasised a set of factors, which could be used to identify the most useful evaluation approach for individual ILE projects.

In summary, the presentations in Transitions Europe 2017 had a strong focus on regional strengths and weaknesses. The presentations tended to argue that teachers need to acknowledge that change is required. One factor that hindered good practice was the fragmentation of knowledge caused by differing agendas across many countries in Europe. However, the topics addressed in the European symposium are questions that are globally relevant. These efforts by graduate and early career researchers—from Australia, Denmark, France, Italy, Netherlands, Norway, Spain, Sweden, and United Kingdom—have enabled practitioners and scholars to continue to work together to understand what we have delivered so far and how we can collectively progress toward our broader goal of improving student learning.

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Children as our educational imperative

Keynote address I

Professor Stephen Heppell
Universidad Camilo José Cela, Spain; Bournemouth University, UK.

I was reflecting on the London Transitions event, organised by the Innovative Learning Environments and Teacher Change (ILETC) project, which was hosted near to some of London's oldest hospitals where, well into the 19th century, medical practice was very firmly committed to blood-letting. "Doctors" would bleed their patients from a complex variety of body locations - wrist, neck, groin (!), arm, etc - each targeted at a specific ailment. The body locations were carefully mapped and documented, a host of local practitioners, largely barbers (who had both location and the necessary sharp blades) advertised their services and their profession. The red and white barber's pole is specifically symbolic of this blood-letting role. The number of bleedings was a placeholder for performance. If you bled folk a lot, you presumably hadn't killed them, and thus you were judged a success.

This long standing practice had only one failing: by and large, it was completely and utterly useless. But as it began to dawn on people that other approaches - like Joseph Lister's new principles of cleanliness and hygiene - evidentially worked better, the barbers carried right on with their blood-letting. Their training, their professional standing, their premises and their history were irrevocably bound to the practice, even when it was evidently nonsense.

Without labouring the analogy still further, that is very much where we are at with education, currently. We are witnessing the stubborn endurance of "pedagogic blood-letting": perfectly reasonable professionals chasing the wrong targets, with the wrong methods, based on the wrong science and with very clear evidence that things are not working. Within plain sight, other teachers, schools, policy makers and nations are showing progress that is self-evident and multifaceted. The medical blood letters and the pedagogic blood letters have this in common too: their subjects suffered and suffer unnecessarily. All this is by way of welcoming the ILETC work to shed light through research and reflection on better learning practice and process.

ILETC is timely and valuable. We are seeing the science of better learning displacing habitual but ineffective past practices. Arguably, the tools of new technologies have impacted on this: professional development is fed and informed by social media's communities of practice; the Internet of Things is bringing us detailed data analysis of the key environmental levels impacting on learning; the Cloud allows us to share and compare Big Data; Skype and similar allow "a window on your world" conversations between students and teachers walking round their new learning spaces, their redeveloped toilets, their considered zoning; their outdoor oases of learning and, as they walk, answering grounded questioning; using stop frame sequences to record movement and usage across new space layouts; feasting on the examples of great learning ideas pinned into Pinterest; listening to and learning from (usually via Twitter) the backchannel from conferences in other timezones and other contexts; and more...

Let us explore two examples from that list: the first anecdotal (and yes, the plural of anecdote is not data, of course). I was working with a cohort of head teachers in the UK exploring different approaches to organisation and I had been encouraging them to explore the wastage involved in a secondary school's timetable: students moving from class to class, pausing a little before lesson end to start "putting away" and starting a little late in the subsequent class as the new materials and resources were assembled for that lesson, let alone the time lost in walking transition. The head teachers were sceptical. They had honed rules for behaviour in transition: walking on the left, using the lavatories, direct route only, and more. Their formulaic 60 minute lessons made timetabling agile, and was the way they had always done things. We Skyped in to a group of children in Norway who were operating a one-day-one-lesson timetable. If it's Tuesday, it'll be mathematics, and so on. After the Norwegian schoolgirl, in excellent English, had explained how their one day one lesson model worked, she invited questions from the still-sceptical head teachers. The first question: "what would you change in your school?".

"Well" said the schoolgirl, "it's the one-day-one-lesson timetable that has made me think about changes needed". The head teachers looked comforted; there were problems, they presumed.

"The thing is", she continued, "now that we have a one-day-one-lesson timetable, we are so far ahead in the curriculum, that we think there is no need to do homework any more".

The head teachers were persuaded in a way that no ministerial policy dictate, or learned journal could have done. This confident student had caused them to pause for reflection on their own practice.

A second example, with rather richer data, comes from our little Internet of Things Learnometer boxes (http://learnometer.net), a research artefact supported by JISC in the UK. We have been capturing: temperature, CO2, humidity, sound, sound rhythms, light levels, air pressure and pollution. Fairly solid research evidence gives us an optimal range for most of these (although we remain uncertain about air pressure's impact). Data capture visits to around 60 examination rooms have currently revealed every single room damaging children's prospects in some way, often profoundly.

"The way we have always done it" turns out to be some distance from the best way to do it and the research team are now wrestling with the ethical dimension of what to say to parents and students let down by the inequity of provision. In too many cases a tiny change in outcomes can be the difference between two grades, and thus between two university offers, and then between two contrasting jobs. The physical environment can make that difference, as can every detail. The detailed, honest, rigorous researched reflections shared in the London ILETC event were a bedrock going forwards. We learn starkly from sport science that the aggregation of marginal gains is worth pursuing relentlessly, in search of the best possible outcomes.

We should not ignore the craft of past practice either. Looking back and reviewing through fresh eyes can be revealing too. Medical practice is just starting to realise that the ancient practice of blood-letting might yet offer cardiovascular benefits to obese people with metabolic syndrome, a new study published in the journal BMC Medicine suggests. Our aggregation of marginal gains needs us to look backwards, as well as forward. We want the very best for our children and other learners.

But there is another reason to pursue better learning too. As we look around the world we can see the failure of past practice. Hundreds of millions of children are starting school, going day after day, year after year, but not really learning, and certainly not attaining student scores better than OECD level two (where you have just mastered enough maths skills or literacy to cope with simple problems). In Zambia for example, almost three-quarters of a recent cohort of youth were innumerate and more than two thirds illiterate, despite 93% of these youths attending school regularly.

And for many children, even the chance to attend is absent. UNICEF in 2016 put the number of displaced children worldwide at around 50 million. Displaced by conflict, flooding, economic collapse and more.

These children are our educational imperative. Current practice is not working for them, despite their commitment to it. With the wealth and stability of Australasia, Europe and elsewhere, we can prototype the components of a new world of learning for all. This is why we need to be relentless in identifying, sharing and validating new, and old, practices. If we are going to mend this world with learning, and to do that affordably, we need events like the ILETC event in London.

Developing and adapting learning spaces

Keynote address II

Diana Bannister
University of Wolverhampton, UK.

In the last 18 months, I have been working with European Schoolnet's[1] Interactive Classroom Working Group[2] and Future Classroom Lab[3] to develop a set of Guidelines for Exploring and Adapting Learning Spaces. Working with eight Ministries of Education, the guidelines contain a set of eight case studies with examples from each of the European countries involved. As part of the guidelines, I have been able to look at the benefits and challenges of changing learning spaces.

It was therefore a great opportunity at the beginning of this academic year began to be one of the keynote speakers at the Transitions Conference – Inhabiting Innovative Learning Environments, hosted by the University of Melbourne in London, UK. This international symposium brought together teachers, researchers, PhD students with education leaders, architects, and sales to explore the question "What is needed to help teachers better utilise spaces as one of their pedagogic tools?"

I wanted to explore the topic of developing and adapting learning spaces, recognising that the language we use is a key to success. It is fundamental that we find the appropriate place on the learning spaces continuum. There are many steps between status quo and transformation. Change creates an instability that invokes vulnerability. School leaders have a unique role to play to ensure stakeholders are consulted and engaged. Not all changes are revolutionary; sometimes simple adaptations can make a big difference.

Technology has become a fundamental part of the change with learning spaces; but there is still a long way to go to prevent the current fragmentation and inconsistency. At present, students have access to their own devices outside the school day, but remain constrained in school by lack of resources; curriculum and assessments where changes have not been aligned. There are challenges that lie beneath the surface and the interconnection between complexities in trying to understand learning environments. We cannot create a new building and think that everything is sorted. The challenge is not just to gather the initial post occupancy feedback, but to determine a process to engage in ongoing collaboration to create sustainable change. It becomes apparent that there are potentially so many different factors to the learning environment that can influence the activity and the likelihood of success.

There is no easy fix; no one size fits all solution. The challenge for all of us is to get beyond the physical appearance. Space is so much more than what can be captured in the photograph. However, technology has become more reliable and commonplace leading to the evolution of innovative and complex pedagogies. We are though still in the period of transition,

1 European Schoolnet: http://www.eun.org/

2 Interactive Classroom Working Group: http://fcl.eun.org/icwg

3 Future Classroom Lab: http://fcl.eun.org/

not every student fortunate enough to be learning in an innovative learning environment. Not every teacher is teaching in these new types of spaces. This conference has allowed us to capture the evidence for autumn 2017, but identifying perfection is impossible because we all need and want different things from learning spaces.

Whilst on the one hand, there is the need for standardisation, it is perhaps the initial similar appearance that stifles the creativity and magnifies the limitations that exist.

Throughout this event was the foresight, vision and understanding that changes in learning spaces need to have ownership. Innovation will not just happen, it needs to be planned, reasoned and challenged.

This conference has opened up an international dialogue that gives just a snapshot of some of the challenges in this discussion on learning spaces. ILETC have created strong foundations for the future landscape of education, but this needs to be built upon utilising the expertise from across the various communities engaged. Architects, teachers, school leaders, researchers and above all students can and should collaborate to ensure that the learning environments we inhabit continue to be innovative. It is this collaboration that will help teachers to better utilise space as one of their pedagogic tools.

Terry White
Association for Learning Environments - United Kingdom

Terry has a passion for excellence in the design of schools and environments for learning and has ensured that the voice and needs of the learner are central to his work. He is committed to sharing good practice in the UK and through his international projects, study visits, working directly with learners, teachers, co-educators and design professionals.

He has extensive experience in Schools and Colleges as Headteacher and Principal. He has worked in public and private sectors of education, with national and local government, schools, industry, universities and design professionals. He was a director of WSP Buildings and a founding Director of Edunova, (integrated education consultancy). He has been the lead Educational Design Advisor on large scale school building programmes, developing and delivering the design brief for over 30 schools.

He is an Executive Director of The Association for Learning Environments, working on their Global Steering Group and adjudicating on the International School of the Future Programme.

Through Learning-led Design he is ensuring there is a strong emphasis on learning and teaching with improvement of educational outcomes and professional learning of all staff, when designing and remodelling learning environments .He has developed leadership programmes to support all staff and students through the process of change, defining in partnership, the new behaviours for learning that are essential in future learning environments.

Using Fällman's Interaction Design Research Triangle as a methodological tool for research into school design

Emma Dyer
University of Cambridge - UK

ABSTRACT

This paper introduces a methodological framework from the field of Human Computer Interaction (HCI) that offers an alternative way of thinking about school design. *The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration* (2008) was originally created by Fällman to support doctoral researchers in the field of Human Computer Interaction to ensure that their experience of design research addressed all possible aspects of design, including communication with stakeholders. This triangular framework offers a different way of looking at some of the messy, intractable problems that occur in the field of school design. The framework is discussed through the example of my doctoral study which investigates where beginner readers read in the English primary school and proposes where they *could* read.

KEYWORDS: DESIGN-ORIENTED RESEARCH, READING, BEGINNER READERS, PRIMARY SCHOOL

Emma is a doctoral candidate in the Faculty of Education at the University of Cambridge. Having worked for BBC Radio for more than a decade Emma retrained as a primary school teacher and worked in several schools in London. During this period, she also set up a national programme for author visits into schools. Emma writes children's fiction with her writing partner, Tim Byrne and co-curates a blog -- architectureandeducation.org with Adam Wood. Emma's doctoral thesis investigates where beginner readers read in the English primary school and where they could read. In an additional study, using a design-oriented research framework by Fallman (2008), she has installed freestanding reading nooks in two London primary schools and researched how these are used by children and teachers in their classrooms. In 2014 Emma won the London School of Economics Research Festival prize for the best short film: Child vs Book. Her research interests include reading and the body; the design of alternative spaces in schools; the relationship between pedagogy and space; and liminal and quiet spaces in primary education.

INTRODUCTION

This paper proposes a methodological innovation that aims to improve the experience of the school environment for its end-users, primarily students and teaching staff. It takes a fresh look at how seemingly intractable problems relating to the school environment might be reappraised and resolved. The methodological innovation takes the form of a framework or model that was developed in the field of Human Computer Interaction (HCI) but which can be effectively employed to research aspects of the field of school design that remain unexplored and unquestioned. Fällman's 2008 paper *The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration* introduces a dialogic, relational and hermeneutic framework that was originally intended to guide students through their doctoral research projects in HCI. Created in collaboration with Fällman's colleagues at the Umeå Institute of Design in Sweden, the framework reflects the complexity and interactive nature of design research while maintaining a focus on the interface or relationship between the design and the end-user: in this case, the school building itself or aspects of that building and the student.

Having identified a significant gap in knowledge about the spaces and places where beginner readers read in the contemporary English primary school in my doctoral research, I use this example to demonstrate how the framework can be employed to draw attention to aspects of the relationship between students, teachers and their environment that make that relationship unsatisfactory. For the purpose of concision, a single example of how this Fällman's framework could be applied in the field of school design is used in this paper, however, it is hoped that further research will extend the scope of this study.

THE METHODOLOGICAL FRAMEWORK

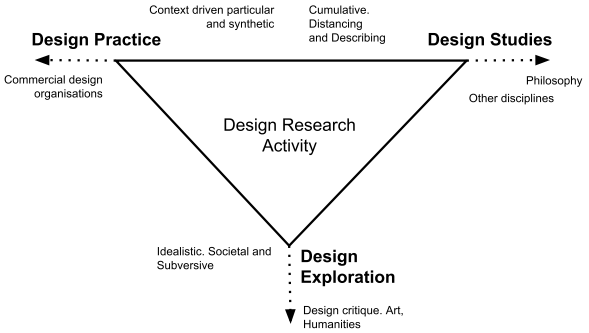

Figure 1.

Figure 1 has been adapted from Fällman's 2008 paper to give an overview of the model. This simple version of the model incorporates three elements or activities: design studies; design practice and design exploration. Design studies is the most familiar of the three elements to non-designer, equating to theoretical, academic research. Design practice brings matters of budget, materials, time, communication with stakeholders and other real-world problems into the equation, while design exploration proposes "What if?", asking the researcher to imagine the benefit to the end-user and to society at large through experiment and subversion of what is generally taken for granted.

The separation of these three elements of design into their triangular formation with a single element at each vertex allows the researcher to choose which combination of two elements of design research they wish to explore at any one time. By excluding a third element, the researcher is free to emphasize aspects of the research which may be compromised or complicated by its addition at any one time. There is no prescribed order when using the model and the researcher is free to move between elements at their own pace, however an outcome of the research process must be a designed artefact.

THE THREE RESEARCH PHASES

> [I]n assessing the impact of education, researchers have tended to focus on what is taught or how it is delivered. Limited attention has been paid to where pupils learn" (Edgerton, McKechnie and McEwen 2011, 34)
>
> Children bring their bodies and emotions to school every day not just their minds" (Mayall, Bendelow, Barker, Storey and Veltman 1996,1)

These two quotations inspired the formulation of my two primary research questions: "Where do children read in the English primary school?" and "Where could children read in the English primary school?" My experiences as a Reading Recovery Teacher in a London (UK) district notable for social and economic deprivation immediately prior to my doctoral research also prompted me to re-evaluate the importance of the school building for learning when children have little space, attention or comfort in their own homes.

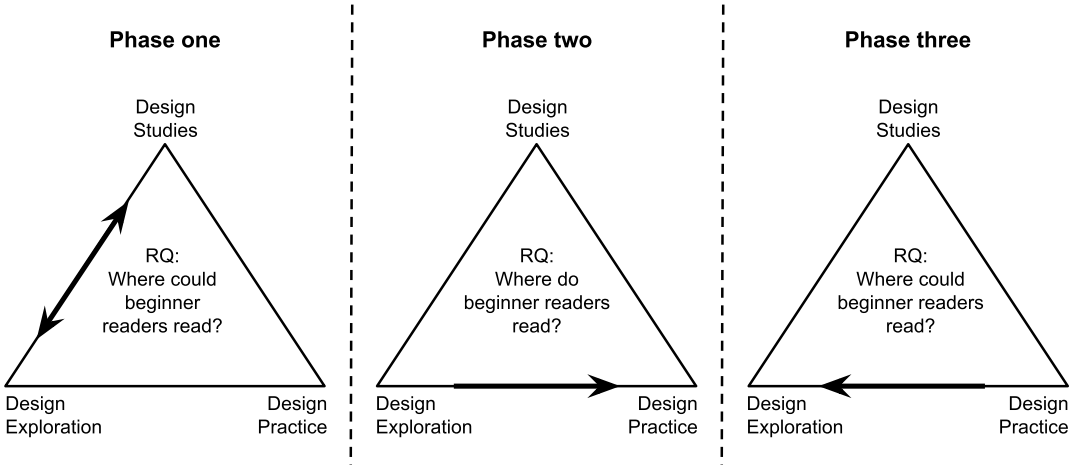

Figure 2.

My research was planned in three phases, as shown in Figure 2, but could equally have continued through other iterations and permutations had time allowed for this. What follows is a selection of findings that emerged in each phase of the project to illustrate the variety of research outcomes.

PHASE ONE: BETWEEN DESIGN STUDIES AND DESIGN EXPLORATION

A feature of design research is that nothing must be taken for granted. In this project, the activity of reading and the teaching of reading was examined through a review of theoretical paradigms of reading, each of which seeks to define what it means to read and to be a reader. The image of a fluent, expert reader -- whether they are a child or an adult -- who is able to lose themselves in a book is often very much at odds with the reality of the reluctant reader in the classroom. Yet it appears that it is the fluent reader who is designed for in the school building rather than the hesitant, or even enthusiastic beginner. Scholars of reading often take for granted the assumption that the body of every reader is absent, cocooned and unaware, whereas my own theoretical perspective of reading, influenced by the phenomenological texts of Merleau-Ponty, draws on a conception of reading as physical and sensory, as expressed by McLaughlin in Reading and the Body (2015). Having contextualized my own understanding of fluent, expert reading as a physical, bodily activity in which the reader learns to habituate and conceal the physicality of the experience, I extrapolated the qualities that differentiate expert readers from beginner readers. I sought precedents of reading spaces inside and beyond the school building that could compensate for the differences between experts and beginners, primarily attending to the vulnerability of beginner readers to unwanted distraction and interruption within the school building. These precedents formed the basis of my first design for beginner readers, known as "the nook."

A dominant paradigm for the teaching of reading in contemporary English primary education has emerged increasingly strongly since 2010. Fundamental to this paradigm is a programme of synthetic, systematic phonics. In the first year of formal education, Year One, when students are five or six years old, the reading ability of all students is assessed by a statutory,

national pass or fail examination. Design for reading in the primary education system in England, therefore, needs to take account of this understanding and delivery of the teaching of reading and consider which aspects of this programme could be supported by design decisions that could help every reader to succeed within this pedagogic model.

Readers are directly and adversely affected by poor design in school buildings. This has been demonstrated through the comprehensive literature in the fields of school design and audiology with reference to noise and learning. Many cohorts of children are particularly disadvantaged by noise in school, for example, those with impaired hearing, autistic spectrum disorder (ASD) and those who are learning English as a second or third language. Acoustic standards can vary according to the types of space where readers learn. Designated teaching spaces, such as classrooms and small group rooms must be of a higher standard than non-teaching spaces: corridors and dining halls. In the second phase of the project, empirical research in schools was undertaken to ascertain where beginner readers read and to ascertain whether these spaces were suitable and supportive of their needs.

PHASE TWO: FROM DESIGN EXPLORATION TO DESIGN PRACTICE

One outcome of the empirical research in a selection of seven primary schools was a simple taxonomy of where beginner readers read in school, Figure 3.

Spaces where beginner readers read in school

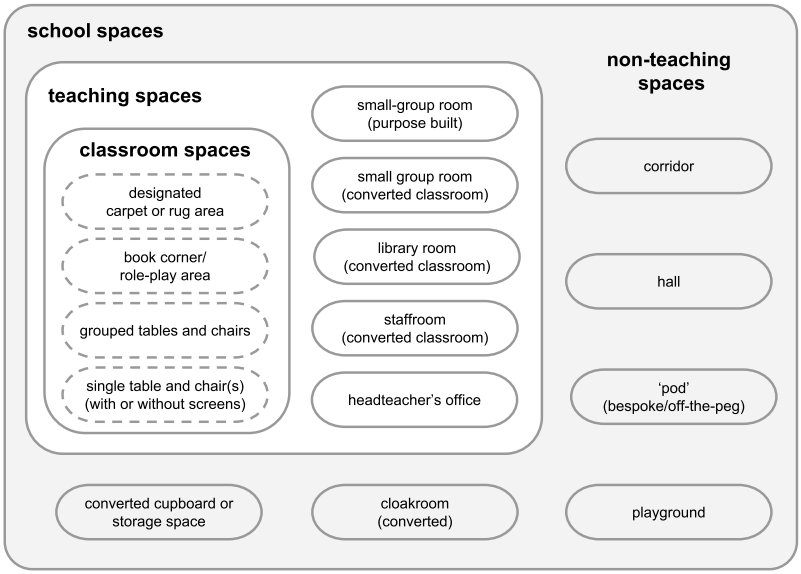

Figure 3.

Beginner readers read in classrooms and corridors; in screened-off corners of assembly halls; in bespoke, wooden, crafted reading pods and in reading corners designated by a single cushion placed beside two plastic cartons of books. A goal of the study was to encourage school designers, policy-makers, architects and school leaders and teachers to engage with this new knowledge about where children read and to engage in discussion about how poorly designed spaces for reading can be improved so that students experience the optimum conditions when learning to read in school.

The variation between schools and even between classrooms in the same school in terms of teachers' design for reading was marked. Teachers complained that their training gave them little experience of design and that their schools provided few resources to help them design spaces for reading, such as time and money. Many teachers improvised book corners in their classrooms with furniture and furnishings brought from home and when I talked to them about their ideal reading corner, it was often very different from the reality of what they were able to offer students. Beyond the classroom, design for reading was haphazard and patchy. Teachers were often unsure where students had been taken for supplementary reading tuition by classroom assistants and had little or no input into the design of these spaces.

PHASE THREE: FROM DESIGN PRACTICE TO DESIGN EXPLORATION

Having created a first iteration of the nook in the design exploration phase, I was able to assess the viability of the design in each of the seven research schools visited during the course of my study. This resulted in a number of changes being made to the first nook design before a second iteration emerged from phase three.

Figure 4.

The second nook was designed to offer an alternative, protected, semi-secluded space within the classroom where students could share books together or enjoy reading alone in a quiet space. In contrast with the school library, storage and display for picturebooks were poorly provided for in classrooms, despite teachers' desire for and attempts to provide something better. The nook, as a consequence, afforded ample provision for the display of books of all sizes that were easily accessible to students.

CONCLUSION

The nook artefact that emerged from this study may be useful as a practical replacement to the reading corner in classrooms, offering inexperienced teachers a piece of furniture that they can easily assemble.

The designed artefact is a secondary outcome of the research for which the primary aim is to re-evaluate and reimagine the way in which education in general and the teaching and learning of reading in particular can be viewed through the prism of design. Beyond the contribution to knowledge about the types and qualities of spaces where students learn to read in primary schools -- an aspect of educational research that has long been neglected -- the use of Fällman's framework has been outlined in this paper as a new methodological approach to school design. This framework, when employed as a research tool, could shape and define further projects that foreground the end-user in the context of the school building, for example, school design for cohorts of children with special educational needs in the mainstream school.

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The mobility of people, not furniture, leads to collaboration

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ABSTRACT

I argue that physical diversity within a larger space is more beneficial for teacher collaboration than flexibility because flexible spaces are not equal to flexibility in the organisation. Teachers share a space when they move around in it amongst each other, not when they are moving furniture around. Most teacher practices are connected to a spatial understanding, which is influenced by the long history of dividing students into classrooms. My ethnographic study explores how the teachers unknowingly are influenced by the roots of their profession and thus arrange furniture against their pedagogical intentions supporting their positions near the display-screens which are used in the beginning of most learning sessions, and in this way reverting to a more traditional furniture setting and practice. The furniture shapes the teachers' actual practice and physically separates them from each other, causing divisions of the space as well as in the teacher practices. I suggest that when designing or researching learning spaces in the future, we should look at the positioning and mobility of the teachers' bodies in the space.

KEYWORDS: FLEXIBLE SPACES; LEARNING SPACES; TEACHER COLLABORATION; HABITS; ETHNOGRAPHY

Mie Guldbaek Broens is educated as a teacher and MA (Ed) in Educational Anthropology. The past 7 years she has been studying physical spaces and social behaviour, mainly in educational environments. She has done in depth research on teachers' collaboration and the relationship with the physical space. This has led her to do studies on acoustic environments with a focus on 21st century learning. She studies schools on a more general level by visiting schools all over the world looking at the connection between spaces and pedagogical approaches.

INTRODUCTION

In this paper I explore how Australian teachers who wish to collaborate are using an open flexible learning space. My study is built on 300 hours of observation of a teaching team consisting of six teachers working with 180 Stage 3 (year 5 and 6) students in one open plan learning space in Sydney. The space is designed as a collaborative and mobile environment for the teachers as well as the students with custom-made movable modular furniture, large-screen displays and a robust Wi-Fi network with access to online resources. All to ensure that both teachers and students are able to be mobile and have a high degree of choice. I chose this space because the school is well known for being successful in changing its physical environment to support its pedagogical intentions (Calvo, 2015, p. 45; Mayfield Awards, 2012). This was the first space they changed and it had been in use for four years when I undertook my fieldwork, aiming to explore the dynamics behind a teacher team used to working in an open agile space.

The space was an important element of my investigation of teachers' collaboration because, as Foucault argues, it is somewhat arbitrary to disconnect the practice of social relations from the spatial distributions as it is impossible to understand one without the other (Crampton and Elden, 2007). Most of us will find it hard to imagine school without imaging a building or a space at the same time. The same goes for teachers' practices, which are closely connected to their understanding of education as a spatial practice.

During my fieldwork, I discovered that when certain traditional teaching practices were taking place accompanied by physical positions, no teacher collaboration would occur. I also realised that in some spaces collaboration amongst the teachers would occur more frequently. This spiked my interest into researching how the teachers position themselves in relation to each other, both physically in the space, and as members of a team.

MY PERSPECTIVE ON THE FIELD

This study is an ethnographic study, which is an approach increasingly being used within learning space research when looking at the physical space and its social actors (Blackmore, Bateman, Cloonan, Dixon, Loughlin, O'Mara & Senior, 2011; Campbell et al., 2013; King, 2016; Palludan, 2005; Saltmarsh et al., 2015; Yeoman, 2015). While much of the literature on learning spaces focuses on the quality of conditions or users' perceptions, I focus on the educational practices and how the space is used and to what effect (Blackmore, Bateman, Loughlin, O'Mara & Aranda, 2011). Ethnographic studies are an asset to educational research, because as a researcher you have an opportunity to immerse yourself into this rather complex field and present an aspect of it. I am exploring this field with an understanding that this research does not stand alone but is part of a developing 'body of work' within learning space research that aims to provide nuanced perspectives on complex learning environments.

My inquiry is inspired by social science research on cultural spatiality and texts, which try to understand how people interact with their environment, and see space as both a medium and a product of social practice (Berger & Luckmann, 1967; Foucault, 1975; Augé, 1995). I focus on the social practices of the teachers and on understanding how the space is produced and reproduced by their agency. For the purpose of this study, I understand everything as socially situated and my perspective is that knowledge and development occurs in the interaction between people and between people and objects.

To have a broad perspective and keep an open mind to new ideas and impressions, I used a range of methods in my fieldwork that helped me expose various themes in the field. Drawing furnished floor plans and registering users' movements turned out to be one of the most valuable methods even though it was very time consuming. By drawing the space I got to know it intimately and I became aware of all the furniture and spaces that were never used. Had I solely been focused on observing the users and following them, I would not have paid attention to what they did not use, which provided an insight into how the teachers interacted with the space in general.

I examined my data using thematic analysis (Braun & Clarke, 2006; McCarter & Woolner, 2011; Thomas & Harden, 2007), a research tool used to identify, analyse and report themes or patterns within data. Themes and patterns are found through

phases of coding, where important instances in the data first are identified and then developed. Initially I coded all my field notes based on themes I had found in my drawings. Then I re-interrogated the data and found recurring words based on physical places and finally I went over the data using the themes that I had established from the patterns developed through my two initial codings. I would, for instance, cluster activities together that would take place in various spaces, thereby noticing that I could interpret the activities to represent two particular and very different types of behaviour, *passive* and *active*. I then chose to use these two categories to re-examine the data with a comparative analysis of the teachers' and students' behaviour to find out if different combinations of active and passive behaviour among the teachers would limit or enforce certain behaviour amongst the student in any way. The power relation between the social actors, especially the teacher's power over the students, might be less obvious in a flexible or open learning space than in a classroom setting. Thus it is important to find a tool that can help analyse how the power relations are in this social setting, both between the users and between the users and their surroundings.

POWER RELATIONS IN THE LEARNING SPACE

The teachers generally have the power over the space because most of the furniture is mobile and provide the teachers with the opportunity to set up the space(s) as they see fit before every term starts. Thus the teachers have the power over the students, in that they dictate their ability to use the space. The teachers are the creators of the space when they reconfigure the space ad hoc for certain activities, and because they configure the space in more permanent settings. The students, however, only co-create the space when they choose places and furniture to work at. After an activity or when the day ends, the space will be "tidied up", a common discipline within educational culture, which means that the furniture will be returned to the places dictated by the teachers. Foucault (1975) argues that the use of power is often invisible to the social actors. Discipline, he states, is the mechanism of power that regulates the thoughts and behaviour of the social actors - people are being shaped without realising it.

As part of my analysis I chose to use concepts developed by Foucault who considers spatiality an integral part of the power relations between the social actors. His theories are built on the notion that power only exist when executed and is not something that can be had (Richter, 2011). When we (people) exercise power there is usually a rationale or knowledge associated with it, we have a knowledge of what we do and what we intend. However, it is important that we do not confuse intention with effect because there is always an element of uncertainty associated with power as it involves more than one actor. This can lead to the outcome not necessarily living up to the intention (Richter, 2011). As in the example above, where the teachers in reality "sit" on the power through the configuration of the space, even though the school purposefully designed the space so both teachers and students would have a high degree of choice and agency.

Foucault argues that we can use panopticon, the hierarchical organisation, as a scheme to inform us of where to distribute individuals in relation to each other in the space, whenever dealing with "a multiplicity of individuals on whom a task or a particular form of behaviour must be imposed" (Foucault, 1975, p. 205). If that is the case, we must be able to reverse the scheme and use it to investigate why the individuals are distributed the way they are, the hierarchy of the furniture and space.

As part of my investigation of the hierarchy of the furniture and their placement, I analysed my furnished floor plans by first categorising the different elements such as furniture that one would: sit on, use as table tops, use for storage, or use to support a presentation. Then I converted the floorplans into diagrams focusing on various power relations between the spaces, the furniture etc. After having worked with different divisions, diagrams and categories, a pattern emerged. Not only were spaces within the larger open space created, in large, by the furniture, but the presentation furniture would address the rest of the space and the seating furniture would address the presentation furniture. This organisation was creating spaces, within the larger open space, that were closed in on themselves and not interacting with each other. The dominating element defining every one of these spaces is what I call the *front*. The front would most often consist of a display-screen or a whiteboard (whether mobile or painted on the wall) and was to a large degree defining the teacher's place within the space.

FIXED TEACHER POSITIONS

When using a display-screen the direction of the viewers is automatically established. The teachers use the display-screens as a visual aid for their explanations and stories while standing next to them, using them like one would use a stage, thereby taking advantage of the furniture's hierarchy to naturally attract attention from the students - their audience. Creating a front, which is used for direct teaching, is a way to support this activity and the role that the teacher has while engaged in the activity. When the teachers take their place at the front certain expectations concerning behaviour is 'projected' into the space. No-one is in doubt that whomever is at the front is the one we should all be listening to. "Eyes up front" is a term we know from classrooms when teachers want the attention of their students. In this situation the hierarchy of the space and the actors is clear. The listeners are expected to be docile and the teachers have the perfect position for supervising them while they teach.

Surveillance is, according to Foucault, an inherent mechanism in the practice of teaching (Foucault, 1975) and though we nowadays do not talk about surveilling the students, we do still emphasise the importance of "supervising", "keeping an eye on" or "having an overview of " the students. This educational culture is apparent in the design of the space I observed, where all the display-screens have been placed where you would stand to have the best overview of the building. Four out of six teachers had placed their caddies (mobile teacher table) permanently at the front in close proximity to the screen. It is likely that the action of placing a mobile furniture permanently anywhere is not questioned because it is at the front which is a spatial distribution we are used to throughout the history of education. During explicit teaching sessions where the screen is used as an aid, it makes sense because the teachers rest their laptop on the caddy. However the teachers never move their caddies and therefore themselves after their presentations, even though the students leave their positions to spread out and work independently.

The teachers' bodies become stagnant and docile in this position, disciplined by the space (the front) and furniture (screen and caddy). Slowly, the space around them is adjusted to this position's permanence, and they start creating an independent space suited for all the different activities and groupings they are working with. The spaces are arranged around the teachers providing options within eyesight and at the same time limiting the options that would require movement. The diverse furniture is moved and arranged within the space near every fixed teacher position instead of grouped throughout the overall space. Gradually, the configuration of the space is influenced more by the teachers' docile bodies than by their pedagogical beliefs. The teachers' fixed positions in space separated from each other cause division in the space as well as in the teacher practices. By using the screens to structure the learning sessions the teachers revert to a more traditional furniture setting and practice and their positions become a catalyst for how the students can and will use the space(s). In duplicating the features between home bases the diversity in the overall space is diminished. The intention of the agile space and the flexible furniture was not to create almost identical home bases, but to provide opportunities for the teachers to create places that would suit the various activities and group sizes.

TEACHER-MOBILITY LEADS TO COLLABORATION

The fact that the home bases are featuring the same elements, is making it less relevant for both students and teachers to move between them, which have consequences for their collaboration. Already during my fieldwork, I identified that the teachers were collaborating more when working in one half of the space, however, it was not until my analysis of the elements in the space and the teachers' movements that I realised the correlation between the established fronts and teacher collaboration or lack thereof. In the area where three home bases are sharing two well-functioning display-screens the teachers tend to collaborate on introductions and explicit teaching sessions. There is not a fixed position next to the display-screen as the teachers place their caddies elsewhere and use a generic table to support their laptop when using the screen. The table is used by teachers as well as students when working independently. This organisation of furniture and hierarchy in the space leads to the teachers working closer together and roaming around the space when the students work independently.

Through my analysis of the teachers' movements around the space with only two display-screens I uncovered that the teachers' mobility and engagement in shared activities support collaboration in the team. Teachers, who move around in a space together and amongst each other, are more likely to collaborate because they have to negotiate, coordinate and share. They start using more time on planning the use of space and how to utilise each other when executing learning activities. They join in committing to the task of optimising the learning situation. When a team has a joint commitment, the commitment no longer belongs to the individual but is shared amongst the collaborators (Amit, 2012). This type of deep collaboration (developing and executing student activities) is rare to see in typical educational environments (OECD, 2016; Schleicher, 2016).

My analysis of the situations in which I observed teachers' collaboration, points to spaces that are not allocated to any specific group of users but can be used by all depending on which activities are being organised, as the most valuable spaces for teacher collaboration. It is possible for multiple users to share a feeling of association and belonging to a space as long as no individual has priority or a permanent place in that space. The hierarchical organisation of the space and actors enables teachers to have equal rights over the space, help students working there and to find ways to move around amongst each other and work together.

Dixon (2013) suggests that we should look at and listen to children's bodies before we teach, because they are the target of pedagogical power, and it will be a way to understand the impact and consequences of the powerful discourses they are shaped by. Inspired by Dixon, I suggest that when designing or researching learning spaces in the future, we will benefit from looking closer at the positioning and mobility of the teachers' bodies in the space.

SUMMARY

I was interested in investigating flexible open learning spaces because existing knowledge promotes spaces that can be reconfigured as a way to provide teachers with choices for their preferred learning setting. An important point of my analysis is that flexible spaces are not equal to flexibility in the organisation. The teachers shared the space when they moved around in it, not when they were moving it around. Thus I argue that diversity in spaces is more beneficial for teacher collaboration than flexibility. During my analysis it became clear that no matter how much the teachers tried, their pedagogical intentions were in effect changed by the strong influence the physical setup had on user's behaviour. Physical elements determined, to a large extend, the teachers' places in the space. Teachers could feel that they were sharing a larger space meanwhile creating their own spaces within it, where their positions and practices would resemble those in a traditional closed classroom. The difference being that in the open space, the individual teacher's practices and behaviour influence the behaviour of the other actors in the space. An important point in my larger analysis (of which this paper reflects one segment) of teacher collaboration is that learning how to share a space is an individual journey that involves changing practices and habits. However, the journey takes place in a joint process with all the teachers who share the space because moving around in the spaces in order to cater for different activities entails that there are no fixed teacher positions. Transport between spaces, which can be done without coordination, does not attribute any value to the learning situation or teacher collaboration. Moving around within a space or between spaces becomes an important distinction.

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Innovative Learning Environments, are they inclusive? Why evaluating the speaking and listening potential of the space matters

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ABSTRACT

The innovative learning environment is a speaking and listening space, a platform for student and teacher collaboration, creativity, complex problem solving and communication. While an increasing body of research is exploring how teachers and students use such spaces, a gap exists in research that defines how these environments include a broad range of inhabitants, in particular a postulated 7–10% of students with suboptimal hearing abilities (Tomlin, 2014; Wake & Poulakis, 2004).

Through an emergent interdisciplinary approach research on an open-plan innovative learning environment explored 3 students with hearing difficulties perceptions of inclusion, aiming to uncover instances of opportunity for equitable participation in speaking, listening and learning situations. Whilst data collection methods privilege student voice, other corroborating evidence such as acoustic measures determine the building's capacity to control noise. Photographs were gathered in an effort to enhance validity and support a multi-lens approach to understanding the setting. Interviews with teachers and students and focus group discussions, broadened insights into the daily occurrences in the space. Through interrogation of the interplay between design affordances, technology, spatial attributes and pedagogy, instances were found that enabled opportunity for inclusion of students with hearing difficulties.

The mixed methods approach led to the discovery of the value of 'nooks' (sensory reduction zones within the learning environment) and 'the trusted other' (a person the case study students identified as a good peer who could aid their learning). Coupled with access to technology tools for listening and learning, the students reported feelings of inclusion in communicative experiences. Noisy spaces with high reverberation times precluded the case study students from accessing clear speech. However, it was found that when student agency was given, self-advocacy and self-regulation mechanisms were exhibited by students i.e. the students explored their environment, finding spaces, places and multimodal platforms that supported their learning.

KEYWORDS: INCLUSION, CLASSROOM ACOUSTICS, HEARING

Leanne is an educator, researcher and passionate about innovative learning spaces that offer enhanced opportunity for participation. Her research skills are evaluating innovative learning environments and the design affordances that enable inclusion in learning opportunities. After working in Education for 18 years, and becoming a member of the Melbourne University LEARN team, she started Learning Space Consultancy. Leanne's research interests are underpinned by Success Case Methodology (Brinkerhoff 2005) which accounts for performance management systems and the role that learning plays in it to achieve results. This has lead to theory building regarding policy and governance and the impact on the individual. In 2012, Leanne was a major contributor towards the Government Draft Standards Committee for the Department of Education and Early Childhood Development in Victoria that formulated hearing accessibility standards for learning spaces.

THE INNOVATIVE LEARNING ENVIRONMENT

Innovative learning environments (ILEs) are speaking and listening spaces, a platform for student and teacher collaboration, creativity, complex problem solving and digital information gathering and sharing. Such learning spaces are auditory verbal environments where the primary information exchange occurs through speaking and listening activities (Munro, 2011). In designing innovative spaces there must be confidence that they are fit-for-purpose, account for diversity and ensure that speaking, listening and communication is accessible. The design principles of innovative learning spaces must enable the inclusion of all students and in particular a postulated 7-10% of students with suboptimal hearing abilities (Tomlin, 2014; Wake & Poulakis, 2004).

A shift away from traditional school design towards ILEs commenced in Australia between 2008 and 2012, when a government initiative known as Building the Education Revolution provided funding to schools to build new learning spaces. Numerous new schools, particularly in the state of Victoria, were designed as technology enhanced learning environments consisting of a series of open-plan visually connected spaces with semi-connected 'breakout' areas. The spaces were designed to inspire student-centred active learning pursuits. Such pedagogical approaches value student collaboration and participation in socially oriented learning and 21st century skill development (Blackmore et.al, 2013 Griffen & Care). Figure 1 is an example of an Innovative learning environment (ILE) built during the BER 2008-2012.

Figure 1: Innovative Learning Environment in an Australian primary school (Leanne Rose-Munro, 2013).

THE PROBLEM

While an increasing body of research is exploring how teachers and students use such spaces, a gap exists in research that defines how these innovative environments include a broad range of students, in particular a postulated 7–10% of students with suboptimal hearing abilities (Tomlin, 2014; Wake & Poulakis, 2004). Australian Hearing, a statutory authority constituted under the Australian Hearing Services Act 1991, provided services to 68,296 eligible children and young Australians with hearing loss during 2012–2013 (Australian Hearing, 2013). An overwhelming majority of these students attended mainstream schools in their local communities (Byrnes, 2011; Vosganoff, Paatsch, & Toe, 2011).

Listening in noise is a barrier to participating in conversation for many people. However, of great concern is that research also indicates that students for whom English is an additional language, and those with speech and language difficulties, learning difficulties, cognitive disorders, attention disorders and behavioural problems also have difficulties listening and interpreting speech in noisy learning spaces (Massie & Dillon, 2006; Rowe & Pollard, 2003; Sharma et al., 2009; Shield, Greenland, & Dockrell, 2010; Smaldino & Flexer, 2012; Snow & Powell, 2008). It is also widely reported that noisy environments adversely affect students with sensory disorders such as autism and vision loss by impacting cognition, heightening anxiety and diminishing access to clear speech (Anderson, 2001; Clark & Sorqvist, 2012; Guardino & Antia, 2012; Katte, Bergstroem, & Lachmann, 2013; Smaldino & Flexer, 2012). Collectively for the purpose of this research, this cohort is referred to as students with hearing difficulties.

The study of acoustics, defined as the properties or qualities of a room or building that determine how sound is transmitted in it, have highlighted detrimental effects of noisy 'classrooms' on learning (Shield, Greenland & Dockrell, 2010). Little is known about noise and acoustics in ILEs, as the interrelationships of pedagogy, innovative spatial design and technology are not yet broadly investigated and reported. This collectively highlights the fundamental importance of evaluating innovative learning environments ILEs to ensure that they offer enhanced opportunity for inclusion and student success.

INCLUSION

It is widely recognised that in mainstream learning environments there is a diverse range of students with a variety of learning potentials and abilities. The term 'mainstream' implies that students will need to adapt to fit into the majority culture, and inclusion signifies that the program will make adaptions to fit the needs of all students in the classroom (Stinson & Foster, 2000). In determining the elements in an ILE that enable inclusion, it is important to consider the quality of the students' experiences whilst accounting for opportunities that help or hinder participation. Kay asserts it is unfair and unproductive to expect students to meet new and higher expectations in 21st century learning spaces if the supporting infrastructure is not there (as cited in Bellanca & Brandt, 2010). To this, little is known about technological, pedagogical and acoustical affordances in ILEs and how these elements play a role in creating new experiences for students with hearing difficulties (Brown & Eisenhardt, 1997; Glaser & Strauss, 1967; Spencer & Marschark, 2010). As such, this research project exists within a transformative theoretical framework that aims to advance the needs of underrepresented or marginalized populations (Creswell & Plano Clark, 2011).

EVALUATING INCLUSIVENESS OF THE INNOVATIVE LEARNING ENVIRONMENT

This research study adopted mixed method multiple case study design involving three students with hearing difficulties in one ILE in which the students form the cases and the school is the site. An interdisciplinary approach using methods from acoustical engineering, audiology and social science research were employed to gain insight into the environment under investigation.

METHODOLOGY AND METHODS

The case study students were central to the investigation and identification of affordances of the ILE, in particular the student's perceived level of inclusion, the quality of their experiences in the learning environment and their interpretation of such. An affordance can be described as a quality of an object or an environment that allows an individual to perform an action (Gibson, 1977; Wright & Parchoma, 2011). Affordances are also properties of the system, as perceived by the user, that allow certain actions to be performed and which encourage specific types of behaviour (Cox et al., 2003). Affordances speak directly to the quality of an experience as a result of an action, and in doing so go beyond the current rhetoric of inclusive education policies that speak to the notion of reasonable adjustments (Disability Discrimination Act 1992, 1992; Disability Standards for Education 2005, 2005).

Research questions asked in this study included:

- What is the lived experience of students with hearing difficulties in innovative learning environments?
- How are teachers planning the use of the environment to promote inclusion?
- What level of noise is present in the environment?
- How and in what ways is communication facilitated?
- What elements within the open-plan learning environment facilitate opportunity for participation in speaking and listening?

The primary aims of the project were twofold: to investigate the affordances of the environment that enhanced inclusion for students with hearing difficulties and to investigate factors that enabled hearing accessibility in open-plan innovative learning environments.

The subsidiary aims were to:

- Investigate the environment's technology and acoustical affordances and properties to determined their influences on inclusion and subsequently what affordances should be adopted as best practice initiatives, and to
- Investigate the teachers' and students' preferential use of places to communicate within the learning space to determine how innovative learning environments could be best utilized for optimal access to speaking and listening activities

The emergent methodological approach enabled the capture of convergent and divergent thinking regarding the intersection of the elements of pedagogy, space and technology in the innovative environment, and the subsequent impact upon inclusion of students with hearing difficulties. Table 1 outlines the qualitative and quantitative methods.

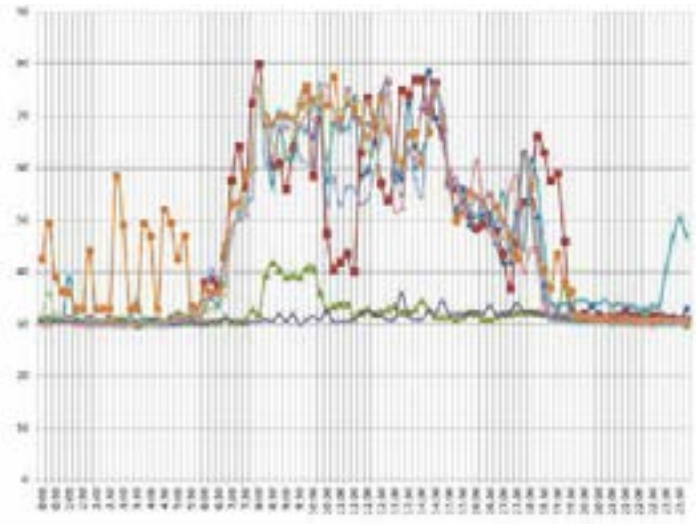
Table 1: Qualitative and quantitative measures.

Qualitative methods	Quantitative methods
Formal & informal observations	Building Acoustic Measurements
Photo elicitation	-Reverberation Times (RT)
Semi-structured interviews	-Noise Logger (dB)
Focus groups	-Clarity of speech (C50)
	Architectural Documents & Drawings
	Technology Audit
	Student hearing test (audiogram)

ANALYSIS

Photographs of the learning environment were taken at various phases of the data collection process. This iterative approach allowed for the capturing of occurrences as they emerged. Photo elicitation enabled the participants and researcher to interrogate their own understandings of the phenomena under investigation (Moss, 2008).

A noise logger, an acoustical measurement tool, logged the average equivalent background noise measured in decibels over time within a set position in the ILE. This measure gave an indication of the typical background noise levels that students and teachers commonly experienced within this space over time. Noise was logged at an average of 75 decibels (dB). It is reported that for intelligible speech to be heard by students with normal hearing abilities at a distance of 2-3

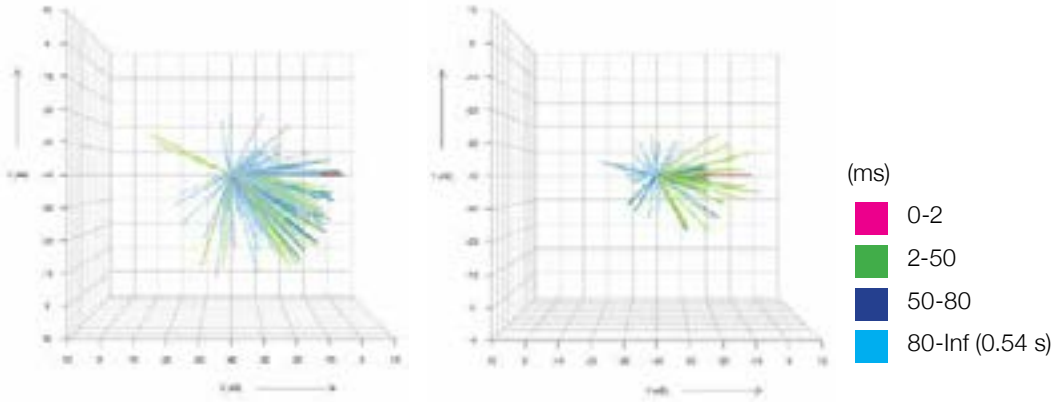


Graph 1: Noise logger data, average noise level reading 75dBA, administered by Marshal Day Acoustics Pty Ltd.

meters from the presenter, background noise should not exceed 55 dB (Flexer, C., Smaldino, J., & Crandell, C., 2005) and the voice of the presenter be 20dB above background noise. Effectively a teacher would have to shout at 95 dB for this condition to be met.

Reverberation times were recorded; these are a simple indication of how the building performs in terms of absorbing sound reflections or echoes. The breakout spaces in the ILE recorded between 0.4 standards > 0.6 RT (reverberation time), satisfying recommended RT for 'classrooms' (AAAC, 2010). However, the adjacent open plan common learning area recorded 1.1 RT, far exceeding recommendations. This noise often spilt into the break-out zones and was reported as 'an annoying source of disruption' by a case study student, this sentiment was repeated by other students and teachers throughout the study.

Finally, innovative equipment was administered by an acoustical engineer that captured the clarity (C50) of speech sounds at



Poor speech clarity. Good speech clarity.

Graph 2: Comparison of speech clarity C50 Marshall Day Iris plot™ readings.

points within the learning environment. These measurements are depicted as an Iris plot™ in table 3, which showed the most direct signal from the source to receiver (red spike) and interfering sound reflections (blue and green spikes). This data enabled the identification of optimal positions for presenting when addressing students in speaking and listening activities in the ILE.

For the specific case of students in classrooms, the Association of Australian Acoustical Consultants recommend the following acoustical design conditions, outlined in table 2, be satisfied.

The quantitative data was fundamentally important in uncovering evidence that corroborated or explained what helped or hindered inclusion in communicative opportunities for the case study students in particular circumstances in the ILE. This then led to substantive inferences about the affordances of the environment that were further interrogated using qualitative methods such as semi structured interviews and focus groups.

Table 2: Guideline for Educational Facilities Acoustics (AAAC, 2010).

Recommended classroom acoustical design conditions Association of Australian Acoustical Consultants Guideline for Educational Facilities Acoustics (2010)
• A spoken voice level at least 15dB above the background noise level throughout the room; • Background noise levels of 30-40dBA, or less when unoccupied; • Overall sound levels (consisting of teaching voice and student voice) no greater than 65-70dBA throughout the room; • Sound absorbing materials, placed to minimise reverberation to less than 0.4s in primary teaching spaces and 0.6s in secondary teaching spaces, including at least 40% absorptive treatment on the ceiling; • A Speech Transmission Index STI > 0.6 in open plan teaching and study spaces • For the further case of students with special hearing requirements the following acoustical design conditions should also be satisfied • Reverberation time of 0.4 seconds or less • Signal to noise ratio of greater than 20dB.

FINDINGS

It was found that in particular locations the teachers voice was clearer, this was attributed to the shape, configuration and structural elements in the room such as noise control acoustic rated wall panelling, lower ceiling height with acoustic rated tiles, carpet and soft furnishings that dampened noise. When students were given agency, the power to act (van Leir, 2008), they intuitively positioned themselves in the spaces that had been empirically identified as having good acoustic affordance, and supported greater accessibility to clear speech.

Technology such as iPads and interactive whiteboards enabled visual clues and prompts to be accessed by the case study students as a substitute to speech communication when excessive noise was generated by surrounding student and teacher activity. Technology devices also provided a level of anxiety reduction by engaging the case study students in learning via multi-modal pathways. 'Special' access to technology tools gave comfort to the students with hearing difficulties who at times completed tasks before other students not identified as having a hearing difficulty. While technological affordances were present and in abundance in the ILE student use was restricted by the teachers who tended to deploy tech tools as 'an additional learning activity' rather than an embedded part of learning. Similarly, the ILE was fitted with a sound-field system, consisting of a number of distributed low-level amplification speakers, a teacher-worn microphone with a student pass around hand-held microphone. The sound-field speakers lifted the voice of the presenter above the background noise, overcoming the distance from the teacher-to-background noise ratio for students. When the sound-field system was in use noise generation momentarily abated in the immediate area as well as co-located spaces. This Lombard effect, the involuntary tendency of speakers to increase their vocal effort when speaking in loud noise to enhance the audibility, was resolved by the sound field system (Flexer, Smaldino, Crandall, 2008). Teachers no longer shouted and competed with each other to be heard when using the system. While all teachers acknowledged the benefits of the use of such technology, it was spasmodically used. This frustrated one of the case study students who took it upon herself to constantly remind teachers to use it.

Developing a culture of trust in working with others was identified by the case study students as fundamental to their inclusion in the ILE. To this, the teachers had not articulated such an observation. There were many times, particularly when noise escalated, that student agency was taken away and didactic teaching prevailed. At these times, the case study students could not access their learning buddy, reposition themselves to acoustically supportive positions or use technology to bridge in to the learning activity. Noise appeared to be the trigger for reverting to didactic teacher-centred practices. Teachers reported feelings of exhaustion after days of working in noisy spaces, justifying decisions to limit collaborative activities in the open plan area and retreat to the breakout areas for quieter teacher directed learning activities, where they felt they could have an impact on noise control.

OUTCOMES OF EVALUATING THE INCLUSIVENESS OF AN ILE

Through the interrogation of the interplay between design affordances, technology, spatial attributes and pedagogy, instances were found that enabled opportunity for inclusion of students with hearing difficulties in the ILE. Although when fully occupied the ILE generated excessive noise, well above recommended standards considered appropriate for workplaces and speaking and listening scenarios, opportunities to participate in diverse learning activities existed with the case study students reporting regular feelings of inclusion. When student agency was given, self-advocacy and self-regulation mechanisms were exhibited by students i.e. the students explored their environment, finding spaces, places and multimodal platforms that supported their learning. At times, the aspirations of 21st century skill development (Griffin & Care, 2012) could be observed. Students and their learning buddies co-constructed knowledge communicating through multi-modal pathways not reliant on the transmission of speech but rather through text, pictures, model materials and technology devices.

When teachers used the affordances of the ILE such as the sound-field system, interactive whiteboard and iPads, noise was moderated and students reported feelings of inclusion in communicative experiences. The discovery of the value of

'acoustic nooks' (sensory reduction zones within the learning environment that moderated noise) and 'the trusted other' (a person the case study students identified as a good peer who could aid their learning) were identified as affordances of the ILE that enabled inclusion of students. See Figure 2.

Figure 2: Example of working with a trusted other in a 'Nook'.

CONCLUSION

Rigorous evaluation of ILEs presents a plethora of opportunity for many stakeholders invested in enhancing educational outcomes for all students. Design principles associated with inclusive fit-for-purpose speaking and listening environments have yet to be broadly identified in the context of education building infrastructure. While many studies have demonstrated that excessive noise has detrimental effects on learning, assumptions regarding open-plan learning environments based on past research may not apply in these technology rich spaces that employed the use of innovative acoustic materials, design elements and student-centred pedagogies.

This study used a multi-lens approach that valued collaboration and interdisciplinary thinking, which sits within the philosophical framework of 21st-century learning environments. Broad approaches such as those described above are supported by Kalikoff who put the case for a mosaic approach that involved the implementation of a series of textured and complementary evaluation strategies that aimed to provide reliable and detailed information about what was being accomplished in the context of the environment under investigation (Kalikoff, 2001).

While it was found that particular identified affordances enhanced inclusion of students with hearing difficulties in the ILE, there were many instances where students were inadvertently excluded. There is an urgent imperative to identify and embed design principles for learning spaces that account for high-quality noise control and professional learning for teachers and administrators involved in operationalising such spaces. As such, return on investment of rigorous evaluation of learning spaces is validated by assurance that identified design principles lead to development of exemplar fit-for-purpose learning environments that offer opportunity for all students, in particular those with hearing difficulties to be actively and successfully included in learning.

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At the OECD, he led projects including the Learning Environments Evaluation Programme, a school level survey on how the physical learning environment supports teaching and learning; country policy reviews in Portugal and Mexico on the effectiveness of school building modernisation and renovation programmes to meet the needs of education; and project on "Higher Education Spaces and Places: for learning, innovation and knowledge exchange". The OECD survey on learning environments resulted in the OECD Centre for Effective Learning Environment's publication "Designing for Education: Compendium of exemplary Educational Facilities 2011" drawing examples from 28 countries across the world. In 2007-2010 he led the OECD report on "Capital Funding in Educational Facilities: The role of public-private partnerships". He co-authored "Managing the Brief for Better Design", Routledge, 2nd Ed (2010).

Hack the school: A creative toolkit to transform school spaces

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ABSTRACT

"Hack the School" project works as an open challenge that offers school communities a guided experience to support the transformation of their learning spaces. The aim is to foster change through a comprehensive and co-creative approach facilitating the transition from traditional uses of space to innovative ones always having the concept of wellbeing as primary agency. A conceptual framework based on 7 principles—welcome, belonging, communication, cooperation, diversity, movement and transduction—and an applied creative toolkit equip the process and provide a unique and novel perspective to the topic of innovative learning environments. Thus, the project channels the emerging needs regarding educational spaces challenging the current regulations that the public administration applies in Spain and initiates a dialogical collaboration between the field of education and architecture. The challenge open to all schools and funded the Jaume Bofill Foundation received over 170 proposals only in the Catalan context where 30 schools were selected and are now becoming effective "hackers".

KEYWORDS: SPACES, WELLBEING, COMMUNITY, CO-CREATION, PROCESS

Silvia Sasot (Architect) and Esther Belvis (Artist-Pedagogue) work on together designing creative processes with the aim to transform educational spaces and foster wellbeing among the communities. They have worked in different educational initiatives both creative and research based with an inherently practical focus. As designers of the Creative Toolkit Hack the School they have had the chance to create and test both a theoretical framework and a set of tools to foster the transformation of school environments.

INTRODUCTION: SCHOOLS SPACES TRENDS AND LEGISLATION IN SPAIN

Innovation trends in education often embrace a frantic change approach which is mainly associated with improved performance and constant adaptability to change. In this paradigm where production and efficiency lead the value of emerging ideas, the concept of space in educational settings has been widely discussed mainly associated with the incorporation of information and communications technology (ICT) (Adell & Castañeda, 2012). Although ICT can be conceived as a trigger of many emerging challenges in education, the truth is that educational improvement involves a conglomerate of interrelated aspects that need to be considered and addressed. Current emerging pedagogies focus on the search of optimal methods and formulas to respond to the standards proposed by the educational systems and other international bodies, such as the Organisation for Economic Co-operation and Development (OECD), whose seven principles of learning have become a key motor for the introduction of the concept innovative learning environments. Despite the value of those principles and its significance in establishing new approaches for both practitioners and policy-makers, the fact is that the conceptualization and possibilities of innovative learning environment (ILE) are subjected to the contextual needs and regulations. There are deep patterns of thinking related to traditional educational buildings design: classroom, corridors, table-chair, teacher desk, teacher room, etc. There is a need to observe and problematize, both subjectively and objectively, the patterns of thinking that go into designing school buildings and educational spaces, as the paradigm related to Spanish school architecture is often quite conventional. Rather than attending to respond to diversity, the predominant paradigm of school building design trends towards homogenization.

Spain has regulations on the types and sizes of spaces that should be included in a building; the government creates an institutional category and sets forth policies on the design of educational sites. When school architecture is strongly regulated by the government, diversities are harder to reach and the thinking endorsed by the government easily gets reproduced. From an objective perspective, and in order to steer away from homogenization, it is necessary to define the key aspects of learning environments from a wider perspective. In our context, a blueprint is provided by the government defining classroom square metres and specific square metres. Only “productive” spaces are considered, i.e. where one teacher leads one group of students. Regulations do not consider shared areas, community spaces and open learning environments. Public schools nowadays are not allowed to create open learning environments because of outdated regulations and technical interpretations. The school spaces design is closer to a factory design (production) than a community design (co-living). This regulation has being revisited twice since Spanish Constitution was signed in December 1978 (March 2010, June 1991). The same thinking concept is found in the May 1978 document (during Spanish Transition 1975-78) and in the document May 1971 (during Franco dictatorship). Thus, it is necessary to shift the paradigm and create a contemporary approach collecting the best from our local history before the Civil War (1936-39) and Franco’s Dictatorship (1939-1975). This architectural conception has been developed and embodied by several generations, making it really difficult to break through this conception that firmly support a traditional approach to learning. However power, along with the government, is also in the hands of designers and planners who do not necessarily always meet the users’ perceptions and experiences of space and places. When the inhabitants of educational facilities are excluded from the design process, the site only represents the vision of the designers, educational managers and government. Thus, it is important to involve all stakeholders within the educational community during the process, starting from their own experiences and feelings.

The project Hack the School (see website: http://bit.ly/2h3p2QY) emerges in a context where out-of-date regulations conditions education and where learning communities aim to take responsibility for their own spaces while being able to explore and develop new innovative pedagogies. In this regard, it is important to note that the project stands for the empowerment of schools and high-school, and thus so by providing not only a set of resources and experiences, but also by triggering a network of knowledge exchange among the different participant centres in Catalonia. This paper presents both the interrelated conceptual framework and implementation of the project, giving evidence of how learning by doing is one of the most effective ways to intervene and raise awareness about the situation of our current learning environments.

HACK THE SCHOOL OPEN CHALLENGE

The Hack the School funded and coordinated by the Jaume Bofill (JB) Foundation, is set up as an open challenge regarding the transformation of educational spaces. All schools and high-schools in Catalonia where invited through a public open call and communications campaign coordinated by the JF Foundation. The idea is at least to hack one school space by developing a micro-project using the resources available or creating prototype of the possible change. More than 170 schools and high-schools reacted to the call, and from those 30 where selected to apply the Creative Toolkit (see website: http://www.fbofill.cat/sites/default/files/Guia_hacktheschool_200217.pdf) and participate in the different Hack the School activities by a committee formed by experts in the field of education and architecture. The JB Foundation also looked for volunteer architects and designers willing to participate in the call with the support of FAD (Fostering Arts & Design - Design Hub Barcelona).

Concretely the project includes the following actions:

Introductory Workshop: An open free workshop was organised to introduce the Creative Toolkit and the key concepts of the Hack the School framework which took place at the Museum of Contemporary Art of Barcelona (MACBA).

Matching Workshop: The selected schools and high schools participate in a matching workshop where they meet their volunteer supporting architects and introduced to the Hack the School Creative Toolkit and Process.

Hack the School Implementation: For three months each school and high-school autonomously applies the Creative Toolkit and participates in different activities. These included visits to other schools that had previously intervened their spaces, workshops lead by architect professionals, creativity workshops carried out in the Museum Centre of Arts Santa Mònica.

Social Media: the Creative Toolkit and JB Foundation itself, promotes the interaction among the participants. Moreover the Creative Toolkit aims for sharing the results of the key moments of the process.

Results & Prizes: Each of the centres where asked to present a report on the results and concretely two specific activities from the Toolkit; the canvas stressing the main aspects of the micro-project developed and a reflection including the main learnings produced. Again, the same committee that selected the projects choose the six better projects that were awarded a prize. A final event was organized where all the centres had the opportunity to share ideas and projects.

REFRAMING INNOVATIVE LEARNING ENVIRONMENTS THROUGH WELLBEING

Hack the School takes current regulations and its constraints opening up the possibilities to overcome them through creativity and co-design. For this purpose, a Creative Toolkit is designed to foster a series of micro-projects in the different schools space through an interdisciplinary approach. The toolkit has a primary goal to help communities to improve learning conviviality through a process that uses design thinking techniques. In this regard, the toolkit has three different parts: a conceptual framework, methodological tips and the creative process itself based on a series of activities.

The conceptual framework is based on the three core aspects: wellbeing, environments and pedagogies. Often the understanding of innovative learning environments, approaches the intersection of spaces, technologies and methodologies.

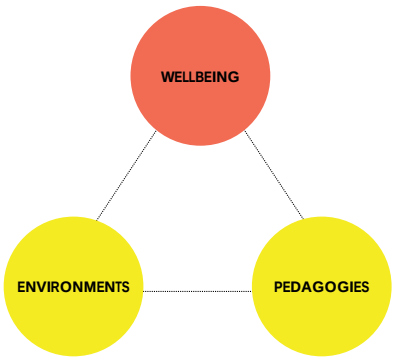

Figure 1: Hack the School Conceptual Framework.

However, for us as designers of the toolkit, it was important to go one step further and reconsider this relationship by including a comprehensive conceptual framework that goes beyond the technicalities of each discipline (architecture and education). To use the umbrella of wellbeing allows a discussion that goes beyond the specificities of the discipline and drives reflection and performance towards a more holistic comprehension of the ILE. To support this framework, seven operational key criteria were included. The seven criteria—welcome, belonging, communication, cooperation, diversity, movement and transduction—serve to visualize the transformation possibilities of the spaces while enhancing a new culture of learning and community creation, widely promoting the global development of children and young people and providing a satisfactory and healthy working environment for the education professionals.

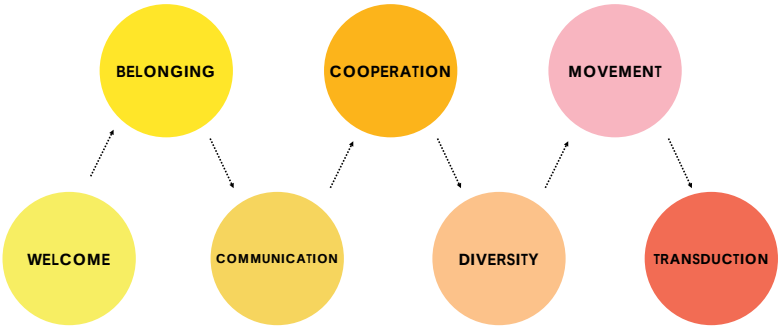

Figure 2: Hack the School Seven Operational Criteria.

This framework serves to sustain the Hack the School process and the design of the Creative Toolkit that helps to foster changes and empowers communities so they can lead transformation on their own and attend to their needs. As said, the Creative Toolkit firstly explores the conceptualization and gives methodological tips to address learning environments transformation. It uses a design-thinking approach so its foundation is inherently practical; the toolkit does not aim to 'academically' educate communities but rather foster a learn-by-doing focus. After that the creative toolkit presents all sorts of activities that are structured in four creative phases: Starting, Discovery, Co-creation, and Assessment.

CREATING-REFLECTING + CREATING-PROTOTYPING

Figure 3: Creative phases.

As Figure 3 shows, the two first phases, *starting* and *discovering* aim to create bonds and reflection among the members of the educational community, while the second focuses on the creation of the prototype and the implementation and assessment of it. The different activities aim to involve the entire community and widely integrate their interests and expectations so the goals and outcomes become imagined, shared and of course, celebrated by the whole community.

OUTCOMES AND CONCLUSIONS

The outcomes of this project can be considered extremely positive. On one hand, all the centres that were selected participated actively in the different activities proposed throughout the process and actively shared on social media questions, ideas and progress. The use of the Creative Toolkit was uneven among communities, depending on their level of autonomy and experience in these kinds of processes; however, most of them state that the Creative Toolkit guides the process and triggers inspiration to create and invent their own participatory activities, ways of working or sharing ideas. Innovation has emerged in different ways and across groups and community members. In this regard, we can argue that the process served to overcome resistance to change and empower educational centres. Moreover, this change of attitude might enhance further changes in each school and high-school despite the limitations of law, and encourage other centres to use the Creative Toolkit on their own.

The relationship between the architects and the educational communities has served to open up a discussion in the public sphere about our tradition and has also promoted an in-depth understanding of how both educational methodologies and spaces are key to fostering wellbeing. In the specific context of Catalonia, this fact links with the willingness of many teachers for changing methods in order to attend diversity and experiment with innovative ways of learning. The project has reinforced communication and engagement at many levels; as some teachers mention, even children and youngsters have given them ideas of how to become better educators or provide ideas for experimentation. In this regard, the project has helped to leave behind a model based on classroom education. Now, any space of the centres can be used for educational purposes, in formal and informal ways. It was surprising to see how in a climate such as ours, schools did not use outdoor spaces and those areas traditionally used only for play-time. This reconceptualization of the space has had an impact on the school organization. In general, changes provide 'more sense' to the way teachers and families want to educate their children and the other way round.

To conclude, the project can be understood as a facilitator of change and its Creative Toolkit as the strategic guide to make it effective. Of course, results did not follow a concrete pattern or standard; but the idea was from the very beginning to help those schools and high-schools to find their own identity, using the space transformation as trigger.

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Where is the White Space for Learning?

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ABSTRACT

How often do teachers limit their pupils' learning by over-planning teaching sessions or over-filling the curriculum? The concept of White Space for Learning is an approach that deliberately builds space into learning activities for learners to think, imagine and shape their own ideas and their own learning.

For some years, as learning practitioners, the authors have separately been exploring ways of empowering students to take greater responsibility for their own learning. They have focused on the conditions that are necessary to make learning more self-organised and self-directed; a pedagogy that explores the transition from being a dependent to independent to interdependent learner through a 'less is more' approach to teaching and learning.

The authors believe this can be accelerated and amplified through the introduction of White Space for Learning, a condition that considers the significance of physical, mental and emotional space to maximise the effectiveness of learning.

KEYWORDS: WHITE-SPACE, LEARNING, INTERDEPENDENT, SELF-ORGANISED, SELF-DIRECTED

Steve Hall: Teacher in secondary, middle and primary schools in England for 35 years; primary school Headteacher for 18 years. Moved into Higher Education seeking new challenges as Senior Lecturer in Education at Staffordshire University in January 2010. Senior Fellow of Higher Education Authority. The concept of white space had already started to take shape within my own teaching and consultancy work by the time I met Jori during his extended study visit to Staffordshire University from Tampere University of Applied Sciences, Finland in January 2015.

Jori Leskela: Teacher in Universities of Applied Sciences (UAS) in Finland for 25 years. Started as a lecturer, subsequently worked as a principal lecturer and head of (IME) study programme and finally, after PhD (Ed), started my third career and became teacher educator in Tampere University of Applied Sciences. I met Steve during my teacher exchange visit in Staffordshire University in the Spring 2015. From our first discussions I have enjoyed discussing and working with him. It seems we have similar mindset and thinking and in the way we both process abstract phenomena.

INTRODUCTION

Kurt Hahn, the founder of the Outward Bound School, cited in James (1990) as having stated we are all better than we know; if only we can come to learn this, then we may never again settle for anything less. The purpose of education is to become 'better', to improve and to achieve. However, the way in which learners are educated quite often restricts or limits learning and achievement of the individual. This may be because there is so little time and space for us to stop and consider what we need to know, understand and be able to do in order that we can become 'the best that we can be.'

This paper raises the issue of white space as a concept or a condition that enables individuals to bring out the best in themselves as learners. It starts by simply asking the question 'Where is the White Space for Learning?'

More than ever in human history, the world is driven by a need for productivity, profit or gain. Every second counts in the eternal drive for greater efficiency and profitability and these transfers to people in the form of a fast moving, highly stressful society and working environment in which there is no time or space to spare for 'non-productive' activities. The point that we miss however is that productivity is not maximised by filling time with activity but by allowing space for creativity, innovation and learning from what we have already done.

Enlightened organisations such as Apple and Lego build in time and space for their employees to step back from their activities to think, to imagine and to use that time to reflect on how they can be more effective and productive. Similarly, such companies develop an ethos and culture within their organisations such that leaders are encouraged to trust and empower their employees with the crucial act of decision-making about how they might be more creative and even more productive. This introduction of mental white space into working conditions and environments for everyone, can lead to employees recognising the differences between either working within their comfort zone or, indeed within their 'discomfort' zone and understanding, which is more productive for them at any particular time.

However, this is not exclusive to the world of business and commerce. Productivity is also seen as a measured output of education where similar principles and practices of 'fitting more in' currently apply. We fill our curricula and our teaching with content and information to raise standards and boost results but what time and space do we leave for thinking, processing, creativity and innovation in learning? Likewise what time and space do we leave in our own lives to stand, sit or lean back to make sense of what we see, hear, feel and do? We all need space for this in our lives and indeed time just to relax for our health and well-being so that we can remain 'productive' and of value to society by being the best that we can be.

WHAT IS WHITE SPACE AS A CONCEPT?

The term 'White Space' has been used as part of the design and development process of websites and other marketing material for some years now. It has become good practice that webpages are not overfilled and cluttered with text and information but that physical White Space is left to make the website feel more attractive, more creative, more accessible and more meaningful. We have taken this use of white space in web design as a conceptual framework to

explore the meaning and value of white space in leadership, learning and life. We see White Space as being essential to the process of combining physical space with mental and emotional harmony and with personal time so that we can be the most productive, effective and the best that we can be.

This has implications for all aspects of our working and resting lives. We would maintain that White Space can have a significant impact on leadership, learning, creativity and innovation but defining it is more of a challenge. It is easier to think of White Space in terms of the impact it can have when it is present and therefore it can be more easily defined in terms of the effect of its absence; but what is it?

We see white space as a condition or set of conditions that are necessary for personal (and professional growth). It is to do with the physical environment around you; about being in a place or space in which you feel at ease and yet inspired and positive about yourself. It is about having time and space for thinking, so that your mind is not so cluttered that you feel overwhelmed and over-stressed with everything it is trying to deal with or process; such that you are not able to focus properly. It is about your emotional and mental health and well-being and what you feel, know and believe about yourself and what you are doing.

We would therefore offer this definition: White Space is a condition or a set of conditions, which are a function of time and space and which impact on your physical environment and your mental and emotional states, such that your thinking and feelings are liberated from unnecessary restrictions or limitations.

White Space is a personalised condition; each individual needs more or less time and space to function, thrive and grow within any situation. At times, an individual will function more effectively within their own 'comfort zone', yet at other times they thrive on the challenge of operating in a zone and state of discomfort. The important issue is that they recognise the difference and can make decisions to effect change when needed.

For example, there will be places where you feel a sense of being 'at home' or 'in the right place'. Sometimes that feeling can hit you the moment you walk into a house, a shop, a garden; you instantly sense being somewhere special. Similarly, there are times when you have freed yourself of the clutter of things you need to think about at home or at work. For some people this is what being on holiday or having 'quality time' is all about when your mind is free to be much more creative, find solutions to problems and to visualise a way forward in your life.

Both of these conditions of time and place impact on your emotional health and well-being and vice versa; how you feel about your surroundings and what you need to think about are affected by your emotional state. Your level of emotional intelligence helps you to manage your emotions but it needs time and space to be at its best. How and what you think, know and believe about yourself and your capacity to be in control of your emotions are a critical part of your ability to function, to survive and to thrive both personally and professionally.

To gain a conceptual understanding of White Space and to appreciate its power in practical terms, feelings need to be taken into account. For example, we have found that it is necessary to explore your feelings when you do and do not have access to White Space as illustrated below.

We would recommend therefore that you consider two different scenarios. Firstly, take a moment to consider an occasion when you were especially restricted, limited, uncomfortable, organised and controlled by others.

Revisit the situation in your mind and try to remember how you felt at the time… We would maintain that at such times you would have been restricted by a lack of White Space and this would have therefore affected your creativity, your productivity and your effectiveness as a person but above all, it is likely to have made you feel frustrated, irritable, resentful and disempowered by someone or something else.

Now think about a time when you have felt particularly liberated, empowered, imaginative, creative. Relive that scenario in your mind and again consider your thoughts and feelings at the time. It is likely that at such times you have either been given or have allowed yourself, sufficient White Space to be the best that you can be.

For both scenarios, compare your emotional state at the times. Can you reach the stage during your reflections at which you become aware of how your feelings were affected? If so, you are starting to understand how White Space and its presence or absence can affect you.

Whilst the importance of White Space is relevant in all aspects of our lives, in this article we will concentrate specifically on White Space for Learning. We will explain why we believe it is important and we will attempt to illustrate in particular where and when it is essential to design White Space into our learning.

WHITE SPACE FOR LEARNING

Although we have offered a general definition of White Space, we are aware that the word 'space' suggests many concepts – in the world of learning and personal development, the term 'space' could mean 'room for growth'.

In the world of education, we see White Space as being about deliberately and strategically leaving 'room for thinking', 'room for creativity', and 'room for learning'. How often do teachers limit their students' learning by over-planning teaching sessions or over-filling the curriculum? The concept of White Space for Learning is that it deliberately builds and designs space into learning activities for learners to think, imagine and shape their own ideas and their own learning.

Why is White Space for learning important and what is its meaning in this context?

In reality, White Space only takes on relevance and meaning when we can define and articulate the bigger picture or context to which it adds value. In this context it is learning or to be more specific, effective learning.

We accept that it is unrealistic to define in detail what constitutes effective learning for every possible context and for every learner, so we propose a framework of six elements that can be shaped and defined according to the individual context for learning.

The six elements of effective learning are (Hall & Leskela, 2017):

- Learning is Authentic and Reflective - learning is meaningful, interesting and compelling and has a purpose to which the learner can subscribe; learning draws from and builds on previous learning which when shared with others is inter-reflective and becomes deeper and more profound,
- Learning is Connected and Collaborative - explicit links can be made to learning in other situations and contexts, to other learners and to other times and places; learning is deepened, enhanced and extended by the learner interacting with other learners and demonstrating inter-dependence,
- Learning has Personal Meaningfulness and Relevance - learning is appropriate to the learner's identity, self-awareness and self-efficacy and to the time and place in which learning takes place,
- Learning is Learner Centred – learning draws on the learner's imagination, innovation, interest and invention; learning is initiated by the learner's own interests and passions,

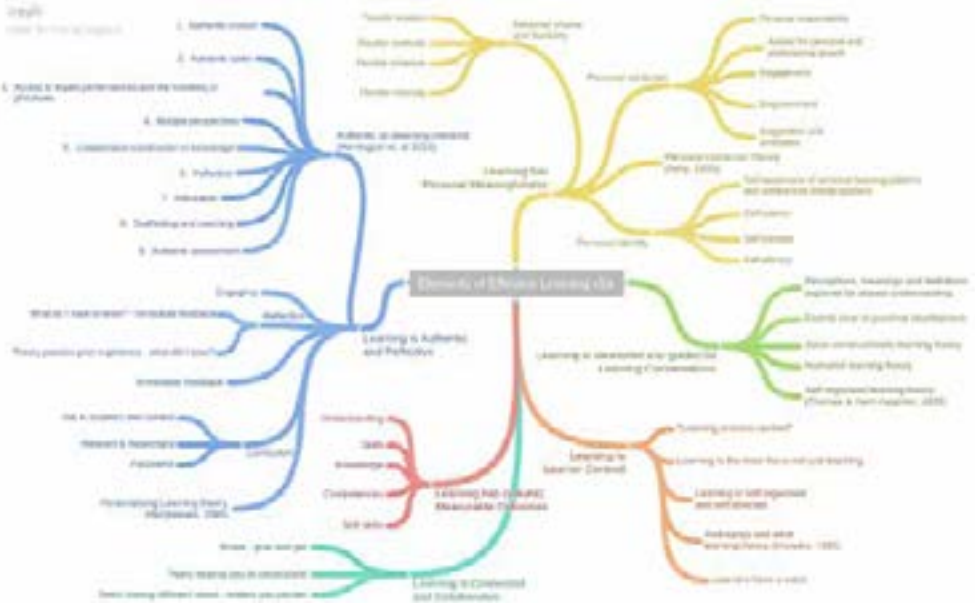

Figure 1: Six Elements of Effective Learning (Source: Hall & Leskela, 2017).

- Learning is Structured and Guided by Learning Conversations – learning is self-organised and self-directed and is framed and scaffolded by the learner's questions, reflections and formative feedback,
- Learning has Valued, Measurable Outcomes - skills, competences, knowledge, understanding and opportunities for

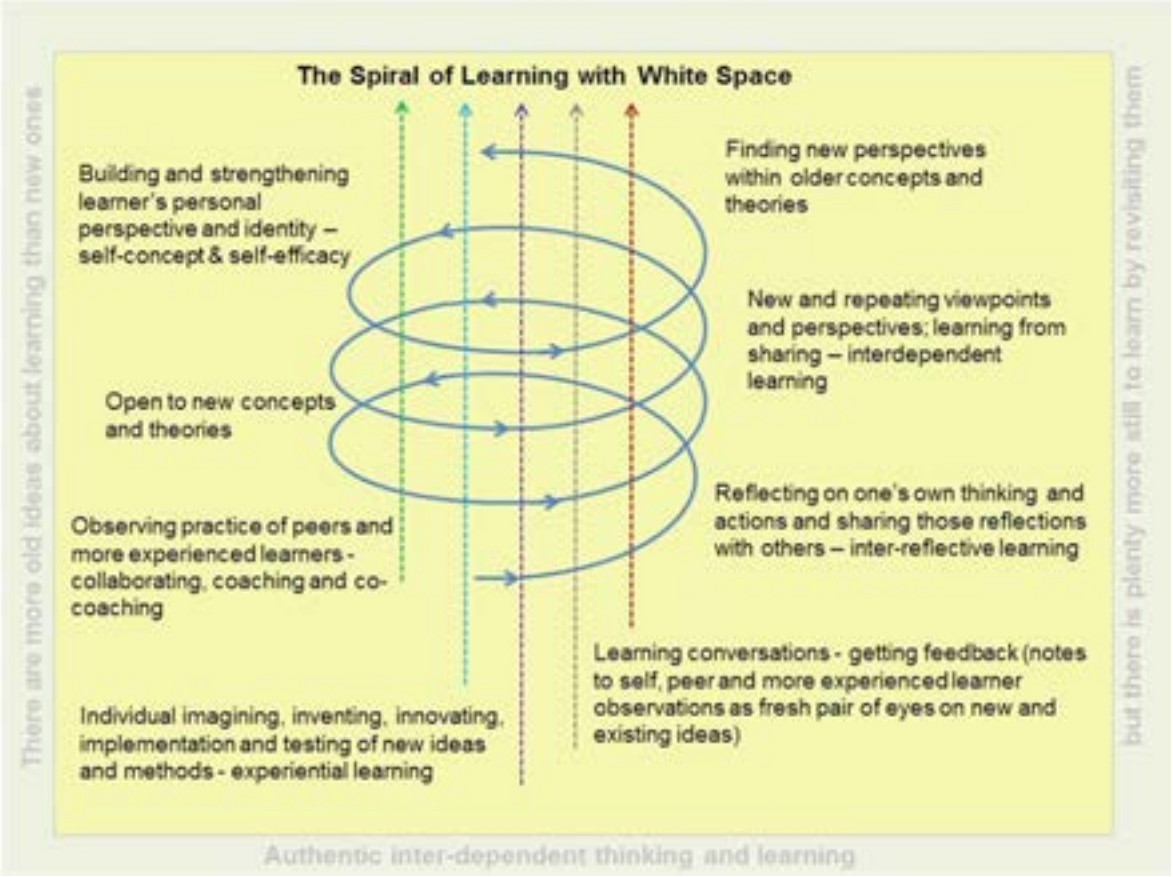

Figure 2: The Spiral of Learning with White Space (Source: Hall & Leskela, 2017).

  achievement are gained, developed and/or extended by the learning.

This model of six elements of effective learning can also be presented as a mindmap.

The way in which White Space adds value to this model can be summarised in the following diagram.

White Space can be used to revisit what we have already learned and being open to looking at that learning again, sometimes with the additional benefit of seeing it through another pair of eyes. It facilitates:

- reflective learning conversations with self and others,
- inter-reflective thinking (letting your perceptions and assumptions be vulnerable and open to be challenged by the opinions of other learning practitioners),
- collaborative, inter-dependent learning (moving beyond being an independent learner),
- authentic learning (letting theory and practice meet and interact while you are learning)
- exploring new concepts with a fellow learning practitioner acting as a coach, co-coach or critical friend provoking deeper reflection and new learning.

White space for learning is therefore important as a fundamental tool to facilitating more effective and productive learning in which the learner takes greater responsibility for their own learning and ultimately full ownership of their own learning as learning practitioners.

WHERE AND WHEN CAN WHITE SPACE MAKE A DIFFERENCE IN LEARNING?

There are many ways in which we can use White Space effectively during teaching and learning. Hopefully our initial thoughts might provoke you to consider your own list for your own circumstances of teaching and learning. We have successfully used White Space as a strategic tool in many ways, including:

- leaving White Space in planning documents for developing ideas,
- planned time to make connections to other learning, for thinking and 'mulling over thoughts,
- unstructured time for follow-up and follow-through,
- spaces to project learners' thoughts and ideas into the mix and to encourage the asking of 'silly' questions,
- pauses in speaking to provide time for processing information and reflecting on its meaning,
- blank pages for doodles,
- places to go to think and reflect, to 'mull over' thoughts and ideas (self-talk),
- coaching and co-coaching questions (learning conversations) to test ideas and understanding through dialogue and self-reflection.

Learning is a process that can be considered as a series of steps or stages. An illustrative model is suggested in Christine Johnston's book, 'Let Me Learn' (1998). The model that Christine promotes, suggests that stages in learning include mulling, connecting, rehearsing, assessing, reflecting and revisiting and implies a need for time and space for the overall process of thinking and learning to be effective. However, the need for thinking, reflecting and processing applies to too many contexts to give a definitive, universal answer to the question, 'Where and when can White Space make a difference in learning?'

Indeed White Space needs to be considered on an individual basis, as a tool for personalising learning, because in any given situation or context one individual will need more White Space in order to maximise their learning as compared to another learner with differing needs. It is the adjustment of White Space to meet the individual's needs which is the skill that teachers, as facilitators of learning, as well as the learners themselves need to master.

Whatever model of learning we adopt, it is clear that there is a process in learning that requires elements of time and space if learning is to be more than merely a superficial memorising of facts. We would maintain that in order for an individual to learn with sufficient depth to gain mastery and understanding in any subject focus or discipline, white space is an essential element.

HOW CAN WE USE WHITE SPACE TO MAKE TEACHING AND LEARNING MORE EFFECTIVE?

A great starting place is to apply three principles at the planning stage of teaching and learning; **allow personal paths, postpone defining and avoid overfilling**. What we offer below are just some examples of how you might choose to apply these three principles in teaching and learning.

For example, whatever lesson planning proforma or tool you use will require you to fill in spaces on a page with writing and/or images that represent the learning you have planned for your learners. The boxes you might feel compelled to fill with writing will probably include:

- Learning objectives,
- Previous learning (to build on),
- Learning activities,
- Assessment opportunities.

But what would happen if you only completed half the space provided for each of the above when you are planning on your own or with colleagues? By doing so you could be adopting an approach that allows **personal paths** by leaving White Space in your planning document, until you find out what the learners' perspectives for each of those four aspects of planning might be. For example, is it good practice if only the teacher decides what previous learning should be drawn on when approaching new learning? Similarly, learners will often, if not always, have a view on what learning activities might

be relevant, meaningful and authentic to their own context so why not leave White Space for their contributions. Likewise, with assessment opportunities – learners' ideas for assessing the extent to which learning has been successfully gained, used and applied are as valid as a teacher's.

From a design point of view, an interesting aspect of planning learning activities is that of learning objectives or intended learning outcomes. There is a school of thought that learning objectives become clearer and more obvious part way through the learning process. Invariably they can change once learners themselves bring their own perspectives into play. An approach that has been used with some success is to **postpone defining** learning objectives/outcomes until part way through a learning activity. By encouraging learners to make their own suggestions as to what learning might be achieved during or after the planned learning activity, before revealing the intended learning outcomes or objectives, you would be offering learners a real and valued voice. Their own input can (and probably will) make a difference and make the learning more effective.

Another very simple but effective 'How?' that teachers might consider is to **avoid overfilling** an information resource (such as PowerPoint or Prezi slides) with text. We are all guilty of cramming in so much information that we want to convey that there is far too much for any person to process in one go. The idea of 'death by PowerPoint' comes to mind and can be easily overcome by leaving white space on any slide or piece of paper that we present as part of a learning situation. White space is essential for an individual learner to process the information in front of them, to interact with it in their minds and to make sense of it, including adding their own ideas. Presentations and informative documents are therefore a great place to start introducing White Space into your teaching and learning.

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Pedarchitecture: Which learning environments for the personalisation of teaching and learning? An educational architecture for the schools of the future

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ABSTRACT

This research investigates the possibility of overcoming traditional learning environment rigidity. It aims to answer how teachers have adapted their teaching to changing learning environments, what impact new educational spaces have on teachers and students, how to organize students with different criteria, and how learning environments can be redesigned in old schools with limited investments. The research studied three schools: in Denmark, the Hellerup Folkeskole in Gentofte and the Ørestad Gymnasium in Copenhagen; in Italy, the Enrico Fermi High School in Mantua. New Learning Environments enhance collaboration and stimulate the exchange of new teaching methods, enabling learning personalisation; in addition to Team Teaching, a "Bridge-Culture" concept was developed, offering a wider vision including structural and organizational details. Consequently, students improved learning skills, felt more responsibility and studied in different ways. In these "architecture feeds pedagogy" schools, some key concepts guide new learning environments design: readability, "semantic-topical", flexibility, invisible pedagogy, and affordance.

KEYWORDS: PEDAGOGY + ARCHITECTURE = PEDARCHITECTURE; INNOVATIVE LEARNING ENVIRONMENTS; TEAM TEACHING AND BRIDGE-CULTURE; THIRD TEACHER; LEARNING SPACES DESIGN

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INTRODUCTION

The cultural background that characterises our societies is undergoing a steady transformation and schools are involved in this change. Education is a global process involving all the supporting structures of human life (Ruini, 2009). In this scenario, the task the school has is to help each student in a process where everyone shapes himself in order to become a person (Maritain, 1943).

Teachers must be able to evolve disciplinary knowledge and teaching methodology according to the integral growth of the student (Bertagna, 2006) so that dignity, creativity and the basic right to schooling and education are recognised for everyone (Mounier, 1935). Both education and schooling are pivotal because one cannot educate without teaching, while it is easy to teach without educating (Arendt, 1961).

This can be done in many ways, but the organisation of learning environments, where the school is "third teacher", needs to be taken into account, as we have been reminded by Loris Malaguzzi (Edwards, Gandini, Forman, 1998).

Space talks (Hall, 1959), the setting itself of the furniture, the students' and the teacher's desks influence students and regulate their behaviour (Foucault, 1975). The teacher can be conceived as a theatre director who, by changing the teaching environment, can produce a different scenario and therefore introduce a new teaching model (Gamelli, 2001).

The analysis starts with the relationships between people, education and learning environments that can stimulate personalised learning. The students must be considered in a position to make choices, independent, responsible, self-sufficient (Hoz, 2005) and conscious of their learning (Collins, 1991; Dent-Read, Zukow-Goldring, 1997; Lippman, 2010). Personalised learning is the most useful strategy, so that each student reaches the best possible results (Miliband, 2006).

DESIGN

The research analysed three schools in two countries: Denmark and Italy.

In Denmark, the Hellerup Folkeskole in Gentofte (Copenhagen), for students aged 6 to 15, and the Ørestad Gymnasium in Copenhagen for teenagers aged 17 to 19.

The choice of Denmark was made for three reasons. The first relates to investments that have been made in the school architecture after the poor results in the OECD-PISA 2000 survey. The second concerns the choice of two schools that interpreted the Danish Government's directions on education to design new schools where it was possible to propose an innovative teaching method with the student at the centre of the education process with its various learning styles (McGrane, 2012). The third is historical: in Denmark since 1844 laws have been issued requiring adequate and clean classrooms, stressing the influence of the educational spaces on child development (Vindum, 2007).

The other part of the research was carried out in Italy, at the Enrico Fermi Institute in Mantua, High School of Applied Sciences for teenagers aged 14 to 19.

Thanks to some structural and organisational changes, introduced by the headteacher, this institute could be taken as an example of what was possible to do in old schools with limited investment, but with a tremendous impact on the pedagogical approach and teaching methodologies.

The aim was to answer the following questions:

- How have teachers adapted their teaching to changing learning environments?
- What impact might new learning environments have on teachers and students?
- How can the educational setting be changed for the personalisation of teaching and learning?
- How can learning environments be redesigned in old schools with limited investments?

METHODOLOGY

In the relationship between education and school, “the building sets the method” (Romanini, 1962, p. 21). “The question of the epistemological pre-requisite on the person’s centrality” (Pavan, 2003, p. 29) is fundamental, according to specific philosophical assumptions (Mertens, 2014).

The ecological paradigm has been chosen through the lens of the European Personalist Movement (Jacques Maritain, Emmanuel Mounier, Paul Ricoeur) with epistemological and anthropological structure of the human person and the influence that learning environments have on the person along with proxemics dimension and strong symbolic value of furniture present in the classrooms.

This research has an explorative character as it used quality survey techniques using the Case Study. It also focused on specific analysis by ‘mixing’ the Phenomenological-Eidetic and Grounded Theory methods, with a hermeneutical approach (Mortari, 2012). This has allowed a thorough understanding of the situation and to simultaneously safeguard the features of real life events (Yin, 2003).

Three schools were chosen as examples, considering them in their uniqueness, since each presents interesting basic information (Merriam, 1998).

As regards data collection, various techniques were combined (Silverman, 2000). Papers and documents supplied by the schools and found on the Internet, videos and photographs, direct observation of the school premises, of the objects as well as the observation of the interactions, group and individual interviews were used, asking similar questions but with a few differences, according to the different cases.

After the headmasters, teachers and students were interviewed. In Denmark, at the beginning of the interviews, photographs of old schools or of traditional teaching methods were shown as a lead-in.

At Hellerup the interviews involved: one teacher for 7 to 9 - year-old children (1st -3rd grade), one for 10 to 12 - year-olds (4th - 6th grade), one for 13 to 15 - year-olds (7th - 9th grade), the Coordinator of Students with Special Needs and a group of five students of different ages (7th - 9th grade). We also participated as observers in two primary school lessons.

At Ørestad two teachers and a group of six students of different ages were interviewed (1st - 2nd - 3rd year).

At Enrico Fermi Institute in Mantua, videos of Danish schools were shown before the interviews. The interviews focused on: a group of six teachers of the first and second year (1st - 2nd), a group of six teachers (3rd - 4th - 5th), both of whom consisted of high school and technical institute teachers; two groups of six students each, for the two-year and the three-year period, split between high school and technical institute.

The results are a selection of narrative material collected during the interviews, according to the ‘eye’ of the researcher.

HELLERUP SKOLE

Figure 1: School interior, by author.

Figure 2: Home base, by author.

Figure 3: The hexagonal-shaped steps, by author

Hellerup has about 650 students and is entirely open-space. There are nine Home Areas where students' daily life takes place. The large central staircase is 'the heart of the school' (Figure 1).

At the corners of these areas there are the Home Bases, two by two-meter hexagonal mobile structures (Figure 2) where pupils sit to listen to teachers' lessons for about twenty minutes. Then they go and sit in freedom where they prefer, in small or large group or alone, to practice school work: at the tables, lying on the floor, on the sofas in the relaxation areas or on the hexagonal-shaped steps (Figure 3). This enables the personalisation of student learning and empowerment.

ØRESTAD GYMNASIUM

Figure 4: School interior, by author.

Figure 5: Meeting room, by author.

Ørestad has about 1200 students, it is defined as "One room, one school" because it is a large cube-shaped building with several floors connected to each other by a helix staircase (Figure 4), the throbbing centre of the school, which is completely 'paper-free' and students use only iPads.

There are only a few classrooms compared to the total number of students because 'school takes place outside school'. Through a network of companies, students have the opportunity to take some lessons outside.

The school is an 'exploration ground' where teachers constantly develop new methodologies allowing each student to learn, be independent, develop their own opinions and to be able to work in a team.

There are several possible different space lay-outs/settings: open-space for individual or Cooperative Learning work, a meeting room where students work in teams monitored by teachers (Figure 5), classrooms with glass walls, where students attend brief frontal lessons, open areas that can be transformed into large spaces where, for example, three teachers can work with about ninety students.

Figure 6: TEAL
(Technology Enabled Active Learning)
classroom with Origami desk, by author.

ENRICO FERMI INSTITUTE

Fermi has around 1800 students. It used to be a school with traditional teaching methodologies centred on the teacher. The headmaster's vision has changed, starting with the total cabling of the building and the introduction of new computer technologies.

Afterwards, subject classrooms were created and assigned to the teachers so that the students reach them at the change of lessons instead of the reverse. Same subject teachers share the classroom and have the teaching materials (personal computers, interactive whiteboard, books) available for the lessons.

By dismantling the partition walls of some classrooms, TEAL (Technology Enabled Active Learning) classrooms (Dori & Belcher, 2005) (Figure 6) with Origami desks were created and, by redesigning some unused areas, informal spaces for relaxation and individual study were set up.

Economic investment has been contained, but with remarkable results in the new pedagogical approach, teaching methodologies, motivation and student learning.

RESULTS

Some fundamental concepts that should guide the design and/or reorganisation of the spaces are highlighted: readability, flexibility, semantotopics, affordance and invisible or latent pedagogy.

The 'readability' of the spaces refers to the possibility of categorising and recognising them immediately through certain elements that allow their orientation (Lynch, 1960; Kaplan, 1987).

There must be an "intrinsic flexibility or actual variety" that is what architects call "built-in-flexibility" (De Bartolomeis, 1983, p. 188-94), so that laboratories can also exist in a nonspecific space.

The design of an educational environment represents a process of attributing meaning to environments, defined as 'semantotopic' (Franceschini & Piaggesi, 2000). In order to design a physical space, that is, a 'topical text', the designers and the beneficiaries of the space must share the same meaning as well as refer to semantics.

The environments offer 'affordances' (Gibson, 1979), which is a kind of 'invitation' through the existing objects that guide actions.

The spaces organisation acts in an invisible way through the 'invisible' (Bernstein, 1979) or 'latent pedagogy' (Bondioli, 2008) which is passively accepted and experienced by teachers.

For these reasons, the three elements: structure, objects, and actions must interact, so as to be coordinated together.

HELLERUP SKOLE AND ØRESTAD GYMNASIUM

Being the schools a total or almost open space, teachers have to be very open minded and flexible and not shy because what one does is visible to everyone and it is an important aspect, from a psychological point of view, as it helps teachers to support each other and share challenges. This organisation allows students to learn more, better and with pleasure.

The teachers point out that the innovative architecture of the school and the new technologies 'nurture pedagogy' and allow the flexible use of learning environments.

At Hellerup and Ørestad there is an on-going collaboration, therefore it becomes easy to locate new teaching strategies, to plan lessons and to recognise the students with different learning styles.

The teachers have made their knowledge and skills available in order to share them in a Peer Education modality among colleagues as well as share the materials produced, the teaching strategies and the possibility to personalise both learning and teaching, in addition to workload.

This has developed a "Bridge-Culture" (Sandrone, 2007), which is a broader concept than Team Teaching, where teachers meet in groups at predetermined times (Dean & Whiterspoon, 1962; Bair & Woodward,1964) because it includes structural and organisational details and allows teachers to overcome the fragmentation of disciplines and the lack of a unifying centre.

According to students of both schools, the Cooperative Learning and Peer Education methods allow rapid, personalised and informal learning, as theorised by Roger Cousinet (1945).

The organisation of learning and teaching spaces can be found in the pedagogical activism theorised by John Dewey, Maria Montessori, Roger Cousinet, Célestin Freinet, supported by new technologies.

The students are closely monitored by teachers, who stimulate their learning in different ways by trying to empower them in order to make them independent in their itinerary, aware of their characteristics and give meaning to their learning. Students are grouped according to the scheme of the teachers, sometimes working in small groups, other times in large groups. This enhances socialising, learning to collaborate and to help.

Students are very good at interacting with the environments, adapting to spaces, using every corner, and making the school a place that feels like home (Volpicelli, 1964).

They feel totally free to choose the place where to study and move, as an open space 'broadens the spaces of the mind'. Flexibility allows students to leave the traditional "isolation and control school" (Iori 1996, p. 120). There is a flow of informal exchange between teachers and students, creating a collaborative atmosphere and educational community.

In both schools, students are not considered as a homogenous mass, but each one is a unique and original person, which reflects the concept of the Danish educationalist Nicolai F.S. Gruntvig (De Natale, 1980). In order to teach in these schools, it is imperative to believe in the pedagogical project and work closely with colleagues at multiple levels.

ENRICO FERMI INSTITUTE

The new organisation of learning spaces by switching to 'subject classrooms', 'debate classrooms' and 'TEAL classrooms', obliged teachers to revise their teaching methods.

Traditional frontal teaching was reduced and new methodologies introduced such as Cooperative Learning, Peer Education and Debate. The use of new technologies allowed teachers to bring the 'school to children's rooms'.

The teachers appreciated the opportunity to share the classroom with their colleagues without having to move continuously from one classroom to another. Again, this modality has created the Bridge-Culture.

The drawback is the lack of informal exchange with the colleagues of the same class, the advantages are however greater. Teachers agree that new teaching methods have increased the students' attention, motivation and interest enhancing positive learning, learning behaviours and discipline management.

Students are thrilled because moving from one classroom to another at the change of lesson allows for a break of 'decompression' and can potentially increase relational exchange and socialisation with students of other courses and familiarisation with the whole school.

The classrooms become 'readable' because the students can personalise them with their teachers. Students claim they are willing to go to school because they find comfortable, familiar environments where they learn without anxiety. An environment that makes them feel comfortable is 'the fuel of motivation'.

CONCLUSION

Célestine Freinet claims that, if modernisation is made possible in the classrooms and learning spaces, it is also possible to modernise teaching (Freinet, 1946).

It becomes important to start from the space, its organisation and new technologies in order to propose a new teaching model where at the centre there is the learner, as the conscious protagonist of his own learning (De Natale, 1980).

The innovative structure of learning environments with the high-tech classroom and "variable geometry setting" (Ferri, 2011, p. 115), albeit with a different organisation, has allowed the introduction of new teaching methodologies and learning personalisation.

In the three schools, the students agree that teachers are not always expert in dealing with new technologies and they sometimes ask students for help in a sort of 'mutual learning process'.

The results of this study represent a useful point of specific analysis of pedagogical architecture and heuristic value for any subsequent investigation.

'Pedarchitecture' seems to be the right word to link pedagogy and architecture of learning spaces.

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International comparative study of innovative physical learning spaces

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ABSTRACT

An international comparative study of learning spaces in higher education has been launched in October 2016 through a collaboration between Paris Ile-de-France Digital University and Kyoto University. Involving today more than 60 institutions on four continents, this project seeks to study the learning spaces phenomenon and its impact on the campuses transformation in a cross cultural approach, through the strategic, material and operational angles. Ten criteria have been defined to study the learning spaces reality and objectives, integration in the campus strategy and in the higher education system, design, technology, evaluation tools and outcomes on the teaching & learning practices. This paper presents the first trends collected through this project, and proposes a comparative view on some of the ten criteria from the different territories to highlight the major similarities and differences, and to identify the best practices and the potential synergies.

KEYWORDS: STRATEGIES, DESIGN, OUTCOMES, INTERNATIONAL, COMPARISON

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INTRODUCTION

An innovative physical learning spaces (formal ones: active learning classrooms, and informal/integrated ones: learning commons, research commons, students commons, and learning centres) international comparative study has been launched in October 2016 thanks to an international collaboration between Paris Ile-de-France Digital University and Kyoto University. This project aims to study the learning spaces phenomenon in higher education through different angles: policies, strategies, design principles, evaluation systems, outcomes on teaching and learning practices, and more globally on the campuses transformation. Beyond the material point of view, it also seeks to compare the institutional context and identify the condition of the success and the generalization of such spaces across different countries, higher education systems, and cultures.

FRAMEWORK OF THE STUDY

RANGE & METHODOLOGY

The study addresses a sample of institutions in four main territories: Europe, North America, Asia (Japan, Singapore and Hong Kong) and Oceania (Australia and New Zealand). The sample of universities has been chosen to be as significant as possible, mixing national and private universities, science-focused and humanities-focused ones, aiming diversity in their size, and located in various regions in each country. The selection of universities in the sample was also based in the existence or on the upcoming existence of learning spaces, integrated in an institution strategy. At the time of the Transitions conference, more than 60 institutions on four continents are involved in this project.

The methodology consists of collecting quantitative and qualitative materials through visits, interviews of stakeholders, managers, designers, faculties, and students, and observations on site using time lapse video recordings, and photo diaries.

We intend to use these data to identify similarities and differences among spaces designed for similar purposes, across the different territories and institutions. From the study of the spaces themselves and the uses/practices they effectively induce, we aim to conduct a reverse analysis first to highlight the design purposes, and the institution's strategy that was applied to this project. This is supposed to outline the conditions of the learning spaces success, and the potential of a large scale generalization.

This paper and the related talk present the first trends and results of the study, especially collected after an eight months stay in Japan.

STUDY'S CRITERIA

The study itself is based on a list of ten major criteria, which participating institutions are mapped against. Those criteria have been chosen as they address the learning spaces not only on their physical point of view, but also on the included (or not) practices. They also cover their genesis, their governance, their motivations and purposes, and their integration in the campus context.

- Terminology & Types of spaces
- Layout & Furnishing
- IT/ICT
- BYOD compliancy
- Location on the campus
- Governance of the project
- Design & Evaluation tools
- Community interactions
- New services
- Teaching & Learning practices

For the purpose of this paper, the following sections present the main specificities and similarities observed across the different territories for some of these criteria.

LAYOUT & SERVICES

LAYOUT, SPATIAL ORGANIZATION, TYPE OF FURNISHING

In almost all types of learning spaces, flexibility and collaboration appear to be the most basic features. The choice of furniture and the layout design reflect those features, through two main types.

The first type of layout and furnishing is based on highly moveable furniture, providing a real flexibility in the spatial organization, and offering a lot of possible configurations. This type of moveable furnishing usually doesn't integrate any specific technology (neither power supply nor video connection). The second type is based on fixed tables, usually designed to promote collaboration by proposing a design that allows all the participants of a group to see each other, and by providing specific features such as wired networking for specific purposes, power supply, and shareable displays. Both of those configurations (flexible / fixed) are almost systematically compliant with the Bring Your Own Device (BYOD) in all territories.

Regarding the choice between the two configurations, some differences can be observed between the territories. If the flexible configuration is often representing the typical active learning classroom, a significant number of the fixed configuration also exists, sometimes differently named. This second type of configuration keeps a significant popularity among students seeking for group work facilities in all territories.

Overall, the mix between flexible and fixed configurations is a reality in all territories, reflecting a mix of slightly different types of teaching and learning practices. Nevertheless, a connection between the geography of the campuses (including the available surface), a cultural way of designing a spatial organization, and the proportion between flexible and fixed configurations can be observed. Typically, US large campuses present a bigger proportion of fixed configurations than the Japanese ones, where a cultural related space optimization way of thinking is applied to compensate a lack of available surface by a versatility in the layout of the learning spaces.

The duality of the flexible and the fixed configurations does not have to be considered as a competition, as both of them can and do perfectly co-exist in integrated spaces such as learning commons and learning centres, in a logic of zoning. Besides, it is interesting to note that despite the – theoretically – flexibility of some spaces, it appears in several significant examples in all territories that the users spontaneously do not change the spatial configuration, inciting some institutions to provide to these users some maps to show some examples of layout they can compose in the space.

NEW SERVICES OF LEARNING COMMONS AND LEARNING CENTRES

On all territories, the integrated spaces such as learning commons and learning centres tend to offer a diversity of new services and features compares to an eventual previous situation such as a library.

The following list presents some examples: laptop & tablet lending system & charging stations; specialized workstations; tech support & workshops; teaching assistance; group work areas; printing stations & fab labs; visualization areas; presentation areas; A/V production studios; relaxing and socialization areas.

The motivations to propose such new services are various. But for several of them, the fact that they are available only in the learning commons or the learning centre create an attractive option for students and faculties.

IT/ICT

BYOD

The BYOD appears to be one of the most potentially impacting criteria in the learning spaces strategy and design, with numerous connections to the other ones. Integrating the BYOD concept in a learning space design process, in whatever form, has very direct consequences on layout and furnishing (especially if mobile device compliant furnishing is part of the spatial organization), on the integrated IT/ICT level (regarding wired and wireless network and video connectivity, and above that a BYOD compliant IT infrastructure), on the governance of the project (if the BYOD and learning spaces are jointly included in the institution strategy), on the new services (especially established to comply and complete the users devices, for instance technical help desk) and of course on the Teaching and Learning Practices (by involving more interactions between the teacher and the students through digital tools and contents).

This first step of the study confirmed a fundamental assertion: learning spaces and BYOD are – together - more than a temporary trend. In all territories, they clearly move in synergy, promoting (and sometimes justifying) each other.

BASIC YET FUNDAMENTAL NEEDS

The BYOD trend especially has very direct consequences on the learning spaces design, and on the top of them, the very basic, yet fundamental, question of the Wi-Fi connectivity. Indeed, the type of devices (smartphones, tablets, laptops) makes an intensive use of wireless connectivity, and even more due to the generalization of cloud based software on the campuses. In several user surveys and interviews, very basic features such as a reliable and fast Wi-Fi connectivity, as well as power plugs, systematically figure on the top of the wish list. The answer that the institution give to those needs clearly impacts the usage of the different spaces.

LOW-TECH TREND & ANALOG/DIGITAL MIX

Usually, all types of learning spaces include a larger part (often the largest one on the campus) of embedded technology than the classical classrooms, lecture halls and libraries However, in Japan and Europe, a trend of “low tech on purpose” may be observed in few spaces. Not only motivated by a cost cutting logic, this trend seeks to support a fully human collaboration, not especially enabled by a specific hardware and software technology, but more but by specific layout and spatial organization.

Regarding this low-tech trend, it’s necessary to mention that it does not present any correlation with the outcomes on the uses and on the practices. Some very interesting ones have been observed in facilities in which the technological equipment was not a priority.

More globally, the learning spaces all around the world tend to validate an Analog/Digital mix as the best way to promote uses and practices. Analog writable surfaces, for instance, are an especially popular feature in almost all learning spaces, and often more than Digital SmartBoards. A zoning mix of high tech and low tech spaces also appears to be a very suitable answer.

DESIGN AND EVALUATION TOOLS

EVALUATION AS A NECESSITY

As learning spaces are increasingly becoming a strategic, financial and operational matter for the higher education institutions, design and evaluation tools have become a necessity. These tools not only provide good practices and guidelines for upcoming projects, but are also used to assess the efficiency and the quality of the existing ones. Measuring the efficiency and/or the quality of an object as a learning space in higher education brings the natural question

of what defines this efficiency and/or this quality: the furnishing? The embedded ICT? The integration in a campus strategy? The transformations induced on the teaching & learning practices? In addition, a distinction needs to be made between two types of evaluation: the pre-occupation and the post-occupation ones.

EDUCAUSE LEARNING SPACES RATING SYSTEM (LSRS)

The first, and still major initiative up today is the Learning Spaces Rating System (LSRS) initiated and developed by the EDUCAUSE Learning Spaces Constituent Group (EDUCAUSE, 2018). The LSRS V1 has been published in 2014 in its original English version, V2 in 2017 (French & Japanese translation in 2017). The LSRS provides a set of criteria for pre-occupation evaluation, organized in 6 sections and covering all the matters involved in a learning spaces project (strategic, material, operational). Overall, the LSRS definitely shows an increasing popularity, that has however to be confirmed beyond the North American borders. Nevertheless, it clearly represents today the reference for evaluation and assessment of learning spaces.

FLEXIBLE LEARNING ENVIRONMENTS EXCHANGE (FLEXSPACE)

Beside the LSRS described above, FLEXspace is a second and complementary tool, more focused on the post-occupation assessment (FLEXspace, 2018). Initiated in 2012, FLEXspace is an online open access repository of various types of various and existing learning spaces, gathering almost 700 records, accessed by 2000 users from 35 countries. FLEXspace provides technical, spatial, technological, organizational, financial data, high definition photos, and examples of practices that can occur in the described space. Even though its popularity is continuously growing, FLEXspace – as the LSRS described above – needs to gain visibility beyond the Canadian and USA borders.

STRATEGY & GOVERNANCE

TYPES OF SPACES

If historically the first learning spaces projects were focused on active learning classrooms, an almost systematic shifting towards integrated spaces (learning commons and learning centres) based projects can be observed in all territories. In several significant examples especially observed in North America, this trend also includes active learning classrooms embedded in the learning commons and the learning centres.

Stakeholder's feedback and testimonies clearly indicated that learning commons and learning centres constitute the current and/or upcoming challenge and opportunities for their institutions' strategy regarding learning spaces.

INSTITUTIONAL OPPORTUNITY

The motivations that lead an institution to launch learning spaces projects, present significant differences between the territories. Those differences appear to be connected to the national higher education context and policy. For instance, a large majority of the Japanese learning spaces establishment has clearly followed two major nationwide policies from the Japanese MEXT (Ministry in charge of the Higher Education): a recommendation to promote active learning in 2009, and the universities' buildings structure anti-seismic strengthening operations that have been funded from 2011 right after the Tohoku earthquake. Besides, highly competitive higher education systems such as the Japanese and US ones tend to use the existing or upcoming learning spaces as a feature to attract potential students.

GOVERNANCE & INSTITUTIONAL STRATEGY

Governance of learning spaces is connected to their locations on the campus. A centralized configuration usually reflects an institution-wide strategy that can show different motivations: visibility in a competitive higher education environment, a will to promote innovation in the students' experience, or taking the opportunity of a renovation to move from a traditional layout to a learning spaces configuration. This is particularly the case for libraries partially or completely switching to a learning commons, involving important changes in terms of organization and HR due to the new services that can be integrated in it. Few very

large scale initiatives are observed as campus wide project, involving most of the campus facilities, and led as the highest strategic level of the institution. They logically reflect high ambitions regarding the students experience and the institution's visibility.

On the other side, more local initiatives, by definition decentralized, are less ambitious in terms of size. These are, for the most part, in the form of active learning classrooms. They sometimes constitute an experimentation that can inspire wider institution-wide projects, even if their limited visibility requests specific communication to be made aware to a wider audience than the natural local users.

On all territories, both institution-wide and local initiatives can still be observed, even though the institution-wide configuration part is clearly and logically increasing since several years, showing how important learning spaces have become in the institution-wide campus strategies.

LOCATION ON THE CAMPUS

The location of the different types of innovative physical learning spaces appears to reflect the existing – or not – campus strategy of the institution, as well as the eventual evolution process the libraries could be involved in.

Active Learning Classrooms

The active learning classrooms locations are various, and can be divided in two categories, regardless of territories.

First, the decentralized active learning classrooms, installed in departments, and usually dedicated to the one they belong to. In that case, and beside the generic ones, some specialized active learning classrooms (geology, chemistry) are appearing in few recent initiatives (see for example, McGill University, 2018). They mix a usual learning spaces based layout, with specific furniture adapted to the purposes of the discipline.

On the other side, centralized active learning classrooms, are usually installed inside integrated spaces such as learning centres and learning commons, and located in a central position in the campus, predominantly in libraries. Such centralized configuration usually reflects diverse motivations: to promote innovation in the libraries, to take advantage of their usual central locations and – often mentioned -, to take advantage of their neutrality in the campus.

No significant differences regarding the repartition between those two categories are observed between the different territories. Besides, a mixed situation can be observed: generic and centralized active learning classrooms located in the learning commons, and specialized decentralized ones in the different departments.

Learning Commons

The matter of the learning commons location on the campus, can be divided in two similar categories as well.

The decentralized learning commons, also installed within the departments, are usually smaller, and mainly designed around collaborative purposes only. They usually reflect a local strategy rather than a campus-wide one.

The centralized learning commons are mainly installed inside libraries. It has been observed that a library located in learning commons can present different configurations: the learning commons entirely replaced the former library, or the learning commons being hosted inside the library (which keep its former layout). The overall proportion of such configurations inside libraries compare to a location outside the libraries is usually measured at approximately 80% in all territories.

CONCLUSION AND SOME KEY CHALLENGES

NUMBER OF FACILITIES AND CAPACITY

The active learning classrooms number on a campus clearly appears to be a key factor to move from an experimental situation to a generalization. Regardless of the territories, multiple examples of well-designed active learning classrooms can be observed, that cannot reach the step of a generalization as they cannot host regular weekly classes. This generalization challenge is not only connected to the practices, but clearly also to their capacity to face a huge number of classes and students. As active learning basic principles tend to avoid large number of students in a same classrooms, the number of active learning classrooms need to be multiplied.

FACULTY DEVELOPMENT

The main challenge of the learning spaces remains the evolution for the students' experiences, and especially of the teaching & learning practices. Especially in the active learning classrooms, that present a strong pedagogic focus, also require teachers to modify their practice to have a real translation from material features to a pedagogic reality. Meaning that in the most successful experiences that have been observed, a genuine faculty development initiative exists in synergy with the learning space itself. This type of proceedings finds especially its relevancy in centralized institution-wide learning spaces strategy. US Universities, in particular, present interesting initiatives in this matter (see for example, University of Washington Libraries, 2018).

Note: This paper contains parts that have been used for communications at the Information Processing Society of Japan (IPSJ) TCE and SSS conferences 2017, and for a paper submitted to the IPSJ Transactions journal.

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Creating a space for creative learning: The importance of engaging management and teachers in the design process

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ABSTRACT

Based on an empirical case study, this paper puts forward the thesis that in order for an innovative learning environment to work intendedly, three things must be aligned: creative teaching (the teacher), space (the designer) and organisation (management). Ideally, when designing new ILEs all three parties are engaged in the design process in order to ensure a common goal: creating the best frame for creative learning. In reality, this rarely happens and the users are left with a physical learning environment where the intentions do not match the expectations and established practises. To remedy this dilemma, the paper proposes an additional activation phase in the design process after the implementation, where the intentions of the space are to be translated into actions and negotiated through appropriation with the users in participatory processes. The purpose of this phase is to match pedagogies with spatial possibilities. The methodology of the paper is Research through Design.

KEYWORDS: CREATIVE TEACHING AND LEARNING, LEARNING SPACE DESIGN, LEARNING SPACE ACTIVATION, RESEARCH THROUGH DESIGN, PARTICIPATORY DESIGN PROCESSES

Bodil Bøjer is an Industrial PhD candidate, based in the Design Agency Rune Fjord Studio in Copenhagen and enrolled at The Royal Danish Academy of Fine Arts Schools of Architecture, Design and Conservation. Her research examines the relationship between learning space design and creative learning processes by using a Research through Design approach in several case studies. The aim is to create new knowledge about the potential use of physical space as a tool to support creative learning and to develop prototypes of furniture stimulating creative learning processes. Bodil holds a MA in Art History and Aesthetics and Culture and has 10 years of practical experience working with spatial design in learning environments and private businesses. She is also the co-author of the book "Læringsrum" (Learning Spaces) that aims to inspire teachers and pedagogues to use the physical learning environment as an active tool in educational activities.

INTRODUCTION

It takes both sides to build a bridge and someone to cross it. The same goes for a good innovative learning environment (ILE): it takes both sides to build it, a designer and a client, and a teacher to use it. Anyone can cross a bridge, but when it comes to an ILE even the best of intentions and pedagogies may get lost, if the teacher does not know how to use the space. It will then become an obstacle instead of an asset.

Space shapes us but is also shaped by the way we interact with and act within space. The interdependence between the physical space, creative teaching and the organisation is widely overlooked when designing ILEs as a new spatial design in itself is expected to change the way we teach and learn. However, simply changing the space is not enough (Imms & Byers, 2017) and the intentions of the space can only be fully realised if the inhabitants of the schools completely understand and support the pedagogical principles informing the provision of these spaces (Burke, 2016). Unfortunately, the intended pedagogies behind a project design tend to be unstated, unknown to, or unshared by those who are to use the facilities (Jamieson, Fisher, Gilding, Taylor, & Trevitt, 2000).

According to a literature review by Blackmore, Bateman, Loughlin, O'Mara, & Aranda (2011) the way a building is inhabited is at least as important as the quality of its design (In: Byers, Imms, & Hartnell-Young, 2014). There is no causal link between learning space and pedagogic change (Mulcahy, Cleveland, & Aberton, 2015) and space and furnishing do not automatically lead to certain actions or learning processes. The use depends on the receiver (Kirkeby, 2006) and the organisation of the school. Beghetto & Kaufman (2014) point out that the organisation or leadership plays a key role in establishing an environment supportive of creativity, which is why just changing the physical settings or the pedagogical methods does not guarantee creative learning. A good learning environment requires a congruence between physical space, pedagogical practices and the organisation of the school (Ricken, 2010).

An ILE is understood as a space that provides a diversity in furniture aimed at supporting different learning situations, often through a highly flexible interior and purpose-built furniture. Imms and Byers (2017) describe three types of learning spaces that are found in many educational institutions today: 'formal' or traditional classrooms focused on largely didactic pedagogies, student-centred spaces focused on transactional approaches to instruction, and what they call a 'third space', where social activities overlap informal and active learning activities. These new learning environments provide the infrastructure to inspire teachers to reconceptualise and rethink their teaching. In particular, ILEs require a new way of teaching because of their particular affordances that do not support 'classical' teacher-centred teaching. Instead, ILEs provide a physical setting for collaboration, experimentation, exploration and immersion in a subject, which are central activities (amongst others) in creative learning processes (Craft, 2005; Cropley, 2001; Tanggaard, 2010, 2014). Creativity is here understood as 'a necessary part of thinking and acting in new ways' (Tanggaard, 2014, p. 109) in a constantly changing world, thereby becoming an important ingredient in learning processes that require us to handle various situations, tasks and practices.

THESIS AND METHODOLOGY

It is my thesis that alignment between creative teaching (the teacher), space (the designer) and organisation (management) is necessary in order to establish the best conditions for creative learning as illustrated in figure 1. Designers tend to be separated from the ultimate users of the physical environment by facility management professionals, which makes the re-negotiation of architecture-pedagogy assumptions quite difficult (Jamieson et al., 2000).

Therefore, I propose a participatory or social form of design processes where both users and management are included in the design process regularly to align needs, wishes and intentions continuously in order to assure ownership, quality and use of the space. I will elaborate on this in the following, based on a specific case where a new ILE was designed at a Danish school near Copenhagen in collaboration with the design agency Rune Fjord Studio.

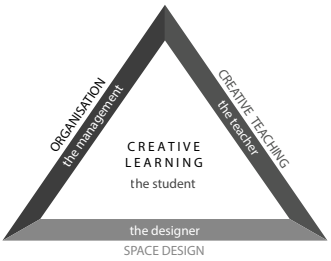

Figure 1: An alignment between creative teaching (the teacher), space (the designer) and organisation (the management) is necessary in order to establish the best conditions for creative learning.

My research approach is Research through Design (RTD), which allows me to generate new knowledge through processes that simultaneously develop, test and improve a design in relation to a specific spatial environment. The methodology of RTD was first described by Christopher Frayling in 1993 (Frayling, 1993) and covers a research approach where the design process in itself becomes a way to acquire new knowledge. RTD investigates the research inquiry from the practitioner's methods and acknowledges practise as a means of gaining new knowledge, which in my project means developing concrete spatial environments while working in an iterative dialogue with a physical material and the users that reflects back on the research. Research reflections are generated in action (Schön, 1983) through the design process and concrete design proposals. Therefore, work with the specific case presented here was based on a concrete design process model, where the stakeholders were inscribed in the process on a regular basis.

THE ASSIGNMENT AND THE INTENTIONS OF THE NEW ILE

The assignment was to design an ILE in an existing common area connecting to classrooms used by 3rd to 5th grade students and in an empty classroom. The new premises were to be used both during regular school hours and for after school activities. The design of the ILE was based on information obtained from meetings and workshops with the stakeholders and ethnographic research (observations of how the space was used and photo mapping) during the first part of the design process. Furthermore, the design was inspired by current research about creative learning (Craft, 2005, 2006; Cropley, 2001; Tanggaard, 2010, 2014) and the relationship between space and learning (Boys, 2010; Jamieson, Dane, & Lippman, 2005; Jamieson et al., 2000; Kirkeby, 2006).

According to Jamieson et al. (2005) spaces outside the classroom cease to exist as paths and become learning spaces in their own rights when they are layered for different ways of learning. A layered environment that provides opportunities for promoting individual, one-to-one, small group, and large group activities allows for an active, self-directed learning activity where the student takes on a more active role in the learning process. According to research on creative learning, pedagogic strategies allowing the students to actively engage in the learning process and for example immerse in a topic of interest over longer time as well as experiment, play and examine promotes critical thinking and helps develop creative skills (Craft, 2005, 2006; Cropley, 2001; Tanggaard, 2010, 2014). To support this, the ILE was designed with different activity zones, flexibility and a diversity in workstations that allows for many types of activities and learning styles as opposed to the original interior consisting only of groups of chairs and tables (see Figures 2 to 4). A set of purpose-built furniture aimed at supporting the needs and ideas of this particular school as well as creative learning as explained above, were especially developed for the space. These include two transformable cabinets designed as potential tools in creative processes, one as a mobile design studio and the other as a tool for presentation.

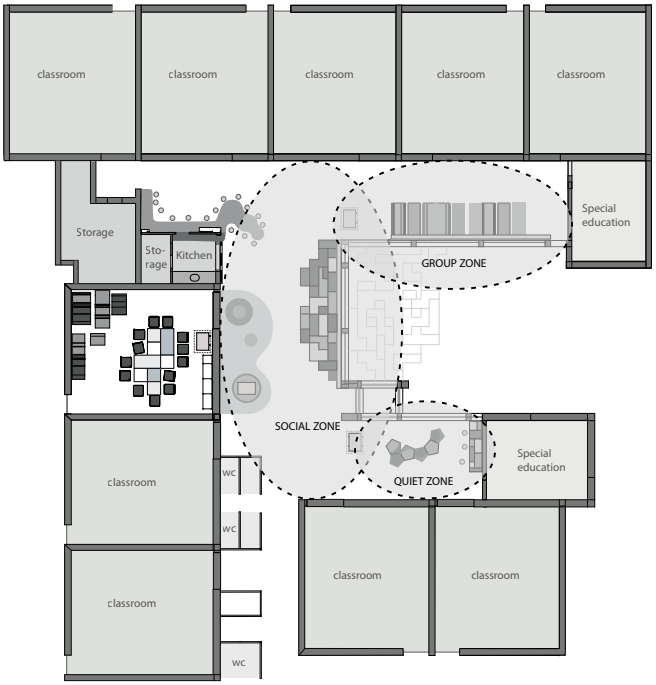

Figure 2: The innovative learning environment at the school, divided into 3 activity zones: Quiet Zone, Social Zone and Group Zone with a diversity of workstations and flexible furniture.

Figure 3: Diners for collaborative work in the group zone.
Photographer: Filipa Pita, Rune Fjord Studio.

Figure 4: Learning landscape and high table in the social zone.
Photographer: Filipa Pita, Rune Fjord Studio.

THE DESIGN PROCESS MODEL AS A TOOL

The triad of relations between creative teaching (the teacher), space (the designer) and organisation (management) served as the starting point for the design process of the new ILE in which I acted as both an observer and a participant. A graphic representation of the process, inspired by the Double Diamond model by the British Design Council (Design Council, 2007), was produced in an attempt to keep track of when to involve the different stakeholders in the design process. The model visualises a design process divided into four distinct phases, Discover, Define, Develop and Deliver (see Figure 5), that respectively opens and closes the process through divergent and convergent thinking (for more information about design processes see for example Lawson, 2005).

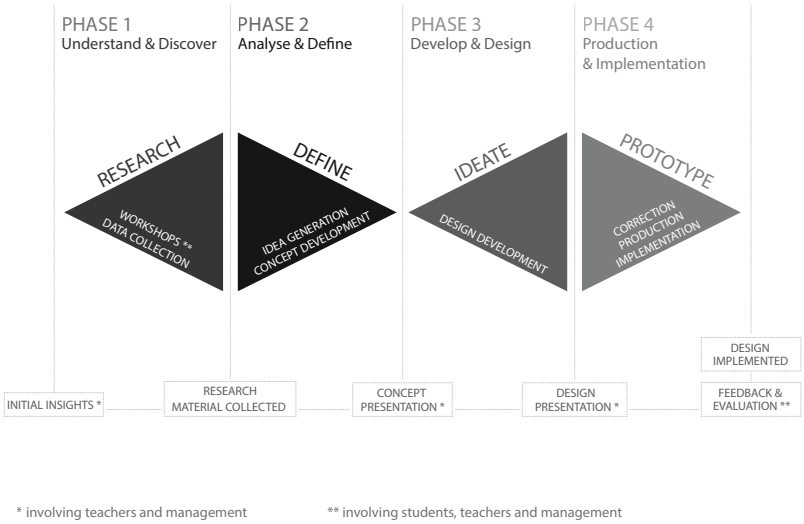

Figure 5: A design process model in four phases by Rune Fjord Studio, inspired by the Double Diamond model.

The intentions were to involve all stakeholders directly or indirectly through ambassadors during the design process on a regular basis. In reality, this was not possible, supposedly because of budgets, time pressure and teachers' workloads. Initial insights into needs, wishes, organisation and pedagogies of the school were obtained from the management prior to the design process, and regular communication between management and designers were held throughout the process. Most user involvement took place during the first phase in which two workshops were held with a group of users to collect information that could lay the foundation for the designing of the space. Only one teacher, two pedagogues and management participated in the first workshop (more were invited) and approximately 30 students and parents took part in the second workshop. The other teachers were informed about the design process regularly by the management with an invitation to comment on the design, but had no direct contact with the designers.

In addition to this, ethnographic methods like photomapping and observations were performed during phase one to collect empirical data that served as a groundwork for the spatial design. Further observation, mapping and interviews with selected teachers are planned in the fall 2017 to follow up on the design.

PRELIMINARY FINDINGS

One and a half months after implementation, the initial experiences were that the students had easily adapted to the new learning possibilities of the space whereas the teachers were experiencing a higher level of difficulty getting used to the possibilities and limitations of the new space (informal interview with management 2017-06-13). A month later we returned to observe the use of the ILE and experienced a big difference in how much the space was used by the different classes. Whereas one teacher took advantage of the variety of work stations in the ILE by working in a dynamic flow between the classroom and the ILE, others stayed inside the classroom for the whole day or used it more sporadically. We even found the transformable cabinets unused.

Subsequently, we met with the teaching team during one of their monthly departmental meetings to explain the intentions behind the design. During this meeting, we discovered that not only were many teachers unaware of the intentions, they did not even know that they were allowed to use certain furniture and had no keys to unlock them.

In retrospect, more effort should have been made to involve the teachers in the design process in order to make the proposed alignment in figure 1. Management was easily engaged in the process, presumably because they were the contracting authority, but it was difficult to engage the teachers, which resulted in very limited direct communication between teachers and designers. The reasons for this remain to be examined, but prospectively it is a challenge to secure the involvement of all parties during the design process.

The teachers' preliminary experience of the space as being difficult to match with their usual way of teaching indicates that the intended alignment between teaching, organisation and space did not happen during the design process. Except one, the teachers were neither directly nor indirectly involved in the design process, resulting in them being unaware (or limited awareness) of the intentions of the space as well as not feeling any ownership for the new design. With the proviso, that any transition from one teaching method to another may be complicated, I suggest that greater involvement in the design process could make this transition easier. Jamieson et al. (2005) stresses the importance of bringing together the key stakeholders during the design process, which demands a visionary strategy for the project prior to the design phase to establish a common language and an overall understanding of the teaching strategy and different learning activities. Furthermore, they point out that the teachers should be guided into using the new types of learning spaces.

AN ADDITIONAL PHASE TO ACTIVATE THE SPACE

Therefore, I propose that a fifth phase, "Delivery & Activation", is added to the design process (figure 6) with the purpose of handing over and activating the project in collaboration with the users in order to help them understand the spatial possibilities. Very often, the interaction between the creators and the users of the learning spaces abruptly ends as soon as the new design has been implemented, which leaves the users with a spatial design they might not know how to use. Without a strong leader to push the project forward, the new design risks becoming an obstacle instead of an asset.

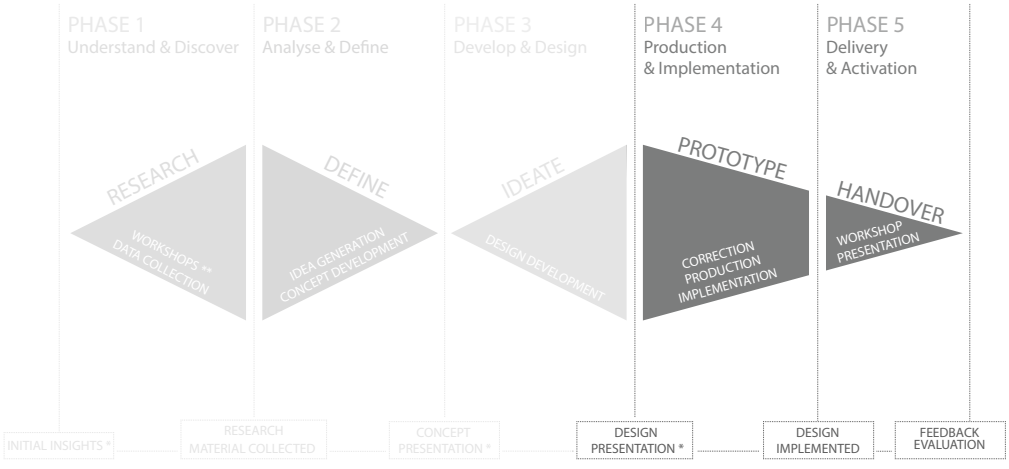

Figure 6: The design process model with a fifth phase for delivery and activation.

As explained earlier with references to Kirkeby (2006) and Imms & Byers (2017) the intentions of a new spatial design can be difficult to decode. During the fifth phase of the design process, the intentions of the space are to be translated into actions and negotiated trough appropriation with the users (both students and teachers) through participatory processes. It is presumed to be an on-going process where a common language and culture is established, because a school design is never totally finished. It constantly develops and transforms with its users.

The actual content of this phase still needs to be developed further. In this particular case, a process is set in motion where the designers will help activate the space on a regular basis. First step has been to motivate and inspire the teachers to use the space and the purpose-built furniture. We also asked them to start using the transformable cabinets and document it in order to inspire each other. Furthermore, the use of the space has become a permanent topic for discussion at their monthly meetings in order to create a work culture that suits all. Subsequently, we plan to develop a participatory process and a toolkit to help unlock the potential of ILEs based on perspectives of co-design.

CONCLUSIONS

In this paper, I have proposed that in order for an ILE to work intendedly, three things must correspond: creative teaching (the teacher), space (the designer) and organisation (management). This has been exemplified in a case study at a Danish school, where a design process model was used in an attempt to engage all participants in the design process and create accordance between creative teaching, space and organisation to ensure a common goal: creating the best frame for creative learning.

The experience from the process indicates that the teachers cannot be expected to know how to use the ILEs as a tool if they are not involved directly or indirectly in the design process and the intentions of the space. Ideally, all stakeholders are involved in the design process from the start-up phase to ensure successful implementation of a new ILE. In reality, this might not be possible because of the size of the school, budgets, time, workload etc. In this particular case, the teachers did not have time to participate in the design process, which might prove to be a general problem related to the teachers' workload. To compensate for this, the paper argues that the design process should also include a process of activation where all stakeholders work together and the designers help the teachers take control of their new physical frames, guiding them into using the space as a pedagogic tool for creative teaching and learning. The goal is to help the teachers experience the space as an asset in their teachings and not an obstacle. For this to happen, it is necessary to gain more knowledge about the connection between the physical space and the learning processes in order to create a common language. This is why it takes both sides to build a bridge – and at teacher to cross it.

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Constructing a framework for the exploration of the relationship between the psychosocial and the physical learning environment

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ABSTRACT

The research field regarding the relationship between the psychosocial learning environment (PSLE) and the physical learning environment (PLE) requires a commonly accepted theoretical framework, enabling comparison of research results and construction of a shared body of knowledge. Based on selected and reviewed literature, this study explores existing conceptualisations, distilling the main aspects as identified by earlier research, and processes these findings in a preliminary conceptual framework. This framework structures the PSLE into the dimensions: personal development; relationships; and system maintenance and change, and the PLE into the dimensions naturalness; individualisation; and stimulation. For each of these dimensions, the framework distinguishes the intended, implemented, and attained representation. Compared to the conceptualisations used in the reviewed literature, this preliminary conceptual framework is more comprehensive, with a balanced representation of both the PSLE and PLE. Further development and empirical testing will be necessary to demonstrate the validity, usability and reliability of the framework.

KEYWORDS: PSYCHOSOCIAL LEARNING ENVIRONMENT, PHYSICAL LEARNING ENVIRONMENT, CONCEPTUAL FRAMEWORK

Siebren Baars is a lecturer at the department of the Built Environment at the NHL University of Applied Sciences, architect, PhD candidate at the Faculty of Built Environment of the Eindhoven University of Technology (TU/e), member of the research group of Living Cities- AUDE – TU/e, member of the research group Open Innovation - NHL, and member of the group of national experts of the committee on effective learning environments of the OECD. Working as an architect at various offices, he designed and conducted many school building projects. In addition, he supervised and conducted many practice research projects into the physical learning environment as a board member of the research group of the BNA (Association of Dutch Architects). Seven years ago, Siebren returned to the University as lecturer, researcher, and supervisor of graduate projects. He has been involved in various research projects of the NHL, including research projects into the adaptation strategies for school buildings to meet innovative pedagogies. For these studies, he has developed a methodology combining stakeholder analysis and building analysis. To improve this methodology, he started a PhD study, with as first result this theoretical substantiation of a preliminary conceptual model for the research into the relation between the psychosocial learning environment and the physical environment.

INTRODUCTION

Interest in research into the learning environment is growing, stimulated by the changing pedagogical visions, shifting from behaviouristic approaches towards progressive and constructivist approaches (Cleveland & Fisher, 2014). Initially, research mainly focused on the psychosocial learning environment (PSLE), emphasising the investigation of the perceptions and experiences of the users on the micro-level of the classroom (Moos, 1980). Recognising the mediating effect of the physical learning environment (PLE) on the PSLE (Oblinger, 2007), the relationship between both has drawn the attention of researchers, including Lackney (2000), and Fisher (2007). Based on explorative studies, various concepts for innovative PLEs has been developed, including those of Fisher (2005) and Nair, Fielding & Lackney (2013). These concepts have already been incorporated in school building policies (Hod et al., 2016), regardless of the scarcity of empirical evidence of the impact of innovative PLEs on the PSLE (Blackmore, Bateman, Loughlin, O'Mara, & Aranda, 2011) - sometimes entailing rigorous consequences. School buildings have been demolished because of presumed dysfunction or inadaptability. Innovative PLEs are stimulating the implementation of innovative PSLEs, but are sometimes impeding return to other PSLEs also (Cleveland & Fisher, 2014). Therefore, developing an evidence-based body of knowledge regarding the relationship between the PSLE and the PLE is of great academic and social interest.

PROBLEM STATEMENT

In recent years, various frameworks have been developed to enable empirical research into the relationship between the PSLE and PLE. However, the research is divided over various disciplines, resulting in fragmented conceptual frameworks, complicating collective advances in this field (Ellis & Goodyear, 2016).

AIM

The aim of this study is to collate the existing knowledge and merge this into a conceptual framework, enabling structured research into the interrelationship between the PSLE and the PLE.

RESEARCH QUESTIONS

Therefore, the following research question is formulated:

- Which qualitative and quantitative aspects of the PSLE and PLE have been identified by the literature as relevant for the research into the relationship between the PSLE and the PLE, and in which way can these aspects be conceptualised in a framework?

METHODOLOGY

To answer this question, a literature review was conducted. Keywords were derived from the research question, supplemented with frequently used keywords in the research field. Several search engines were used, combining keywords of the PSLE with keywords of the PLE in various combinations. The literature was selected based on inclusion and exclusion criteria, including the publication date, number of citations, research topic, and type of publication. Subsequently the literature was studied in detail. Identified qualitative and quantitative aspects of both the PSLE and PLE were processed in a table, enabling analysis by comparison. Conceptualisations of both the PSLE and the PLE were compared, and merged into a preliminary conceptual framework, processing dimensions and aspects for which there is a reasonable consensus. Subsequently, existing frameworks used in recent research were compared with the preliminary conceptual framework, establishing the differences.

RESULTS

REPRESENTATIONS OF THE PSLE AND PLE

Analogous to van den Akker's (2013) conceptualisation of the curriculum, this research distinguishes the *intended*, *implemented* and *attained* representations of the PSLE and PLE. Referring to the different temporal phases and stakeholders perspectives, several researchers apply comparable conceptualisations, including Blackmore et al. (2011), and Radcliffe et al. (2008). The intended representation refers to staff's ideals, described in formal policies. The implemented representation refers to the observable practice and the perceptions of those bringing policy into practice. The attained representation refers to users' performance and experiences. This distinction is relevant because in different representations aspects may be contradictory, causing mediating or moderating interactions (Akker, Gravemeijer, McKenney, & Nieveen, 2006). Unexpected research results can often be explained by these contradictions. Frequently mentioned contradictions include the staff's intended PSLE versus the teachers' perceived PSLE (Gislason, 2009), the staff's intended learning goals versus the assessed learning outcomes (OECD, 2013a), and teachers' actual use of the PLE versus the intended use of the PLE, requiring teachers' "spatial competencies" (J. A. Lackney, 2008).

PSLE

Following the authoritative conceptualisation of the PSLE by Moos (1980), this research distinguishes the dimensions of *personal development, relationship*, and *system maintenance and change*.

Personal development

The dimension *personal development* can be conceptualised by the aspects *open-endedness, relevance/integration* and *environmental interaction*.

Open-endedness refers to the learning goals and outcomes, shifting from predefined end-products towards personalised, process-related learning outcomes, tailored to the student's individual learning potential, interest, and preferred learning style. *Relevance/integration* refers to the learning content, which, as a consequence of the open-endedness, should not be organised by subject matter, but by students' learning needs, in a multidisciplinary context similar to the reality outside school, where subject areas are not divided but interconnected (OECD, 2013b). *Environmental interaction* refers to the interaction of school's direct environment with learning, enabling students to provide an observable, meaningful contribution to the environment with their learning outcomes (OECD, 2013a).

Relationships

The dimension *relationship* can be conceptualised by aspects of *teacher support*, *critical voice, student negotiation, group cohesiveness* and *student involvement.*

Teacher support refers to teachers' sensitiveness to identify and to respond to individual learner's needs (OECD, 2013a). Conversely, learners must feel free to express their learning needs, and to comment on the learning and teaching activities, referred to as *critical voice. Student negotiation* refers to the students' construction of knowledge by mutually assessing the viability of ideas. Performing cooperative tasks requires learners being mutually respectful, helpful and supportive, referred to as *group cohesiveness*. Therefore, learners must be interested in the learning content, attentive to others, participating in activities, performing additional work, and appreciating being a group member, referred to as *student involvement*.

System maintenance and change

The dimension *system maintenance and change* can be conceptualised by the aspects of *order and organisation* and *shared control.*

Order and organisation originally refers to the qualitative sub-aspects on the micro-level of the classroom. Much literature on innovative PLEs focuses on defining the quantitative aspects on the micro-level and meso-level of the PSLE. Various authors,

including Fisher (2005) and Thornburg (2004), have conceptualised the learning modalities, learning activities and learning settings on the micro-level of students' PSLE. On the meso-level of a school, the grouping of learners was critically reviewed, with the organisational units of the class, subject matter, and scheduling being questioned. Therefore, alternative concepts have been developed, based on block scheduling and students grouped in Small Learning Communities (SLC), supporting multi-disciplinary activities and fluently merging and splitting of learning settings (Nair et al., 2013). The aspect *shared control* refers to the learning activities management , traditionally the responsibility of the teacher. In learning-centred PSLEs, learners are stimulated to be more self-regulating.

PLE

Following the conceptualisation of the PLE by Barrett et al. (2015), this research distinguishes the dimensions *naturalness, individualisation* and *stimulation*. Although sometimes further subdivided, the same dimensions are distinguished in other conceptual models, including the PST framework (Radcliffe et al., 2008), and PLACES and SPACES (Zandvliet, 2014).

Naturalness

The dimension *naturalness* can be conceptualised by the aspects *light, sound, temperature, air quality*, and *links to nature*.

Research into the healing environment (Ulrich et al., 2008) stimulated the attention to aspects related to the natural needs for a safe and healthy PLE. A growing number of studies confirms the impact of these aspects on students' performance and wellbeing, including the recent research of Barrett et al. (2015).

Individualisation

The dimension *individualisation* can be conceptualised by the aspects *flexibility, connection*, and *ownership*.

Flexibility refers to the availability of a variety of supportive technologies, furniture, fittings and equipment in students' PLE, as proved to influence the variety of teaching and learning activities (Imms & Byers, 2016). Pre-scheduling learning activities and learning spaces is contradictory to the aspect *open-endedness*, assuming immediate adaption of the learning settings to students' actual learning needs. Therefore, and because of efficiency, learning spaces will often be used for different learning settings simultaneously or sequentially by easy and quick rearrangement or simultaneously by a varied spatial arrangement.

Connection refers to the spatial configuration and interaction of learning spaces. Traditional classrooms are mostly too small-sized to accommodate multiple arrangements efficiently (Bissell, 2004). To avoid needless rearrangement, it is more efficient to compose a learning cluster of differentiated learning spaces (Nair et al., 2013). To enhance communication, interaction, and observation - prerequisite for *teacher support* and *student involvement* – these learning clusters must be open and transparent (Nair et al., 2013), only separating learning activities susceptible for interference. On the PLE's meso-level, internal connections are asserted to enhance the integration of disciplines, and external connections are asserted to enhance the environmental interaction.

Ownership refers to the perception of the users' ability to manage and control the PLE, promoting feelings of safety, responsibility, and belonging (Scott-Webber, 2004). Therefore, the spatial concepts usually exclusively allocate learning clusters to small learning communities. General logistical routes should not traverse these clusters, avoiding distortion of activities and presence of students not belonging to the SLC (Gislason, 2009).

Stimulation

The dimension *stimulation* can be conceptualised by the aspects *complexity* and *colour.*

Complexity refers to the diversity of PLE's physical presentation. The peripheral perception of the PLE is asserted to influence learning by sensual stimulation as "third teacher" (Strong-Wilson & Ellis, 2007).

Colour refers to the colours used in the PLE. Research has shown that colours influence both emotions and physiology, but also that colour preferences are depending on personal characteristics (Higgins, Hall, Wall, Woolner, & McCaughey, 2005).

Despite strong claims, the impact of these aspects is not unanimously established in the empirical practice and therefore disputed (Blackmore et al., 2011).

PSLE– PLE Relationship (PPR) framework

	INTENDED		IMPLEMENTED		ATTAINED
PSLE	***ideal / formal intended***		***perceived / operational***		***assessed / experienced***
personal development • *relevance/integration* • *environmental interaction* • *open-endedness*					
relationships • *teacher support* • *critical voice* • *group cohesiveness* • *student negotiation* • *student involvement*					
system maintenance and change • *shared control* • *order and organisation*					
	INTENDED		IMPLEMENTED		ATTAINED
PLE	***ideal / formal intended***		***perceived / operational***		***assessed / experienced***
naturalness • *light* • *sound* • *temperature* • *air quality* • *links to nature*					
individualisation • *flexibility* • *connection* • *ownership*					
stimulation • *complexity* • *colour*					

Figure 1: PSLE– PLE Relationship (PPR) preliminary conceptual framework.

The aspects identified in this paper have been merged into a conceptual framework for exploring the PSLE – PLE Relationship (PPR) (see Figure 1). Comparing this PPR framework with frameworks used by the reviewed publications, this study observes that much research focuses either on the PSLE or PLE, with a comprehensive operationalisation of the PSLE and a limited operationalisation of the PLE, or vice versa, leaving key factors unexplored. Additionally, most research focuses on the micro-level of the classroom; the meso-level of the school organisation and the school building is under-researched.

Research focused on user's experiences, mostly provide limited or no information regarding the analysis of the PLE, in particular regarding the operationalisation of the quantitative aspects of the PLE related to the dimensions of *individualisation* and *stimulation*. The recent research of Zandvliet & Broekhuizen (2017), by example, analyses students' perceptions regarding the PSLE and PLE, but does not provide a quantitative analysis of the PLE studied.

Conversely, PLE-focused research mostly does not report comprehensively on the PSLE. For their study into the conceptualisation of school building types, Dovey & Fisher (2014) selected schools by their intended innovative PSLE. They

note that, contrary to expectations, several schools are not hindered by building types that are assumed to impede innovative PSLEs. An analysis of the intended, implemented and attained PSLE could have explained this apparent contradiction.

The research of Barrett et al. (2015) into the impact of the PLE on learning outcomes also lacks a comprehensive analysis of the implemented and attained PSLE. The operationalisation of the implemented PSLE was limited because recording teachers' perceptions was not allowed for privacy reasons. The operationalisation of the attained PSLE was limited to the cognitive learning outcomes. Contrary to expectations, the research establishes weak impact of the aspects *connection* and *complexity*. The authors presume that this might be explained by the predominant pedagogical approach, emphasising learning in the classroom. An analysis of teachers' perceived PSLE could have supplied more insight.

Most of the reviewed research focuses on the micro-level of the student's learning environment. To enable research into a wider variety of formal and informal learning spaces, the Pedagogy, Spaces and Technology (PST) framework was developed by Radcliffe et al. (2008). The PST framework uses trigger questions, promoting a project-specific operationalisation of the aspects of pedagogy, space, and technology in various life-cycle stages. Several studies have been conducted on a single subject, recording the changes in teaching modes, learning experiences, and technology use before and after changing the learning space (Byers 2016). However, whereas the flexibility enables application of the PST framework in different situations, it hinders an unambiguous interpretation of aspects and their operationalisation (Ellis & Goodyear, 2016), complicating the comparison of the identified aspects with other frameworks.

DISCUSSION

This review merges the insights of research from various disciplines into the preliminary PPR framework. In this framework the key aspects, as identified and defined by the reviewed literature, have been arranged into dimensions, analogous to comparable conceptualisations of the PSLE and the PLE.

Compared to existing frameworks, aspects are added or amended, based on the reviewed literature. The meso-level of the aspect of *order and organisation* was not included in the reviewed frameworks, although frequently mentioned in the literature. The relevance of adding this aspect must be tested, including the demarcation between this aspect and the aspect *shared control*. Compared with the conceptualisation of the PSLE by Zandvliet, this framework adds the aspect *teacher support*, addressing the attitude of teachers towards learners, as the aspect *critical voice* addresses the attitude of learners towards teachers. Also for these two aspects, the demarcation requires attention.

In the PPR framework, the aspects are not operationalised in the distinguished representations yet. The relevance of aspects is not always undisputed. They may vary by educational level, and may be assessed differently depending on the stakeholder's position. Aspects may manifest themselves differently in the various representations, and may be difficult to operationalise in some situations. In addition, it should be noted that this framework is extensive. The operationalisation may prove to be rather elaborative.

FURTHER RESEARCH

The relevance of the aspects, and possibilities for operationalisation must be established by further research. Therefore, prior research may be explored, investigating and selecting the most effective methodological instruments. Subsequently, case studies should be conducted, testing the operationalisations by using the selected methodological instruments. The framework can then be modified based on the results of the case studies, resulting in a final version, tested on validity, usability and reliability.

CONCLUSION

This review started with the research question, which aspects are relevant for the research into the relationship between the PSLE and the PLE according to the literature, and in which way these aspects can be organised. This review establishes a reasonable consensus regarding the involved aspects, but also notes that the conceptualisations used are still under development. Merging existing conceptualisations, the preliminary PPR framework provides a fairly complete and balanced conceptualisation.

Further research is needed to test the preliminary PPR framework in an empirical setting to prove the validity, usability and reliability of the framework.

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Design with knowledge – Light in learning environments

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ABSTRACT

A range of artificial lighting characteristics have been found to influence our visual and cognitive capabilities, mood, motivation, and/or (social) behaviour – all affecting how we (academically) perform. One of such influential characteristic is spatial contrast, or the way light is distributed in space causing a pattern of light and darkness. This study looks at if and how spatial contrast influences pupil behaviour, and specifically their ability to concentrate. We first explored whether variances in pupil noise, physical activity and mood, which have been found to affect concentration, occur when exposed to either a high or a low spatial contrast in their learning environment. Preliminary data from field experiments in a primary school indicates towards decreased noise levels and improved environmental satisfaction when a high spatial contrast condition is present. This possibly implies improved environmental circumstances to concentrate. Further research to confirm this assumption will be undertaken.

KEYWORDS: ARTIFICIAL LIGHTING, ATMOSPHERE, PUPIL BEHAVIOUR, MOOD, NOISE, CONCENTRATION

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INTRODUCTION

Over the years a significant body of evidence has been accumulated that demonstrates our physical (built) environment influences our ability to act (Gifford, 2007). This has been found particularly true for educational environments, where a range of parameters has been identified that influences our behaviour, wellbeing, and ultimately academic performance. Light is one of such influential parameters (Barrett, 2015). For those designing or using educational facilities it is relevant to understand how lighting conditions may influence our ability to perform curricular activities. A better understanding of the relationship between indoor lighting conditions and human (learning-related) behaviour, empowers to design more suitable learning environments.

Our research, embedded in the architectural practice Henning Larsen, explores this relationship specifically in public, primary schools in Denmark, where recently a major educational reform took place (The Danish Ministry of Education, 2014). Greater emphasis is now put on stimulating "learning" through: physical playfulness, diversity in curricular activities, and addressing individual learning styles instead of applying a generalized approach. As a result, Danish primary schools have implemented a teaching philosophy that promotes for individuality, flexibility and diversity.

Ideally, the design of spaces where this "new" learning takes place facilitates these educational principles. This environmental need has also been recognized by the Danish local governments, and a significant number of primary schools have been or are currently in the process of being renewed or refurbished. In line with this development, our research ambition became to explore how artificial lighting can play an active role in creating such supportive "new" learning environments, and simultaneously grow our knowledge on how artificial lighting influences (learning-related) behaviour of pupils in Danish primary schools.

THE INFLUENCE OF ARTIFICIAL LIGHT

Previous researchers studying the influence of artificial light on users of learning environments found that certain characteristics impact their visual and cognitive capabilities, biological clock, mood, motivation, and/or (social) behaviour – ultimately affecting (academic) performance. Most evident are "light" characteristics such as intensity, colour temperature and combinations hereof (Sleegers, 2012; Mott, 2012; Wessolowski, 2014), as well as "system" characteristics such as glare, flicker, and control (Winterbottom, 2009). Yet little studied, but possibly equally influential are "spatial" characteristics of artificial light, which co-define the appearance of (Boyce, 2014) and consequently the perceived atmosphere in (Vogels, 2008) a space. One of these is spatial contrast, which is the result of how (artificial) light is distributed in a space, creating a pattern of relative light and darkness. A pattern with great variation is considered high-contrasting or non-uniform – also referred to as "dramatic", whereas a pattern with little variation is considered low-contrasting or uniform – also referred to as "plain" (Flynn, 1973, 1979; Govén, 2009; Boyce, 2014).

The main difference between light- and system characteristics, and spatial contrast is that these first two are *product* variables, defined by the technical characteristics of the lighting installation fitted. Whereas spatial contrast is a *design* variable, meaning that it is tailored by the architect to fabricate the intended spatial experience (Boyce, 2014), and herewith a perceived atmosphere (Vogels, 2008). As our research is embedded in architectural design practice with a strong emphasis on optimizing the spatial experience in our built environments, exploring the influence of spatial contrast in learning environments became the theme to investigate further.

THE ARCHITECT'S RESPONSIBILITY

Arguably, architects should treat artificial light with similar importance as they do for natural light, which is commonly considered a significant design criteria to guarantee a healthy and stimulating indoor learning climate. It seems well recognized that daylight, when utilized wisely, can improve our wellbeing, indoor experience and academic performance (Gifford, 2007). For instance, one regularly referred to study verified that allowing the right amount of daylight indoors helps to learn faster and achieve better results (Heschong Mahone Group, 2003; World Green Building Council,

2013). Besides having quantitative value, daylight is also considered a rich qualitative resource. In particular when it comes to designing a dynamic learning environment with variations of intensities, colour, orientation and movement of natural light through a space. Such variations have been found to influence our spatial experience over time, and herewith to increase motivation and our ability to learn and be creative (Jensen, 2012).

Nonetheless, the availability of natural light in interior spaces will fluctuate depending on location, orientation, time of day and season, and artificial light is often required to complement or overcome a lack hereof. As a consequence, it has significant influence on our spatial experience and should likewise be a design criteria on the architect's agenda. However, when interviewing numerous Danish educational architects about their (artificial light) design practice, it became apparent that it is not (yet)considered noteworthy beyond meeting the basic illumination requirements in the national building regulations. These merely safeguard that the 'average user' is able to comfortably move, read and write by prescribing a maintained average illumination and uniformity level for all hours of use. With this realisation in mind, we explored what the consequence of this approach has been for the indoor lighting conditions in today's learning spaces.

ARTIFICIAL LIGHT IN TODAY'S LEARNING SPACES

Field studies in eight Danish primary schools (of which four examples are shown in figures 1a-d) revealed the common application of 'one-type-fits-all' ceiling-based artificial lighting systems, resulting in a relatively uniform, or low contrast, distribution of light. The consequential spatial appearance, or perceived spatial atmosphere, was often described as "functional", but "dull", "uninspiring", or even "hospital-like" aka unpleasant. When discussing how these systems are used during teaching hours, educators' responses did not go much beyond: "… *switching it ON at the start of day, and OFF at the end*". But when asked to elaborate on their experience with and/or use of light in general whilst teaching, several went on to describe how they did use it in some form. In most examples, their intention is to create (in their words) the 'right' atmosphere to promote behaviour and mood that benefits pupils' ability to concentrate. Some did so by deliberately de- or increasing the existing light level based on the type of curricular activity at hand. Others used their own sources of light such as candles or

Figure 1a: Lyngby Skole.

Figure 1b: Albertslund Skole.

Figure 1c: Sophia Skole.

Figure 1d: Ørestad Skole.

Figure 1: Impressions of artificial lighting conditions in primary Danish learning spaces.

simple plug-in table luminaires to promote local focus and quietness, or to cluster pupils' attention in small groups. These and other examples revealed that a number of educators sought to create a particular atmosphere intended to foster focus and concentration amongst pupils when deemed valuable (e.g. certain curricular activities).

ATMOSPHERE TO CONCENTRATE

Previous research revealed that conscious design with light and darkness co-defines the appearance of a space (e.g. Boyce, 2014), which contributes to our experience of atmosphere (e.g. Vogels, 2008). This is, amongst others, shaped by the way light is distributed in a space, or spatial contrast, as described above. Our field studies in eight primary learning environments revealed that a low-contrast, or uniform, distribution of artificial light has become the norm. The resulting luminous atmosphere is described as functional, though uninspiring and dull. Having also learned that educators try to modify this atmosphere by using local light sources instead of the generic ceiling lighting to promote focus and concentration, they are effectively changing the manifestation of spatial contrast in their environment.

These findings suggest that spatial contrast has the potency to be an instrument for educators to orchestrate a different-then-normal atmosphere in their learning environment, and in their view, aid concentration during certain curricular activities. If this idea could be demonstrated true, then artificial lighting might receive greater attention in learning space design. It was therefore further explored in a design context by hosting workshops with a number of architects at Henning Larsen, which led to the formulation of the following hypothesis:

> Focussed, local light leads to high-spatial contrast that co-constructs an atmosphere that promotes pupil behaviour and mood states benefitting their ability to concentrate"

These workshops also informed the design of an artificial lighting prototype capable of creating the wished for high-spatial contrast by educators on-demand.

THE 'LIVING LAB'

To validate this hypothesis, this prototype has been implemented in four learning spaces of *Frederiksbjerg folkeskole* (figure 2), a new public school located in Aarhus (DK). This school, inaugurated in August 2016 and co-designed by Henning Larsen, is considered: "*a benchmark example of the new educational ideals translated into supportive learning environments*" (Norhcon, 2016), and was therefore thought to be a credible example to evaluate our hypothesis in the context of the new reform.

Figure 2: Impression of the new Frederiksbjerg Skole in Aarhus (DK).
Henning Larsen, © Hufton+Crow

The four spaces selected are located in close proximity and have relatively similar natural light and spatial layout characteristics. Two spaces are used each by one group of 1st to 3rd grade pupils (aged 6-8 years), and host a varied

palette of curricular activities. The other two spaces are used by eight rotating groups of 4th to 6th grade pupils (aged 9-12 years) for 90-minute mathematics lessons. Both demographic and curricular settings were thought to benefit from improved pupil concentration.

The “prototype design” has been implement in addition to the existing “default design” in these four spaces. The **default lighting design** consist out of six evenly spread ceiling luminaires. Users may choose to either switch all six luminaires: OFF (option A, figures 3a+3b) or ON (option B, figures 4a+4b) – with an option to increase or decrease the overall light level. The default ON state causes a low-contrast distribution of light, and complies with the current Danish building regulations to provide for an average “working area” illumination level of 300 lux with a uniformity ratio of 0.6 during all hours of use. The **prototype lighting design** consists out of the default system complemented by six additional suspended pendants above typical work surfaces (aka working desks) permitting for local, focussed light at eye-level. Users may choose to switch all lighting OFF (option A, figure 3a+3b), or to activate the default ceiling lighting only (option B, figure 4a+4b) which results in a low-contrast distribution of light. They may also choose to activate both the default and new pendant system simultaneously (option C, figure 5a+5b), or the pendant system only (option D, figure 6a+6b). Both results in high or very high-contrast distributions of light.

To evaluate the validity of our hypothesis, the influence of the high-contrast prototype lighting design on pupil behaviour and their mood, was compared to that presented under influence of the low-contrast default lighting design.

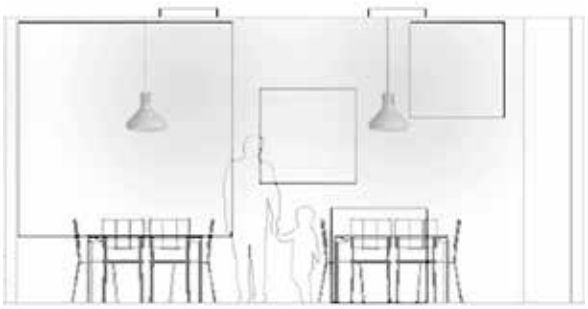

Fig.3a: Option A (all luminaires OFF).

Fig.4a: Option B (ceiling lighting ON).

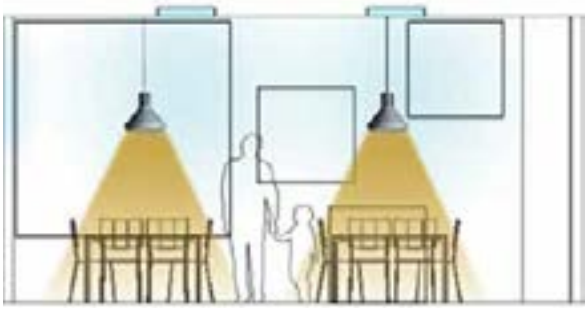

Fig.5a: Option C (ceiling + pendants ON).

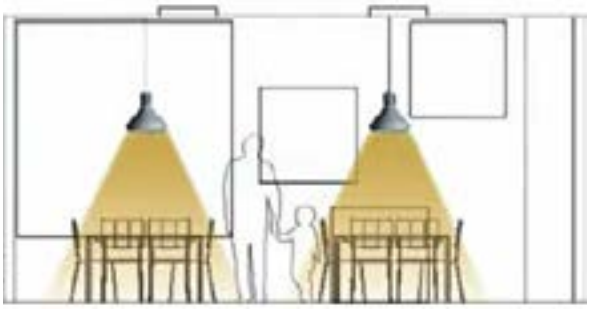

Fig.6a: Option D (pendant lighting ON).

Figures 3a – 6a: Four distinct illumination principles in the test rooms.
Henning Larsen, Imke Wies van Mil.

Figure 3b: Option A (all lighting OFF).

Figure 4b: Option B (ceiling lighting ON).

Figure 5b: Option C (ceiling+pendant ON).

Fig.6b: Option D (pendant lighting ON).

Figures 3b – 6b: Four versions of spatial distributions of light.
Henning Larsen, Halfdan Trolle).

DATA COLLECTION

To evaluate whether the prototype design effected pupil concentration, we looked at two specific behavioural pupil actions: their noise levels and their physical activity during a curricular session. A correlation is thought to exist between the level of noise pupils are exposed to (including their own noise), and their ability to concentrate (Klatte, 2013). And in similar fashion, this seems also the case for physical activity, and specifically the length of time seated at one place. It is anticipated that for our hypothesis to be considered valid, the prototype design should lead to lower average student noise and longer average time seated at the working place. In addition, we also assessed variances in pupil's feelings towards their learning environment, anticipating greater satisfaction to positively influence mood and motivation. To exclude as many intervening variables as possible, a range of other (environmental) factors have been measured as well.

A mixed method approach is applied to collect the described quantitative and qualitative data. This included anthropological techniques such as non-participant in classroom observations, semi-structured interviews and focus groups with educators and pupils, as well as continuous measurements of the indoor climate variables, and recordings of the lighting system usage. Noise levels have been recorded with sound-level meters, and physical activity by observations and video documentation. Data collection took place during the months of February, March and April of 2017. In each of the four learning spaces, the pupils and their educators experienced the two lighting designs in succession for three continuous weeks. Two of the spaces (one lower, one mid-level) used the default lighting design during the first three-week interval, and the prototype lighting design during the following three weeks. The other two rooms experienced both situations in opposite order. The weekly schedule of curricular activities in each space, as well as their furniture and spatial layouts were kept consistent during the entire research period.

PRELIMINARY FINDINGS

Currently we are in the process of analysing our data. Preliminary findings however tend towards supporting our hypothesis that high spatial contrast, created by focussed, local light distribution may lower average pupil noise. A first analysis of the collected sound data indicates that during activation of the local pendant lighting, the average noise level in

these rooms decreased up to 10%, which is deemed significant. In addition, a positive increase in environmental satisfaction by both educators and pupils was found, and educators estimated (but could not prove) longer periods of concentration amongst pupils. Further analysis of video recordings and observational notes is required.

The immediate outcome is however that *Frederiksbjerg skole* requested for the prototype lighting scenario to be made into a permanent installation (figure 7), and to be replicated in other spaces too. Not only is this a successful conclusion for our design led research approach, this also allows for a longer period of study during Autumn 2017, which may make our initial findings more reliable and robust. In addition to previous methods, additional pupil exercises, both quantitative and qualitative in nature, will be added to our data set. Analysis of these exercises may possibly indicate more accurately what the impact of the new lighting scenario is on pupil's ability to concentrate. If further data analysis backs up our initial findings described above, we might also be able to conclude that the current buildings regulations not necessarily promote the most favourable luminous learning environments, and changes should be considered.

Figure 7: Permanent lighting installation inaugurated by the pupils and educator.
Henning Larsen, Imke Wies van Mil.

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A framework of factors for learning environments evaluation

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ABSTRACT

This research has developed a framework to enable architects and educators to identify the factors that they see as most significant in the relationship between innovative education practices and innovative learning environments. The framework provides conceptual organization for a set of factors that are relevant to the planning and implementation of innovative education practices in innovative learning environments. A questionnaire derived from the framework enables users to develop a profile of significant factors appropriate to a particular project. The profile can be aligned with the evaluation needs and purposes matrix developed by the Evaluating 21st Century Learning Environments project (www.e21le.com) to identify the most appropriate evaluation approach to use in conjunction with that project.

KEYWORDS: EXPERT ELICITATION, EVALUATION, INNOVATIVE EDUCATION PRACTICES, INNOVATIVE LEARNING ENVIRONMENTS

Graeme Oliver is a private education researcher and consultant. He is currently completing his doctoral studies at the Melbourne Graduate School of Education with a focus on the evaluation of 21st century learning environments (see www.e21le.com). Graeme has extensive experience in education leadership at school, state, national and international levels. He was ten years as a leader at the world recognised innovation project of the Australian Science and Mathematics School, South Australia (www.asms.sa.edu.au). The ASMS is extensively cited as a centre of excellence in innovation in the OECD report Innovative Learning Environments (see http://www.oecd.org/edu/ceri/innovativelearningenvironments.htm). Graeme has experience of education policy development and implementation at state and national level, especially as a Board member of the South Australian Certificate of Education (www.sace.sa.edu.au) and as a Board member of the South Australian Secondary Principals Association and Vice-President of the association (http://www.saspa.com.au/).

INTRODUCTION

The research reported here describes a framework of key factors considered most significant to the evaluation of 21st century learning environments based on feedback from a pool of identified experts. The framework deliberately integrates the perspectives of architects and educators.

The need for such a framework was derived from the Evaluating 21st Century Learning Environments Australian Research Council project. The development of the framework relates to the overarching research question "How can we determine which learning environments best support 21st century pedagogies" (Imms, Cleveland, & Fisher, 2016). The purpose of such a framework is to map the terrain so practitioners can best identify their particular situation and circumstances for evaluation of the complex field of relationships between learning environments, teaching and learning practices and learning outcomes. This research responds to a key research question, *What factors do architects and educators see as most significant in the relationship between innovative learning environments and innovative education practices?*

DEVELOPING THE FRAMEWORK

A conceptual framework to support the research was developed through a literature review. The literature focussed in particular on architectural approaches to design and evaluation in education settings, and education approaches to the implementation and evaluation of new approaches to teaching and learning in innovative learning environments.

Nineteen models or frameworks were identified in the literature that are used in various ways to support the implementation and evaluation of innovative education practices in innovative learning environments. These were analysed in terms of their key purpose, organising features and detailed features or issues addressed. The models were organised into three groupings that reflected their declared or implied purposes.

The first group was those models that had a technical performance orientation (Copa & Pease, 1992; Higgins, Hall, Wall, Woolner, & McCaughey, 2005; Preiser & Nasar, 2008; CELE, 2009). These models came from an architectural orientation and tended to have a background in Post Occupancy Evaluation or Building Performance Evaluation. The *Evaluation of Quality in Education Spaces* framework (EQES) developed for the OECD/CELE project is an example of a deliberate attempt to make evaluations of education facilities more education-oriented to assist education authorities and schools optimise the investment in and use of educational spaces.

The second group was those models that had an education systems or policy orientation (Johnson & Lomas, 2005; Radcliffe, Wilson, Powell, & Tibbetts, 2008; Lippman, 2010; Ellis & Goodyear, 2016; Partnership for 21st Century Learning, 2016; Owens & Valesky, 2015). These models often had an orientation towards supporting declared positions on 21st century learning and technology rich learning environments suggesting that education systems and policies should be actively supporting technology enhanced innovation.

The third group of models had an orientation to addressing learning environments as a part of an education ecosystem and as such allowed for the development of a situational profile within that ecosystem (OECD, 2013; Blackmore, Bateman, O'Mara, & Loughlin, 2011; Lee & Tan, 2008; Basye, Grant, Hausman, & Johnston, 2015; Plotka, 2016; Ministry of Education NZ, 2017; Gislason, 2010; Centre for Educational Research and Innovation, 2013). These models tend to include a transactional concept of the relationship between people and space which emphasises that the understanding of the nature of a learning environment will be constructed by those who occupy it and that this will change over time.

There is concern expressed in the literature that despite this seeming abundance of models to support the implementation and evaluation of innovative education programs in innovative learning environments, evaluations of learning environments need to become more sophisticated (Cleveland & Fisher, 2013). Lee and Tan (2008) highlight that evaluation of learning spaces is not normally done by "experts" in the field and that evaluations of learning spaces have been "limited in depth, rigour and theoretical grounding, and heavily reliant on informal and anecdotal evidence" (p. 3). Imms et al. (2016) suggest that recent evaluation work in the field has been "too particular in focus and method, and therefore being limited in its

usefulness to practitioners" (p. 19). The framework developed through this research addresses these issues by helping provide stronger conceptual grounding of the relationships between innovative education practices and innovative learning environments, and through this allowing for more informed alignment of evaluation with practice.

KEY IDEAS UNDERPINNING THE FRAMEWORK

Four key ideas were derived from the literature review that formed the basis of the framework that was developed for this research:

1. Evaluation needs to be cross-disciplinary in that it can combine the perspectives of academics and practitioners in the fields of architecture and education
2. Evaluation needs to be carried out over a period of time that recognises the ongoing interactive developments that occur between space and its users
3. The framework needs to help organise the multitude of complex issues that interact in this field in a manner that allows users to make appropriate sense of their particular situation
4. The framework needs to help identify approaches to evaluation that will be most appropriate to the particular situation identified by the users.

The framework that was developed has the following features:

- Phases – Four phases in the cycle of implementation and evaluation (Design / Transition / Consolidation / Re-appraisal).
- Focus – Two foci for framing consideration of issues (Learning Environment Focus / Education Practice Focus).
- Perspectives – Key perspectives declared within each focus at each phase of the implementation and evaluation cycle. The perspectives represent the orientations of Learning Environment Designer / Education Leader / Education Practitioner / Education User.
- Factors – Are the specific points for consideration flowing from each perspective at each phase of the evaluation cycle? There are 18 factors presented at each Phase of the framework for a total of 72 factors for the entire model.

This framework is represented in Figure 1. This figure is an overview that shows how the phases, foci and perspectives are situated, but does not give details of the factors that are a part of the framework. Detail of the factors is presented in other documentation on this project (Oliver, 2016).

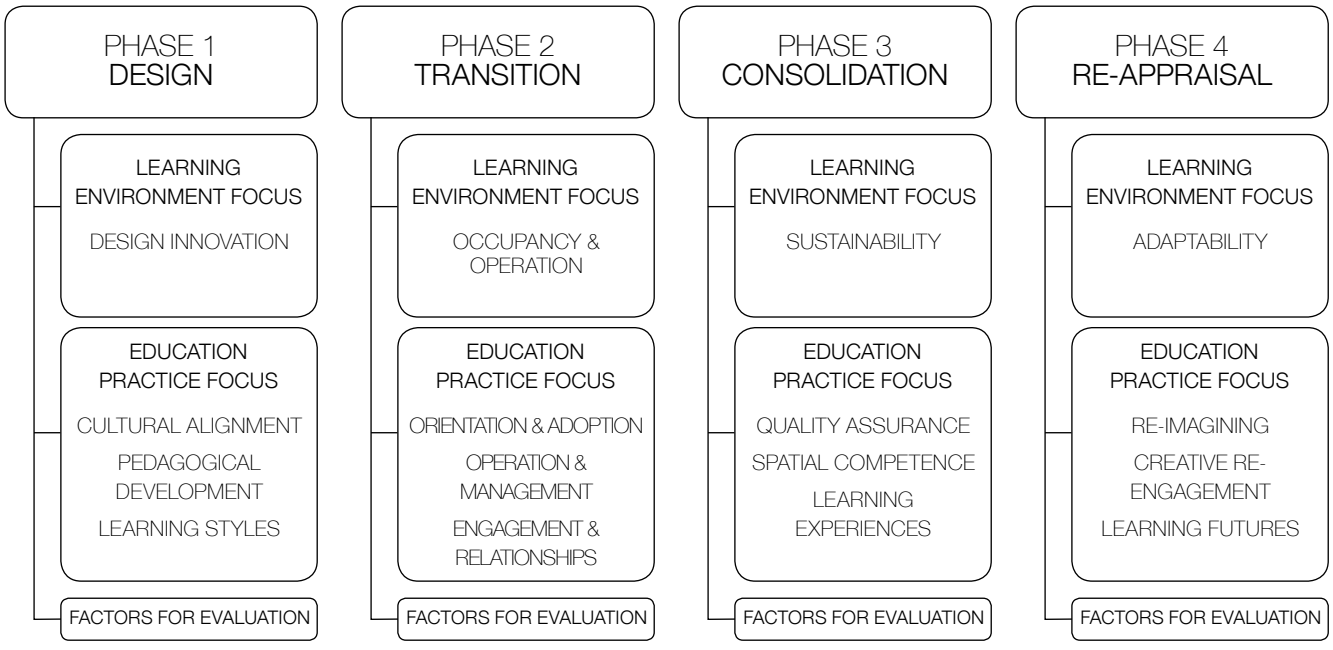

Figure 1: An overview of the framework for the evaluation of innovative education practices in innovative learning environments.

REFINING THE FRAMEWORK

A questionnaire was developed based on the framework to gather feedback on respondents' perceptions of the significance of the factors identified in the framework. Respondents are asked to give their view of the significance/ importance of each factor as it relates to the implementation of innovative education practices in a new learning environment development project at the four phases of the framework. Responses are given on a Likert type rank of significance.

DATA COLLECTION

Responses to the questionnaire were gathered based on a methodology of expert elicitation. The general concept of expert elicitation is a process of gathering information and data from qualified people in the field. Experts are generally considered to be people who have a background in the subject and are recognised by peers and those conducting the study as qualified to answer the questions. Expert elicitation is seen as a most appropriate methodology for this research as it supports the integration of perspectives from different disciplines and accepts each expert as being valid in their own right. The approach to expert elicitation used in this study was based on the work of Meyer and Booker (2001).

Experts were identified in consultation with peak professional organisations in architecture and education. The experts were required to have academic or professional qualifications in their area of work and to have had recent relevant professional experience in designing and/or implementing innovative education programs in innovative learning environments.

The questionnaire was distributed to 43 identified experts. There were 20 full responses provided, 9 from people with a primary background in architecture and 11 from people with a primary background in education. Two respondents had an academic and professional background in both architecture and education but declared that their current primary orientation was with architecture.

DATA ANALYSIS

The data was analysed with reference to the guiding question for this study "What factors do architects and educators see as most significant in the relationship between innovative learning environments and innovative education practices?".

The data is derived from a Likert type response set. As such the data only has ranking (ordinal) value, and cannot be used to ascribe qualitative comparisons of the factors. The purpose of the data analysis is to identify those factors that the respondents see as most significant and least significant in relation to the framework for the evaluation of innovative education practices in innovative learning environments.

The judgements for determining whether factors should be included or excluded in a revised framework are qualitative judgements based on a combination of considerations:

- Are there consistent patterns of responses from the respondents in identifying some factors as being significant and some as not significant? These patterns are represented through scatter plot charts as indicated in Figure 2.
- Are there clusters of sets of factors that indicate ways in which the factors might best be represented in the framework? Cluster analysis was done using univariate cluster analysis (UCA) using four point clustering. Four point clustering is considered appropriate in this situation as the two extreme clusters can indicate the sets of "clearly in" and "clearly out" factors and the two middle clusters identify the factors that need further consideration.
- Qualitative judgements were referenced to the original framework that was used to identify the factors and to develop the questionnaire. This identified factors that respondents considered sufficiently significant or not sufficiently significant to include in the framework. It also identified issues that may cause re-consideration of the framework itself.

The data was organised into a range of combinations for analysis. Twenty-one combinations of respondent groupings (architect, educator or all), time phases of the framework (phase 1, 2, 3, 4 or all) and rating of significance (extremely significant or not significant at all) are analysed in the doctoral thesis. For this report selected analysis is presented to respond to the guiding question presented above.

DATA INTERPRETATION

There is strong agreement between architects and educators as to the most significant factors in the relationship between innovative learning environments and innovative education practices.

Figure 2 shows a scatter analysis of factors for ratings of extremely significant by all respondents across all phases. The scores used for this analysis are the average of "extremely significant" responses from all respondents across all four phases of the framework. The scores range from 92% extremely significant (Education Principles) to 22% extremely significant (Operational Alignment).

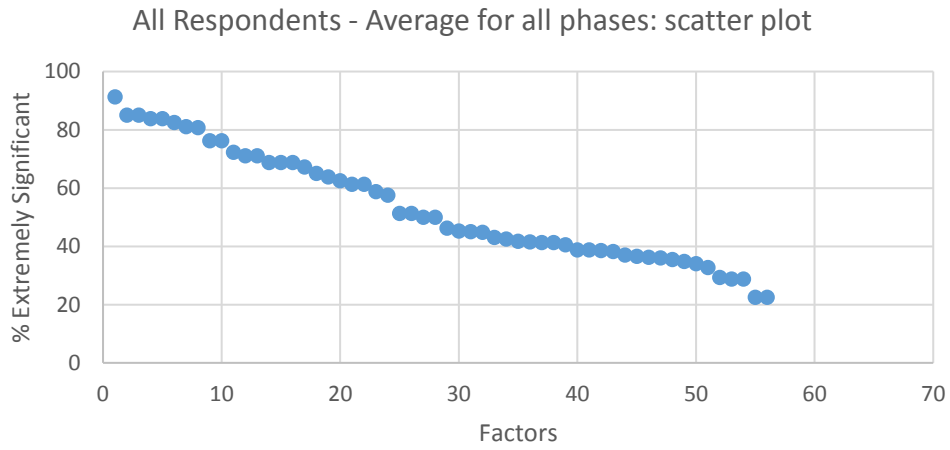

Figure 2: Scatter analysis and of factors – all respondents "extremely significant" for all phases.

The patterns shown in this analysis identify a clear spread of responses suggesting there is appropriate discrimination between factors from the high end of the ratings to factors at the low end of the ratings.

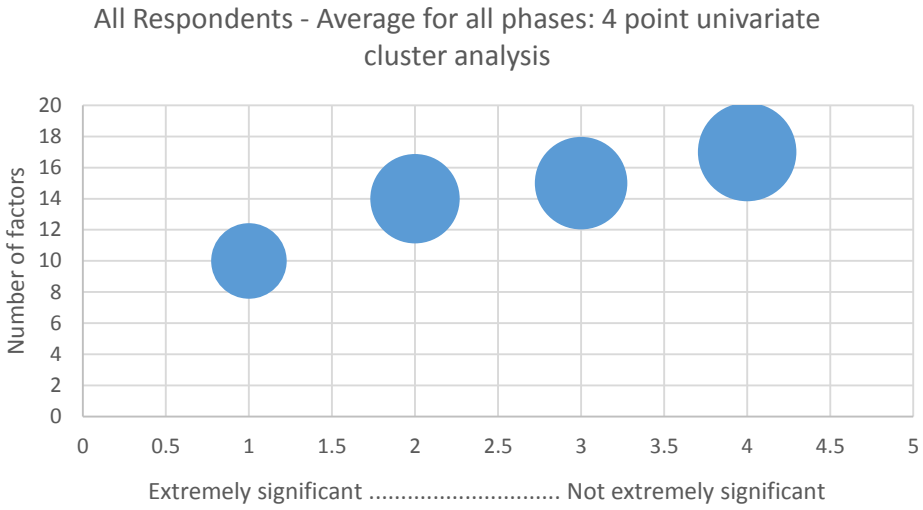

Figure 3: 4 point univariate cluster analysis groupings for all respondents "extremely significant" for all phases.

Figure 3 shows the clusters that are identified using four point univariate cluster analysis derived from the rankings shown in the scatter plot diagram. While this is statistically considered an 'approximate solution' it provides clusters that are useful groupings of the factors for the purpose of developing a profile and refining the framework.

Table 1: Listing of factors in four point univariate analysis cluster groupings for all respondents "extremely significant" for all phases.

Factors Cluster 1 (10) High extremely significant	Factors Cluster 2 (14)	Factors Cluster 3 (15)	Factors Cluster 4 (17) Low extremely significant
Education Principles	Student Ownership	Learning Activities	Building Performance Evaluation
Student Engagement	Pedagogical Flexibility	Flexible Design	Design Standards
Learning Culture	Professional Practice	Community Context	Facility Adaptation
Stakeholder Engagement	Collaborative Learning	School Operations	Facility Sustainability
Teaching Approaches	Inquiry Learning	Student Achievement	Realisation of Affordance
Student Well-being	Teacher Capacity	Design Brief	Occupancy Adaptation
Student Voice	Stakeholder Consultation	Spatial Innovation	Quality Indicators
Pedagogical Innovation	Social Milieu	Furniture Function Evaluation	User Adaptability
Integrated Technology	Stakeholder Buy-in	Future Learning	Cost Efficiency Evaluation
Professional Engagement	Virtual Learning	Learning Connections	Occupancy Evaluation
	School Identity	User Comfort Evaluation	Facility Reconfiguration
	Learning Styles	Developmental Leadership	Technical Provision Evaluation
	Professional Learning	Facility Viability	Spatial Optimisation
		Spatial Awareness	Professional Re-imagining
		Teaching Programs	Future Proofing
			Operational Refinement
			Project Management
			Operational Alignment

Table 1 lists the factors identified in each of the clusters. These clusters are for the combined rankings for architects and educators. There was a high degree of similarity between the clusters formed using other variables for the rankings (e.g. architects alone or educators alone). Because the data is derived from a Likert style ranking process, an analysis of the statistical significance of factors in different UCA sets could not be conducted.

What the analysis from this research shows is that using the questionnaire with people who have expertise in the field will produce results that have clear and consistent patterns that give the basis for further qualitative decisions of interpretation in relation to forming a situational profile. Based on this analysis the framework can be presented to include the factors identified in cluster one at each of the phases. This is shown in Figure 4. This presentation of the framework shows nine factors being identified as extremely significant at all four phases of the framework. There are 11 further factors identified as extremely significant at various phases of the framework.

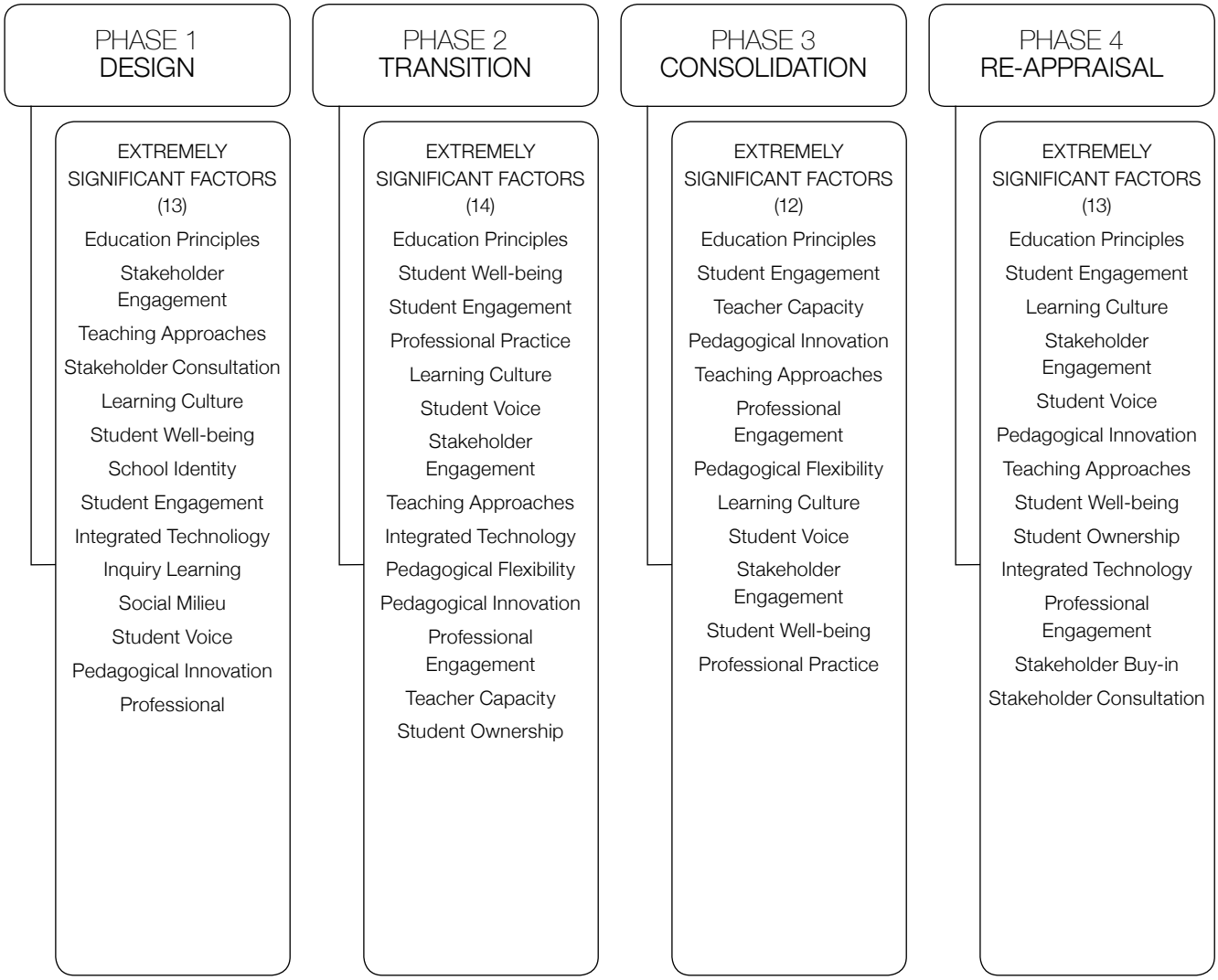

Figure 4: Factors identified in cluster 1 extremely significant for each phase of the framework.

WHAT CAN THIS MEAN?

The ultimate purpose of forming such clusters is to create a situational profile that is of most value to the user group in guiding the implementation and evaluation of their particular project. A profile could be expansive and include all of the factors indicated in cluster one and cluster two in this analysis. Or a group could decide to have a quite focussed profile and use a five point UCA that might produce a cluster of only five or six factors in cluster one.

CONCLUSION

This research set out to investigate what factors architects and educators see as most significant in the relationship between innovative learning environments and innovative education practices, and how these factors could be organised into a situational profile to support the implementation and evaluation of specific projects. The research developed a framework of possible factors identified through a literature review. A questionnaire was developed based on the framework to identify respondents' ratings of the factors. The validity of the framework for the declared purpose was tested through a research process of expert elicitation. The data were analysed using multiple iterations of scatter plot analysis and univariate cluster analysis. The patterns shown in the analyses demonstrated consistent significant discrimination of factors across the ratings from extremely significant to not significant, consistent clumping into groups using univariate cluster analysis and consistent patterns in the allocation of the factors into the UCA groups.

Since the data were derived from Likert type responses, a qualitative ranking of the data and further qualitative judgements are required to determine the exact nature of any particular interpretation.

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