CHAPTER

7

Learning spaces: Built, natural and digital considerations for learning and learners

This chapter should be cited as:

Abstract:

The goal of this chapter is to assess research that can inform understandings of places and spaces of learning. The chapter assesses evidence across three types of learning spaces: built spaces, digital spaces, and natural spaces. It looks at the role of these different kinds of spaces for learning, attainment, interpersonal relationships, skills development, wellbeing and behaviours – across four pillars of learning to know, to be, to do and to live together. The chapter also explores how learning spaces can be actively shaped, felt and understood through practices and policies that occur within and around them.

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7.1 Introduction

The goal of this chapter is to assess research that can inform understandings of spaces of learning. In addition to legislated formal schooling, different kinds of educational settings and experiences have become embedded in people's daily lives around the world **(Sefton-Green, 2013)**. To some extent, all forms of collective and organized activities for children and young people are 'educational'. People learn everywhere, including in what have been termed formal, informal and non-formal 'learning environments' **(e.g. Eshach, 2007)**. These learning spaces are connected to learning contexts such as primary and secondary education, including home schooling and alternative formats, higher education and community-based and non-profit organization learning provision. The fact that such provision is often funded not only by governments, but also via philanthropy, civil society and other kinds of welfare provision **(Poyntz et al., 2019)** means that who gets to define and evaluate what counts as learning (and learning spaces) is not straightforward.

While building on the work that has been done on 'learning environments' **(e.g. de Kock, Sleegers and Voeten, 2004)** what is distinctive about this chapter is that it specifies 'environment' as a spatial category. As an entry point,

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learning 'spaces' are understood to be the built and 'natural' sites in which learning occurs. However, as many human geographers have argued, physical spaces are not simply containers for human action; they cannot determine learning in a singular or simple way; and physical spaces do not exist in a social vacuum, somehow separate from the action that happens 'in them'.

Space can be understood as the ways in which geography shapes social relations and practices, connecting things and people **(e.g. Lefebvre, 1991; Massey, 2005).** This is sometimes called 'spatiality' **(Keith and Pile, 1993)**, which identifies the coming-together of the physical and the social in different ways across more localized places, such as through migration, technology, or other aspects of mobility in and across land, cities and continents. In thinking about this in relation to education, this means attending to the role and characteristics of particular places of learning, but also the connections (and

divisions) present and enabled among them, for example, as learners move between home and schools, migrate to new countries and communicate with others and with information from across the globe. While having physical (or material) characteristics, places are also shaped and imbued with social meaning culturally, historically and spiritually, as well as spatially connected and influenced by places elsewhere. This combined sociomateriality of places is centred on relationships, among people, with the built environment and other species, and with the land and its histories and future possibilities. While often taken for granted as a backdrop for human activity, place plays a central role in the shaping of human interactions, philosophies, belief systems and actions. Thus, a spatial perspective is important in education, but in some approaches it has not been explicitly considered as a component of learning. In this chapter, we focus on assessing research on learning spaces.

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It is also important to note how this chapter frames learning. The chapter includes a wide variety of research on: (1) explicit, visible and measurable learning, such as prioritized in curricula or measured through assessment outcomes; and (2) implicit or hidden learning that extends beyond the explicit curricula of education. This means that the chapter addresses the link between learning and spaces in two ways. Firstly, the chapter makes reference, where relevant, to aspects of the pillars of learning outlined in the Delors Report **(International Commission on Education for the Twenty-first Century, 1996).** In other words, we consider how learning in spaces includes and extends beyond academic learning to also include important elements of social and emotional learning (SEL), such as learning to know, learning to do, learning to be and learning to live together. The extension of these pillars into corresponding and interrelated areas of cognitive, socioemotional and behavioural learning is also

relevant for the work that is outlined in this chapter **(UNESCO, 2015)**. This includes, for instance, where school classrooms are designed to prompt certain kinds of interactions between children that foster ways of living together, or where learning outdoors can teach ethical ways of being with the natural world. The chapter assesses how learning spaces can enable or inhibit these pillars and areas of learning and their associated educational outcomes (e.g. academic knowledge, citizenship and values, behavioural and action competences, social and emotional skills).

At times we have used the specific UNESCO pillars and domain terms for learning, while in other places we have indicated where these terms overlap or are cognate with other descriptions of learning from within specific fields. This is particularly the case where there may be an over-emphasis in these framings on orientations from the Global North **(Sharma, 2018)**. As such, this assessment

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chapter also considers the ways in which learning spaces and places are experienced, constituted, and practised differently across varying identities, cultures and geographies, including in relation to the Global North and South, and by Indigenous and non-Indigenous learners. This is important as it points to not only the diversity of learning spaces and experiences, but also the ways that inequity and colonization can be part of the geographies of education **(Haluza-Delayet al., 2009)**. One way we might think about this is to look at how categories such as 'formal' and 'informal' may mean different things in different places or may simply not be appropriate. For instance, we want to be particularly cognisant of not equating formal education with classrooms, particularly because doing so may not tally with approaches outside of those dominant in the Global North. To ensure that this chapter does not only discuss learning sciences from the limitations of the Global North, we include authors and

theories that speak to theorizations of learning spaces in and from the Global South **(Connell, 2007)**. Other chapters in this publication look at some of the contextual social, environmental, political and economic factors that affect (particularly) access to learning - including transport, the availability of water/energy and investment in schooling. However, with a focus on learning spaces themselves, this chapter seeks to acknowledge different conceptions and understandings of place (and particularly 'land') that extend beyond western notions of the term − both in terms of the examples and the philosophical perspectives on which we draw, including centering Indigenous and Global South scholarship as part of the assessment of existing research in this area.

Secondly, the chapter uses an explicitly geographical frame to help expand the possibilities of what it means to talk about learning, that is, how where you are influences what and how you

learn, in some cases beyond the intended curriculum, assessment or aims of the education. In this chapter this includes, among others:

- the recursive relationship between building design, classroom layout, outdoor or non-built places, and learning technologies (whether analogue or digital) and the curricula and values of the societies in which they are located;

- the experiential and immersive aspects of formal and non-formal learning, including new forms of technological augmentation;

- the ways in which digital, outdoor or 'alternative' learning spaces might seek to reconfigure both the sites and processes of more 'traditional' forms of education.

Driven by a focus on the importance of space and place to learning, the chapter draws in part on a body of work by historians that has traced the evolution of (especially) school buildings

since the nineteenth century, and the ways in which changing school architectures reflect changing views of education **(and vice versa; Burke, Cunningham and Grosvenor, 2010)**. However, with an interdisciplinary remit, it also extends that historical work through an assessment of contemporary learning spaces and issues, including through contributions from fields such as Indigenous studies, neuroscience and psychology, sociology, and sustainability studies. It also broadens the scope by extending to spaces beyond the Global North, and to learning spaces beyond school architectures − specifically digital spaces and land and the natural environment.

Finally, we note that this chapter was not based on a systematic review, but rather was topic driven based on the identifying contributing authors with key expertise to write short syntheses of research on learning spaces. As such, this chapter is an expert-based appraisal of the current

research landscape. While this process could be described as 'subjective', it draws on the contributing authors' extensive engagement in their areas of study. Contributors have taken care to include references to scholars whose work is robust, while also from groups that continue to be marginalized in academic referencing (e.g. women, People of Colour [POC] and/or scholars from outside Europe/the United States).

Broadly, the contributing authors used a combination of online searches, manual searches of authors' own resources, and follow-up searches in bibliographies of works cited. Contributing authors undertook the following specific steps to locate relevant and appropriate literature: (1) used keyword and search string strategies in a variety of databases (e.g. EThOS, JSTOR, Scopus, ProQuest); (2) referred to a mix of academic and grey literature; (3) where available, aimed to synthesize insights from systematic reviews, meta-analyses or narrative reviews; (4) attempted to provide a balanced account of the state of their fields while prioritizing highly influential contributions (e.g. high number of citations relative to publication date); and (5) oriented the selection of literature towards combining general overview research, and more specific case studies and/or topical focus within a broader field.

The rest of the chapter highlights a range of established and nascent research related to the effects and effectiveness of learning spaces (for instance in terms of learning, assessment, behaviours, human and planetary well-being, friendships and belonging). However, given the complex causality between learning spaces and these outcomes, we urge caution in drawing overly simplistic conclusions about the relationship between, for instance, classroom design and learning outcomes.

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7.2 Key questions addressed in this chapter

What is the role of learning spaces in education? In other words, how does where we learn affect what we learn through education? This is considered in three subsections.

1. What is, or what can be, the role of built spaces in learning?

2. What is, or what can be, the role of digital spaces in learning?

3. What is, or what can be, the role of natural spaces in learning?

7.3 Key findings

The chapter assesses the state of research through three domains of 'learning spaces': built spaces, natural spaces and digital spaces. Within each, we identify and assess key trajectories of research and provide examples from different styles of education and types of provision (e.g. formal, informal, non-formal, alternative). Given the embeddedness of built environments on land and with digital spaces, we also point to ways that these three types of learning spaces interact with each other in shaping overall learning experiences.

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7.3 .1

BUILT SPACES

7.3 .1 .1

INTRODUCTION

Our assessment in this area indicates increased attention in academic research to the ways in which built spaces can influence educational outcomes. Indeed, the OECD is undertaking an ongoing programme of consultation around 'Effective Learning Environments' **(OECD, 2013)**, by which they mean built learning environments. The research literature shows that school and other physical spaces can affect learning, including attainment, engagement, perceptions of student–teacher interactions, interpersonal competencies, well-being and behaviours (i.e. across all four pillars) **(Blackmore et al., 2011)**. However, as Blackmore et al. **(2011)** also indicate, causality between the design of physical spaces and outcomes is hard to clearly determine (given

the presence of multiple other factors), and in some cases robust and/or internationally comparative evidence is lacking.

This section therefore begins with a general overview of the existing evidence of how built environments (may) affect learning – both from the perspective of architects' and designers' aspirations, and the evidence around outcomes. It then adopts a broader view of the relationship between built design and learning, examining how social practices may interact with built design in shaping educational experiences. It explores learner participation in school design as a specific form of 'learning to do', and the experiences of learners and teachers themselves. Although education spaces exist outside those sites designated as 'schools', the vast majority of research on built educational spaces has focused on schools and school buildings. The notion of built spaces can be extended to designed aspects of playgrounds and outdoor settings **(these are**

reviewed in more detail in section 7.3.3). Where appropriate, evidence from other settings is reviewed, although this is more limited.

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BUILT LEARNING SPACES AND THE INTENTIONS OF THEIR DESIGNERS

This subsection examines research that has focused on the intentions of architects and other built environment professionals for learning spaces. It is important to recognize that any connection between the built environment and learning starts with the ways in which aspirations for learning are, effectively, 'built-in' from the very design stage. Evidence in this area is based on a series of important, large-scale, systematic projects although is limited to the twentieth century, mainly to school architecture, and, largely, to the Global North. This is linked to the emerging field of learning spaces research in higher education that has focused on the design, evaluation and management of learning environments in universities **(Ellis and Goodyear, 2016)**. Starting with schools, these projects set out a series of key issues and challenges for learning space design that are expanded in subsequent sections of this chapter (divided here, as in most research, between evidence from the Global North and Global South). In addition, some examples of the research literature on the intentions of the built environment of other types of learning spaces is included at the end of the section.

School architecture has a fairly recent history. While 'schools' may have been housed in a range of buildings, by the end of the nineteenth century mass compulsory education had become established across the industrialized nations of the Global North. The global reach of the classroom as the basic component of schooling was also established if not yet achieved. School architects were generally employed by the nation-state and designed schools according to contemporary educational principles and norms **(Burke and Grosvenor, 2008)**.

A significant driving force behind much twentieth century school design, especially in the Minority Global North, was the idea that school buildings could promote good health and physical well-being.

A key, overarching feature of early school design was international knowledge exchange. Architects engaged in school design used study tours of varying lengths of time, scope and intensity to inform themselves of what was considered best practice in the wider world. For instance, British architects visited North American cities to determine the best school forms for the growing metropolis **(Burke and Grosvenor, 2013)**. Most famously, architects David and Mary Medd from England spent an entire year travelling around North America visiting schools and meeting with educationalists **(Burke, 2013)**.

A significant driving force behind much twentieth century school design, especially in the Minority Global North, was the idea that school buildings could promote good health and physical well-being. For instance, architects collaborated with medical specialists in determining that buildings should be well ventilated. In Europe, the first 'open-air' schools were designed with removable walls from the 1890s. In the decades after the

1940s, architects working for the United Kingdom Ministry of Education made detailed measurements of children in school buildings calculating the reach of their limbs and their sight-lines so that scaled fittings and furnishings could best be designed for learning.

From the 1950s onwards, the urgent need to reconstruct school buildings across Europe coincided with a concern to examine how architects could enhance the strengthening of democracy through education. In Italy, for example, the preschools of Reggio Emilia emphasized through design how the building could have agency as a teacher. In England, efforts to open up and make use of all spaces in schools beyond the traditional classroom came to influence architects across the world, and especially in 'alternative' education settings such as Steiner schools **(Kraftl, 2006)**. In these settings, architects and teachers attempted to experiment with 'traditional' Western classroom layouts – for instance, in the creation of more 'home-like' environments in

Steiner kindergarten through the use of soft furnishings and a circular floor plan, and through the use of highly organized learning materials (by size, colour and purpose) in the Montessori classroom **(Kraftl, 2013)**.

In the past 30 years, architects and built environment professionals active in the field of learning environment research have historically been informed by environmental psychology and 'person-environment fit' studies (and latterly emerging work in the neurosciences), with the purpose of evaluating the impacts of built spaces on learning outcomes **(Fraser, 1991)**. There has been an emphasis on recording the measurable sensory qualities of internal environments. For instance, Barrett et al. **(2015)** propose three principles that should therefore inform school design: naturalness (light, sound, temperature, air quality and links to nature); individualization (ownership, flexibility and connection); stimulation (appropriate level of complexity and colour). The relationship between school buildings and

learning here is conceptualized as directly impacting the brain's functioning **(Barrett et al., 2015)**. Learning is understood in this context as the rate of academic progress based on formal pupil achievement.

There is also more limited evidence about school design principles and aspirations from the Global South. Although learning spaces pre-existed colonial rule, much of the historical research on such sites starts with the colonial period, in particular because of the ways that European notions of education and 'school' were imposed. Additionally, many countries in the Global South have an historic legacy of colonial school buildings, which persists into the stock of contemporary school buildings and more generally into approaches to learning space design **(Uduku, 2018)**. The oldest were built more than a century ago by missionaries who made education and schooling essential to Christian conversion **(Fafunwa and Aisiku, 1982)**. There are examples of the mission school across the world, particularly in India, Africa and Latin America.

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Often these early schools and classrooms were first built using locally obtainable materials and to the specifications of missionary building handbook formats, centred upon Christian educational principles (**Waddell, 1970**). The missionary-developed design guidelines for these schools were further standardized by colonial governments as in the case of schools in former British colonies to create colonial school design standards (**Uduku, 2018**). Until 1945, the funding for colonial schools was linked to grants in aid and all schools (government, private or missionary run) had to comply with a number of criteria, including design standards, successful examination pass rates and teacher qualifications, to receive this funding (**Ajayi, 1969**). Teaching and school design up until the post-Second World War period thus were modelled on European educational standards.

From the post-war period, with the involvement of international organizations such as UNESCO and the World Bank, school design in the Global South became more international in its standardization (**e.g. De Raedt, 2014**). UK and US educational facilities researchers collaborated in the production of the UNESCO school building guides (**Uduku, 2018**). These UNESCO offshoots developed design guides related to local climate conditions and encouraged construction using local materials and the design of child-scale school furniture, as well as the initiation of child-centred learning. For instance, in Nigeria, the demonstration schools project was developed by a Nigerian firm in association with UNESCO consultants and produced climate sensitive school designs across Nigeria's climate zones (**Uduku, 2018**).

The collapse of many Global South economies from the mid-1970s to 1980s meant that most classroom design did not evolve as had been hoped, often deteriorating in quality with a lack of investment. However, so-called 'aid' built schools have, since that period, tried to address these challenges, particularly in rural contexts (**Amin, 2014**). More

recently there has been a more concerted effort by international organizations and NGOs to address the need for education as a Millennium and now Sustainable Development Goal. The key emphases here have been on school design that is sensitive to local intersections of climate, culture, natural materials and contemporary teaching methods **(Uduku, 2018)**.

As a result, significant evidence shows that school buildings are not and have never been merely containers for learning – they relate to their surrounding communities in a range of ways. In other words, there is considerable evidence that the 'external' relationships (some involving different forms of informal and formal learning) are just as important as the 'internal' relationships that buildings foster **(Collins and Coleman, 2008; Holloway and Pimlott-Wilson, 2011; Kraftl, 2012)**. As defined above, the geographical concept of 'spatiality' offers a lens through which to understand these broader sociospatial processes. These approaches need not be detached from studies

of the internal, material details of school buildings; indeed, key studies (including those cited above) have examined how the material properties and arrangements of objects in schools have fostered specific learning relationships that are embedded in pre-existing social relations, such as computer suites that assume individualized learning, and the building-in of neoliberal educational ideals into school building programmes **(McGregor, 2004, p. 356; Kraftl, 2012)**. Others have addressed issues such as the wider role of the school aesthetic in advancing (both within and beyond the 'school' community itself) forms of surveillance, citizen formation, reproducing dominant economic ideologies and constituting urban relations **(Gulson and Symes, 2007; Pykett, 2009; Christie, 2013)**.

Moving to the present day, a further important finding stemming from studies such as those above is that despite strong international trends in educational architecture, school design is tied closely to national

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7

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and international shifts in political economy. Where neoliberal governance has been strongest, for example, the social ambitions of both architecture and planning have shrunk, via different mechanisms. Profession-wise, architects' capacities for effecting real change have been curtailed through downgraded statuses and fewer, reduced roles in public building procurement. Education, like architecture, has become increasingly marketized, with schools distinguishing themselves visually and commercially, and calling on architecture for assistance **(see Rowe, 2017, pp. 136-137 for discussion of Australian schools and architectural brand-management)**. In the design professions more generally, a 'tendency to abdicate from futuring' **(Tonkinwise, 2015, p. 88)** means disengagement from 'big' issues, such as social inclusion.

Meanwhile, particular social and political issues have become explicit – more urgently and clearly social problems requiring spatial responses. For example, Uduku **(2018, p. 118)** has shown how post-apartheid, racial

integration in South Africa necessitated new school building design guidelines and, for primary schools, increases in net space to accommodate schools' extended roles as centres for feeding programmes. In the US, Erickson **(2016, p. 563)**. has explored planners' and educationalists' joint work designing vast educational campuses aimed at encouraging desegregation by drawing on students across multiple, racially- and economically segregated city zones.

Although smaller in scope, there has been an increasing focus on the built learning spaces of universities and other forms of higher education. These emerging literatures have responded to trends – especially in the Global North – towards increased investment in the built environments of (particularly) university campuses **(van Heur, 2010)**. The imperatives for such innovation are diverse but centre on the marketization and neoliberalization of University education – as campuses are seen as key 'selling points'

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to attract students and as nodes for urban and regional innovation **(van Heur, 2010)**. Significantly, although including investments in spaces such as lecture theatres and libraries, these intentions often extend beyond the specifics of learning to the commercial functioning and roles of universities **(Amcoff, 2020)**. However, as evidence in the next section attests, the (re) development of campuses is also related to different domains of learning − both in terms of its effects on and support for, more flexible, less didactic kinds of learning interactions, and in terms of the creation of cultures and communities of learning **(Temple, 2009)**. Significantly, many studies focus on the latter − how campus spaces can be turned into places of learning that attempt to (literally) concretize the aspirations of universities for the kinds of learners they want to produce, with a focus on capacities such as flexibility, innovation, creativity, sustainability and individual responsibility **(Berti, Simpson and Clegg, 2018)**.

There is also a wide range of literature that considers the intentions of built learning spaces beyond primary to higher education. For example, there is quite extensive research on the learning contributions of built religious environments. Vosko **(1991)** writes about his work as a designer of religious spaces for adult learning, including undertaking 'audits' of the environmental factors of built religious spaces in terms of their implications for participation and congregational learning. Considerations in these learning spaces include invoking a sense of hospitality through building materials, lighting, temperature and ensuring physical accessibility for all. Vokso **(1991)** also discusses shifting relationships between teachers and learners in religious settings, often with a move away from environments set up for the dispensation of knowledge, and instead providing rooms and seating arrangements aimed at mutuality and collaboration **(see also WG2-ch8)**. Other factors such as sightlines, use of digital media and signage are also considered aspects

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of built religious environments that maximize participation and learning. In reviewing work in Jewish education, Lynn-Sachs **(2011)** discusses synagogue-based education relative to other spaces such as Jewish day schools and preschools, camps and community centres; as well as comparing the features of these spaces to congregation-based Christian education, as well as secular schools. Other researchers have also documented the mirroring of synagogue schools to the institutions of public schooling throughout the twentieth century **(Cuban, 1995; Weinberg, 2008)**. Additional areas that have considered the built environment across a range of ages and learning dimensions include community centres, libraries, zoos, aquaria, science centres, botanic gardens and museums **(e.g. Gupta et al., 2019; Cole, Lindsay and Akturk, 2020; Hassinger-Das et al., 2020)**. Due to the scope of this literature, in the following sections on particular learning outcomes related to built spaces, we focus in particular on primary to higher education learning environments.

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EVIDENCE ABOUT HOW BUILT ENVIRONMENTS AFFECT COGNITIVE LEARNING OUTCOMES FOR SUBJECT-BASED ACADEMIC KNOWLEDGE

Whilst the intentions of architects are an important starting point for assessing the relationship between the built environment and learning, those intentions – and the experiences of learners – are also based on evidence about the relationship between physical design and learning outcomes **(Trask and Khoo, 2021)**. In this section we discuss 'learning' in relation to cognitive outcomes and skills **(WG3-ch5)** directly related to intended aims of education, such as those of curriculum, skill and subject outcomes, although there are overlaps with other outcomes such as behaviours (see following section). However, it must be noted immediately that evidence about the direct relationship between design and cognitive learning is limited. This is because the connection

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between learning outcomes and built environment is mediated and complicated by tangibles (e.g. quality and design of ventilation) and intangibles (e.g. school and classroom culture) **(Blackmore et al., 2011; Higgins et al., 2005, p. iii).**

In terms of primary and secondary schools, conventionally, building performance is assessed against measurable attributes and subjective reports, to optimize conditions for learning. There are several established frameworks such as 'Post Occupancy Evaluation' (POE) and 'Building Performance Evaluation' (BPE). These assessments have been limited due to high cost, although a number of assessment tools have been developed in an effort aimed at standardization **(e.g. Organising Framework on Evaluating Quality in Educational Spaces (OECD, 2009)**, Design Appraisal Scale for Elementary Schools **(Tanner and Lackney, 2006))**. Furthermore, their value to users of existing buildings is frequently unclear.

Investment in schools' built environments seeks to create learning spaces conducive to developing desirable learner

capabilities of team work, communication, interpersonal and intercultural interaction, emotional and digital literacies **(Filardo 2008; Temple, 2009; Lippman, 2012).** Yet no significant body of evidence indicates that the quality and design of the building can be causally linked to learning outcomes as measured by standardized assessments **(Higgins et al., 2005)**. Importantly, Blackmore et al.'s **(2011)** literature review found research concentrated on the design phase, with less research undertaken on the educational practices and outcomes that arise.

Large-scale quantitative studies have attempted to evaluate the effects of light, ventilation, colour and flexibility of furniture on student and teacher performance **(Keep, 2002; Lackney and Jacobs, 2002; Higgins et al., 2005; Durán-Narucki, 2008; see the next section).** Incremental improvement in student achievement is gained when renovating low or medium quality built environments when connected with improved attendance, reduced illness and

...naturalness (light, etc.), personalization (flexibility) and stimulation (colour, aesthetics) 'contribute to student progress in learning'.

teacher retention, particularly in disadvantaged communities **(Schneider, 2002; Buckley, Schneider and Shang, 2005; Mendell and Heath, 2005)**. These factors can have an impact on school climate, but that effect plateaus at a certain point **(Higgins et al., 2005; Loi and Dillon, 2006; Temple and Reynolds, 2007; Gislason, 2009)**. Recent quantitative studies aiming to 'control' through research design for familial background, type and location of the school and teacher quality provide some evidence that naturalness (light, etc.), personalization (flexibility) and stimulation (colour, aesthetics) 'contribute to student progress in learning' **(e.g. Barrett et al., 2015; Barrett et al., 2019)**. Early childhood studies based on play-based measures of developmental learning find that more natural outdoor environments do improve cognitive, affective and physical outcomes **(Morrisey, Scott and Wishart, 2015)**. However, these studies generally ignore mediating intangible variables such as peer relationships, teacher practice, pedagogy and other school-related factors.

While there is a growing body of evidence on the links between physical environment – aspects such as toxins like lead, and access to clean water –and student development, especially in early years, including cognitive and SEL, the majority of studies relate to the Global North. Nonetheless, an international review of research in this area found that despite a paucity of research, similar issues on links between the physical environment and learning are found in the Global South from water pollution in Mexico to the effects of lead in Egypt on development **(Ferguson et al., 2013)**. A mixed methods study of Ghanian inclusive schools found an urgent need to improve ventilation, and less obvious factors such as colour schemes of walls, in order to better include a diverse range of students **(Ackah-Jnr and Danso, 2019)**. The COVID-19 pandemic has blurred the boundaries between the physical learning spaces of home and formal schooling, with lack of adequate conditions exacerbated in the Global South. An overview of the South African educational

response to COVID-19 shows that many students are severely disadvantaged by lack of appropriate facilities at home, including infrastructure to support distance learning. However, the longer-term effects on learning outcomes are yet to be determined **(Soudien, Reddy and Harvey, 2022)**.

Specific evidence around the introduction of more flexible and/or open classroom spaces is, however, more robust (although this does not mean that these environments are somehow necessarily more effective than 'traditional' designs). Mobile furnishings and technologies can be a catalyst for teacher experimentation to meet students' learning needs by enabling group learning, collaborative peer interactions and student agency **(Blackmore et al., 2011; OECD, 2013)**. Personalized spaces can impart

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a sense of security **(Lee, 2007; Woodman, 2016)**. With a shift from teacher-focused to student-focused pedagogies, critical factors are schoolwide planning for use of flexible spaces, teacher professional preparation, resourcing, building maintenance and serial redesign over time as digital technologies develop **(Clark, 2010; Blackmore et al., 2011; Deed and Lesko, 2015; Woodman, 2016; Imms and Byers, 2017; Blythe, Velissaratou and OECD, 2018)**. However, open learning spaces can increase teacher anxiety if not well prepared and supported **(Saltmarsh et al., 2014; Barrett et al., 2017)** and can have a negative impact in terms of learning outcomes on students with visual, speech or hearing impediments **(Klatte, Bergstrom and Lachmann, 2013)**.

Within higher education settings, there are fewer studies about the relationships between the built environment and cognitive learning. These are similarly inconclusive about the direct effects of (for instance) learning space architectures, light, temperature and other conditions because, as with schools, these effects are complex and combined

with a range of other influences. In higher education settings, it has been found that temperature 'comfort zones' can impact upon students' learning – for instance, extreme cold, heat and noise have negative impacts **(Marchand et al., 2014)**. However, as with several studies, these findings are based upon students' perceptions of learning rather than standardized testing outcomes **(e.g. Sörqvist, Halin and Hygge, 2010; Halin et al., 2014)**. Indeed, Scott-Weber et al. **(2013)** argue that post-occupancy studies of higher education student outcomes in (predominantly) university classrooms are generally lacking. In one of the most comprehensive attempts to address this gap, Scott-Weber, Strickland and Kapitula **(2013)** introduced a three-part methodology – drawing on self-reported engagement factors, secondary data and emerging brain science – finding statistically significant improvements in student engagement as students moved from old to new, purpose-built classrooms (although the built/designed details of the spaces are not specified in their

work). Rands and Gansemer-Topf **(2017)** report similar findings in a separate study. There is also still the issue here that this and other studies rely heavily on student self-report in terms of 'engagement', even if specific engagement factors – motivation, collaboration, focus, feedback – are specified, noting again that these are not only contingent on the built environment **(Temple, 2009; Tampubolon and Kusuma, 2019)**.

| **7.3** | **.1** | **.4** |

EVIDENCE ABOUT HOW BUILT ENVIRONMENTS AFFECT BEHAVIOUR, HEALTH AND WELL-BEING OUTCOMES

This subsection focuses on assessing the existing research on how primary to higher education built environments may affect student behaviours, health and well-being – in other words socioemotional and behavioural outcomes that may connect with, but also extend beyond, the specifics of cognitive learning **(WG3-ch4)**. As with cognitive learning outcomes (see the previous section), while environmental quality evaluation frameworks do not systematically assess student well-being, behaviour or experiences, there is some evidence of these impacts. Lopez-Chao et al. **(2020, p. 2)** review a wide range of studies that have, for instance, demonstrated the impact of lighting and noise on children's attention, the effects of thermal changes on problem-solving and the impacts of views of nature (or even green walls) on feelings of restoration, maths performance and vocabulary. They find a positive but complex relationship between maths performance and ventilation, room size, views and place attachment, but that higher chair comfort and thermal comfort actually decrease performance **(López-Chao et al., 2020, p. 10)**. Research tends to ignore the wider range of learning competencies associated with the four pillars of learning, as well as a lack of robust methods for evaluating them **(Byers et al., 2018)**.

Nevertheless, recent studies (although largely confined

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Over the past decade there have been important developments in the interdisciplinary field of neuroarchitecture...

to Australia) have begun to investigate the impacts of flexible learning spaces on health and well-being. In schools that have removed traditional rows and desks and replaced them with more lounge-like furniture and open/break-out spaces, there have been improvements in learning engagement and student well-being **(Kariippanon et al., 2018)**. Attempts to introduce physical activity interventions (e.g. moveable furniture) have led to a positive effect on working memory but no impact on BMI or bodyfat **(Parrish et al., 2018)**. There is currently much hope and expectation that advances in environmental neuroscience and psychology will provide the necessary insights for school designs that are more nature-based, physiologically informed and better for mental health and well-being **(Salingaros et al., 2008)**. However, there is much discipline bridging groundwork that remains to address the gap in understanding of how neurobiological processes link with environmental drivers of behaviour **(Berman et al., 2019)**.

Moreover, flexible spaces do not on their own necessarily improve learning outcomes and more 'traditional' designs may be equally appropriate depending on the curriculum, approach, values and outcomes desired in a particular learning space.

Over the past decade there have been important developments in the interdisciplinary field of neuroarchitecture **(Eberhard, 2009)**, examining the effects of spatial design, building layouts, urban form and aesthetic characteristics on various aspects of human experience, including perception, cognition, well-being, stress, spatial perception, way-finding, memory and behaviour. However, again, there is little evidence that this approach is yet being applied in the design and architecture of school environments, as confirmed by a recent review of the field **(Karakas and Yildiz, 2019)**. There is enthusiasm to develop neuroscientific approaches in learning environment research should the field move beyond the experimental stage **(Noriega et al., 2016)**.

Finally, in the absence of reliable research about the direct effects of school buildings on learning outcomes (and especially cognitive learning outcomes), there has, by contrast, been a very large body of work on learners' and teachers' experiences of being in physical learning spaces **(Daniels et al., 2019)**. This research has extended across a number of disciplines, but it is most prevalent in human geography – in the so-called 'geographies of education' **(Holloway et al., 2010)** – given a focus in that research on critically analysing the workings of educational spaces, and upon listening to the voices of those doing teaching and learning **(Kraftl, 2020)**.

A key focus in work on the geographies of education has been on the power relations that operate in built learning spaces (and which are perhaps unique to spaces called 'school'). As Kraftl **(2013)** evidences in his work on alternative education, it is the combination of rules, behaviours, uniforms, smells and physical design (corridors, classrooms, furniture) that makes up what is understood as a 'school'. Indeed,

he shows how families who withdraw their children from mainstream schools do so because of the perceived negative effects of the environment on their children **(also Conroy, 2010)**. There is an established body of evidence that has explored how children and teachers experience and attempt to subvert power relations in schools **(Youdell, 2006; Taylor, 2013; Catungal, 2019)**. For instance, Pike **(2008)** examined how children negotiate the micro-spaces of UK school dining halls in order to subvert rules imposed on them about what they can eat, and when, and how they can move around the space **(see Berggren et al., 2020, for a similar Swedish study)**.

A second important body of evidence has focused less on the intended outcomes of built learning spaces for learners than their experiences of those spaces, especially in respect of the development of identities and friendships **(Newman, Woodcock and Dunham, 2006; Holloway et al., 2010; Kraftl et al., 2021)**. Valentine **(2000)** showed how the 'informal' parts of the learning campus – corridors, for instance –are critical

> A key focus in work on the geographies of education has been on the power relations that operate in built learning spaces.

…'informal' parts of the learning campus - corridors, for instance - are critical places where children and young people negotiate 'narratives of identity' related to bodily size, gender, sexuality and character traits.

places where children and young people negotiate 'narratives of identity' related to bodily size, gender, sexuality and character traits **(WG2-ch4)**. This work has shown how students with certain capacities or bodily traits – such as disabilities – may feel excluded by combinations of built form and expected behaviours that make them feel unsafe, 'different and thus "out of place"' **(Holt, 2004, 2007; Pyer et al., 2010; Holt et al., 2012)**.However, often in conjunction with architects and other built environment professionals, scholars have attempted to demonstrate how such exclusionary forms of design (in association with rules, norms and teaching practices) can be changed to create more inclusive environments. For instance, Newman, Woodcock and Dunham **(2006)** demonstrated how 'nurturing' environments that were less rigid in their design (through the use of colours, soft furnishings and more informal layouts) feel safer and more welcoming to pupils.

There has also been some limited scholarship on the relationship between 'green' or 'sustainable' learning space design and SEL outcomes, with some evidence that 'early attitudes and knowledge [of sustainable design] shape the later thinking of adolescents and adults' **(Leeming, Dwyer and Bracken, 1995, p. 3)**. Indeed, the National Research Council of the National Academies of Science enlisted a group of scholars to investigate the possible relationship between green schools and student achievements and they had difficulty in finding any research available that addressed the topic **(Earthman, 2016)**. However, a key, recent piece of research from Australia – data from 624 children, aged 10−12 years old, who completed a survey adapted from the New Ecological Paradigm (NEP), and General Ecological Behaviour (GEB) scales for children – has shown that the physical learning spaces of sustainably designed schools can act as pedagogic tools that influence children's environmental attitudes and behaviours **(Tucker and Izadpanahi, 2017)**. Analyses indicated that

...children's environmental attitudes and behaviours, and that children attending schools designed for sustainability had more pro-environmental attitudes and behaviours than children in conventional schools

sustainable design in schools was a powerful predictor of children's environmental attitudes and behaviours, and that children attending schools designed for sustainability had more pro-environmental attitudes and behaviours than children in conventional schools **(Wake and Eames, 2018, report similar findings in New Zealand)**. The above study corroborates prior research recognizing the impact of sustainable design in schools on children's environmental learning **(Newton, Wilks and Hes, 2009; Cole, 2013)**, and suggests that experiential learning via sustainability features at school, such as such as solar panels, use of recycled water and natural daylight, provides children with the opportunity to be mindful of, and to affect, consumption of energy and water **(Kang et al., 2015)**. Experiential education, such as learning in outdoor classrooms and schoolyard gardening, can also increase students' relationships with nature and their sense of contributing to action on sustainability issues **(Wake, 2004; Wake and Birdsall, 2016).**

Meanwhile, literature also reveals contradictory results in cases where green school programmes might not necessarily enhance student sustainability outcomes (consciousness knowledge attitude, behaviour). Some studies found no significant relationship between sustainable building attributes and environmental attitudes **(e.g. McCunn and Gifford, 2012)**. Similarly, Olsson et al. **(2016, 2019)** suggest that investment in a green school project (in their case in Taiwan) had no benefits in terms of sustainability knowledge, attitudes and behaviours among students. The findings indicate that the intended 'education for sustainable development' in schools had a small positive effect on students' sustainability consciousness, while in grade 9, the effect was negative **(Olsson et al., 2019)**.

As with cognitive learning outcomes, research on socioemotional and behavioural outcomes in higher education settings is more limited. It also focuses largely on students', teachers' and university managers'/ leaders' perceptions of the benefits

> ...key work by geographers of education has highlighted how - particularly for students from minority ethnic and religious groups - the physical spaces of a university campus may be exclusionary.

of (for instance) investment in new buildings **(e.g. Temple, 2009, 2014)**. This research should be interpreted carefully given that critical scholarship on neoliberal university systems has identified how campus investment is often linked to competitive imperatives to attract (fee-paying) students **(Ball, 2012; Breeze, Taylor and Costa, 2019)**. Moreover, the range of 'outcomes' is fairly disparate – from the positive effects of increasing pedestrian walkways on physical activity **(Sun, Oreskovic and Lin, 2014)**, to measures to increase bicycle uptake on campus **(Chevalier, Charlemagne and Xu, 2019)**, to – in one of the most comprehensive studies – the positive effects on self-reported well-being/behaviours of functionality and layout, cosiness and pleasantness, concentration and comfort, and 'modern' design **(Castilla et al., 2017)**. The first two factors – functionality/layout and cosiness/pleasantness – were found to be consistently the most important for nearly 1,000 students across thirty classrooms **(Castilla et al., 2017)**. Finally, mirroring scholarship on school-based power-relations

and identities, key work by geographers of education has highlighted how – particularly for students from minority ethnic and religious groups – the physical spaces of a university campus may be exclusionary since they can embody and symbolize majority cultural norms **(Hopkins, 2011; Bunce et al., 2019)**. Meanwhile, several important studies have demonstrated how the campus, halls of residence and purpose-built social spaces are key places at which students develop senses of identity (particularly those learners living away from home for the first time and transitioning to adulthood), belonging and 'home' **(Brooks, Byford and Sela, 2016; Holton and Riley, 2016; Sykes, 2016; Cheng and Holton, 2019)**.

7.3 .1 .5

INVOLVING LEARNERS AND OTHER STAKEHOLDERS IN LEARNING SPACE DESIGN: PROCESSES, OUTCOMES AND CHALLENGES

This subsection looks at fairly well-established evidence about the processes and benefits of

The primary motivations for involving children and the wider school community in the process of creating school spaces differ according to the agenda of those who initiate the process.

involving learners – especially children – in the design of built learning spaces. Given that the vast majority of available evidence is about school design, this is the focus for the section. After considering different approaches to, and structures for, learner participation in design, it examines the benefits and drawbacks of participation, in a context where it is usually assumed that learners' involvement in design processes is unequivocally beneficial. It also examines some of the evidence about the outcomes of participation for learners – including, although generally less well-established, in terms of learning outcomes.

Children's involvement in school design takes many guises: from informing the vision for major new buildings, extensions or refurbishments; to ongoing, everyday spatial and material adjustments and appropriations in an existing school as part of a participatory school culture[1] **(see also den Besten, Horton and Kraftl, 2008; den Besten et al., 2011;**

Kenkmann, 2011; McCarter and Woolner, 2011; Chiles, 2015). The primary motivations for involving children and the wider school community in the process of creating school spaces differ according to the agenda of those who initiate the process. While child-initiated emancipatory processes might represent a participatory ideal **(Hart, 1997; Chawla, 2001; Fielding, 2001)**, the impetus for a new or reconfigured environment, centred on children's learning, most often emerges from priorities set by adults.

Government-initiated school design and construction programmes have sometimes identified involvement of the school community as a requirement, citing the need for engagement as a means to achieve higher quality school buildings, offering educational benefits to the students involved and a sense of ownership for the wider school community **(Heppellet al., 2004)**. Individual schools extending or renewing their physical spaces have also initiated processes of

[1] http://www.designingwithchildren.net/ http://www.designingwithchildren.net/

engagement, commissioning design teams that prioritize user participation **(e.g. Sanoff, 1999; Hubner, 2005; Yanagisawa, 2007; Jilk, 2009; Hofman, 2014; Chiles, 2015)**. Significantly, some school buildings would not be realized without the vision, commitment and voluntary labour of the local community. In community development and humanitarian aid contexts, a school building might be built by volunteers from the school community, often including children in that building process, alongside international volunteers **(Narea, 2017; Fan and Tanoue, 2019)**. Such construction sites have also become contexts for skills training

and capacity building, sometimes also formalized through links to further or higher education **(Cuevas, 2018)**.

Also underpinning approaches to participatory design are attempts to challenge (European) norms of architectural practice and power. In the Canadian context, the concept of 'design sovereignty' recognizes the danger that Indigenous forms of built learning spaces are exploited by designers and architects, and that the only way to counteract this is through the appointment of Indigenous people as lead architects (currently only 18 out of 10,000 registered Canadian architects are Indigenous) **(Fortin, 2020, p. 243)**. This principle of self-determination could be applied across other forms of exclusion from design of built learning spaces. For example, in Northern Ireland, McAllister and Sloan **(2016)** involved young people aged 13–18 with autism spectrum condition (ASC) in a school design study to instruct designers on what they thought made up an autism-friendly environment,

recognizing that a person's interaction with their environment is not always a positive one and that the experiences of children with ASC regarding playgrounds, security, noise, comfort, circulation round the school, simple legibility of space and break out space should be built into school design.

The structural constraints on education as a context for participation mean that it is important to also consider speculative, exploratory design activities with children to be a part of the wider 'School Participation Project'. Competitions such as 'The School I'd Like' in the UK **(Burke and Grosvenor, 2003)**, and similar contests in the US and Australia, have invited children to rethink the relationship between physical space and learning. School design projects that invite children's involvement are almost always of low priority when it comes to establishing such fundamental principles. Some critics would therefore argue that participation in this context can only ever be limited to influencing relatively token decisions about

Also underpinning approaches to participatory design are attempts to challenge norms of architectural practice and power.

...a wealth of positive impacts and benefits associated with learner participation in school design are identified.

space, materials and use, never really challenging assumptions about education, learning and space **(den Besten et al., 2011)**. Notwithstanding these limitations, a wealth of positive impacts and benefits associated with learner participation in school design are identified.

Most school design participation activities by children are framed in developmental terms and linked to the formal curriculum. Learning activities can build upon or use the school design project as a resource linking to almost any subject area. The benefits of this approach lie in the school building project becoming a 'worked example' in learning **(JIA, 2020)**. Learning and achievement are aided by providing 'first-hand, relevant experiences that contextualize learning.' **(Kendall, Muirfield and Wilkin, 2007a, pp. 17 18; Kendall et al., 2007b)** Interactions between the design or construction team and the students can offer inspiration as well as insight into possible professions **(Sutton and Kemp, 2002)**. Students have also been shown to learn technical knowledge relating to building and architectural

principles, including materials, structure, construction and sustainability **(Parnell, Cave and Torrington, 2008)**.

Beyond the subject-based curriculum, there are many overlaps, firstly, with the benefits of art and design education and secondly, with voluntary activity and enterprise education. Participants and their teachers commonly perceive improvements related to creative development – such as capacity to experiment, take risks and problem-solve – and improvements related to aspects of personal and social development – such as self-confidence and self-esteem, communication skills and working with others **(The Sorrell Foundation, 2006; WG1-ch4; WG2-ch8; WG3-ch4)**. Wider education-related benefits include motivation to learn, improved behaviour, enjoyment of school and ability to learn independently **(for summaries of reported benefits see Bentley, Fairley and Wright, 2001; Sorrell and Sorrell, 2005; Parnell, Cave and Torrington, 2008, Deveson, 2008)**. A few studies have related pupils' participation in the design of school buildings

The sense of environmental competence that can be developed through place making activity has been linked with increased well-being resulting from children's improved abilities to exercise control over their environments (connected with their wider rights as children, as enshrined in the United Nations Convention on the Rights of Children), and to derive health and educational benefit **(Day et al., 2011, p. 51)**. School participatory design processes have provided student participants with opportunities to develop collaborative, cooperative and dialogic relations with other actors, resulting, in some instances, in the development of empathy and open communication skills. Adult–child relations have also been shown to adjust, with the attitudes of both staff towards students and students towards staff taking on a new form; each seeing the 'other' not in their role, but as 'more human' **(Parnell, Cave and Torrington, 2008)**.

Perhaps the most fundamental rationale for children's involvement in school design is that it will lead to more appropriate spaces, ultimately therefore improving children's comfort, well-being and the inclusiveness of experiences of school and learning. The task of examining and evidencing such relationships, however, is complex to the point of being prohibitive (in parallel with attempts to evidence the relationship between built space design itself and different learning outcomes (see preceding sections). One of the common effects of school community engagement during the design phase, however, is a sense of ownership among diverse participants **(Higgins et al., 2005)**. Whether this is due to the process or the resulting product is difficult

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to ascertain. However, children's experiences and perspectives often differ greatly from those of the adults who are tasked with designing the space that they will inhabit – not least due to obvious physiological differences. It follows then that architects and designers who have engaged with children in the school design process have reported that they have gained knowledge, insights and 'ways of seeing' that have informed their spatial design and of which they would otherwise have been ignorant of (**Sorrell and Sorrell, 2005, p. 60; Clark, 2010; Hofmann, 2014**).

All of the above potential benefits and positive impacts of school design participation are dependent on positive and appropriate processes. Badly implemented and disingenuous processes of involvement have been shown to provide contexts for coercion and manipulation, or have simply wasted participants' time and effort by being ineffectual, resulting in negative attitudes and participation fatigue. The benefits of involvement in school design and re-design are by no means guaranteed, and careful attention

needs to be paid to the implicit politics in architecture and spatial organization (**den Besten et al., 2011; Kraftl, 2012**).

Textbox example: Sustainable Community Schools in Chicago

In contrast to the neoliberal moment of severe government austerity, there are localized efforts to ensure that historically marginalized communities are able to secure the resources they have been structurally denied. Cases such as Sustainable Community Schools (SCS) in Chicago straddle concerns with built learning environments (**section 7.3.1**) and place-based and community education (**section 7.3.3**), as they question the necessity for learning to take place within the walls of dedicated, built spaces such as 'schools'. They also reference the wider built environments in which (potential) learners live and attempts to address forms of structural inequality. In Chicago, Illinois, given the realities of the built environment in cities for Black and Latinx residents experiencing poverty and structural racism in

'sustainability' in Chicago Public Schools (CPS) appears in the form of permanent resources secured by a justice-centred teachers union.

the form of disinvestment, food deserts, housing insecurity and dwindling educational resources, 'sustainability' in Chicago Public Schools (CPS) appears in the form of permanent resources secured by a justice-centred teachers union (Chicago Teachers Union). Targeting twenty schools on Chicago's West and South sides, the SCS initiative seeks to infuse historically disenfranchised schools with resources in the form of lower class sizes, support for English language learners, long-term relationships with community organizations, ending harsh discipline policies and access to early learning. Moving from austerity practices where governments remove resources from communities that have historically had the least, SCS has targeted communities and schools that have been historically marginalized to provide them with resources usually provided to schools that are prioritized in the district. Similar to the logics of environmental sustainability, SCS views schools as viable centres of education if they are replenished with what is needed

to create thriving communities inside the school walls, with a longstanding commitment to inclusion (e.g. along the lines of race, class, gender (dis)ability and sexual orientation). At the same time, the large emphasis is on 'if'. As funding for SCS was secured as part of a union contract negotiation, late-stage capitalism in the form of budget shortfalls and the current COVID-19 moment unfortunately give school districts and big government the chance to rescind efforts that prioritize marginalized communities. In the broader fight against white supremacy and capitalism – which takes place beyond as much as within school walls – SCS has the opportunity to stand as a model of government accountability rooted in a commitment to address expressed community need **(Chicago Teachers Union, 2018)**.

7.3	.1	.6

CONCLUSION

This section has examined evidence about built learning

Built learning spaces can - in conjunction with various rules, norms and teaching practices - have both positive effects on issues beyond academic learning, too - especially around learners' own experiences of power relations, identity and exclusion.

spaces in learning, with a focus on primary to higher education built learning spaces. The section reviewed the intentions of architects and other stakeholders involved in the design of built learning spaces in terms of the effects and outcomes they have sought to engender. It then assessed a range of international literatures exploring the relationship between built learning spaces and learning outcomes, behaviours and student experiences. The evidence on the relationship between built spaces and cognitive learning outcomes remains unclear: certain kinds of (especially flexible) spaces can have benefits for some kinds of learners, but the sheer range of intersecting and complicating factors makes it difficult to be definitive. The evidence about the potentially positive impacts of built spaces on behaviours and senses of well-being is clearer, with, again, flexible environments leading to a range of positive effects and affects. Built learning spaces can – in conjunction with various rules, norms and teaching practices – have both positive

effects on issues beyond academic learning, too – especially around learners' own experiences (and subversion) of power relations, identity and exclusion. Thus, listening to learners' own voices as well as 'measuring' learning or behavioural outcomes is key; this principle is also central to an established body of work highlighting the many benefits (but also challenges) to including learners in the design of built learning spaces. Those benefits can be many, but include a greater sense of 'belonging' with the learning community, greater willingness to learn and the wider benefits of social inclusion and acquiring skills not usually learned in the classroom.

7.3 .2

DIGITAL SPACES

7.3 .2 .1

INTRODUCTION

While it can be assumed that the digital is distinct from the

'physical', this divide is hard to sustain in practice as much of what is discussed as digital learning spaces is an extension of the types of built spaces outlined above – that is the embeddedness of different technologies within built educational spaces **(See WG2-ch6 for a discussion on educational technology)**. Hybrid learning spaces can be understood as (i) physical (with virtual aspects), and (ii) virtual (with physical aspects), with understandings of the latter being contributed to from learning sciences, computer supported collaborative learning and human computer interaction studies **(Ellis and Goodyear, 2016; WG2-ch6)**. While there are numerous reports in the literature of beneficial educational effects associated with a wide variety of computer-based teaching systems, especially when used in well-resourced experimental situations, evidence of significant, sustained beneficial effects at scale is mixed **(Pane et al., 2014)**.

This section on digital learning spaces examines work on the promises of digital technology in education, with the most sustained research being in the areas connected to Learning to Do, and Living Together or the behavioural aspects of learning, with limited evidence about the connections between digital learning spaces and cognitive learning outcomes. Alongside these promises has come a range of criticisms that the digital technologies of the past 40 years have failed to deliver improved education **(Selwyn et al., 2018)**. To examine the ways in which different positions on digital education have implications for what types of learning spaces are conceived and introduced, this section is based on what Ash, Kitchin and Leszczynski **(2018)** outline as 'geographies produced by the digital' which indicate that 'the digital is mediating and augmenting the production of space and transforming spatial relations' **(Ash, Kitchin and Leszczynski, 2018, p. 29)**. This includes a focus on the unevenness of access to technology and notions of a 'digital divide', that can be about divisions in physical aspects like urban areas and nations, and divisions between and within social categories

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...critical studies of technology that start to examine not only the pedagogical and curriculum, or practice aspects of these learning spaces but also the politico-economic geographies of learning spaces.

like race, class, gender and so forth **(Ash, Kitchin and Leszczynski, 2018; McLean, Maalsen and Prebble, 2019)**. Geographies produced by the digital can also encompass infrastructure and software studies, and critical studies of technology that start to examine not only the pedagogical and curriculum, or practice aspects of these learning spaces but also the politico-economic geographies of learning spaces **(e.g. forms of privatized data driven learning spaces, Williamson, 2018)**.

Focusing on geographies of the digital allows us to look at the ways in which technologies are creating new types of learning spaces, including those that we might see as topological – in which students, teachers, schools, universities, lecturers and so forth – are connected via new networks of infrastructure and the introduction of technologies like virtual reality. These new spaces lead us to questions about what sort of learning, teaching and assessment is being created in these spaces. What is outlined below also speaks to both the ways digital technologies may

hasten an end to the traditional classroom, understood as an historically relatively stable walled enclosure, while also extending the possibilities of such classrooms **(Benade, 2017)**.

7.3 **.2** **.2**

DIGITAL TECHNOLOGIES IN FORMAL SETTINGS

This section outlines the extensive research on computer-based digital tools in primary, secondary and higher education classrooms. This has been the primary body of work that has connected technology, teaching and learning. This section highlights that while this has been an area of much focus, particularly in higher education, with significant comparative and large-scale research evidence of how digital learning spaces reshape teaching and learning, there is little substantive research that identifies links between digital technologies and educational achievement. These digital technologies produce material spaces and create new connections between digital and physical spaces.

The use of digital tools is becoming increasingly widespread and heterogeneous. This reflects a conjunction of two trends. Firstly, there has been a strengthening of pedagogical approaches that favour active and collaborative learning, cognitive apprenticeship, guided exploration, learning through participation in valued (knowledge) practices, and experiences that foster learner autonomy **(Lave and Wenger, 1991; Bereiter, 2002; Sawyer, 2014;** **Lave, 2019)**. Secondly, personal computers and mobile devices have become much more affordable and widely owned – to the point where, in the richer countries, students are expected to provide their own internet-connected devices. Any such device provides a multiplicity of software and hence opportunities for learning **(Ellis and Goodyear, 2019)**.

The diversity of uses to which a tool can be put means that there

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> In broad terms, tools can be used productively – to create something – or epistemically – to improve one's learning – or both.

is little scientific value in trying to quantify the inherent educational benefits of any specific tool. A better approach is to consider the alignment between tool and purpose, and especially to develop strategies that help students make their own well-justified decisions about which tools to use for which kinds of learning (e.g. cognitive, behavioural). In broad terms, tools can be used productively – to create something – or epistemically – to improve one's learning – or both. Research in this area is now providing better insights into (i) how people develop greater fluency in the use of tools, and (ii) methods for designing and managing learning spaces as complex material–digital ecologies or assemblages of tasks, tools and people. This work includes a focus on new forms of collaboration, innovation and insights into the incorporation of technology into the physical design of learning spaces **(Verillon and Rabardel, 1995; Säljo, 1999; Moen, Mørch and Paavola, 2012; Dovey and Fisher, 2014; Dam a and Jornet, 2016; Markauskaite and Goodyear, 2017)**.

Contemporary technologies – like social media, smartphones and digital gaming – emphasize learners as active co-producers of knowledge **(Kafai and Burke, 2016; Goodyear and Armour, 2019a)**. Research on these digital technologies in schools has mainly focused on the process of implementation, explaining how, why and for whom digital technologies are effective in given contexts **(Galvin and Greenhow, 2020; Greenhow et al., 2020)**. However, too much emphasis has been on the technology itself **(Greenhow et al., 2020)**, with few studies measuring the impact of contemporary media on student learning outcomes **(Greenhow and Askari, 2017)**, how engagement and learning may vary across diverse and potentially vulnerable groups **(Galvin and Greenhow, 2020)**, and/or how classroom practices in schools can enrich and relate to young people's informal learning outside of school **(Goodyear and Armour, 2019b; Rutledge, Dennen and Bagdy, 2020)**. One notable exception is the work on the links between behavioural learning and student engagement in the area of what are called 'active

learning classrooms'. Using quasi-experiments, Byers and Imms have found what they claim is a causal relationship between: 1) the use of 'next generation learning spaces; with a polycentric design; and, 2) improvements in students' perceptions of the effectiveness of educational technologies, student collaboration, interactivity, collaboration, and preference for the space **(Byers and Imms, 2014; Byers, Immsand Hartnell-Young, 2014; Byers, Hartnell-Young and Imms, 2016; Imms and Byers, 2017)**. Nonetheless, additional research is needed to draw generalizations and to better understand how these contemporary digital media are used in classrooms and in ways that optimize engagement and learning.

There is a body of research that looks at the way digital technologies connect to new forms of Learning to Live Together, superficially work on socioemotional and behavioural aspects of learning. Research exploring participatory cultures **(Jenkins et al., 2007; Halverson et al., 2018)** and/or the affordance of digital media **(Greenhow and Lewin,**

2016**)** helps to explain how digital technologies can create new types of collaborative learning spaces **(Halverson and Shaprio, 2013)**. A participatory culture can be explained as 'a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices' **(Jenkins et al.,2007, p.3)**. Evidence highlights how new technologies create spaces for learning through engendering cultures of play, practice and social interaction **(compare Greenhow and Lewin, 2016; Kafai and Burke, 2016; Third et al., 2019; Ito et al., 2020)**. For example, the social networking affordances of social media, while carrying with them negative effects around bullying and discrimination **(Waters, Russell and Hensley, 2020)**, can enable new forms of inquiry, communication, collaboration and identity work in classrooms, while impacting positively on cognitive, social and emotional outcomes **(Greenhow and Lewin, 2016; Krukta and Carpenter,**

==Evidence highlights how new technologies create spaces for learning through engendering cultures of play, practice and social interaction.==

As a relatively nascent area of research, there is, as yet, little evidence of the connection between smart classrooms and outcomes.

2016; Greenhow and Askari, 2017). Smartphones and mobile apps afford new pathways for learners to assemble knowledge from diverse sources and in varied formats, rather than a single-source content creator (Halverson and Shapiro, 2013; Gardner and Davis, 2016; Goodyear and Amour, 2019b). Furthermore, commercial and educative digital gaming use in classrooms also provide examples of how game design environments develop different types of spaces to develop expertise, through opportunities for expressions and collaborative problem solving, authentic assessment, automatic feedback, programming skills, creative design, role play and situated decision making (Kafai and Burke, 2016; Kangas, Koskinen and Krokfors, 2017; Hussein et al., 2019).

7.3 **.2** **.3**

HYBRID CLASSROOMS: 'SMART CLASSROOMS', VIRTUAL ENVIRONMENTS AND EMERGING TECHNOLOGIES

This section focuses on 'smart classrooms' in an emerging area of research on technology and learning in 'hybrid' classrooms, cutting across primary, secondary and higher education. It focuses on technologies such as the increased application of artificial intelligence (AI) in the classroom. While AI has long been part of hybrid classrooms, such as Intelligent Tutoring Systems, new forms of AI are now being used such as facial recognition technologies that aim to not only recognize student faces but also identify and propose learning interventions (McStay, 2019). As a relatively nascent area of research, there is, as yet, little evidence of the connection between smart classrooms and outcomes. However, there is a growing body of both quantitative and qualitative research on the experiences of learners and teachers in these classrooms.

The vision of a smart classroom is 'instrumenting the physical learning space with rich and interactive technologies' (Tissenbaum and Slotta, 2019, p. 424). Smart classrooms are 'technology-rich… equipped with wireless communication, personal digital devices, sensors, as well as virtual

learning platforms' **(Li, Kong and Chen, 2015, p. 46)**. This creates a hybrid physical/digital space for learning and teaching where data captured in the physical learning environment and in digital spaces support a 'rich and interactive' smart learning environment.

Smart classrooms are conceptualized as having a range of new digital technologies that capture learning and teaching data through digital devices, sensors, through online platforms and within virtual environments. These are typically understood as part of the Internet of Things (IoT). This also extends to Internet of the Body (IoB), which involve wearable devices such as smartwatches and fitness trackers, and classroom-based sensors such as video cameras, which automatically collect biometric data for analysis and feedback **(Royakkers et al., 2018)**. Ideally, a rich and interactive smart classroom aims to support learner and teacher activities and decisionmaking. Some expected uses would be providing teachers with information on the relationship between pedagogical

approaches and immediate and long-term student social behaviour; engagement in learning and academic outcomes; and even the relationship between these and environmental factors such as the temperature control of classrooms **(Liu, Huang and Wosinksi, 2017)**.

There is a considerable amount of research in the areas related to smart classrooms. For example, intelligent tutoring systems are widely studied in the field of AI. In particular, how these can be used and expanded in learning contexts to support teacher decisionmaking, in real-time **(e.g. Holstein, McLaren and Aleven, 2017)**. Intelligent tutors are adaptive technologies designed to be responsive to learners and their changing needs, as they progress through a learning task. Questions need to be asked about how these are embedded in the learning, rather than replicating traditional teaching approaches. Can these be used in ways that are more immersive, such as pedagogical agents and non-playing characters in serious games, and in ways that take advantage of new learning spaces and places?

Ideally, a rich and interactive smart classroom aims to support learner and teacher activities and decisionmaking.

> ...while local based initiatives have been successful in ameliorating inequitable access to technology for learning, there is little evidence of large-scale systemic success.

7.3 .2 .4

DIGITAL DIVIDES, INEQUALITY, AND UNEVEN ACCESS TO TECHNOLOGIES IN EDUCATION

This section primarily deals with the issue of digital access and inequality, or what is commonly called the 'digital divide' **(Selwyn, 2004)** that connects learning to a range of factors including geography, such as remoteness. The section outlines that the comparative evidence in this area, often undertaken through survey research, has shown that there is significant inequality in technological access. The section also includes evidence that while local based initiatives have been successful in ameliorating inequitable access to technology for learning, there is little evidence of large-scale systemic success. The section includes a case study of the digital divide in Latin America.

Any instance of digital education inevitably bumps up against issues related to 'digital inequality'. This refers to longstanding (and seemingly persistent) 'digital divides' in levels of basic access to devices and connectivity, alongside less obvious 'second order' differences in the quality of digital engagement once an individual is connected, and the outcomes that accrue as a result **(Selwyn, 2004; Helsper, 2020)**. Around the world, levels of digital exclusion are found to be patterned by issues of race, ethnicity, income and multiple intersections therein. Indeed, with around 3.6 billion individuals (47 per cent of the world's population) still lacking access to the internet **(ITU, 2019)**, any notion of digital technology facilitating a global transformation of educational engagement is profoundly misplaced. Moreover, there are sustained within-population disparities around the world in terms of skills to use technology, levels of media and information literacy, and other competencies required to benefit from digital technology use **(Broadband Commission for Sustainable Development, 2017)**. As such, digital technologies are acknowledged as both exacerbating existing social inequalities and introducing additional layers of disparity to people's ability to engage in

(and benefit from) educational opportunities.

Nevertheless, many people remain profoundly optimistic about the capacity of digital learning to address (and overcome) societal inequalities. On one hand, digital technologies are seen as a ready means of increasing people's opportunities to engage in learning regardless of their pre-existing circumstances. Such optimism surrounds current enthusiasm for a shift to home-based virtual schooling – with online technologies believed to give students the ability to engage in education on an 'any time, any place, any pace' basis that best fits with their needs. This was certainly the logic at the beginning of the 2010s surrounding the initial introduction of MOOCs – 'massive open online courses' – that any individual could engage in for little or no cost **(Rohs and Ganz, 2015; Gameel and Wilkins, 2019)**. This is also the logic of many educational interventions in the Global South. Most notably, perhaps, the much-touted 'One Laptop Per Child' initiative in the 2000s distributed millions

of robust self-powered netbook computers to children in some of the most deprived regions with a view to supporting self-directed learning **(Ames, 2019)**. Current initiatives in South Asia and sub-Saharan Africa are continuing this logic – utilizing basic digital technologies such as mobile phones alongside emerging AI technologies to create access pathways to schooling **(Gallagher, 2019)**.

This raises a key tension with regards to the continued application of digital technologies for inclusion and empowerment in education. While these interventions often result in some initial local success, they are usually found to ultimately fail to disrupt or reverse longstanding inequalities and disparities in educational participation. At best these interventions are seen to advantage those who were already advantaged **(Tewathia, Kamath and Ilavarasan, 2020)**. In short, those who benefit most from digital education are those who are already well-educated, well-resourced and without constraining life circumstances –

Around the world, levels of digital exclusion are found to be patterned by issues of race, ethnicity, income and multiple intersections therein.

Although the digital divide is another way to set up borders between wealthy and poor neighbourhoods, there are initiatives that challenge those barriers…

what Tressie McMillan Cottom **(2017)** terms 'the roaming autodidacts'. While digital learning might increase the educational participation of these already privileged classes, it does not usually result in a widening of educational participation to others who were previously not engaged.

TEXTBOX EXAMPLE: DIGITAL DIVIDES AND INFORMAL LEARNING SPACES IN LATIN AMERICA

This case study focuses on Latin America to link non-formal learning with the promotion of social activism to prevent digital divides. According to DaSilva and Ferreira **(2016, p. 8, contributor translation)**, informal learning in reference to social media and digital learning is '… the process by which people acquire knowledge, skills, and attitudes through everyday experience and exposure to the environment in which they live'. There are studies exploring this kind of learning in terms of control and responsibilization of youth **(Kwon, 2013)** in addition to the tradition of positive youth development **(Kirshner, 2015)**, with both

approaches focusing on questions of human development, social integration and possible pathways into employment.

In the community of Abasolo in Chiapas, Mexico, in July 2016, some educators from Escuelas Normales (teacher training schools) created the collective project Ik ta K'op, which in the indigenous language Tseltal means 'word in the wind'. The initial goal of the project was to share information on the social movement promoted by The National Coordination of Education Workers (CNTE) of 2013 in Mexico. The ultimate result was that, thanks to Ik ta K'op, the community gained internet access and began using common communication platforms, such as WhatsApp, to share information. The main informal learning from this

virtual project was building the meaning of 'community internet', 'right of autonomy' and 'internet governance' in that indigenous community **(Lay, 2018)**. Although the digital divide is another way to set up borders between wealthy and poor neighbourhoods, there are initiatives that challenge those barriers, for instance, a free access wireless network was successfully deployed in Ciudad Bolívar in Bogotá, Colombia, after the community worked with non-profit and public organizations **(Pedraza, Cepeda and Ballesteros, 2013)**.

Another important consideration is how the virtual and informal production of learning has an ethnic character, such as the case of learning mathematics in Huánuco, Perú **(Ramón and Vilchez, 2019)** or the development of apps to learn indigenous languages in Mexico **(Le Mur, 2018)**.

DATAFICATION, PLATFORMS,

7.3   .2   .5

AND THE CREATION OF DIGITAL EDUCATION SPACES

This section focuses on the ways in which our understanding of what is a 'learning space' has evolved in response to changed economic and technological conditions, chiefly the explosive growth of pervasive internet platforms and related developments driven by the 'big-tech' sector (e.g. automation and AI). Evidence of these changing developments has been primarily based on qualitative studies of the experiences of system leaders, teachers and students, and the ways in which the measurement of learning has changed through these developments. There is little evidence of whether these developments are connected to rises and falls in learning outcomes.

The latest, largely unforeseen, crisis caused by the COVID-19 pandemic has ignited a discussion about the changing meaning of space and co-presence in education, with all

The latest, largely unforeseen, crisis caused by the COVID-19 pandemic has ignited a discussion about the changing meaning of space and co-presence in education...

the opportunities and problems associated with a sudden, hasty 'pivot' to online delivery. What kinds of spaces are therefore created when digital technology becomes, in its various forms, part of the educational milieu? There are two parts to this: (1) datafication; and (2) platforms.

Datafication describes the increasing use of digital data in education, which has meant increases in data volume, variety, concentration and speed, which emerged along with the ongoing expansion of digital learning and education management technologies **(Lawn, 2013; Williamson, 2017; Landri, 2018; Jarke and Breiter, 2019)**. The far-reaching promises of datafication include the capacity to better cater for individual student needs, provide better and faster feedback, optimize classroom management, and reduce workload, as well as monitor learning paths and intervene early enough (for instance, through applying predictive measures) **(Williamson, 2017)**. Students and teachers using such technologies continuously leave (digital) data footprints,

which are used for various kinds of data analytics before being fed back into instructional, organizational or governmental decisionmaking. Such data footprints not only include learning performance indicators (e.g. tests), but also, to a growing extent, sociodemographic and behaviour data about technology usage. These technologies have become central to an overlap between new forms of student surveillance and specific forms of behavioural learning **(Manolev, Sullivan and Slee, 2019)**.

Indeed, as digital and automated data increasingly become integral features of educational governance and practice, evidence shows they deeply affect teaching and learning spaces as well as the organization, management and supervision of schools **(e.g. Jarke and Breiter, 2019)**. In doing so, they also show tremendous effects on the (transformation of) subjectivities of teachers and (young) children, which poses new challenges, for example, for professional autonomy and children's rights **(e.g. Bradbury, 2019)**. These challenges are

augmented where datafication apparently comes with powerful feedback loop effects – that is, data frequently results in a need for more or better data, more standards, and more focus on (good) data production **(Thompson and Sellar, 2018)**. Ironically, however, even though there is more data than ever before on what happens in schools and classrooms, we still seem to know little or even less about how to improve education outcomes. For example, in countries that have been forerunners in the datafication of schooling scores in international assessments such as PISA are declining (Hartong et al., forthcoming).

Alongside datafication has emerged the growing role of digital platforms in the coordination, governance and surveillance of social life, including education.

Alongside datafication has emerged the growing role of digital platforms in the coordination, governance and surveillance of social life, including education **(Fuchs, 2010; Bucher, 2012; Kelkar, 2017; Van Dijck, Poell and De Waal, 2018; Williamson, 2019)**. Educational platforms configure digitally produced spaces where key educational processes (teaching, learning and administration) are affected in three interrelated ways:

1. platforms are proprietary and controlled virtual environments where multiple educational actors (e.g. teachers and students) and processes can be digitized, datafied and standardized;

2. through digitization and datafication platforms apportion and individualize educational support and guidance; and

3. through standardization and the development of flexible protocols and infrastructures, platforms create openings through which third parties (e.g. external, often for-profit, providers of educational services and products) can enter the virtual educational space as add-ons, integrations and extensions.

At the risk of oversimplification, academic research on the emerging platforms in education tends to take one of two positions: one broadly supportive and optimistic and, while involving critique, generally focuses on these contributing to improved cognitive learning outcomes; the other more critical, circumspect and sociological in scope.

The first position relies on data intensive methods and computational approaches and argues that platforms create network effects where people can draw simultaneously on the wisdom of crowds and the personalized assistance enabled by real-time and precise algorithms. This research generally goes by the name learning analytics (LA) and is associated with 'the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs' **(Long et al., 2011)**. The main aim of LA is the collection of multiple forms of data from a variety of learning platforms and apps, in order to diagnose and predict dimensions of educational performance, and ultimately produce 'actionable insights' of immediate and demonstrable instructional effectiveness **(Clow, 2013; Siemens, 2013)**. Other popular trends include using LA to identify variables and behaviours that promote student success and address the need for

quality assurance of educational services **(Lester et al., 2017)**. The evidence supporting these claims is, however, mixed. Some studies report positive learning outcomes within educational platforms compared to traditional environments, but these outcomes do not transfer across contexts **(Winne, 2017; Kizilcec et al., 2020)**. Similarly, experimental research on automation in platforms has found that automated teaching methods have moderate positive impacts, but are only as effective as, and often less effective than, human teachers **(Ma et al., 2014; Steenbergen-Hu and Cooper, 2014)**.

The second position draws attention to various forms of reductionism occurring within educational platforms, as a result of logics of prediction and automation **(Perrotta and Selwyn, 2019)**, as well as the growing interface between surveillance, governance and datafication in education policy **(Gulson and Sellar, 2019)**. In this more critical camp, the main pedagogic feature of platformized spaces is their 'operational bias' **(Andrejevic, 2020, p. 95)**, which prioritizes seeking to

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act preemptively, thus removing the need for pedagogic agency **(Knox, Williamson and Bayne, 2020)**. Notable studies in this camp use data analysis to warn against an overreliance on large datasets, collected through digital learning platforms such as MOOCs, suggesting that platforms do not ameliorate familiar challenges in education: self-selected participation and fragmented, socially stratified patterns of engagement **(Gillani and Eynon, 2014; Rohs and Ganz, 2015)**. In other words, big data does not mean good data, and platforms can be just as problematic as 'traditional' learning spaces.

7.3	.2	.6

CONCLUSION

This section has highlighted that there is substantial evidence for the connection between the following areas of technology and learning spaces: (1) the experiential aspects of teaching and learning including the use of emerging technologies; (2) the impact of technology

and technology companies, on how learning is administered and governed; and (3) the enduring inequality of technological access. There is far less evidence on the connections between digital spaces and learning outcomes. The COVID-19 pandemic means that the digital spaces of learning have been widely distributed (away from the buildings of schools to homes) and highly differentiated (with implications for learning outcomes, not just between but within countries **(Reimers, 2022)**. There remains the need for critical research on the learning effects of the use of education technology during the pandemic **(Williamson, Enyon and Potter, 2020)**.

7.3	.3

NATURAL SPACES

7.3	.3	.1

INTRODUCTION

This second main section of the chapter's findings recognizes

that learning experiences are often designed to occur in, or in relation to, the natural or non-built environment, and that all learning is necessarily situated on and in relation to land. We highlight evidence on how considerations of land are embedded within all education (implicitly and/or explicitly), as well as how land and natural spaces can be engaged more intentionally as part of experiences to learning to know, to do, to be and to live together (or learning 'about, in and/or for' nature). The section will assess the evidence relating to the roles of natural spaces in trajectories of outdoor and environmental education, community and place-based education approaches, interspecies learning and education, and Indigenous approaches to land and environment in learning and education. Running through these bodies of literature are varying views of whether humans and human-made objects, including built environments, should be considered separate from, or also as part of, the natural world. 'Nature' is understood neither

as an objective category or a universal experience; the concept of 'naturalness' needs decoupling from individual understandings of the natural world and the intricacies of specific places in which learning might take place.

7.3 **.3** **.2**

OUTDOOR SPACES AND LEARNING

Various forms of education undertaken 'outdoors,' or in other words, beyond the built environment, are identified in the research literature as a means to support people's personal and social development through the building of relationships with self, others and the environment **(e.g. Wattchow and Brown, 2011; Fiennes et al.,2015; Harris, 2018).** With a range of historical roots in locations such as the UK and Scandinavia **(e.g. Sandell and Öhman, 2010; Freeman, 2011),** forms of outdoor education are now popular across many societies and offered by non-profit organizations, sometimes for business or leadership

Proponents of outdoor educational approaches reference them as effective interventions for a range of outcomes such as increased confidence, positive affect and communication skills, and developing concern for others and the environment...

training, and also as a means of learning the curricula of formal education. Proponents of outdoor educational approaches reference them as effective interventions for a range of outcomes such as increased confidence, positive affect and communication skills, and developing concern for others and the environment, including for all ages in a range of settings. Outdoor learning is also noted for its ability to be adapted to support a range of curriculum subjects at the primary to higher education levels of formal education. Indeed, outdoor and environmental education programmes have undergone significant diversification and expansion in recent decades to reach this variety of aims, through a growing call for education that is cross-curricular, locally relevant and emphasizes student responsibility and personal growth **(Beames and Ross, 2010)**. As Gray **(2018a, p. 146)** offers, outdoor learning is not new, 'just newly important', providing a 'potent vehicle for alternative learning' – often premised on experiential learning **(Nicol, 2014)** and making a shift away from transmissive

learning approaches.

Whilst challenging to quantify, there is evidence that outdoor education, when planned and well taught, does lead to positive effects **(Hattie et al.,1997; Rickinson et al., 2004; Fiennes et al.,2015; Ardoin and Bowers, 2020)**. For example, the embeddedness of outdoor learning in Scotland's national Curriculum for Excellence **(Learning and Teaching Scotland, 2010)**, and links to the national curriculum in England and Wales **(DfES, 2006; Ofsted, 2008; DfE, 2018)** demonstrate its perceived ability to contribute to a broad and balanced curriculum that promotes spiritual, moral, cultural, mental and physical development **(DfE, 2014' WG3-ch5)**. It also provides a fundamentally different space to the classroom that affords learners the opportunity to explore different behaviours and interactions **(Kraftl, 2013; Harris, 2018)**. In terms of contributing to the four pillars of education, 'outdoor learning' typically aligns most strongly with Learning to Be and Learning to Do; developing broader 'essential skills' **(Angus et al., 2020)**, such as

...cultural differences can become a defining pivot in learner's corporeal experiences and associated (negative) interpretations of outdoor learning environments.

teamwork and communication that support the use of specialist knowledge and technical skills, and focusing on personal growth and environmental learning, for example, through an emphasis on decisionmaking and social responsibility.

Research demonstrates that in Global North settings, experiences of outdoor learning do not lead to universally positive experiences. The most obvious (but perhaps perceptively diminishing barrier) is the masculinized Outward Bound model that dominates classic outdoor learning rhetoric **(McKenzie, 2003; Gray, 2018b; Riley, 2019)**. Mycock **(2018)** points to the exclusionary processes that emerge through material engagements with outdoor learning environments and the politics of nature and natural materials, which may be highly gendered. She observes how 'mud governs individuals and their experiences' **(p. 455)** in the context of forest school and school garden spaces, acting to reinstate gendered and class-based identities and performances, and limit children's 'muddy

encounters'. Other research has suggested that cultural differences can become a defining pivot in learner's corporeal experiences and associated (negative) interpretations of outdoor learning environments **(Friedel, 2011; Hickman Dunne, 2019)**. Attention has also been drawn to the role of (dis)ability – both physical and intellectual – in perceptions of, and reality of access to, particular, nature-based learning environments **(von Benzon, 2011, 2018; Hickman Dunne, forthcoming)**. These observations point to some deficits in understandings of the contribution of outdoor and environmental learning to learners' holistic education. Firstly, for whom is it an effective educational intervention and why, and under what circumstances might it be less effective? Secondly, how applicable is this model of learning to other cultural and geographical contexts, and do we understand the diversity of outdoor learning activity that is taking place across the globe? Natural spaces can be enablers for the pillars of learning and their associated educational

outcomes. However, there can be a blindness to the exclusive qualities of nature and outdoor environments, particularly when framed from Western perspectives on outdoor learning.

The promotion of alternative outdoor learning approaches, such as slow adventure **(Varley and Semple, 2015)**, and the embedding learning in place through elements of ecopedagogy **(Kahn, 2010; Payne, 2014; Dunkley and Smith, 2018)**, go some way to addressing some of these deficits. There is no doubt that outdoor education practice has developed to reflect the wider diversity of people who now access it. However, further work that pushes empirical understandings of people's socially mediated engagements with outdoor education settings is important, to understand the potential of nature to act as a more inclusive and critical learning space.

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COMMUNITY AND PLACE-BASED LEARNING

The research literature documents diverse trajectories of approaches to community and place-based education, most with intended critical and/or environmental learning outcomes. Also taking place on land, and in – or in relation to – non-built or outdoor spaces, approaches describing themselves as 'community-based' or 'place-based' typically vary from those using the terms 'outdoor learning' in that they are more likely to prioritize social issues and learning (and with environmental learning in much place-based education) **(WG3-ch5)**.

One influential body of work on community-based education builds on the work of Brazilian educator and philosopher Paul Freire in critical pedagogy. Engaging adult learners in community-based education to overcome their conditions of oppression through the co-creation of knowledge **(Freire, 1970)**, this approach has a broad legacy. In Latin America, Freire's legacy strongly influences critical environmental education today, with scholars often highlighting his concept of praxis and the

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...focus on the communities most vulnerable to degradation as a result of social and environmental conditions, such as the Indigenous, peasants, traditional fisher people and slum dwellers, and have inspired promising research strands.

dialectics between 'denouncing the dehumanizing situation and announcing its overcoming' (**Freire, 2000, p. 37**). Such educational approaches focus on the communities most vulnerable to degradation as a result of social and environmental conditions, such as the Indigenous, peasants, traditional fisher people and slum dwellers, and have inspired promising research strands. For example, the 'education in public environmental management' project, based on a critical pedagogy framework, aims at promoting participatory democracy in the management of territories; and 'community-based environmental education' and has also been inspired by decolonial theories and political ecology (**Quintas, 2007; Almeida and Loureiro, 2015; Magalhaes and Loureiro, 2016; Souza and Loureiro, 2018; Vitor, Goncalves and Sanchez, 2019; Melo and Barzano, 2020; Oliveira, et al., 2020; Pelacani et al., 2020; Stortti, Espinosa and Garcia, 2020**). A review of critical environmental education research in Latin America (**Sanchez, Pelacani and Accioly, 2020**) suggests that the urgency of a fairer distribution of wealth and income

and the workers' rights movement has mobilized grassroot approaches to critical community-based education. This trajectory of critical work has also informed approaches to ecopedagogy and other perspectives on critical environmental education (**e.g. Kahn, 2010: Misiaszek and Torres, 2019**).

Using a community-as-pedagogy framework (**Freire, 1970**), a study of a community-based education programme in a Latin American rural high school context investigated how community connections strengthened students' perceptions of social relationships and environmental leadership (**Selby et al., 2020**). The results showed an increase in students' knowledge of the local environment and community environmental issues. It was an endeavour to draw attention to, and encourage engagement in, complex socioenvironmental issues and to help transform 'youths' ability to envision, enact, and expand upon community-derived conceptions of "environmental leadership"' (**p.2**).

A second related trajectory of community and place-based learning emphasized in the research literature is the 'environmental justice' movement and its impacts on education. In the 1980s, environmental justice emerged in the US as a social movement that linked social justice and environmentalism. Distinct from conservationist forms of environmentalism, environmental justice framed notions of the environment broadly and recognized that all environmental spaces, natural or built, are tied to power relations **(Bullard, 1990; Teelucksingh and Masuda, 2014)**. Structural inequities and differential access to power results in affluent white communities being better able to protect their environments from undesirable land uses **(Pulido, 2000)**. In contrast, those who are marginalized poor, racialized and Indigenous, in both more developed countries and less developed countries, bear the burden of environmental risks, such as pollution, climate change and exploitation of their land and natural resources. The spatial dimensions of environmental injustice include both the risk distributions that concentrate in areas of deprivation **(Bullard, 1990)** and also the terms of risk causation, as found in the sociospatial politics that surround truth claims made by competing stakeholders involved in environmental decisionmaking **(Waldron, 2018)**.

Environmental justice is posed in the literature as uniquely tied to both formal and informal learning spaces and the need for integrated visions of learning **(Haluza-DeLay, 2014)**. Formal education settings are key sites to conduct evidence-based research that validates the everyday experiential knowledge of grassroots environmental justice actors. Many of these actors are women and Indigenous people who become activists because of the risks they bear. Schools can also play a role to inform children of their social justice and citizenship rights to access healthy environmental spaces, especially for children who live in communities that suffer from environmental injustices **(Peloso, 2007)**. In turn, grassroots

,...those who are marginalized poor, racialized and Indigenous, in both more developed countries and less developed countries, bear the burden of environmental risks...

Theoretically based on theories of social capital and relational power, Warren calls for a new approach to urban education reform that is linked to social changes in America's cities.

environmental organizations, which position marginalized communities as active agents of change, provide informal learning that empowers and fosters environmental resilience.

A wide range of initiatives has also recently emerged across the US in order to promote connections between community-based organizations and schools. Warren **(2005)** states that such community initiatives can contribute to school improvement through improving the social context of education, fostering parental and community participation in education, transforming the culture of schools by holding school officials accountable for educational gains, and building a political constituency for public education to support the delivery of greater resources to schools. Warren links the success of urban school reform to the revitalization of communities around the schools through developing collaboration between public schools and community-based organizations. In order to do this, they identify a typology of three approaches and exemplar

models for each: the service model (community schools), the development model (community sponsorship of new schools), and the organizing model (school–community organizing). Despite the differences, these three models appear to have a number of features in common and all seek to build stronger and more collaborative connections between and among parents, educators and community members. Theoretically based on theories of social capital and relational power, Warren calls for a new approach to urban education reform that is linked to social changes in America's cities. The review concludes that community-based education can build social capital among educators, parents and community, which can expand the capacities of schools in a way that it calls 'a new view of urban education reform'.

A third central body of literature on place-based and place-responsive education has developed more recently. This research extends prior work on community-based education to account for 'place' in educational

provision, including a focus on communities as well as the land and natural settings within which they are embedded. Place-based education has emerged as an approach, harnessing locally distinctive contexts into teaching and learning, including its geography, ecology, politics and sociology **(Woodhouse and Knapp, 2000)**. For the last several decades, the heterogeneous movement broadly termed here, 'place-based education,' has sought to facilitate learning in local areas through providing students with opportunities to encounter local people, local issues and to experience phenomena in a 'real world' setting beyond the classroom. Other identifiable sub-fields of the loosely linked movement are curricular provisions for place-responsive learning, area studies, urban education and other forms of place-related formal and non-formal education.

In the scholarly research literature, place initially emerged as a key context for 'place-based' pedagogies of various kinds **(Gruenewald, 2003; Sobel, 2004; Skamp,**

2009). Linking his work to that of Dewey, Smith **(2002)** suggests place-based education grounds learning in the local or the particular place of students' lived experiences. Early perspectives extended critical pedagogy to take account of the role of the setting or eco-social context of education. Gruenewald (later Greenwood) **(2003)** theorized 'critical place-based' and 'place-conscious education' and later argued the need for an examination of places to reveal 'the often contestable nature of the dominant beliefs and motives' **(Greenwood, 2013, p. 97)** that shape our perspectives of places. A number of authors **(Ingold, 2000, 2011; Somerville, 2008; Payne and Wattchow, 2009; Wattchow and Brown, 2011; McKenzie and Bieler, 2016)** have sought to particularly understand the processes of place-based learning. For example, Sellers **(2009)** suggests that curriculum itself needs to be considered as a 'milieu of becoming' wherein assembled entities change as they expand their connections to each other and to other newly encountered entities or beings **(see also WG2-ch8; WG3-ch5)**.

> Place-based education has emerged as an approach, harnessing locally distinctive contexts into teaching and learning, including its geography, ecology, politics and sociology.

...in addition to enhancing community-school relationships and students' attitudes toward their schoolwork and their communities, place-based education affects student motivation for, and engagement in, learning.

Informed by process philosophies (for e.g. Heidegger and Deleuze), a proliferation of writing has used the term 'place-responsiveness' in an effort to sustain and understand how people and places are in ongoing reciprocal relation via learning **(Cameron, 2003)**. Mannion, Fenwick and Lynch **(2013)**, among others, link place-responsiveness with educational endeavour in the term place-responsive pedagogy, which they define as explicitly teaching 'by-means-of-an-environment' with the aim of understanding and improving human–environment relations. It involves educators' own experiences and dispositions to place, learners' dispositions and experiences, and the ongoing contingent events in the place itself (including the presence and activities of other living things). Other education research has focused on psychological orientations to place and place attachment, and has emphasized various aspects of place that can shape learner identity, including through place-based learning **(Chawla, 1992; Ardoin, 2006; Kudryavtsev,**

Stedman and Krasney, 2012). In an evaluation of four place-based education programmes, Powers **(2004)** finds that in addition to enhancing community-school relationships and students' attitudes toward their schoolwork and their communities, place-based education affects student motivation for, and engagement in, learning. A salient emerging theme is that special education students performed better during the place-based learning activities.

Textbox example: School-based garden learning

Teachers, school leaders and communities are responding to increased food insecurity and the need for more outdoor learning spaces by connecting with community gardening and small farming as living classrooms **(Williams and Brown, 2012; DiClaudio, Hughes and Savoca, 2013; Williams and Anderson, 2015)**.Research has found that garden-based learning spaces offers unique opportunities for teachers to connect students with important global nutrition issues and local economic

alternatives for students learning food growing, preparation and consumption, while also learning about important social justice and sustainability issues **(McKenna and Brodovsky, 2016; Niewolny and D'Adamo-Damery, 2016)**. In many garden-based learning spaces, schools and teachers have the opportunity to situate gardens as learning labs for science learning and closely connect students with skills for addressing food insecurities and centering civic engagement around food politics. School and community gardening also offer the opportunity to centre cultural and biological diversity and interdependence. One example of garden learning can be found in Portland, Oregon at the Learning Gardens Laboratory (LGL). This is a 12-acre garden where university students and community members work with young learners through hands-on and place-based education. The LGL is one of a growing number of garden learning spaces in the city of Portland where the focus of learning includes sustainable gardening and healthy nutrition through permaculture **(Williams**

and Anderson, 2015). Another example is the D-town Farm where Black urban farmers have a Food Warriors programme that engages youth in food systems learning that focuses on a sense of agency through food justice, environmental awareness, diverse agricultural techniques and health food preparation **(DBCFSN, 2019)**. Furthermore, examples of garden learning rooted in land-based education and decolonial efforts are centering Indigenous ways of knowing as central to students learning **(Tuck, McKenzie and McCoy, 2014; Bang, 2016; Lever, 2020)**. Most importantly in both garden-based learning and food pedagogies, is that learning spaces are sites of learning to recognize the multispecies interdependencies and how such systems require critical understanding in order for us not only to survive but thrive together on the planet.

In addition to research on the effects of being in particular places for learning, there is also a literature on the benefits of movement across places, such as the scholarship on walking

School and community gardening also offer the opportunity to centre cultural and biological diversity and interdependence.

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Walking pedagogies offer opportunities to circumvent the implicit lessons of institutionalized environments, while also raising opportunities to explore the curricula found in different spaces and places.

pedagogies. Walking is receiving attention for its capacity to enact curricular and public pedagogies, as well as community action, but also because of the critical place engagement that it offers **(McPhie and Clark, 2015; Springgay and Truman, 2019)**. Walking produces opportunities for different forms of socialization and subjectification when compared to sitting in more homogeneous and static environments where students sit at desks in rows, facing one direction. 'Materialities of classrooms do crucial but often unnoticed performative work in enacting gendered power' **(Taylor, 2013, p. 688)**, as well as reinforcing racial, colonial, ableist and class/caste powers. Similarly, ostensibly public spaces, notably urban environments, but also rural spaces, have become increasingly commodified and privatized, further shaping how it is possible to be in these places **(Richardson, 2015)**. Walking pedagogies offer opportunities to circumvent the implicit lessons of institutionalized environments (indoor and outdoor), while also raising opportunities to explore the

curricula found in different spaces and places.

Walking pedagogy is, however, not inherently equitable. Walking is a cultural construct and is changeable for different people, in different environments, at/in different times. Some people are more physically able to walk than others (and some may not be able to walk at all). The shape, position, length of stride and speed of your walk can signal privilege or poverty **(Becker, 2016)** –for example, where just walking down a street as a person of colour can be taken as an act of criminal intent in some places **(Cadogan, 2016)**. In contrast, the pastime of walking in the countryside for leisure or well-being is most often undertaken by privileged white people in the Global North due to their conceptions of landscape and the urban, and prevailing ableist and privileged notions of health and access. Walking pedagogues have a responsibility and opportunity to consider what their walking pedagogies allow (and for who), what they might reinforce (and to whose detriment), and what

they might disrupt (and for whose empowerment). Walking has been researched as pedagogy in a range of formal and non and informal settings, including in outdoor learning **(Beames, Higgins and Nicol, 2012; Gray and Colucci-Gray, 2019)**, decolonial walking pedagogies **(Walsh, 2015)**, walking libraries for women **(Heddon and Myers, 2020)**, non-ableist walking **(Stenning, 2020)**, participatory methods of research **(Snepvangers and Davis, 2019; Borthwick, Marland and Stenning, 2020)**,

radical performance **(Smith, 2015)**, and First Nations protest and/or liberation **(Hamilton, 2020)**.

7.3 **.3** **.4**

INTERSPECIES LEARNING

Research that focuses on the relationships among humans and other aspects of the material world embraces not only animate beings but inanimate and

...learning takes place, through relations with other agentive beings.

inhuman elements **(Ogden, Hall and Tanita, 2013)** in opening up new accountabilities in understanding learning spaces **(Van Dooren, Kirksey and Münster, 2016)**. The human is understood to emerge, or in other words learning takes place, through relations with other agentive beings **(Rautio, Tammi and Hohti, 2020; see also Hohti and Tammi, 2019)**. As Tsing **(2012, p.141)** contends, 'Human nature is an interspecies relationship'. Thus, growing up is understood to be inherently about co-becoming of humans with other life – animate and inanimate **(Hird, 2009)**.

There is nothing particularly new about a focus on relations – on humans as interconnected with nature per se. It is not historically novel, as Bach **(2018)** points out, nor is it new to many Indigenous cultures **(Ellis, 2005; TallBear, 2011)**. The newness arises from the current means – technologies and ways of thinking – with which we can learn more about the multispecies webs that enable our existence.

Advances in fields surrounding education proper, such as childhood studies or childhoodnature approaches **(e.g. Horton and Kraftl, 2018; Cutter-MacKenzie-Knowles, Malone and Barrat, 2020; Kraftl, 2020)**, as well as environmental education **(e.g. Lloro-Bidart and Bansbach, 2018; Kraftl et al., 2019)**, have for some time emphasized attention to connectivity and coexistence through approaches labelled as (new) materialist **(Snaza et al., 2016)**, sociomaterialist **(Fenwick, Edwards and Sawchuck, 2012; McKenzie and Bieler, 2016)**, posthumanist **(Snaza et al., 2014)** or multispecies inquiry **(Rautio, Tammi and Hohti, 2020)**. Most of these have exemplified a shift of focus both empirically and onto-epistemologically from individuals to relations and multiplicities, from large-scale certainties to micro-scale situatedness and webs of interrelations, exposing, for example, systems of domination at work in curriculum and pedagogy **(Snaza et al., 2016)**. Deborah Bird Rose **(2011)**, among many environmental philosophers, stresses a shift from atomism to connectivity, and from certainty to uncertainty. Education, however, has been

among the slowest of disciplines to attend to these shifts **(e.g. Pedersen, 2010)**, and has instead celebrated universal (e.g. ahistorical, apolitical, geographically and spatially indistinct) ideas of learning **(Fenwick, Edwards and Sawchuck, 2012; Snaza et al., 2014)**.

Some process-oriented educational research, sometimes described as 'new materialist', or 'post-human', now emphasizes our lived and embodied experience in educational settings **(Kraftl, 2013)**. These researchers actively target the binary of culture/nature and the idea of human stewardship of nature **(Taylor and Pacini-Ketchabaw, 2015; Malone, Truong and Gray 2017)**. Others emphasize the significance of learner embodiment in settings **(Hackett and Somerville 2017)**. Lloro-Bidart **(2017)** considers the role of non-humans, suggesting that other species and the human can be a 'community of knowers'. Post-human or 'more-than-human' approaches, therefore, seek a revision of modern ideas such as 'stewardship' of environments (with its paternalistic associations of mastery and control), challenging learners towards a

greater acceptance of the current state of environmental crisis (for example climate change and biodiversity loss), and foreground the importance of alternative ways of knowing (via, for example, Indigenous knowledge, embodied and affective knowing, and ethical response-abilities). Pederson **(2011)** and Quinn **(2013)**, clarify that such approaches must decentre the human subject so that we can develop an 'understanding of what it means to learn with and from rather than about nonhuman animals' **(Pederson, 2011, p. 20)**.

In-depth research about child–animal relations highlights human children and other animals as co-becomings **(Van Dooren and Rose, 2012; Hohti and Tammi, 2019)**. It is suggested that human–animal relations can, in general, be conceived as powerful relationships intrinsic in their value to children **(Risley-Curtiss, 2010; Tipper, 2011)**, and reviews of research show that caring for a companion animal may promote respect and compassion for all animals and nature **(Prokop and Tunnicliffe, 2010)** as well as increase general health and

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well-being **(McCardle etal., 2011)**. Childhood nature or child–animal scholarship shows that a situated learning with (cf. learning about) produces connections and a sense of belonging **(Taylor et al., 2015; Cutter-Mackenzie-Knowles, Malone and Barrat, 2020)**. This kind of research further argues that situated relations and forms of education are performative: they are world-making **(Haraway, 2008)** and, as such, relevant to education far beyond learning.

As one trajectory of work concerned with these framings, common worlds pedagogies propose alternatives to dominant educational approaches that promote universalized understandings of 'the developing child', instead situating young children within the actual worlds they inherit and inhabit amidst current conditions of global environmental precarity **(Taylor, 2013, 2017; Taylor and Pacini-Ketchabaw, 2015; Kraftl, 2020)**. While recognizing the importance of children's physical, emotional and other aspects of well-being, common worlds pedagogies seek to cultivate pedagogical

attention to environmentally damaged places in ways that resist reinforcing the human-centredness on which our current times of environmental precarity were formed. Therefore, rather than re-centering the child, through everyday pedagogical encounters, common worlds approaches work with pedagogies that notice and respond to children-in-relation with the more-than-human as a conduit for creating more livable worlds for all – where the more-than-human includes materials, other species, land, weather and more.

Examples of this work include studies of children's relations with local impacts of climate change **(Rooney, 2019)**, polluted waters **(Nxumalo and Berg, 2020)**, waste **(Hodgins, 2015)** and plastics **(Kraftl, 2020; Berry, Vintimilla and Pacini-Ketchabaw, forthcoming)**. Central to an emphasis on children's place relations and the refusal of human-centredness, is a commitment to considering places and their more-than-human inhabitants as storied, vibrant and active participants

in children's relational learning, rather than a mere background for children's learning. Common worlds perspectives on place and the collective learning therein are transdisciplinary, drawing from Indigenous land pedagogies **(Bang et al., 2014; Simpson, 2014)**, new materialist perspectives on affective pedagogies **(Blaise and Pacini-Ketchabaw, 2019; Nxumalo and Villanueva, 2019)** and more-than-human geographies of place **(Instone and Taylor, 2015)**, amongst other influences **(Taylor, 2017)**.

Since much of the work of common worlds scholars is situated within settler colonial contexts, engagements with children's place relations also include foregrounding the ways in which childhood pedagogies can disrupt the erasure of Indigenous communities, knowledges and lands **(Nxumalo, Vintimilla and Nelson, 2018; Land et al., 2019; Nxumalo, 2019)**. In addition, common worlds pedagogies attempt to confront the impacts of settler colonialism through attention to fraught relationships and awkward encounters between children and animals such as raccoons **(Pacini-**

Ketchabaw and Nxumalo, 2015), rabbits **(Taylor, 2020)**, bees **(Nxumalo, 2018)** and kangaroos **(Taylor and Pacini-Ketchabaw, 2018)**.

Within a focus on the ethics and politics of children's place relations, recent common worlds work has drawn on Black feminist geographies and Black speculative storytelling to re-imagine childhood pedagogies as capable of interrupting the absenting and deficit constructions of Black children's relationships to so-called natural places **(Nxumalo and Cedillo, 2017)**. Taken together, this literature suggests a need to attend to the ways in which place and space are central to Black, Indigenous and other intersectionally marginalized people's oppression and liberation.

| **7.3** | **.3** | **.5** |

INDIGENOUS LAND-BASED LEARNING

A final area of research that informs current understandings of 'natural spaces' of learning

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is that of Indigenous land-based approaches to education. Bang et al. **(2014)** have written that 'Land is; therefore, we are', recognizing that within Indigenous cosmologies, existence and identities are inseparable from relationships with the land. When we (Indigenous people) speak of the land, we are referring not simply to the piece of ground on which we might stand but also to the water, sky, human and non-human beings, spirits and forces that, in their reciprocal relationships, form and sustain all life. Over Indigenous peoples' long history, the land has been our most valuable site of learning and source of knowledge **(Simpson, 2014; Cajete, 2015; Wilson and Laing, 2019)**. This has been disrupted, however, by the colonization, settlement and creation of colonial nation states on our traditional territories – processes that start with and are continuously maintained by the displacement and dispossession of Indigenous peoples from their lands. Settlers' claims to our territories, resource extraction and industrial activities continue to erode our access

to the land. Formal education systems, a critical component of the machinery of colonization and initially designed to assimilate and enfranchise Indigenous peoples, have been a poor substitute for the pedagogy of the land **(Simpson, 2017)**. Beginning with our children's forced attendance at residential schools in the mid-1800s and persisting today, educational systems in settler colonial countries have been sites of epistemic and ontological violence against Indigenous peoples **(Simpson, 2014; Wildcat et al., 2014; Ahenakew, 2016; Hall and Tandon, 2017; Wilson and Laing, 2019)**. Both inside and outside the classroom, our lands, bodies, identities and ways of being and knowing have been regulated, controlled, policed and reconstructed by steadily enforced colonial regulations and norms.

Land-based education is one way that Indigenous peoples continue to resist the violence of colonial systems. As Wildcat et al. **(2014, p. 1)** argue, 'if colonization is fundamentally about dispossessing Indigenous people from land, decolonization must involve

forms of education that reconnect Indigenous peoples to land and the social relations, knowledges and languages that arise from the land'. Simply moving students from a classroom to the land is not equivalent to 'decolonizing' or 'Indigenizing' education. The change in location must be accompanied by 'a change of philosophy, a change of curriculum, a change of teaching methodologies, a change of content' **(Wilson and Wilson, 1999, p. 138)**. Rather than the 'self-in-relation' model that prevails in Western culture and has formed the basis of educational practice and policy in mainstream school systems, the framework for land-based education is a model of 'self-as-relationship… rooted in the context of community and place' **(Wilson, 2001, p. 91)**. This sense of self generates a pedagogy that centres on the land and all our relations (those we share the land with; all that forms, animates and sustains human and non-human life; and our collective and individual experience, knowledge and perspectives) as our primary texts and teachers.

Over the last few decades, a growing number of First Nations and other school systems have moved away from classroom-based teaching and taken up or returned to land-based education. Encouragingly, this has contributed to the revitalization of Indigenous traditional teachings, practices and languages. At the same time, however, many land-based programmes draw on, promote or entrench supposedly 'traditional' teachings, ceremonies and practices that, in fact,incorporate colonial dogma, hierarchies, roles and protocols that reflect the influence, internalization and transposition of colonial, Judeo-Christian and Western constructs relating to gender, sexual orientation, race and class **(Denetdale, 2006; Wilson, 2015, 2018; Wilson and Laing, 2019)**. These include, for example, requiring trans or two-spirit people to assume gender roles in ceremonies that conform to the gender assigned to them at birth, imposition of types of clothing, enforcing women to sit a certain way, the professionalization of the role of Elders and the

> …the framework for land-based education is a model of 'self-as-relationship… rooted in the context of community and place'.

commodification of ceremonies and 'traditional knowledge'. The avenue through which Judeo-Christian and Western culture has corrupted misconstructed 'traditional' teachings, ceremonies and ways of being has been colonial practices, such as church-operated residential schools and the legally enforced suppression or criminalization of Indigenous spirituality and lifeways. Repetitive experiences of epistemic and ontologic violence have left many of our Elders understandably reluctant, unwilling or unable to pass along teachings and practices from their own families and communities to subsequent generations.

Queering land-based education challenges problematic 'traditional' teachings and practices, Hunt and Holmes **(2015, p. 156)** describe queering as 'a deconstructive practice focused on challenging normative knowledges, identities, behaviours, and spaces thereby unsettling power relations and taken-for-granted assumptions'. In the context of Indigenous land-based education, this deconstructive practice applies to

both what we teach (including, for example, challenging prevailing essentialist constructs and understandings relating to gender or sexuality) and how we teach (including, for example, our expectations with respect to where teaching and learning take place, who our teachers are, or what appropriate power dynamics might be within a group of students and teachers). Queering land-based education also demands our focus on what might best be described as 'reconstructive practices', that is, the radical reclamation and reassertion of Indigenous peoples' cosmologies, of our relationships with the land, and of the knowledge and practices that have nourished and animated these relationships and have enabled and supported our survival, sustainability and well-being. Taking queer theory out of the classroom and into the bush removes it from the abstract context of a text and situates it and us, as teachers and students, in the multitude of relations that constitute the land and ourselves. Together, we place ourselves in

what Muñoz **(2009, p. 22)** might call 'a sort of ontologically humble state', recognizing that what we think we know about queerness, about the land and about ourselves as teachers and learners will be continually reshaped by a practice of relational accountability, reciprocity, radical listening and a readiness to unlearn and learn anew from and with the land and each other.

7.3	**.3**	**.6**

CONCLUSION

This section has provided overviews of key areas of research on the role of natural or non-built spaces in learning. This included diverse bodies of work on outdoor and environmental learning, community and place-based learning, interspecies learning and Indigenous land-based learning. While the framings and research reviewed here are not exhaustive, they provide a broad sense of the types of ways that non-built or more natural environments can shape learning to 'know, do, be, and live together' **(International Commission on Education for the Twenty-first Century, 1996)**. These learnings surpass the intended curricula of formal and non/informal education programming and also include the unintended or hidden learning taken from the ways we implicitly interact with the places and world around us. In considering education that goes beyond academic learning to challenge and provide new directions to the big issues of our times, such as colonialism, racism, gender-based violence, fascism, climate change denialism, technologism and more, the research reviewed here suggests possible critical directions for more intentional engagement with natural learning spaces in the futures of education.

7.4 Key messages (implications for education policy and practice)

The wide-ranging evidence reviewed in this chapter suggests a myriad of implications for understanding and designing learning spaces. Core to its contributions, however, is the growing recognition that where education takes place matters for what is learned – whether that be cognitive, socioemotional or behavioural learning – both intentionally, as well as unintentionally, through what is afforded or assumed in various leaning environments

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The wide-ranging evidence reviewed in this chapter suggests a myriad of implications for understanding and designing learning spaces. Core to its contributions, however, is the growing recognition that where education takes place matters for what is learned – whether that be cognitive, socioemotional or behavioural learning – both intentionally, as well as unintentionally, through what is afforded or assumed in various learning environments.

As a corollary, trajectories of research have identified that who has access to different kinds of learning spaces also limits or enables what is able to be learned. Inequities of race, colonization, region, gender, income, ability and other factors shape access to various types of digital, natural and built learning spaces, and thus people's access to learning and their experiences of it.

These core understandings, as well as their nuances, have many implications for education policy and practice. In relation to exploring further the 'best place' for various learning foci

and outcomes, this has, to date, been inadequately considered in education policy in primary to higher education settings. Still too often, education is taking place in classrooms that remain unchanged from those envisioned at the beginning of mass schooling. There are miseducative effects if we assume that optimal learning occurs through transmissive modes and stationary bodies, and that all types of learners can equally be engaged through mainly cognitive orientations to education and learning. Understanding learning as requiring doing and being, as involving social and emotional practices and active capacities, then requires more attention to the built and non-built spaces in which learners interact, move and effect change in living together. The assumption that adding datatification and digital platforms to, or in lieu of, classroom-based settings is inherently positive for student engagement and learning also needs to be further problematized. While digital means can, in some cases, provide further access

to and modes of learning, the evidence suggests they need to be considered critically to determine the circumstances under which they can indeed be beneficial.

The research indicates the scope for education policy and policy-making to further engage with the growing evidence on the benefits of varied environments for cognitive, as well as socioemotional and behavioural, learning outcomes. This includes:

- not only considerations such as accessible and sustainable school design, but also when being outside of school buildings in outdoor, community, place and land-based settings can increase the sense of meaning and connection that learners gain from their education and lives;

- a consideration of the benefits of non-formal/ informal learning; in an age of increasing digital connection and yet personal isolation, and associated lowered mental health outcomes for youth and adult learners, it is critical that formal learning go beyond future job training, to enable learners to find belonging and purpose in their present contributions to a complex and at-risk world;

- connecting formal schooling with the research on the importance of experiential and place-based learning.

Practitioners often have an experienced understanding of how to engage learners in learning to know, do, be and live together in ways that are experiential and placebased, to move through and outside of schools and university classrooms and digital spaces, to enhance engagement and learning. However, without the support of policy, professional development and parental and community education, they also face challenges in trying to diversify and optimize the use of learning spaces to benefit learners.

Overall, further consideration is needed of how both policy and practice can be advanced to more intentionally engage with the effects of learning spaces for a variety of learners.

7.5

[Key recommendations (policy recommendations, future research)](#)

We close by highlighting some key recommendations for policy-making and future research.

POLICY RECOMMENDATIONS

Based on our assessment, the following have been identified as areas of need for policy-making that further address learning spaces.

1. As outlined above, education policy-makers would benefit from further considering the 'where' of learning in curriculum and pedagogy (policy-making), as otherwise the 'where' can be at cross purposes, rather than supporting and contributing to, the intended 'what' of education.

2. There is a need to increase education policy's consideration of informal and non-formal learning contexts. This includes recognizing the need for a broader uptake of non-school based learning for furthering socioemotional and behavioural learning outcomes, as well as increasing cognitive

learning outcomes for a diversity of learners.

3. Further consideration is needed of how new technologies and insights in architecture are changing, and can transform the insides of classrooms and schools, their configurations, objects, relationships and other aspects that can optimize or contribute to learning outcomes.

7.5 .2

RECOMMENDATIONS FOR FUTURE RESEARCH

Based on our assessment, the following have been identified as areas of need for future research on learning spaces.

1. Longitudinal and comparative work on changes in learning space design and cognitive learning outcomes. This could focus on outcomes associated with sustainable design (and connected to the SDGs) and hybrid spaces, as well as be more sensitive to the diversity of spaces and ways in which people learn around the world.

2. Interdisciplinary research on the interconnections of built space, natural spaces and digital spaces.

3. Increased research on non-school learning and the relationship of non-school learning to systems.

4. Research implications of considering other species and objects as influences on learning.

5. Broadened research focus on informing all education with Indigenous and land-based priorities.

6. Expanded research on ethical issues of the use of artificial intelligence and smart classrooms, including data collection on students and teachers.

7. Research on teacher led implementation of smart classrooms and learning outcomes.

8. Displacement, refugee children and associated unique digital education needs.

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