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Creating Dynamic Places for Learning

An Evidence Based Design Approach

Springer

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Acknowledgements

Creating Dynamic Places for Learning is a culmination of years of designing school buildings, research from the Graduate Center of the City University of New York, USA, and La Trobe University, Bendigo, Australia, and curating the interior spaces of learning environments around the world. While cliché, this book would not have been completed without many people. I would like to thank:

Both Grace Ma, Senior Editor Education, Australia, New Zealand, and South-East Asia Springer Singapore, and my co-editor Dr. Elizabeth A. Matthews. Grace believed in the vision for the book and has been nothing but encouraging. Without Elizabeth, this book would never have been accomplished. Her focus to details ensured that each chapter maintained the vision for this book.

All the authors who have contributed chapters to the book. The significance of their contributions is a book that re-imagines how professional organizations, policymakers, educators and architects, interior designers, and educational specialists and planners approach to the design of learning environments.

My wife (Uzo) and my sons (Stephen, James, and William) who inspire me to wake up every day and want to see what each new day has to offer. I must thank my mother (Estelle), brother (Jay), and sister (Beverly), who instilled in me the conviction that I can accomplish anything.

The many friends who over the years have been influential with my development as an educator, researcher, designer, and person. These are people in the USA, Sweden, and Australia, who, without knowing it, have always inspired and encouraged me to question how and why learning environments are designed.

<div align="right">Peter C. Lippman, Ph.D.</div>

Working on Creating Dynamic Places for Learning has been an amazing experience. It has provided my colleague Peter, the contributing authors and I the opportunity to provide a critical perspective on the development of the physical places and spaces that comprise learning environments. As Peter noted, this project would not have been possible without the support of so many including:

Our editors and the supporting staff at Springer, who worked tirelessly to help us manage the book, timelines and were always supportive and enthusiastic about the project.

My wonderful daughter, Olivia, who provided the encouragement needed to complete the project.

And my long-time colleague and friend, Peter Lippman, whose passion for architecture and science is unmatched.

<div style="text-align: right">Elizabeth A. Matthews, Ph.D.</div>

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Introduction

Prologue: Basis for This Book

Peter C. Lippman and Elizabeth A. Matthews

Abstract Rather than promoting normative concepts about school buildings, the notion of *dynamic places for learning* advocates for an *Evidence-Based Design Approach.* This approach incorporates a multi-disciplinary perspective that draws upon empirical research from the fields of environmental psychology, education, and architectural practice. To elucidate the complexities involved with creating a dynamic learning environment, the reader will explore different aspects of the design process that can positively and effectively influence the interior spatial organization of the school building. To provide the reader with insight to these different aspects, this volume is composed into three sections. These sections are Visioning Process, Research in Context and Design. The Visioning Process examines the series of steps taken for imagining the educational and physical and/or redesign of the learning environment. Research in Context introduces research that examines the opportunities and challenges for teachers and learners in real-life learning situations. Lastly, building on the theory and current research in the fields of education and environmental psychology, Design presents a framework for presents a framework for the design of school buildings. Hence, this book is unique in that it serves to incorporate a variety of perspectives which the authors believe will enable researchers, educators, and designers to take actionable steps to create dynamic places for learning.

Keywords Evidence-based design · Dynamic learning environments · Innovative learning environments · Transactional worldview · Design of school buildings · Space · Place

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P. C. Lippman and E. A. Matthews (eds.), *Creating Dynamic Places for Learning*,
https://doi.org/10.1007/978-981-19-8749-6_1

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Overview of the Book

What constitutes the ideal physical setting for student learning? Over the past decade, researchers, policymakers, educators, and designers have tried to identify the key facets that support student learning and engagement. Historically, classrooms, specialized instructional spaces, art rooms, music rooms, and common learning areas are generally understood as gathering spaces in which learning occurs. It is this view that has led to the reproduction of school buildings as unimaginative and alienating places for the learner. The ideal learning environment, however, is not merely a static place in which learners are intended to acquire knowledge, but rather, these are challenging places that are in all ways evolving. Indeed, the ideal learning environment is an ecosystem which is not only evolving in step with the needs of the teachers and learners, but most importantly is *dynamic*.

The premise of this book is to provide readers with the foundational concepts of research, practice, and theory as core considerations when creating dynamic learning environments. Accordingly, the volume advocates for the use of the *Evidence-Based Design Approach* through the incorporation of a multi-disciplinary perspective that draws upon empirical research from the fields of environmental psychology, education, and architectural practice. Those involved in the planning of school environments need access to current research as well as examples of applications in real-world school settings. Toward this end, the authors of each chapter aim to situate the reader in different stages in the creation of the learning environment. This volume is constructed so that, the reader will, first, consider the visioning process for the educational and physical design and/or redesign of the learning environment. Secondly, the reader will explore evidence-based models of school designs as well as research that occurred in learning settings. Lastly, building on the theory, literature, and current research, a guiding framework for the design of school buildings that fosters high levels of learner engagement is presented.

Defining Dynamic Learning Environments

In the effort to create the ideal learning environment, the concept of the Innovative Learning Environments (ILEs) has emerged and often regarded as a formidable catalyst for change when creating spaces for teaching and learning. Indeed, over the past several years, ILEs have become the de facto design of policymakers, educators, and designers (OECD, 2006) with the hope that these new and improved learning spaces would be associated with enhanced learning experiences and improved students' academic outcomes. The appeal of the term "Innovative Learning Environment" is certainly understandable. Innovation is desirable and a forward way of thinking that would be apropos for the ethos of educational settings. Unfortunately, a clear definition of the ILE has never come to fruition, and as a result, policymakers, teachers, researchers, and designers who hail ILEs cannot explain what such spaces would

consist of (or what they would not consist of) and exactly how they would be materialized in school or classroom design. Moreover, it is unclear what the intended effect of an ILE would be on the key social and cognitive tasks with which students engage.

According to the Merriam-Webster Dictionary, innovative can be defined as … *introducing… or using new ideas or methods about how something can be done* (Oxford Dictionary, 2021). Such a definition begs the question "How are new ideas and methods being used to construct and design spaces and improve learning?" In order to understand why this question is so critical to the spatial design of school buildings, we must look at some of the historical trends in classroom design. By the 1890s, school buildings had evolved from the one-room schoolhouse to structures that were organized around the physical and developmental ages of the children. Even though these buildings were more complex to construct, essentially, they were nothing more than a series of one-room schoolhouses, graded classrooms, organized along and around corridors. During this period, students and teacher's desks and chairs were unbolted from the floor (Bissell, 1995). Unbolting the furniture from the floor allowed the furniture to be moved and re-arranged. The opportunity to move the furniture to support learning was a seminal change in the design; however, this did not lead to a more progressive approach in how teaching and learning occurred nor did this change how classrooms were configured (Rivlin & Wolfe, 1985). Even with the ability to re-configure the classroom, these spaces maintained the structure used in the one-room schoolhouse (Tanner & Lackney, 2005). The teacher was located at the front of the room, while the students were located in rows facing the teacher.

By the end of the twentieth century and the beginning of the twenty-first century, as new ideas about pedagogy continued to emerge, such as team-teaching, cooperative group work, individualized instruction and hands-on learning, school buildings that featured classrooms were viewed as inconsistent with how learning and teaching were intended to occur. In the 1960s and 1970s seemingly in response to these new educational ideas, the open-plan school buildings came into fashion. However, these buildings, which were devoid of purposefully planned instructional spaces, were incongruent with the practice of teaching and learning. These buildings were often not successful as learning environments (Lippman, 2010; Sanoff, 1993; Rivlin & Wolfe, 1985; Weinstein, 1979). This was due in large part to the use of a space that was designed with the intention for supporting as manay as six to eight class stations and hundreds of students. Such a space was frequently perceived as disruptive to the practice of teaching and learning. Many policymakers, educators, and architects had not anticipated the consequences of their decisions. Often one result of the *new* and *improved* warehouse-like learning environments was that teachers and students were left vulnerable to noise (Rivlin & Wolfe, 1985; Weinstein, 1979).

Today, many designers who plan ILEs have reproduced the floor plan of the open-plan school buildings or reproduced school buildings with corridors that feature angled walls, fewer doors, and an abundance of interior and exterior glazing (Fig. 1). However, these features are not new concepts, but rather has been a staple of architectural profession for the past 50 years. These staples have led to what may be perceived as dynamic buildings, but have not necessarily led to the creation of dynamic places for learning. Despite the lack of evidence to support the creation of ILEs, the idea

that these environments are ideal for teaching and learning continues to be embraced. One aim of this volume is to challenge the idea of ILEs. Toward that end, we propose the use of the term *dynamic places for learnings* (DPLs) as a more useful alternative (Fig. 2).

The primary difference between ILE and DPLs is that ILEs are described in terms of *space,* rather than conceptualized in the context of *place.* Space is, generally, defined as a dimension in which things are located and as something abstract, without meaning, while place refers to a location in the physical environment with meaning. In contrast to ILEs, DPLs recognize that learning occurs in actual locations in the

Fig. 1 Example of an ILE which is a singular space. This singular space is ambiguous as there are few locations, other than tables, in which they may settle and focus on learning

Fig. 2 Example of a dynamic place for learning, where a variety of locations have been created in the building and where needed furniture is curated to support the different ways that learners acquire knowledge

physical environment. Whereas a space can be re-imagined to make places, places are differentiated settings crafted into the physical environment. Understanding the differentiation between space and place, the authors of this volume hope to initiate a paradigm shift from ILE to DPL. While some experts in the field may argue that the difference between the terms ILE and DPL is purely semantic, we contend they are not equivalent frameworks. ILEs offer visions that highlight a physical environments that seemingly provides an array of opportunities for teachers and learning. Underscoring these visions, but never really spoken, are that educators and learners are responsible for curating the furniture in the space to support formal and informal social interactions. While this new environment is assumed to afford an array of opportunities, the possible constraints within the physical setting are often not given sufficient attention. In some cases, spaces that fail to work are seen as a "user error" rather than as a design flaw.

To create DPLs, the idea for the spatial design of the school building must be re-imagined. Having space does not translate to having a *sense of place*. To create a sense of place, the planning must consider the notions of comfort, safety, prospect, refuge, and legibility. Rather than planning buildings with large and open gathering spaces that can be continually be re-configured, learning environments should provide a variety of different places for smaller social groupings to gather and acquire knowledge. Ideally, different settings may be crafted into the corridor and the common learning area. By re-imagining these settings, individuals and groupings of no more than four students (Lippman, 2023) have places in which to retreat so that they may re-engage in learning (Lippman, 2023). Hence, dynamic learning environments, whether in existing buildings or newly constructed buildings, shall be understood as including differentiated places in the physical environment that have been crafted and/or curated with appropriate furniture and resources to support the different ways that teachers and students can work effectively.

Another distinction between ILEs and DPLs is in how ILEs have been defined. Mahat et al. (2018) define ILEs as spaces where innovative pedagogy occurs within innovative architecture. This definition is not only vague and imprecise, but circular. More importantly, Mahat et al. neither define innovative pedagogy nor describe innovative architecture. Furthermore, this definition presumes that ILEs are the catalyst for positively influencing how teachers facilitate learning and learners' appropriation of knowledge. Rather than using the term innovative which suggests ground-breaking, this book presents the notion of the learning environment as dynamic, because it is … *marked by usually continuous and productive activity or change* (Oxford Dictionary, 2021). Ironically, the spaces that make up ILEs, generally, are neither responsive nor attentive to how people develop.

DPLs on the other hand acknowledge the transactional nature of the learning environment (Altman, 1992). A Transactional Worldview is an ecological/environmental perspective that embraces the notin that the social environment and physical environments are active. Hence, the social environment shapes the physical environment, and the physical environment, in turn, influences the activities of the social environment. This perspective recognizes the interrelationship between the learner(s), the

learning, and the physical learning environment. In this scenario, learning may be understood as a function of the people who shape and influence the school building.

Unlike ILEs, DPLs begin with an understanding the pedagogy of the place. Literature and research are genuinely reviewed as a foundation for crafting the design of the building. Similar to the modernist architects, the buildings and the interior settings are fashioned from the evidence, not normative mindsets, on how people learn. This information leads to the creation for a variety of differentiated locations in the physical environment to support learning. Hence, the design of the different settings is attentive to how people acquire knowledge and participate with others. Attention is given to how the classrooms and the common learning areas are crafted, i.e., ensuring that there are locations for large group meetings, cooperative group work, and independent learning. Hence, a sense of place is created. Furthermore, the specific furniture and resources associated with each location is not an afterthought nor based purely on esthetics, but rather are responsively selected and curated to support the variety of ways that people can work effectively in the physical environment.

To conclude, the integration of research may also be perceived as part of this dynamic process for creating learning environments. The literature and research on learning environments may be used to shape and influence how settings are designed to engage the learners and educators. Once these settings are activated, research may be conducted to examine how the settings are operationalized. The findings from the research will lead to understanding how the literature was translated into real-world settings. Since the findings will provide evidence on how the spatial design functions in relationship to the transactions, the research will advance our knowledge about how learning environments may be crafted and curated to support the pedagogy of the place.

Understanding and Creating Dynamic Places for Learning

To assist policymakers, educators, educational specialists, researchers, and designers, the editors recognize an Evidence-Based Design Approach when planning school buildings (Lippman, 2010). Rather than merely focusing on pedagogy and/or the theory and practice of learning which are influenced and influenced by the social, political, and psychological development of learners, EBD highlights the contribution that physical environment has on learning (Phiri, 2014). The reason that EBD can have a positive impact on the design of the learning environment is that this approach benefits from a multi-disciplinary planning and continual assessment of its function and impact on teacher and student behavior. Hence, this approach can provide insights for crafting and curating settings that enhance learners' experiences in the physical environment (Lippman, 2010).

We hope a result of reading this volume is that the reader can move beyond generalizations about how to create modern learning environments or transform existing school buildings into a modern learning environment. Furthermore, this book challenges the notion of ILEs and normative mindsets about the building as

instruments of change, by showcasing applied research methodologies in context. By presenting how research informs adaptive teaching practices and participatory learning processes (Martin, 2002), this book will introduce research that examines the complexity of these settings while offering understandable recommendations for educators, educational specialists, and designers. These recommendations will consider how settings are crafted and consider how to curate classrooms (existing and new) to support explicit learning, cooperative learning between peers and independent learning, the spaces outside classrooms (the common learning area) to support cooperative learning between peers and independent learning, as well as the remote/virtual settings inside and outside of the school building.

Organization of the Sections and Chapters of This Book

While concerns surrounding the design of the learning environment may be similar for policymakers, educators, researchers, educational planners and specialists, as well as architects around the world, the premise of this book challenges the conceptual model for creating schools. More importantly, the premise offers international examples that examine how buildings may create a sense of place, consider the culture and context that influences the educational vision for the milieu of school building, all of which is grounded in the literature and research, inform the reader in how settings may be crafted and curated to support the learner(s), learning, and the things to be learned. As indicated, our premise is simple. The three sections of this book highlight specific themes, whereas the chapters tell unique stories that support our framework for creating dynamic places for learning. Therefore, the sections for the book are (1) *The Visioning Process*, (2) *Research in Context*, and (3) *Design* as each relates to the practice of education, research, and design.

The Visioning Process in Relationship to Practice

This section examines how dynamic places come into being. McGrath and Fischetti tell the story of an elementary school in New South Wales, Australia. Their story envisions how the physical environment may be transformed to align with a philosophical evolution about the role of schools in society. Whereas McGrath and Fischetti examined transformation, Deed provides a literature review for guiding the visioning process for a school in Iraq, Saudi Arabia. This chapter raises questions relating to culture, the practice of western architecture values and how these approaches come together. This section of the book concludes with Kristen's exploration into the practice of teaching at a university in the United States of America. Grounded in educational theory, Kristen examines possible approaches for engaging university students in appropriating knowledge for themselves. Underscoring her approach are recommendations for curating the university classroom. By understanding the

visions of the educators, future research may be conducted that explores whether the foundational concepts for each of these learning environments were attentive to the variety of ways that teachers and learners activate the different settings.

Research in Context

This section further builds upon the concepts introduced in the previous section and provides discussion on the extant of the research on the physical environment of the school building. The chapters that comprise this section explore how the design of the settings can either enhance or inhibit opportunities for the learner(s) and learning. This section leads with Matthews who examines the effects that the alteration of physical space through the use of invasive security measures has on high school students in the United States of America. In many ways, this chapter harkens to *Big School Small School* (Barker & Gump, 1964). The research of Barker and Gump examined the effects of how the overall size of the student population can directly impact studetnts' transactions in the learning environment. Whereas Matthews extends this perspective to include culture and parent engagement as a function of learning. While Matthews investigates the impact of metal detectors on the overall student population, Bergström, Rönnlund, and Tieve along with Southall, Deed, Matthews, and Cardellino provide research that explores learning as a function of teacher engagement, project-based work, and the design of the physical environment. The research by Bergström, Rönnlund, and Tieve occurred in a renovated classroom setting in an upper secondary school in Sweden. Furthermore, this research may be described as a participatory action research project. As a participatory action research project, teachers, and learners were transformed as they worked through the dissonance between the physical environment, the intended practice of teaching, and actual ways that learning occurred. This research project highlights the evolutionary nature of the learning environment. While Bergström, Rönnlund, and Tieve showcase the dynamic qualities of the learning environment, Southall, Deed, Matthews, and Cardellino introduce on-going research that emerged because of the pandemic. This research examined how cooperative group construction projects were used in an elementary school in Australia as a means to re-engage learners to being in school.

Like the previous section, this portion of the book ends with an academic research project conducted at a university in the United States of America. Unlike the previous research project which took place in the physical environment, this study explores remote/virtual learning. Oliver's research not only examines the intention of technology as a resource for learning and the role of the teacher, but also explores the types of places that are curated in the physical environment by teachers so that they are able to engage responsively with students. As the visioning process portion of this book introduced ideas about how the physical environment may be crafted to support learning, this section provides evidence for how learners and teachers are shaped and influenced by their learning environments. From this evidence, the

researchers, educators, educational planners, and specialists, as well as designers have information about how learning occurs in the physical environment and may transfer this knowledge to the design of school buildings.

Part IV: Design

While the visioning porcess section of this book provides insight for how school buildings may be conceptualized and the research in context portion of the book presents research about the intersection between learning, the learners and the physical learning, this section of the book amplifies these stories by grounding the spatial design of the learning environment in the available evidence about pedagogy, culture, and spatial design. Dyck and Lippman offer a socio-historical perspective on why and how schools have been designed. The authors present Montessori, Central Park East Public School in New York City, and Big Picture Learning Australia, as precedents of progressive educational approaches that acknowledge the situated nature of learning theory and personalized learning theory. By grounding the design of school buildings in historical and contemporary learning theories, Dyck and Lippman offer a unique perspective on how school buildings can be planned. In addition to exploring learning theories, the subsequent chapter by Lippman introduces Gibson's Affordance Theory (1979). Rather than examining only the affordances as hard and soft features of the learning environment, Lippman brings forward Gibson's concept of the niche. Niches are settings in the natural/physical environment that are shaped in relationship to the learners and teachers who activate them. Lippman's subsequent with following chapter explores Bronfenbrenner's Ecological Theory (1979). The premise for this chapter is that the school building is understood as being composed of different systems. These systems ground the transactions of the teachers and learners in the numerous settings that compromise the learning environment. Lastly, Byers' chapter returns the reader to the concept of ILEs. Byers further interrogates the editors' notions about the narrative about ILEs. Furthermore, the author reflects on the diminished role that Evidenced-Based Design has played in school design. Nevertheless, Byers describes how utilizing evidence can help to dramatically shape learning spaces. These final chapters present ideas for design of the learning environment that are grounded in the literature, theory, and practice of education. With this information, existing and new buildings may be re-imagined for today and tomorrow.

References

Altman, I. (1992). A transactional perspective on transitions to new environments. *Environment and Behavior, 24*(2), 268–280.

Barker, R. G., & Gump, P. (1964). *Big school small school*. Stanford University Press.

Bissell, J. (1995, May). *Patterns for effective high school environments.* Unpublished Thesis. University of Wisconsin, Milwaukee.

Gibson, J. J. (1979). *The ecological approach to visual perception.* Houghton Mifflin.

Lippman, P. C. (2010). *Evidence base design for elementary and secondary schools: A responsive approach to creating learning environments.* Wiley.

Lippman, P. C. (Expected Date of Publication: 2023). How are complementary pedagogical settings, which have been intentionally designed for learning in open plan learning environments, used by students and teachers in vertical high school buildings? PhD., LaTrobe University, The School of Arts, Sciences & Commerce, Victoria, Australia.

Mahat, M., Bradbeer, C., Byers, T., & Imms, W. (2018). *Innovative learning environments and teacher change: Defining key concepts.* Retrieved from Melbourne, Australia. http://www.iletc.com.au/publications/reports

Martin, S. H. (2002). The classroom environment and its effects on the practice of teachers. *Journal of Environmental Psychology, 22*, 139–156. Elsevier Science Ltd.

OECD. (2006). *21st Century learning environments.* OECD.

Oxford Dictionary. https://www.lexico.com/definition/dynamic. Retrieved 11 May 2021.

Phiri, M. (2014). *Design tools for evidence-based healthcare design.* Routledge.

Rivlin, L. G., & Wolfe, M. (1985). Institutional settings in children's lives. Wiley.

Sanoff, H. (1993). Designing a responsive school environment. *Children's Environments, 10*(2), 140–153.

Tanner, C. K., & Lackney, J. (2005). *Educational facilities planning: Leadership, architecture, and management*. Allyn & Bacon.

Weinstein, C. S. (Autumn 1979). The physical environment of school: A review of the research. *Review of Educational Research, 49*(4), 577–610.

Visioning Process

School Designs for Personalizing and Co-constructing the Learning Journey

Jason McGrath and John Fischetti

Abstract The opportunities of new physical spaces in schools in many places around the world provide educators a chance to do more than rearrange the tables and chairs. These new physical designs echo an architectural era that can align with a philosophical evolution about the role of schools in society. This transformation provides a chance to rethink the nature of the pedagogy, curriculum, instruction, and assessment. More importantly this allows a rethink of the role of learners in co-constructing their journeys with educators, the role of learning from home opportunities of emerging technologies and the place and priority of wellbeing. This chapter builds on recent research of the authors that investigated the literature and compiled feedback and recommendations of thought leaders in the field.

Keywords School design · School transformation · Wellbeing

Introduction

The opportunities of new physical spaces in schools in many places around the world provide educators a chance to do more than rearrange the tables and chairs. These new physical designs echo an architectural era that can align with a philosophical evolution about the role of schools in society. This transformation provides a chance to rethink the nature of the pedagogy, curriculum, instruction, and assessment. More importantly this allows a rethink of the role of learners in co-constructing their journeys with educators, the role of learning from home opportunities of emerging technologies and the place and priority of wellbeing. The future-focused skills of

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critical thinking, problem-solving collaboration, global mindedness, ethics, Indigenous ways of knowing and wellbeing are all part of this "new school" approach that can be mirrored by the design and physical space of a school building. This chapter builds on recent research of the authors that investigated the literature and compiled feedback and recommendations of thought leaders in the field.

The chapter will share:

- The future role of schools;
- The changing role of "learner" and "teacher";
- The conceptual and physical designs of such schools;
- A focus on multiple ways of knowing and a future-focused lens;
- The role of emerging technologies;
- The critical element of equity;
- The implications of policy and assessment.

This collaborative work is built on prior publications from the thesis "What if Schooling was a twenty-first-century invention" (McGrath & Fischetti, 2019a, 2019b) and our shared work reinventing schooling and teacher education in New South Wales, Australia. We support our recommendations with evidence and alternative lenses in which we might view the purpose and functions of schools, learners, teachers, leaders, and those who promote education for all in a society where education is the way forward toward a bright future.

What if Compulsory Schooling Was a Twenty-First-Century Invention?

Many educational experts now believe schooling and the systems around schooling need a major overhaul but argue that change is difficult due to its history and the pervasive understanding within communities about what schools should look like. The thesis used futures approaches to consider the counterfactual research question, "what if compulsory schooling was a twenty-first-century invention?" The purpose of the thesis was to examine how futures methodologies can be utilized to create new models of schooling. The use of futures approaches provides opportunities to create options that support function leading form (Sullivan, 1979). The main data collection process adopted a modified Delphi process (Aichholzer, 2009; Landeta & Barrutia, 2011) to engage with an expert panel of academics, policymakers, practitioners as well as experts in a range of areas such as Indigenous ways of knowing and physical design of schools. The Expert Panel considered how schools could be different as well as what might be lost in four areas. The four areas were (a) the purpose of schooling, (b) the role of learner and teacher, (c) physical design of schools, and (d) system of schooling.

The modified Delphi process involved a predetermined four-round process. Seventy consensus statements were agreed on by the panel at Round Three. These

were developed into 29 Future School Elements (FSE) and organized into a Three Pillar Framework involving pedagogy, practice, and structure (McGrath & Fischetti, 2020).

As part of round four, the Expert Panel members were asked to create their own scenario (Fuller, 2017; Ramírez & Wilkinson, 2016) for future schooling using the statements from the earlier rounds. Seventeen individual scenarios were created by panel members which were distilled into five scenarios for future schooling, including a vignette which was written to summarize the scenario from a learner's perspective (McGrath & Fischetti, in press). The solutions offered in this research project are not simplistic or linear. Instead, the solutions offered have been developed to work within complex adaptive systems that support contextualized (Ball et al., 2011; Barber et al., 2010) and pluralistic (Ball et al., 2011; Bingham & Burch, 2019) options. This envisions a future where models of schooling become more varied across sites as a result of a flattened bureaucracy and the strengthening of stakeholder voice, especially the voices of current learners.

Rather than the industrial approach to policy setting of the past, we posit the need for more contemporary policy decision-making approaches that value context (Ball et al., 2011; Barber et al., 2010; Elmore, 2016) and seek more pluralistic (Ball et al., 2011; Elmore, 2016) options based around an understanding of schools and educational systems as complex adaptive systems (Joksimović & Manić, 2018; van der Steen et al., 2013). This is encapsulated in the metaphor offered by Ansell et al. (2017) suggesting the need to adopt a "jazz orchestra" (p. 295) mindset, which indicates more adaptive, flexible improvisation compared with a belief that there are a set number of futures (responses) to choose from.

Future-Focused Schooling and School Design

We identify three key components as part of our definition of future-focused schooling. Firstly, there is a greater focus on the work of the learner rather than the teacher (Abbott, 2010). Secondly, there is a stronger connection between school-based and community-based expertise (Abbott, 2010) that provide opportunities for students to express choice and engage in deeper learning than classroom-centric schools of the past (Zhao, 2012). Thirdly, there is greater personalization in the experience of individual learners over their schooling (Ball et al., 2011; Elmore, 2016).

In turn, these features of future-focused schooling influence the physical and virtual school design. Firstly, we argue that school design should be envisioned through the lens that each learner is unique (Robinson, 2006; Zhao, 2018a) rather than assuming that the physical space requires students to conform to a common learning experience. Secondly, school design should expand the interface with community, both local and beyond (McGrath & Fischetti, 2019a). Thirdly, we should expect to evolve greater variation in school design both internally (different spaces within

a school) (Mulcahy, 2015) and externally (schools look differently to each other) (Downton, 2009b).

These components of future-focused schooling are developed throughout the chapter. Figure 1 illustrates how these ideas have been translated within our work to provide an example of components of school design for future-focused schooling to be mixed and matched based on the vision and culture of the community in which the school is embedded.

The Future Role of Schools

The future role of schools is a contested space. Some argue basic literacy and numeracy skills remain the goal—others extend this to the broader, problem, and critical thinking skills tested through PISA. Alternatively, many argue for a more radical change that rejects high stakes testing (Sahlberg, 2014; Zhao, 2018b) in preference for a focus where education is personalized and aims to support lifelong learning that prepares students for the world they will live.
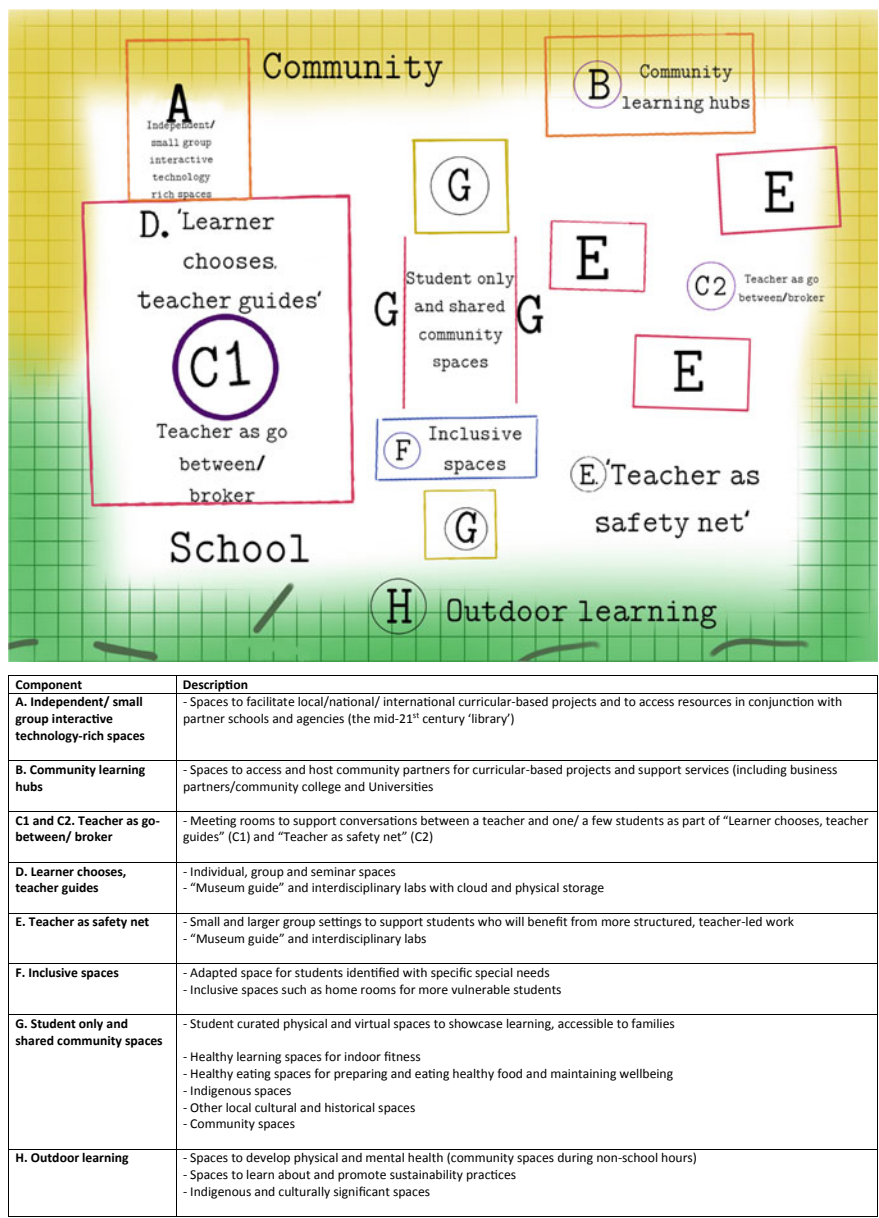
The Expert panel agreed on six consensus statements relating to the future role or purpose of schooling (Table 1). These were summarized into two FSEs as part of the research. FSE1 places the role of school within the current period of societal change by focusing on democracy, ethics, and redressing exclusion. FSE2 places the role of school as preparing students as lifelong learners in a world requiring skills to learn, look after oneself, and work collaboratively.

The Changing Role of Learner and Teacher

Catalysts for current changes in the role of learner and teacher include the demise of industrial thinking. Instead, new thinking such as postmodernism (Lam, 2014; Slattery, 2012) has promoted interdisciplinary thinking and a focus on developing connectedness across the curriculum. Adolescence is now starting earlier and remaining for a longer period of time increasing the importance of this developmental period within school life (Steinberg, 2014). Increased valuing of Indigenous ways of knowing encourage an increased "relational orientation" (Holmes, 2014) between learner and teacher. Technological advancements have led to developments in (a) how we understand learning through neuroscience (Reyna et al., 2012), (b) available tools to support learning such as through e-learning, and (c) raised ethical questions within society such as the use of Artificial Intelligence (Jules & Salajan, 2019).

As the role of learning and teaching changes from an industrial, "pre-professional age" (Hargreaves, 2000) focused on teacher-led practice, the physical design of school is also challenged to go beyond the simple "container as classroom" (Mulcahy, 2015) structure of one classroom box, one teacher, and about 30 students. The learner has a more active role in contemporary schooling which can be further harnessed.

Component	Description
A. Independent/ small group interactive technology-rich spaces	- Spaces to facilitate local/national/ international curricular-based projects and to access resources in conjunction with partner schools and agencies (the mid-21st century 'library')
B. Community learning hubs	- Spaces to access and host community partners for curricular-based projects and support services (including business partners/community college and Universities
C1 and C2. Teacher as go-between/ broker	- Meeting rooms to support conversations between a teacher and one/ a few students as part of "Learner chooses, teacher guides" (C1) and "Teacher as safety net" (C2)
D. Learner chooses, teacher guides	- Individual, group and seminar spaces - "Museum guide" and interdisciplinary labs with cloud and physical storage
E. Teacher as safety net	- Small and larger group settings to support students who will benefit from more structured, teacher-led work - "Museum guide" and interdisciplinary labs
F. Inclusive spaces	- Adapted space for students identified with specific special needs - Inclusive spaces such as home rooms for more vulnerable students
G. Student only and shared community spaces	- Student curated physical and virtual spaces to showcase learning, accessible to families - Healthy learning spaces for indoor fitness - Healthy eating spaces for preparing and eating healthy food and maintaining wellbeing - Indigenous spaces - Other local cultural and historical spaces - Community spaces
H. Outdoor learning	- Spaces to develop physical and mental health (community spaces during non-school hours) - Spaces to learn about and promote sustainability practices - Indigenous and culturally significant spaces

Fig. 1 Two-Way School Village example of future-focused school design (components for inclusion)

Table 1 Expert panel consensus statements relating to the future role or purpose of schooling

FSE	Consensus statements
FSE1—Reframe the purpose of schooling to support democracy, ethics, and redress exclusion	Consensus for both impact and equity: "The purpose of compulsory schooling would celebrate diversity and not unintentionally marginalize minority groups or be color blind to difference." "The purpose of compulsory schooling would have its central mission as a democratic one: the challenge of living peacefully in plurality and difference and development of moral autonomy and focus on ethics." Consensus for equity: "The purpose of compulsory schooling would be decolonized, anti-racist, and anti-sexist."
FSE2—Reframe the purpose of schooling to learn for life	Consensus for both impact and equity: "The purpose of compulsory schooling would focus on learning how to learn (metacognition) and self-responsibility for learning (personal agency), including ability to think, communicate, collaborate, make decisions, and solve problems focused on nurturing creativity, empathy, entrepreneurship, self-understanding." Consensus for either impact or equity: "The purpose of compulsory schooling would focus on learning how to learn throughout life to optimize personal adaptive capacity and resilience, develop skills/capabilities/competencies needed for contemporary and future living and to be flexible/adaptive in new situations." "The purpose of compulsory schooling should be preparation for lifelong learning journey that will enable adaptability in the workforce, integrated with communities and the values of the knowledge economy. All secondary students would be college and career ready as they prepared to leave high school or its equivalent."

Schools are being challenged to move away from the "prevailing wisdom [which] assumed that children were born to be taught rather than to learn" (Abbott, 2010, p. 9).

The results of our research confirmed the proposition that schools should design and expand opportunities for learners to assume responsibility in the learning process. Where possible transformative schools should create a teacher–learner relationship where the "Learner chooses, teacher guides" (FSE10). The learner is able to "take more responsibility for their own learning by initiating inquiry, searching for solutions using multiple sources." This creates an environment where "learning would empower students… learners would select and connect with multiple teachers for