



THE UNIVERSITY *of* EDINBURGH  
Moray House School of  
Education and Sport



## **Scottish Attainment Challenge Project**

**Scottish Government-funded initiative undertaken by eight university schools of education across Scotland**

# **Reconceptualising attainment through shared learning spaces which promote achievement, health and wellbeing**

### **Authors:**

Professor Do Coyle, Dr Laura Colucci-Gray,  
Ramone Al-Bishawi, Jonathan Hancock

30th June 2020

<b>Contents</b>	<b>Page</b>
1. Project members	2
2. Executive summary	2
3. List of abbreviations	6
4. Introduction	7
5. Research questions	10
6. Framing the question	11
7. Methodological approach	12
8. Analytical approach	18
9. Analysis	18
9.1. Case Study 1: Shared Learning Spaces	18
9.2. Case Study 2: Shared Garden Spaces	26
9.3. Case Study 3: Shared Hybrid Spaces	36
10. Conclusion	45
11. Taking ideas forward	46
12. References	47

## 1. Project members

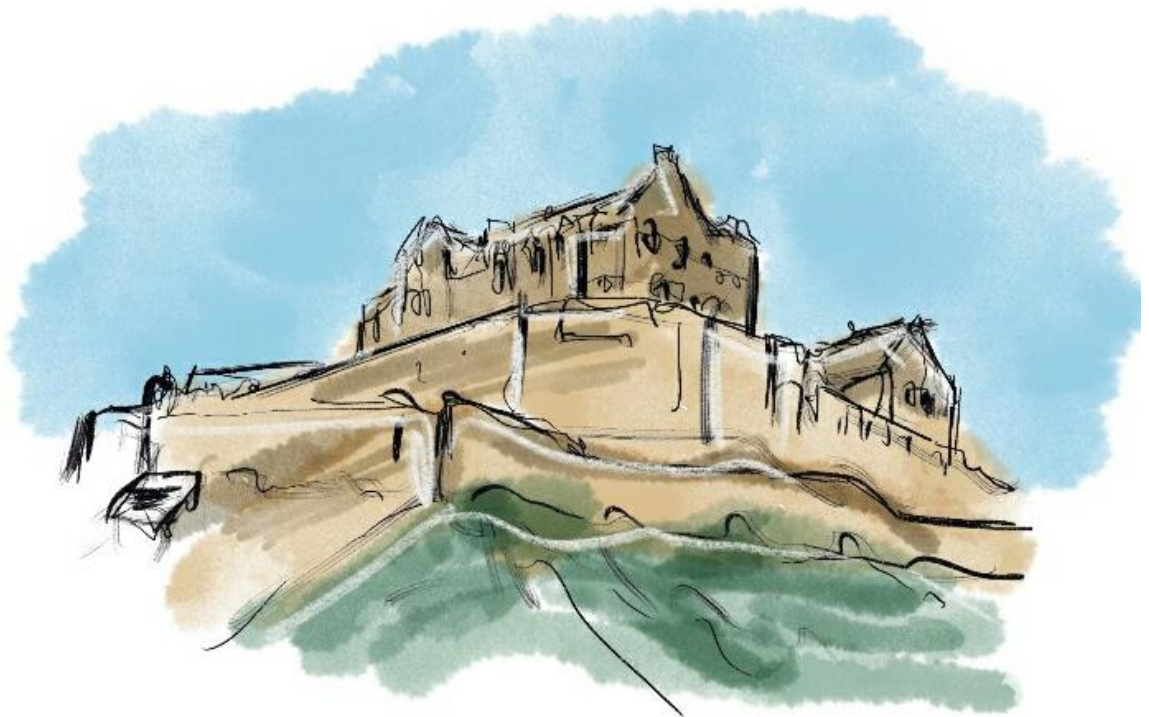
Professor Do Coyle (Principal Investigator)

Dr Laura Colucci- Gray (Co-Investigator)

Ramone Al-Bishawi (Research Assistant)

Jonathan Hancock (Research Assistant)

Christian Hanser (PhD Student)



## 2. Executive summary

### **Reconceptualising attainment through shared learning spaces which promote achievement, health and wellbeing**

This study focuses on ways in which the Scottish Government Attainment Challenge can be re-positioned through an approach to working with student teachers and partnership schools, which promotes alternative ways of designing and sharing learning. The fundamental idea driving the study is that the social and natural environments in which children are brought up, where they learn, are not 'empty' spaces; they are spaces of significant social, cognitive and emotional exchanges which play a significant role in the development of language, imagination and memory. Learning spaces can become 'places' to the extent to which learners can build positive relationships with one another, and the non-human context around them, thus building shared learning experiences and a sense of belonging: places are thus 'shared learning spaces'.

This awareness of space is central to recognising the diversity of cultural and relational backgrounds that our children bring to school from their own home environments. Most importantly, it enables teachers to recognise the opportunities of 'space' and related 'spatial literacies' as a means to widen children's awareness of theirs and other peoples' diversity, while exercising their own creativity in designing and bringing forth new learning spaces/places.

This study is set on the premise that our future and early career teachers need to have an understanding of the strengths and challenges of 'spatial literacies', in order to develop pedagogies that are place-based and place-responsive. Involving children as designers of their own learning spaces reformulates the idea of attainment as 'achievement', as children are given the chance to participate in decision-making about important matters affecting their lives; and they are able to exercise both their duties and their rights to a fulfilling and meaningful life.

Using a Participatory Action Research (PAR) approach, the research design included participant interviews and focus groups, online questionnaires, and shared learning event observations, featuring across three overlapping case studies.

Through these three case studies, we sought to answer the following overarching research questions:

1. What teaching practices are made visible to student teachers for re-positioning children as 'agents', and reconfiguring the local and in-practice manifestations of injustice and exclusion in terms of achievement?
2. What patterns and variations can we observe across the different 'learning spaces' to inform social justice-oriented teaching practices?
3. In what ways do student teachers experience plurality across different learning spaces to support achievement for all pupils?

**Case Study 1: Shared Learning Spaces.** An emerging international research base informs us that constructing learning spaces can impact positively on pupil learning (Clark, 2010; Byers & Imms, 2016), and that involving learners in the co-design of learning spaces significantly increases student engagement and can boost academic performance (Barrett et al., 2015). As part of the project, a Shared Learning Space (SLS)

was developed in Moray House School of Education, University of Edinburgh, connected with other innovative spaces within and beyond the university. The purpose of SLS is to enable student teachers, pupils and other participants to explore different concepts of networking physical, shared, virtual, and hybrid spaces, alongside measuring their impact. This case study focuses on linking SLS with a secondary school in an area of social and economic deprivation. Working closely with a team of teachers and a group of pupil researchers engaging in dialogue about defining high quality learning, a series of three SLS events were organised between student teachers at the university and a group of 12 pupil researchers. In the interactive events, pupils delivered mini-lessons to communicate how they like to be taught and their preferred learning styles. The purpose of this set-up was to allow pupils to take on the role of experts and allow interaction and sharing with the student teachers on an equal footing, thus deconstructing the typical power dynamic between teacher and learner. The case study sought to explore:

- The impact of pupils and student teachers exploring the potential of pupil voice and pupil agency in promoting a sense of achievement through shared learning spaces.
- The perceptions of student teachers and pupils in terms of the value and success of shared learning spaces.
- The extent to which experiences of shared learning might lead to changes in student teachers and pupil thinking about the significance of learning in school.

**Case Study 2: Shared Garden Spaces.** School gardens are often referred to as a movement seeking to reconcile the health and well-being of individuals with radical forms of community participation (Green & Duhn, 2015). Evidence from a pilot initiative, involving pupils across three primary schools in growing food in school gardens, suggested that re-orienting the teaching focus from curriculum knowledge to action, centred on growing vegetables and caring for gardens, has significant potential to enhance engagement, wellbeing, responsibility and learning in young people. The original project involved three schools situated in three areas with some of the highest levels of social and economic deprivation in the city of Aberdeen (Gray et al., 2019). While such experiences are in line with international studies (Chawla et al., 2014), they also press for new conversations about teachers' understanding of attainment, and how teachers can be prepared to support pupils to learn together in the garden space. For this case study, interviews were conducted with teachers and headteachers from six schools (ranging in categorisation from decile 1 through to decile 10 on the Scottish Index of Multiple Deprivation (SIMD)), featuring food growing garden spaces. In addition, five student teachers that were interested in developing shared garden spaces were interviewed as a group. The case study sought to gain an insight into:

- How headteachers, teachers and student teachers perceive and articulate their ideas of pupils' attainment while learning in the garden.
- The impact of engaging in the shared garden space on the learning, confidence, health and wellbeing of pupils.
- The motivations of headteachers, teachers and student teachers in terms of the value of the gardens for promoting achievement.

**Case Study 3: Shared Hybrid Spaces.** A face-to-face interactive workshop for student teachers organised to take place in the Shared Learning Space and in the grounds at the University had to be postponed due to the COVID-19 lockdown. Instead, a series of workshop sessions were arranged to take place virtually over three mornings, with 81 student teachers attending across the five sessions. The workshop sessions covered topics such as agile learning spaces, spatial literacies and pedagogies, new and emerging technology for shared learning, and school gardens as shared spaces. As such

the workshop acted as a focal point for the culmination of the research project, bringing together the two project strands (Case study 1, SLS, and 2, School Gardens) into one event. Data were captured through digital recording of the sessions, in-session surveys and a post-workshop questionnaire. This case study sought to explore:

- How considerations of spatial literacies impact on student teachers' futures thinking and the development of high leverage practices for transformational change.
- The impact of learning space design on the achievement, attainment and experience of all learners.
- The potential for incorporating considerations of shared learning spaces and spatial literacies into the school curriculum and ITE programmes.

## **Key findings from our research**

### **Shared Learning Spaces**

- Participation in the Shared Learning Space created a platform for pupils to lead learning and learn independently, which increased their confidence and self-esteem as well as developing a sense of inclusion, value and ownership (of space and of learning).
- Engagement and interaction with pupils across the Shared Learning Space helped to develop student teachers' awareness of spatial literacies and how 'shared spaces' can be utilized to increase pupil agency and achievement.
- The Shared Learning Space project enabled 'borderless' learning otherwise not possible. It encouraged pupils and student teachers to engage socially and cognitively in a mutually respectful approach to teaching and learning, strengthening the relationship and understanding between them.
- The learning events in the Shared Learning Space, used a range of technologies thereby providing borderless authentic deeper reflection about quality learning with pupil voice at the core.

### **Shared Garden Spaces**

- Teachers perceived the potentiality of the gardens for raising pupil achievement; attainment was thus re-conceived as a set of capabilities instead of isolated cognitive gains, including observational, communication, practical and organisational skills.
- As in SLS, participating in the Shared Garden Space created opportunities for pupils to take on the role of expert and lead learning, increasing confidence and a sense of self-worth that visibly fed into other aspects of their learning.
- Engaging in the garden space also benefited the physical and emotional health and wellbeing of pupils, teachers and their parents; it raised awareness of healthy eating and sustainability, and fostered a sense of resilience and community spirit.
- Student teachers were enthusiastic about the potential of school gardens as inclusive spaces, and were viewed by school staff as vital to facilitating transformational change; however, strong leadership, strategy and creating a 'community' approach in schools was required to effectively support and sustain shared garden spaces and realise their potential.



## Shared Hybrid Spaces

- Participation in the online Shared Hybrid Spaces workshops raised student teachers' awareness of the impact of space on learning and teaching, and the kind of high leverage practices they could employ to develop and design inclusive learning spaces in their schools.
- The case of an agile learning Primary School classroom and an opportunity to engage with pupils and teachers involved in this initiative prompted the student teachers to explore how to utilise space in new ways in their classrooms, to promote pupil agency, ownership and achievement.
- The involvement of student teachers in the design of an 'agile' and shared garden space indicated growing awareness of student teachers' understanding of connecting curriculum subjects to concrete experiences, and to bring together learning of concepts with values of social and ecological justice.
- Student teachers drew on their explorations of futures thinking in the workshop to consider 'curriculum innovation' as inextricably linked to 'space creation', and called for the incorporation of concepts of spatial literacies in the school curriculum and on ITE programmes.
- The workshop raised student teachers' awareness of the learning potential of making visible the connectivity between the design of lessons and the design of learning spaces.

## Recommendations

Based on the research evidence and our key findings, we recommend:

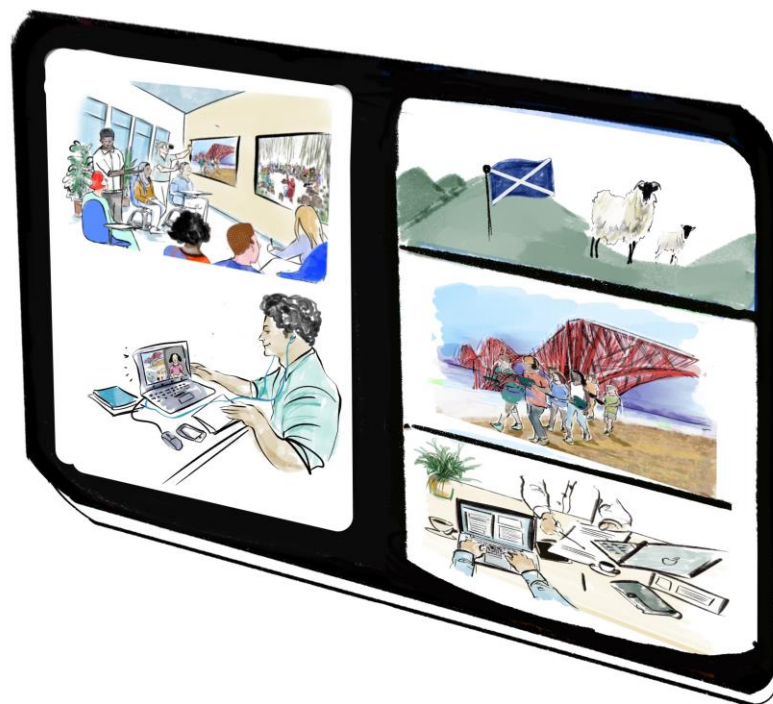
- Build on the increasing awareness of life spaces in our COVID-19 world, ensuring that learning spaces are not limited to the physical, but are conceptualised by schools and universities as dynamic and integral to the quality of learning.
- Design Initial teacher education programmes to include the introduction and exploration of spatial literacies in primary and secondary schooling and their impact on learning for all pupils.
- Challenge student teachers to engage in learning space design as an overarching concept for developing Curriculum for Excellence e.g. by unravelling further the concept of shared learning across outdoor, indoor, and virtual spaces and experimenting with Architecture and Design Scotland's interdisciplinary toolkit<sup>1</sup> across a range of schools.
- Provide practical guidance on space design as inextricably connected to curriculum design, which demonstrates how design awareness can lead to curricula that meet all students' needs.
- Develop through partnership networks the use of multilevel participatory action research involving student teachers, early career and experienced teachers, pupils and educators to build a bank of case study materials based on manageable, 'here-and-now' resources (e.g. garden spaces).
- Disseminate key messages concerning the impact of spatial literacies in a COVID-19 world through practitioner research, professional reports, webinars and other means.
- Connect stakeholders (professional, academic and business communities) to ensure investment in rethinking learning spaces from a multilevel, interdisciplinary perspective to inform policy and practice.
- Conduct further longitudinal scientific research, supported by the Scottish Government, to carry out an exploration into the impact of shared spaces on learning, which is under researched and under-theorised (e.g. building on the innovative work in Australia and New Zealand).

---

<sup>1</sup> The toolkit is still in development and available upon request.

### 3. List of abbreviations

SLS	Shared Learning Spaces
ITE	Initial Teacher Education
TE	Teacher Educator
HT	Headteacher
T	Teacher
ST	Student Teacher
P	Pupil





## 4. Introduction

### 4.1. Considerations of space and the implications for attainment and achievement

This study focuses on ways in which the Scottish Government Attainment Challenge can be re-positioned through an approach to working with student teachers and partnership schools to promote alternative ways of designing and sharing learning. It is a given that educators are driven to 'improve' schooling for all children from many different perspectives, guided by policy and professional documents, research studies and by evaluating progress through national and international norms such as PISA tests. The team at Edinburgh, however, has identified a crucial factor which evidence confirms influences learning, but which receives little or no attention on educational agendas from a holistic educational perspective – referred to by Comber and Nixon (2008) as '*pedagogical silence*'. We suggest that in order to find ways to enable more learners in schools to feel valued, to want to learn more and to be recognised for their resilience, efforts and individual strengths throughout the formative years of formal schooling, we have to understand: (i) how conceptualising *learning spaces* from an ecological and holistic perspective impacts on learning, and (ii) how teachers and learners can work together for co-creation of those spaces for making visible learner achievements.

Our research, therefore, is underpinned by two key tenets: 1. That learning spaces impact on the quality of pupil learning and teacher teaching (OECD, 2013; Mulcahy, Cleveland and Aberton 2015); and 2. That by valuing individual learners in tangible, genuine ways through individual and group achievement, learner attainment will be enhanced in practiced ways. This leads to constructs of 'space' and 'achievement' as fundamental factors in the Scottish Government's Attainment Challenge.

The OECD Report *Innovative Learning Environments* (2013) evidences how pedagogic approaches are embedded in ways of conceptualising spaces for learning. Similarly, the National Research Council (2006) in *Learning to Think Spatially* emphasizes that without paying explicit attention to learning spaces and spatial literacy 'we cannot meet our responsibility for equipping the next generation of students for life and work in the 21<sup>st</sup> century'.

### 4.2. Spatial literacies for pupils' achievement

This study draws on growing awareness of 'spatial literacies' (Green, 2014) in education, building on work in Geography and Arts and Design which recognises that the social and natural environments in which children are brought up and where they learn are not 'empty' spaces. They are spaces of significant social, cognitive and emotional exchanges, which play an important role in the development of language, imagination and memory. Hence, spaces carry values and experiences, shaping the way in which children and young people make sense of the world around them. From this view, what we commonly refer to as 'spaces for learning' are not the equivalent of a static representation, such as the map of seating arrangements in a theatre or indeed in a classroom. Quite the opposite, learning spaces are matters of *doings and being*; learning spaces are *relational* contexts in which children and teachers are both situated and a part of, carrying an intrinsically creative capacity at their core (Timeto, 2015). In this sense, learning spaces can become 'places' to the extent to which learners can build positive relationships with one another, and the non-human context around them, thus sharing commonalities of experiences and a sense of belonging: places are thus 'shared learning spaces'. Mulcahy et al.'s (2015) work provides case studies of how classrooms, in the

physical and traditional sense, can dispel 'closed walls' illustrated by the example of difference between a house and home. They suggest that learning spaces be conceptualised depending on the goal of learning events from a physical, social and cognitive relational perspective co-created by both teachers and learners. Similarly, according to Muller and Goldenberg (2020), feeling socially connected contributes to a more positive learning experience and brings together the cognitive and physical spaces into a relational dynamic which impacts on learners' sense of value.

Ostensibly, however, for many children the experience of learning in schools and classrooms is largely a 'displacement' experience (Anderson, Sangster et al., 2017). Such displacement is felt through the 'gap' between the home environment and the school environment, with their different norms and modes of communication. This gap may be experienced more sharply by those children whose English is an additional language, or by those whose means of interaction may be largely sensorial - such as children in the early years - or more generally - children whose 'physical' modes of interaction dominate over the more conventional written or verbal forms (Ivinson, 2014). Such 'gaps' are often invisible, although the recent COVID-19 crisis has put into sharp view the inequities, which characterise the experiences of children at school: from the availability of materials resources, electricity and internet access or simply the ability to 'receive' appropriate information. Such experience has highlighted the importance of 'space' and that the educational space can be a fractured experience for many pupils living with multiple forms of disadvantage (United Nations, 2020).

So, increasing awareness of the close link between space and literacy, slow to be recognised by educators, has now gained significant momentum. Research evidence demonstrates that in formal learning contexts, space impacts on the way learners learn (Berris and Miller, 2011; Barrett, Davies et al., 2015), their cognitive capacity to inquire and solve problems, their motivation to learn and build self-esteem and ultimately on achievement. Such findings go hand in hand with mounting evidence about the benefits of the outdoors on children's cognitive abilities and sense of wellbeing (White et al., 2019).

In addition, reviewing learning spaces not as physical units - but as relational fields - enables the addition of a new conceptualisation of learning as rooted into the materiality of the body and the bodily nature of affective experiences. Valuing the role of the body in learning is key to understanding - for example - the role played by physical health and cognitive development in learning. In *Human Nature and Conduct*, Dewey (1922) described human action as not always deliberate or planned but, rather, based on habits. Dewey envisioned habits as biological functions, like breathing or digestion, and as such, they have tremendous impact on our will, our capacities, our perception and other important realms. Hence, the spaces children inhabit, at home as well as in schools, have significant influence in the 'learning' habits that children form.

This experiential and embodied view of cognition and learning is also key to recognising that 'creativity' and 'diversity' are not simply desirable aspirations, or abstract constructions, but they are integral features of the process of being. In this sense, all children are essentially both creative and diverse, their learning emerging at the intersection of both human and non-human (or more than human) elements: the relational field is a hybrid and heterogeneous fabric where '*boundaries are provisional, never finished articulatory practices*' (Haraway, 1991, p. 313).

On this basis, this study is set on the premise that our future and early career teachers need to have an understanding of the strengths and challenges of 'spatial literacies', in order to develop pedagogies, which are place-based and place-responsive. Such newly

acquired knowledge and confidence can enable new teachers not only to make use of opportunities embedded in new spaces and places for learning, but also to actively engage pupils in co-designing *their own* places for learning (Green, 2014). Involving children as designers reformulates the idea of attainment as ‘achievement’, as children are given the chance to participate in decision-making about important matters affecting their lives; and they are also able to exercise both their duties and their rights to a fulfilling and meaningful life.

The following principles underpin the design of the study:

1. Achievement is understood as the experience when an individual feels successful about their own learning (based on feedback, mentoring and a sense of wellbeing generated). It is not in this study perceived as the outcome of processes using normative measures of attainment e.g. as in examination systems.
2. Learning is ubiquitous, and we have to explore and recognise a wider range of potential learning spaces and what these might be, who owns them, the conditions under which they grow and develop their subsequent ecologies for ‘successful learning’.
3. Narrowing the attainment gap involves learners engaging with and owning their learning. The team is working on the principle that finding ways of enabling individual pupils to have a sense of achievement will impact positively on their attitudes to schooling, learning and sense of self.
4. Engagement and ownership require a sense of growing motivation for meaningful learning, which individuals perceive as respecting their own identity and self-esteem, and as enabling them to ‘successfully’ co-develop relevant and appropriate knowledge and competences.
5. We adopt an ecological position where learning involves pluriliteracies (plurilingual, pluricultural strands) to embrace contexts for learning that are rapidly changing in terms of our global world.
  - A pluriliteracies stance values the physical experiences that pupils have in creating their own learning spaces by taking account of physical movements, practical skills and pupils’ interactions with humans and non-human beings and artefacts.
  - Digital technologies enable us to create and connect with alternative spaces (indoors and outdoors), which may be co-constructed by participants to become shared multimodal learning spaces.
  - Spatial literacies and spatial justice are critical in conceptualising what is meant by shared learning spaces and the mobile flexible communities which develop and thrive in them.
  - Directly involving all learners in the ecologies of growing spaces and making visible the relational impact of the physical, social and cognitive elements, will provide a shared sense of belonging, the co-construction of safe spaces as well as cognitively challenging ones, which are sustainable and have no boundaries.

This resonates with a *relational approach* to pedagogical practices, which provides alternative ways of investigating and addressing the attainment gap.

## 5. Research Questions

### Overarching Research Question

1. In what ways might a relational and spatial approach to the curriculum address the attainment gap?

There are three strands to the research, each one considering a particular spatial context:

1. Shared Learning Spaces, will make use of the medium of digital technologies to enable children to take a leadership role in their learning; 2. Shared Garden Spaces, will focus on learning as co-created with other humans and non-humans; 3. Shared Hybrid Spaces will focus on supporting teachers to develop awareness of the value of spaces and their potential integration to create rich learning ecologies (Williams et al., 2011). Our questions on 'attainment as achievement' were thus posed as follows:

1. What teaching practices are made visible to student teachers for re-positioning children as 'agents', and reconfiguring the local and in-practice manifestations of injustice and exclusion in terms of achievement?
2. What patterns and variations can we observe across different 'shared learning spaces' to inform social justice-oriented teaching practices?
3. In what ways do student teachers experience plurality across different learning spaces to support achievement for all pupils?





## 6. Framing the Question

Taking spatial literacies as a basis for developing understanding of equality, diversity and broader social justice dimensions in education, a significant role is played by teaching practices, which may either dislocate or reinforce cultural, linguistic and social exclusions that are entrenched in curricula and in classrooms. 'High leverage practices' (HLP) are normally understood as 'core' practices of a teacher's repertoire, which teachers use to support students' learning (Calabrese-Barton, Tan and Birmingham, 2020). Not simply technical skills, such practices range from providing an adaptive response to students' thinking (Thompson et al., 2013) to eliciting student voice and performances (Lampert et al., 2013). We build on such concepts to include 'spatial literacy' as a form of HLP stretching beyond the classroom environment to include outdoor spaces. Hence, 'spatial' HLP include both those which children use to 'take up space' in the classroom (Hand, 2012; Rubel, 2017), but most fundamentally those which re-position children as 'active place-makers' (Green, 2014; Gray, Colucci-Gray et al., 2019) in a world in becoming. In promoting this active repositioning of children vis a vis learning spaces, we maintain that creativity and diversity are built-in *from within*, as children engage with the material process of reconfiguring the relational environment in which they learn, and the 'who and how' they learn with.

Viewing learning through the lenses of 'space' and 'relations' in space impacts on the concept of knowledge and the curriculum. If 'spaces' are never empty, they carry knowledge practices which arise as a result of relational 'trafficking' continuously shifting and re-modelling the lines of inclusion/exclusion of particular ideas, languages, people or groups. Hence, within a field of relations also curriculum becomes a 'relational' construct, whereby learning opportunities are co-located and co-produced by those involved and the physical setting in which they are situated. For these reasons, Haraway (1991) insists that questions about space - and the experience of space - must be continuously asked if we wish to understand the experience of knowing and learning.

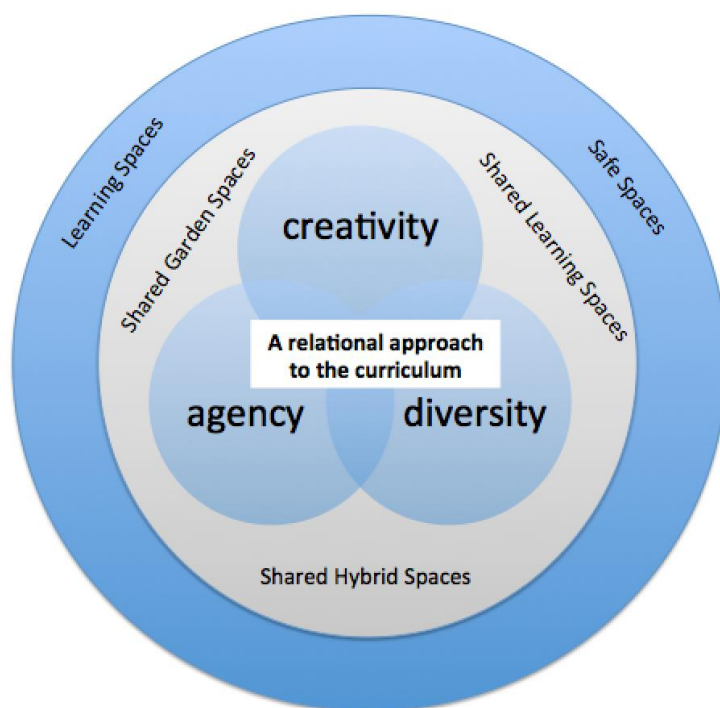
*How to see? Where to see from? ... Who gets to have more than one point of view? Who gets blinkered? ... What other sensory powers do we wish to cultivate besides vision? (p. 194).*

Such notions resonate strongly with theorists' writing in the field of social justice in education as in the conceptualization given by (Grundy, 1987: 105), whereby a (social justice) curriculum: *'allows indeed encourages students and teachers together to confront the real problems of their existence and relationships.'*

The framework of this research is thus informed by 'Learning Ecologies' (Williams et al., 2011), which we understand as spaces of ongoing and dynamic re-configuring of meaningful relations through which pupils gain access to memorable and powerful learning (see Figure 1 below). 'Learning ecologies' comprise shared and safe spaces for learning and it is on the basis of such principles that pupils can exert their agency, diversity and the possibility to create (creativity).

The diagram includes the three case studies constituting the project; it also mentions a fourth, additional space: the shepherd's hut. This will be part of Christian Hanser's focussed PhD study, exploring the potential of 'nomadic' spaces, to support community learning and engagement<sup>2</sup>.

## Learning Ecologies



The Shepherd's Hut

Figure 1: Conceptual Framework

<sup>2</sup> Thesis title: A Scottish classroom beyond walls? Investigating student teachers' negotiations of meaning when applying transformative pedagogies through a mobile tiny house as experimental classroom.



## 7. Methodological approach

The overall methodology of the project is Participatory Action Research (PAR), used both in public health and in educational settings, with the purpose of reducing inequities, by involving the people who, in turn, will take actions to improve their own conditions (Baum, MacDougall and Smith, 2006). In this framework, the data collection element of PAR is directly linked to reflection and action, seeking to document as well as to change. Following the framework for trans-disciplinary research offered by Bergmann et al. (2012), PAR will be operationalised according to 3 interconnected levels:

1. The cultural norms underpinning the ways in which 'attainment as achievement' is understood within the educational community (**Cognitive and epistemic dimension**);
2. The meaning-making processes involving different participants (**Social organisation**);
3. The formation of 'hybrid' forms of learning spaces connecting different linguistic expressions and modalities for engagement and communication (**Communicative and practical dimensions**).

A mixed method, multi-strategy case study approach was undertaken in order to gather both quantitative and qualitative data and to support data triangulation. The research design included participant interviews and focus groups, online questionnaires, and shared learning event observations, featuring across three overlapping case studies.

### Case Study 1: Shared Learning Spaces

Shared learning for student teachers involves teachers, pupils and stakeholders in co-creating flexible, shared learning spaces, which are physically, cognitively and socially 'fit for purpose' in that they encourage a shared sense of value and connectivity otherwise not possible. These shared spaces embrace agile learning and genuinely co-construct learning with other spaces bringing 'the outside in, and the inside out', across physical, virtual and temporal boundaries.

Research informs us that co-constructing learning spaces can impact positively on pupil learning (Clark, 2010; Byers & Imms, 2016), and that involving learners in the co-design of learning spaces significantly increases student engagement and can improve academic performance (Barrett et al., 2015). However, increasingly there is a call from academics and policy makers (McNeil & Borg, 2017; Goodyear et al., 2018) for further investigation into the impact of space on learning (Boddington & Boys, 2011). The indication that space has a significant impact on learning suggests a strong imperative for local authorities and governments to test this out across a wide range of relevant contexts.

A Shared Learning Space (SLS) was developed in Moray House School of Education and Sport, to enable student teachers, pupils and educators to explore the potential of networking physical, shared, virtual, and hybrid learning spaces, alongside measuring their impact on learner thinking, self-value and sense of achievement. The SLS employs innovative support for participants in making high quality remote learning accessible through new and emerging technology.

Prior to the SLS events linking student teachers with pupils, initial focus groups with seven teacher educators and semi-structured interviews with a head teacher, mentor

teacher and three newly qualified teachers were conducted. These interviews explored what we do well and what we could do better in Initial Teacher Education. This process helped to deepen our understanding of the challenges teachers face in addressing the attainment gap and helped develop a shared vision and an authentic Participatory Action Research approach (McIntyre, 2008) for exploring this issue through Shared Learning Spaces.

Subsequently, a series of shared learning events were organised between the University and a partner secondary school in Edinburgh, a new build and Digital Centre of Excellence situated in an area of social and economic deprivation, taking place across several weeks. The events digitally connected the university space with a classroom known as 'The Cloud' in the Secondary School. The purpose of shared learning was pupil-led, focussing on in-practice meaning of high quality teaching and learning. In total, three events took place involving a group of 12 S3 pupils from the Secondary School and student teachers who were enrolled on ITE programmes.

Previous research involving much larger groups of partner schools highlighted the importance of establishing a common conceptual understanding of SLS with partners and the necessity of working with a small pilot group in the early stages (Coyle & Al Bishawi, 2016). Therefore, prior to this study, a strong working relationship was prioritised between a group of schoolteachers, pupil researchers and the university Shared Learning Team in preparing a foundation for Participatory Action Research. Using an adaptation of the collaborative Delphi process (Sekayi, D., & Kennedy, A. 2017), the principles of shared learning and a common understanding of spatial thinking emerged based on learning conversations and shared academic and professional documentation. Throughout the dialogic process pupils were researchers and educators were learners. Everyone focussed on inclusive learning design.

In the first two events, the school pupils took turns presenting Science mini-lessons across the Shared Learning Space to student teachers. The aim of mini-lessons was for the pupils to communicate how they like to be taught and the approaches they preferred. In the third event, two student teachers took up the challenge from the school pupils to present their own Science mini-lessons across the Shared Learning Space. The purpose of this was to enable the pupils to take on the role of experts and allow interaction and sharing with a larger group of student teachers (also actively involved in the lessons e.g. asking questions) on an equal footing, deconstructing the typical power dynamic between teacher and learner.

Each of the events was video and audio recorded. In addition, post-event interviews were conducted with University staff and teachers who had been present. Student teachers were asked to record their reflections in their programme journals. Interviews were conducted with the two student teachers that taught mini-lessons before and after the event to capture their initial expectations and post-event reflections. Following the conclusion of the events, focus groups and 'walking tours' were conducted with the S3 pupils at their school. A 'mosaic approach' (Clark, 2010) was utilized as a way to capture the thoughts and opinions of our participants in relation to their own learning and what it means to be themselves and understand how their identities are shaped and constructed. The walking tours involved pupils guiding researchers around their school and taking them to and describing their favourite spaces in the building. The focus groups sought to capture the pupils' reflections on teaching mini-lessons and participating and collaborating with student teachers across the Shared Learning Space to inform future thinking.

Shared Learning Spaces focused research questions:

1. What is the impact of pupil researchers and student teachers together exploring the potential of pupil voice and pupil agency in promoting a sense of achievement through shared learning spaces?
2. What are the perceptions of participants in terms of the value and success of shared learning spaces?
3. How might the experiences of shared learning lead to change in participant (student teacher, pupil, teacher) thinking?

## Case Study 2: Shared Garden Spaces

School gardens are often referred to as a movement seeking to reconcile the health and wellbeing of individuals with radical forms of community participation (Green & Duhn, 2015). Scotland specifically constitutes a case in context due to the recent surge of educational 'strategies', such as "Closing the attainment gap" (Scottish Government, 2017a), Learning for Sustainability Vision 2030+ (LfS National Implementation Group, 2016) and 'a STEM strategy for Scotland' (Scottish Government, 2017b) aiming to enhance opportunities for all school pupils to access employment, good health and social integration. However, as pointed out by Christie et al. (2019) the policy landscape is a contested terrain, often confronting teachers with irreconcilable expectations. Pressure to raise standards of attainment on tests scores is at odds with the evidence for 'closing the gap', pointing to wider social factors such as parental participation; authentic student engagement and approaches to troublesome and troubled pupil behaviour (McCluskey, 2017). Against this background, evidence from a pilot initiative involving three schools in food gardens within the city of Aberdeen, suggested that re-orienting the teaching focus from curriculum knowledge to action, centred on growing vegetables and caring for gardens, has significant potential to enhance engagement, responsibility and learning in young people in areas with high levels of social and economic deprivation (Gray et al., 2019). While such experiences are in line with international studies (Chawla et al., 2014), they also press for new conversations about teachers' understanding of attainment, and what particular conceptions may be generated by teachers who are learning with pupils in the garden space.

The garden space case study brought together three dimensions as part of a qualitatively based phenomenological enquiry. The first examines the 'garden space' as a 'place' of co-production of the curriculum, which arises from the agency of the pupils 'being and doing' gardening. The study will thus focus on the teachers' perceptions of children's own self-value and 'success'. A second dimension concerns the experiences of head teachers and teachers who either have been or are seeking to become involved in the gardening initiative. Finally, a third dimension looks at the perceptions of student teachers who have been recently involved in the piloting of a training programme they sought to sign up to voluntarily while enrolled in their one-year teacher education programme. Specifically, the focus is on their prior exposure to outdoor learning and/or knowledge of gardening; the choices that they make with regards to planning, classroom management and assessment in order to support children's learning; additional professional needs and requirements to support children's access to the formal curriculum in specific subject areas, such as science. The interviews provide detailed perspectives from the interviewees on how they perceive the gardens as being an enabler of children's learning and attainment, as well as their prior exposure to gardening and their personal and professional motivations.

Teachers and headteachers from 6 schools participated. The schools ranged in categorisation from decile 1 through to decile 10 in the Scottish Index of Multiple Deprivation 2020. Four of the schools were in the lower half of the SIMD with two of these being in, or bordering on and with intake from, decile 1 of the SIMD, amongst the most deprived areas in Scotland. At the other end of the scale one of the schools was in decile 10 of the SIMD, an area of relative wealth and no deprivation. From these schools the interviewees consisted of two headteachers, a deputy headteacher, 7 classroom teachers of which 2 were newly qualified teachers (NQTs), and one community support teacher. In addition five student teachers were interviewed as a group.

Teachers who had been involved in school garden activities with their classes in each of six schools were interviewed with a view to gaining insight into their experiences and their views of the potential of school gardens to contribute to the meaningful learning and wellbeing of the children in their classes. We were particularly interested in teachers' narratives of attainment, and the ways in which discourses which construct children in areas of deprivation as 'deficient' - when measured and compared on a scale with pre-determined goals - may be challenged through experiences of enquiry, whereby curiosity and emotional engagement are prime drivers. We wanted to know to what extent alternative narratives of attainment may be elaborated by teachers who have been observing the children. For example, we were interested in how teachers viewed garden spaces as offering something more or different to the more conventional classroom practices; and specifically whether such spaces may support learning and development of children from very diverse social and emotional backgrounds.

Shared Garden Spaces focused research questions:

1. How do headteachers, teachers and student teachers perceive and articulate their ideas of pupils' attainment while learning in the garden?
2. In what ways does engaging in the shared garden space impact on the learning, confidence, health and wellbeing of pupils?
3. What are the motivations of headteachers, teachers and student teachers about the value of the gardens for promoting achievement?

### Case Study 3: Shared Hybrid Spaces

A workshop for student teachers was organised to take place in the Shared Learning Space at the University. However, due to the COVID-19 lockdown the face-to-face workshop had to be postponed. Instead, a series of workshop sessions were arranged to take place virtually over three mornings. ITE student teachers were invited to participate and 81 attended across the five sessions; during the workshop the number of attendees did not drop below 75. The workshop sessions covered topics such as agile learning spaces, spatial literacies and pedagogy, new and emerging technology for shared learning, and school gardens as shared spaces. As such the workshop acted as a focal point for the culmination of the research project, bringing together the two project strands (SLS, School Gardens) into one event.

The workshop sessions were interactive and the students were encouraged to comment and contribute small tasks during the sessions, as well as respond to Mentimeter<sup>3</sup> surveys for immediate reactions and reflections on the topics of discussion. Students

---

<sup>3</sup> Mentimeter is presentation software that can be used to create interactive presentations, allowing engagement with audience and participants in real-time. <https://www.mentimeter.com>.

were asked to consider their knowledge and awareness of spatial literacies, and what impact spatial literacies could have on their teaching; potential for incorporating shared learning and new and emerging technologies in their future classrooms. Participants were also asked to complete a task considering what the idea of 'learning outside' made them feel like, both as a student and as a teacher, and to design a garden space for school grounds in two stages: the first, in green pen, their own design of a garden space; and the second, annotating the first design with a red pen, any changes to the design following consideration of Black-Hawkins, Florian and Rouse's (2007) 'Framework of Participation'. The reflections and designs were posted to Padlet<sup>4</sup>. Following the penultimate session of the workshop, the students were encouraged to design their own shared learning spaces, and to post these to Padlet.

The final workshop session involved a Headteacher, Classroom Teacher and two Primary 6 pupils from a school in Edinburgh. The Primary 6 class had been involved in a project to design their own classroom, and the teachers and pupils spoke directly to and interacted with the student teachers about their experiences. All workshop sessions were video and audio recorded, apart from the final session, which was only audio recorded to protect the anonymity of the pupils participating in the workshop.

At the end of the final workshop session all participants were sent an online questionnaire, distributed through the Bristol Online Survey (BOS) tool, which captured their reflections on spatial awareness and co-designing learning spaces; integrating school gardens into the curriculum; challenges associated with promoting garden spaces in their future schools; linking with external sites to promote achievement for all learners; the impact of spatial literacies on pupil achievement; and including spatial literacies on ITE programmes. This web-based survey tool allows questionnaire design with a variety of question types, and allows participants to edit their responses, supporting reliability. The tool has the benefit of allowing for the collection of both quantitative and qualitative data, with 'open' responses to allow participants to elaborate on their answers. The questionnaire received 26 responses (a 32% response rate), which is above response rates for nationally distributed surveys (Salah and Bista, 2017).

Hybrid Spaces focused research questions:

1. In what ways does a consideration of spatial literacies impact on student teachers' futures thinking and development of high leverage practices for transformational change?
2. In what ways does a consideration of space and learning space design impact on the achievement, attainment and experience of all learners?
3. How might considerations of shared spaces and spatial literacies be incorporated into the school curriculum and ITE programmes for the benefit of all learners?

---

<sup>4</sup> Padlet is an online virtual "bulletin board", where students and teachers can collaborate, reflect and share links and pictures in a secure location. <https://en-gb.padlet.com>.



## 8. Analytical approach

All interviews and focus group data were transcribed and analysed to draw out the key ideas and views presented by the different respondents and consider any commonalities, or differences, across the different contexts.

Initial coding, focused coding and theoretical coding (Charmaz, 2006; Braun & Clarke 2006) were employed as an analytical tool, as this allowed comparisons to be made across the various data sets. Transcripts were colour-coded, allowing emerging themes to be captured and the highlighting of patterns and consistencies across the data. Video recordings of SLS events were revisited to pick up on any commonalities and link to themes from participant reflections.

Case study 1, Shared Learning Spaces, and case study 2, Shared Garden Spaces, were analysed separately, and then initial findings were brought together and cross-referenced to determine common themes and outliers across the two cases. These initial findings helped to develop the research themes and analytical framework for case study 3, the Hybrid Spaces online workshop. Analysis of the online workshop session with Primary School pupils and teachers learning in an agile classroom included referring back to themes that emerged from the SLS events and School Gardens data to detect commonalities. Likewise the online questionnaire for student teachers was analysed with reference to previous focus groups and interviews with student teachers in case studies 1 and 2.





## 9. Analysis / Findings

### 9.1. Case Study 1 – Shared Learning Spaces

#### 9.1.1. Conceptualisations of attainment

In the early stages of the project we asked a number of teachers, mentor teachers and deputy head teachers to describe what pupil attainment meant to them and some of the challenges associated with this. One deputy head explained that what was most challenging was supporting families who were experiencing in-work poverty; up to 80% of pupils at the school who were currently studying for their Highers had to work and sometimes up to 30–40 hours a week. Families want to be aspirational for their children but are struggling with many competing demands.

It was important for teachers to be proactive in encouraging community involvement, as attainment was not perceived as something education can tackle alone. Teachers felt it was imperative that the whole social context was considered. One teacher spoke of the significance of celebrating all the different achievements learners make:

T: *If a young person goes and gets a job that should be celebrated as equally as if a young person is going to university. The school should be supporting those two pathways as much as possible. It is not just about jobs... it is about for some people that are coming from a care background, the celebration of the pathway and ability to be a positive member of society as well.*

For the teachers it was important for student teachers to have consistently high expectations about engagement and respect for those around them and high expectations about attainment. A significant barrier was pupils struggling to lead their learning sometimes due to behavioural support needs. The Shared Learning Space initiative was seen as an opportunity for pupils to take ownership of their learning through a variety of strategies:

T: *That idea of young people leading learning for each other is probably the pinnacle isn't it.*

Teachers believed that providing a nurturing learning environment in which pupils feel a sense of ownership and confidence in directing their own learning would impact on achievement and in turn attainment.

#### 9.1.2. Developing Confidence and Leadership

In the SLS events involving Secondary school pupils and student teachers, pupils were encouraged to take the lead in researching, preparing and presenting their mini-lessons. They had control over the Science topic and style of presentation, and sent an invitation to students, with a picture of all the pupils and a message 'looking forward to discussing learning with you, and hopefully giving you some feedback on what we look for in a teacher'.

At the first event the two sites linked through visual and data streaming boards, one pupil mini-lesson focused on 'Explosions in Space'. The style of this presentation was immediately interactive, with the pupils beginning by asking their linked site of student

teachers what questions they had. This led to the following exchange, with pupils acting as experts and the student teachers taking on the role of learners.

ST1: *I want to know if you can hear explosions in space.*

P: *Well it's a vacuum, so no.*

ST2: *So what is an explosion then?*

P: *Basically just a chemical reaction.*

ST3: *Why do things explode in space?*

P: *Generally from the expansion of gas.*

One teacher educator noted the confidence of the pupil presenter, and that the student teachers were initially surprised by the interactive start to the presentation before settling in:

TE1: *[The pupil] was confident, he was in control and he was taking on the role of teacher, which was quite interesting. Immediately there was interaction, asking the audience questions. The students were taken aback.*

After the two presentations concluded there was an opportunity for the student teachers and school pupils to interact and engage further. The dialogue centred largely on learning styles and preferences, with student teachers keen to hear from the pupils themselves about how they liked to learn. Learners were ready to explain why they enjoyed YouTube videos for science learning because they could stop and start when they liked and review, or take notes at their own speed. Again, the pupils took the lead to act as experts on the topic.

ST1: *Would you rather learn by asking questions rather than being told all the information in one go?*

P: *Yes completely, it's like reading a book. You'd rather be shown the information than told it, so that you can figure it out for yourself, because then you're more likely to remember it.*

ST2: *Do you like to do that individually or as part of groups?*

P: *A balance of both is alright.*

T: *What's the pros and cons of both?*

P: *Well in a group you get to bounce ideas off of one another, so it's good to hear what other people are thinking in comparison to what you're thinking. Whereas by yourself you just get to go over what you already know.*

During the second SLS event, students noticed in particular how the same group of pupils seemed to grow in confidence presenting and interacting through the shared learning space, as the following written feedback shows:

ST: *Interesting that pupils were less intimidated teaching through the screen, yet I feel the opposite!*

ST: *Pupils are more confident behind the screen.*

ST: *More confident teaching through a screen.*

One of the student teachers who responded with their own mini-lesson picked up on the 'screen' and technology acting as a means for pupils to interact with more confidence than they perhaps would if it was in-person.

ST1: *I'm thinking about some of the pupils I've had on placement, where I know they might know an answer, they might want to ask a question, they don't want to put their hand up. Having everything through the technology, a teacher could have a screen where it either has the answers or questions popping up, it makes it more anonymous for them so they can contribute. But then you also get kids who might then rely on that so there's the balance.*

In reflecting on participation in the SLS events, the pupils revealed that they did in fact initially feel nervous. They said that delivering the mini-lessons was quite an intense experience, because *'there were a lot of people watching us, and the pressure's on not to get anything wrong'*. However, they also commented on how presenting the mini lessons turned out to not be as nerve wracking as they first imagined.

P3: *It turned out to be a lot easier and more fun to do than I expected it to be because it was quite nerve wracking to think of presenting in front of all those people, and then it turned out to be a lot less intense.*

Pupils contrasted the feeling of presenting face-to-face with delivering a mini-lesson through SLS, commenting that there was less pressure because the people weren't actually in their physical space. They also recognised some of the challenges of presenting through technology, for example explaining and interacting through practical tasks.

P2: *In a classroom, it's more nerve wracking because the people are actually there in front of you but it's usually clear to hear and clear to see as well. It would be easier, for instance, to do practicals because... in the classroom, we could properly see it in front of us. So sometimes it's easier in the classroom, but other times it can be easier through the screen because it's less pressure.*

Overall, the mini-lessons were seen as a valuable experience, because pupils enjoyed preparing for them, and they offered new opportunities. They had the confidence and assurance of wanting to present again, and to suggest ways in which the experience and interaction could be enhanced, for example through changes to the layout and set-up of the shared learning space.

P4: *I'd do it again. But I'd have a different set up so that the other side can see what we're pointing out on the board. We were standing at the side of the board, so if the camera's at a different angle.*

Pupils who hadn't presented were interested in doing a mini-lesson, because as observers it seemed fun and interesting. They could also perceive the value of an experience that placed them in the role of teacher and expert.

P2: *And it seems like fun, like seeing from the teacher's perspective. And it seems that like, because you're learning as well while you're teaching, and you probably learn more doing it like that.*

The pupils recognized that their experiences of shared learning with the student teachers had instilled confidence in them and provided experiences and skills that would be valuable in the future. They suggested it would be valuable for everyone in the school to have the same experiences.

*P4: You should be allowed to have at least one experience with it, because it does build your confidence up. Like talking to people through the screens, and talking to people when you're doing a lesson. So all years should be at least allowed to try it. Because they'll need to do it when they're older.*

*P3: Public speaking's quite a big part of modern day society, so it could be used as a tool to build up people's confidence.*

Literature suggests that participants cautiously venture into new learning spaces unsure of how to occupy them, and gain the benefits of these spaces if their exploration of them is supported (Kollar et al., 2014). In the SLS events, the position of the Secondary pupils shifted between observer, active participant, and leader. Ownership of the learning space shifted from teacher educator to student teacher and increasingly to the pupils. The mini lessons were the initial steps towards an exploration of authentic shared learning where space and learning is negotiated between its occupants across sites. These events were significant in that they afforded student teachers the opportunity to witness pupils developing confidence, agency and ownership of the learning and spaces they occupy, with pupils actively leading and reflecting on their learning.

The shared learning events created a forum in which multiple understandings and interactions were able to occur simultaneously. Student teachers were able to relate to pupils in their own learning environment, and gain perspectives on how pupils learn with insights into the factors and conditions that shape pupil ideas of what it means to learn while in school. The pupils gained an insight into what teachers do to prepare a lesson, and the challenges they face and some of the techniques they employ. This sharing and exchange across the SLS served to strengthen the pupil and student teacher relationship, allowing them to engage in mutually respectful approaches to learning and teaching.

### 9.1.3. Promoting Ownership and Inclusion

Through the SLS events, the pupils were given ownership of their own mini-lesson topics and presentations, and also agency in terms of communicating to student teachers how they like to learn. During discussions in the first SLS event, the difference in the presentation style of the two mini-lessons was noted; the first group had used a lot of videos to illustrate their points, and a quiz to consolidate knowledge, while the second group used a more interactive question-and-answer style, engaging with their audience. The student teachers wanted to know if the pupils had any preferences over these teaching and learning styles. Pupils saw positives in both methods, as more direct styles *'gives you a lot of time to think about what you're being told and realise what you think about those things and remember it well'*, whereas through interactive styles *'things can happen like little moments that will make you remember things further'*. During the student teacher mini-lessons, the pupils offered their thoughts on style and pace of learning and demonstrated an understanding of adapting teaching styles depending on the context.

*T: Did you guys find the pace of learning okay, could it have gone quicker, or was it right, or was it too slow?*

P: *It gave you enough time to absorb the information as you went along. There's slower points within the lesson and that's just a different way of teaching. And you've got to have that sense of ingenuity for what's not going well, and find out different ways to get around that, like using a Kahoot [quiz] at the beginning or at the end of the lesson to summarise or to find out what people know already. It's knowing what works in different situations.*

Pupils were happy that they were asked lots of questions by student teachers during the links, as it gave them a chance to reaffirm their own understanding on particular subjects. They also felt that the lessons they prepared had impacted on what the student teachers delivered, and therefore their opinions had been listened to and were valued.

P2: *We had videos and practicals, so they had practicals. So they obviously saw what we were doing and incorporated some of that too, because they must have thought that if we did it, then we must have enjoyed it.*

P1: *It definitely felt as if they've listened to what we've been saying.*

I: *And how does that kind of make you feel when you know, teachers are taking on board the way you like to be taught?*

P1: *It's like a good thing because it makes you feel like the lessons that we did prepare had... impact on the student teachers, it's not just a lesson, it's a lesson suited to you.*

Having a say in how learning and teaching was conducted in their classrooms, and having teachers listen and take their views on board, was very important for the pupils.

P1: *It honestly depends what teacher it is because yeah, there are some teachers in school I know who do teach like this, but others stick to old ways. And there's some teachers in the school that don't listen to what the students are saying sometimes... They just kind of carry on with their lesson plan and sometimes that can be annoying.*

As well as input into learning and teaching, pupils also valued having ownership of different spaces and learning environments. On the walking tour, pupils discussed their favourite spaces in their school and why these were important to them. A variety of different spaces were highlighted, including the library, the PE area, and the art classrooms. Pupils discussed how the space had been used in efficient and effective ways, and how location and design could enhance learning.

P: *The upper floors. A lot of the art classrooms are really, really nice. There's a nice view from the top there...it's good for a bit of inspiration.*

One group of pupils in particular favoured the library space in the school; they liked the fact that the library was a public space, and in their previous school they weren't allowed to go into public spaces. The pupils commented that they felt more connected with the community and more able to interact in the community in this space, and with a greater sense of freedom in attractive settings. They also frequently referred to respect; respect for property, respect for self, and respect for others. Ownership featured in discussions about this library space, where they had 'adopted' their own table. In terms of physical space, the pupils felt that they had ownership of spaces where they socialised and also where they learned.



### 9.1.4. High Leverage Practices

The SLS events developed an awareness in participants of how space can impact on learning and teaching. Reflecting on their SLS experiences, pupils felt that an understanding of and ability to work in different spaces (in this case physical and virtual space) was an important skill for teachers. They believed working in different spaces would increase flexibility and greater reflection on teaching practices.

*P3: It's a valuable thing for teachers to be able to work in a different space. It's not giving you like barriers or restrictions. It's more just making you teach in a different way. You're having to think about what will work and what won't work. It's something different to get you thinking about how you normally teach and how that could be improved.*

Involvement in the SLS events prompted student teachers to also consider conceptualisations of space, and how an understanding of the ways in which these interplay in the classroom and in other learning sites were often limited to considerations of physical space. For example, a Masters student involved in the second SLS event with school pupils commented that: *'I don't think we currently pay equal attention to social, physical, cognitive spaces – we focus mainly on the physical'*.

Two student teachers took up the opportunity of teaching mini-lessons through the SLS, and drew on the advice and messages that the secondary pupils had presented to them through their own mini-lessons. The students were encouraged to have ownership of not only their own mini-lesson plans and forms of presentation, but also the layout of the Shared Learning Space. The format of teaching through SLS prompted the student teachers to be more creative in how they planned and presented their lessons.

*ST1: I've delivered this lesson, but in a classroom where I could just say, what ways are there that microbes get transmitted. And then people will tell me, whereas I can't do that, because, like I said, you can't do that sort of discussion... there needs to be other ways to do it. It's really useful because it is making me be so much more creative with how to deliver that.*

The feedback from the secondary pupils was overwhelmingly positive. They enjoyed the practical elements of the lessons and the fact that the students had tried to make it interactive and enjoyable. Pupils also recognised the format of teaching through the SLS heightened aspects of the classroom experience. For example, silences can be amplified through the delay or distance of interacting through technology. The pupils could see clearly how the structure and organisation of the student teacher mini-lessons have helped to overcome these challenges and create a fun and engaging atmosphere.

*P: You could tell they put a lot of work into it to make it fun and entertaining for us. They were getting us to join in, which was really good, cos then you're paying attention during the lesson, you're not half asleep.*

*P: They contained the right amount of facts and both had practical... The way they worked around and worked with the space was really good.*

Whilst participating in the lessons, the pupils said they had a strong sense of learning independently, in the same way as they would learn through play and experimentation.

*P1: It's like that feeling of... when you're outside and you're playing and you're learning through that. Like you're learning on your own through experimenting... it's*



*because it's a bit more independent. You feel more like you're teaching yourself in a way.*

The pupil's journey during the shared learning events, facilitated by student teachers through their own mini-lessons, demonstrates a step in the direction of leading their own learning and learning more independently, something teachers participating in this study described as the 'pinnacle' of learning.

The student teachers were inspired by their experience of teaching through the SLS, and wanted to investigate ways to build on this and to take further advantage of engaging with pupils in shared spaces, for example, by increasing the level of interactivity. They suggested incorporating elements such as shared or interactive 'collaborative documents', to ensure the pupils always felt involved and engaged, and were offered further opportunities to lead the learning.

ST1: *As you're developing this shared learning space, using a shared interface... so that they could actually physically write, and interact with us. Like they could write and leave us messages...there's different ways that technology could be used to therefore enhance the discussion.*

The student teachers wanted to make the event more personal to create a truly shared experience between themselves and the pupils.

ST2: *Making sure it's more personal in that regard, like that's the key when it comes to teaching, that's the difference between a lesson and a YouTube video. You know, using their names makes it a shared experience. I think for them as well it would show that, you know, we are just as much invested in their education as any of their teachers there.*

Importantly, the SLS mini lessons offered experiential opportunities for student teachers to participate in high leverage practice. It developed their awareness of spatial literacies, and allowed them to explore how different concepts of space can be utilized to enhance the experience of all learners.

### Key findings from case study 1:

- Participation in the Shared Learning Space created a platform for pupils to lead learning and learn independently, which increased their confidence and self-esteem as well as developing a sense of inclusion, value and ownership (of space and of learning).
- Engagement and interaction with pupils across the Shared Learning Space helped to develop student teachers' awareness of spatial literacies and how 'shared spaces' can be utilised to increase pupil agency and achievement.
- The Shared Learning Space project enabled 'borderless' learning otherwise not possible. It encouraged pupils and student teachers to engage socially and cognitively in a mutually respectful approach to teaching and learning, strengthening the relationship and understanding between them.
- The learning events in the Shared Learning Space used a range of technologies, thereby providing borderless authentic deeper reflection about quality learning with pupil voice at the core.

## 9.2. Case Study 2 – Garden Spaces

### 9.2.1. Conceptualisations of Attainment

How headteachers, teachers and students involved in the shared garden spaces conceived of the attainment challenge differed across roles and schools. One common theme among responses was the links between outdoor learning, literacy and numeracy.

T: *Well, obviously you can do a lot of Literacy and Numeracy outside, a lot of measuring, counting, things like that. And obviously on the Literacy side you get quite a lot out of it. Lots of new vocabulary.*

Student teachers attending a workshop on school gardens linked attainment with issues of sustainability and global citizenship, and talked about the garden space as offering equal opportunities for all children.

ST3: *Kids that live in flats maybe don't have the opportunity to grow things by themselves or see their parents doing it. So maybe that could somehow engage them more into producing fresh ingredients and actually learning about that, and recycling.*

ST1: *It could almost maybe be an equalizer too. If you live in a city there's very few gardens... It's something that they're all getting a part of together and at an equal level, no one's better than anyone else, they're all getting involved... they've got the same ability as anyone else. And their background doesn't matter in that case.*

At one school, the community support teacher talked about attainment in terms of parental engagement, and the benefits this could have for children.

CST: *I think if parents are coming in and doing gardening with their children... it's very positive for the child, it's time spent with their parents. There's everything from the counting to the research to the cooking, it's such a massive amount of information that they can get from learning together. And I think it will be hugely positive.*

All teachers perceived the potentiality of the garden space to engage pupils to learn about the growth of the plants but also the wider aspects of caring and maintaining the garden, and collaborating with other members of the community. In this view, attainment was viewed broadly as a set of capabilities instead of isolated cognitive gains, including observational, communication, practical and organisational skills.

One of the headteachers recognised that 'when they come back, there is a readiness to learn', pointing to the impact of gardens on the wellbeing of children who are often impeded in their learning by behavioural issues, affecting themselves or others in the class. However, she was also quick to recognise that she could not directly correlate such gains with 'attainment' as a product to be measured, valuing instead the broader process of 'nurturing' the child, occurring over a longer period of time and involving the whole school.

HT: *Can I say it's impacting on things like attainment? I couldn't directly correlate that, but certainly on the kind of positive attitudes towards looking after things, nurturing things, in our own environment, that's been a real positive for us... For us it is about nurture, so if we have children who are ready to learn, then that will in time impact on attainment.*

Both notions of attainment as achievement and as nurturing pertain to the collective, entailing a transformation of the way in which 'educational provision' is viewed and 'children's learning' are implemented. In this school in particular, the school in the area of greatest deprivation, the headteacher was so convinced of the potential benefits of the garden space that she instigated the expansion of the available garden areas (raised beds) to a whole school programme to enable all children in all classes to engage in learning through the garden. Hence in this regard we may see a 'closing of the gap' in the way in which schools may fill the vacuum that exists between 'have and have nots', by transforming the range of opportunities and possibilities for children to learn as part of the school community. However, in order for pupils' learning to be described according to the curriculum's existing categories, the role of the teacher is key in mediating the transition from direct experience to abstract concepts.

### 9.2.2. Developing Confidence and Leadership

The practical nature of working in the garden spaces and engaging in problem solving activities in a different environment to the classroom gave the pupils the confidence to make mistakes, learn from them, and find solutions.

T: *We'd planted things too close together, and they were able to see that. They were using their problem solving skills... That's too close, it's not gonna grow, we need to move it. It did give them that freedom, and that confidence to actually make mistakes. It was okay cos it was in the gardens, they could go and fix it themselves, that maybe they don't have so much in the class.*

Staff at the schools gave a number of examples of how the confidence of children grew as a result of learning and engaging in the garden space. At the school situated in the most deprived area involved in the study (SIMD 1), the class teacher was able to describe how a sense of pride had been instilled in the pupils from the whole process of involvement in the garden space, from planting to harvesting and presenting their work to others.

T: *They were quite a boisterous lot and it was very nurturing for them to look after things, seeing the development from planting it as a seed, having to actually go out, water it, and seeing it grow... Then they got to share round the other classes when we did harvest it. So they had that sense of pride, we've managed to grow this from scratch and make it into something.*

This pride and sense of achievement was echoed at other schools. For the pupils, the journey of growing, caring for and harvesting the plants developed confidence in their abilities.

T: *They're very proud. If they harvest something and they bring it along you can see that they've been delighted to have grown it. And they've had cooking sessions whereby they might not have originally thought they would have liked to have eaten it, but they tried it and given it a go, and I think that's all about developing confidence as well.*

It was recognised by teachers that the practical aspects of learning in the gardens added a focus and fostered greater engagement from pupils, including in other areas of school life. One teacher commented that for certain pupils who struggle academically, the sense of self-confidence fostered through practical work in the gardens '*feeds into the other aspects of school where they're finding things difficult.*' At several schools, pupils who

engaged with the garden spaces were then able to take on the role of experts and share their knowledge and experience with other classes. This leadership role for the children, as the active holders of knowledge rather than passive recipients, was encouraged by teachers who could view first hand the positive impact it generated.

T: *I've worked with a whole range of pupils who have not been interested in some of the work we do in class. Gardening has helped them develop greater confidence in themselves, they see themselves as a leader. It's a real kick for the kids, if they're the ones who are teaching... And I take a backseat, to show them that it's not the teacher who is the fountain of all wisdom and knowledge, we're all learning together.*

In this sense, the primary pupils in the garden spaces experienced a similar shift of role to the secondary pupils who participated in the SLS events in case study 1, transitioning from learner to active participant to expert. During such transition, great value is placed on the possibility to lead learning while accepting the possibility to 'make mistakes' by sharing a 'safe' space with significant others. The creation of these safe, shared spaces therefore facilitates this transition and instils a confidence and sense of self-worth in the pupils that was clearly evident to teachers.

### 9.2.3. Promoting Ownership and Inclusion

An emphasis on pupil ownership was incorporated from the very beginning of the development of the primary school garden spaces, with pupils designing and then creating the garden themselves. Pupils viewed the spaces as their own creations and took on the role of safeguarding and sustaining them.

T: *It made them take a bit more pride in what they were doing because it was theirs. They wanted to show it off, so they were always out in the playground and telling people not to go near it, not to stand in the planters.*

Several schools mentioned the risk of vandalism to the gardens. At one school, which was in the early development stage, there were hopes that involving the pupils in the garden and fostering a sense of responsibility and ownership would help to prevent any damage, with one teacher stating that '*hopefully if they've put a lot into it, it should be a little bit more protected*'. At another school, where the garden was in its third year, they viewed the complete lack of vandalism as a huge positive, and linked it to the pride and responsibility children felt towards the garden space, and the community spirit that it had engendered.

HT: *We have a huge amount of vandalism in this area, very challenging. And one of the real positives about this, which I guess shows the importance of it to our children, we've had no vandalism in the garden at all... I do think that there's a real positive attitude about it, the children have a pride in it. I think there's quite a community feel to it, sort of community of responsibility.*

All schools talked about pupils' enthusiasm towards their garden. One teacher gave an example of how the excitement for engaging with the garden space spread from one class across the school and generated interest with other pupils.

T: *When they realized actually it was a special thing, that they were the only class getting to do it, they were excited for it. A lot of them have siblings, either in classes above or below. So getting to go into each of the classes and show them*

*what they've managed to grow, and getting them to taste it... I've been with P5 for the last three years, it's always one of the first questions they ask when they meet the teacher, are we doing the garden this year?*

The practical nature of the work in the gardens also provided pupils with opportunities to create and shape the physical school environment, giving them a sense of involvement and inclusion.

T: *They were using spades and they had the big loppers and stuff. And they really enjoyed that, it makes them feel more mature. And it also makes them feel even more part of the school... they're more interested in their surroundings, they take better care of things if they're involved in creating.*

Many interviewees highlighted the importance of teachers learning alongside the children in their class. For some teachers, working in the gardens was a completely new experience. The headteacher of one school talked about how initial nervousness around working in the garden had evolved into 'a real bonding exercise' for the teacher and class. The class teacher at this school expanded on her experience.

T: *I don't have a garden, never done any gardening in my life. I was a bit nervous to start off with. I was very open and honest with them, I'm not an expert... If they were asking me things that I didn't know, I would be honest with them, oh I'm not sure let's go and see if we can find that out together. So I think they did realize that actually teachers are just human as well, we don't know all the answers.*

The group and team work and the communication and cooperation inherent in working in the garden spaces was perceived as assisting in the development of social skills amongst all pupils, but also particularly those pupils who were struggling socially. Teachers noticed that for pupils who found it difficult to build friendships, the activities in the garden helped them to make meaningful connections with their peers and with adults helping in the garden, with discernible impacts on behaviour and emotional wellbeing. As one teacher commented: 'It's improved their behavior and helped them get on better with their peers, because they're not tending to fall out or to be at a loose end at break times.' It was mentioned by several teachers that this development of social skills was having a positive impact on health and wellbeing.

#### **9.2.4. Supporting Physical and Mental Health and Wellbeing**

Many of the teachers at schools with garden spaces spoke about the potential of these spaces to impact upon the physical and mental health and wellbeing of pupils and others. They spoke at length about developing knowledge of healthy eating, acknowledging that through the practice of tending to the school gardens children were able to learn more about the process of how food arrived on their plates. Teachers also commented that teaching in the gardens had impacted positively on their own diets and that of the pupils.

In addition to physical health, the impact of the garden spaces on the mental and emotional wellbeing of pupils was also emphasised. Teachers highlighted the importance of pupils actively caring for and nurturing plants and the larger garden space, with one headteacher commenting: 'actually looking after something else and caring for something else, like that's obviously a big part of the benchmarks for health and wellbeing'. Another headteacher elaborated on the nurture principles of the school and how these were benefiting the children.



HT: *I think our children see this as a real nurturing experience. I do think that's hugely important for us. Children need nurture. And this is a great way for them to understand the importance of nurture... whether it's their tatties or their strawberries, they're learning how to be nurturing towards something, which is hugely beneficial for them.*

A community support teacher at one school also talked about the mental health benefits for some of the adults who were helping out in the gardens.

CST: *One of the mums that I've worked with for a year, she definitely gets quite a lot from it and it's definitely helpful for her mental health, it doesn't have to be gardening but just to have a focus. And her son who's left school is actually coming as well.*

There was further general feedback from some of the parents and adult helpers, who had at first been hesitant to engage.

CST: *When I do my groups and you're speaking to people, just generally, a lot of the feedback was 'it was good for their mental health getting out'. Once they'd met the people in their group, they realized, well actually it was okay, because prior to that if you didn't know them you're like, 'oh they might judge me for this'.*

A group of student teachers who were keen to develop garden spaces in their placement schools and as NQTs discussed how the change in environment, from indoors to outdoors, could be beneficial for emotional health and also for concentration and focus.

ST2: *It's the change isn't it, too. I mean being stuck in the same classroom all the time, and nothing really changes in it. Whereas you can see the changes in the outdoors and you can feel it and engage with it.*

ST1: *And the mindfulness of it and the like calming, maybe, the change from outdoors to indoors. So when they're actually indoors, okay, we're going to concentrate more because we're not indoors for so long, maybe.*

ST2: *Even for us it's, well it can be boring. I don't know about you, but I get sick of the same four walls every day... I feel like if I'm feeling cooped up like that, they're going to be feeling the same if not more.*

However, several of the students in this group also spoke of their frustrations at being unable to initiate or develop garden spaces at their placement schools. They attributed this to an unwillingness or lack of enthusiasm from other staff at the school, who would cite heavy workload or health and safety as reasons for not developing gardens. This speaks to the important role of school leadership in creating and fostering environments where new learning spaces can be created and supported.

### 9.2.5. High Leverage Practices - School Leadership

In the interviews, headteachers at schools with garden spaces spoke about their role in initiating, supporting and further developing the garden. In the early stages, this involved a lot of careful planning about how to first develop and introduce the garden in the school. The headteacher of the school in the area with the highest level of deprivation described the careful planning that went into planning and introducing the initiative, stating that there were '*lots of conversations around how this would work, how we'd get teachers on*



*board, how we'd get the pupils on board'. School leaders talked about the importance of supporting and motivating their staff, as well as the pupils, to take ownership of the garden space, in order for it to be a success.*

HT: *If people have an enthusiasm for it, capture it and let it go, let them run with it, and it gives the staff a sense of empowerment, as well as the children.*

At schools where there was only one or a couple of classes using the garden, headteachers described their vision for spreading it across the school and how this was vital in maintaining and further developing the project.

HT: *I feel that for it to be sustainable other people have to come on board, or should be invited to come on board. There's potential maybe to buddy classes up, so that younger ones are learning from the children who've been doing it for a couple of years now and been involved. I think we will have to look at that over the rest of the school session so that next session, a new generation of children, hopefully, will show an interest.*

Some teachers discussed the pressures of being responsible for the school garden, particularly if they were the only teacher involved, and the need to spread responsibility across other staff members. One teacher, who had been the only teacher in her school involved in the garden space for the previous two years, acknowledged that she had taken on too much responsibility and there was a need for fellow staff to help support development of the garden.

T: *That's something I'd like to share the responsibility of between teachers because I found it really difficult to sustain it all by myself, when I'm involved in a lot of other initiatives and different things as well. So, that will be a next step for the school as well, actually sharing it across the school as opposed to just one class.*

Even when the garden was being used by a lot of classes there were challenges with how to manage use of the garden effectively and encouraging all staff and children to take a role. Headteachers recognised that getting staff on board and spreading responsibility across the school could be challenging at times. Schools where the garden space was in the early stages or first few years of development wanted to take 'a much more holistic approach', but headteachers did not always share specific strategies for achieving this. One headteacher discussed training for staff and pupil support assistants, and how this could help to expand use of the garden area across the school and sustain the project in the event of staff turnover.

HT: *We've committed to all our pupil support assistants attending training on the in-service day. It's developing those leadership skills, not only of our teachers but thinking about how our pupil support assistants can lead on things within the school.*

For some schools, the maintenance of the garden was a success in itself and a necessary step before expanding to more classes could be contemplated. One teacher felt that the fact that the garden was still being tended to and had not been dropped after the first year was 'a positive sign', because '*quite often things like that come and go, and then they get forgotten*'. At the school where the garden was used by all the classes, the headteacher was grateful to the staff in the school that had been so supportive in the initiative and helped it to grow.

HT: *What's really impressed me is how engaged people have been, how on board people have been, that's children and adults across the school. That's been lovely for me as a headteacher. Because quite often you come forward with things and it's, here we go, here's the next fad. But it hasn't been like that, they've really embraced it because of our nurture principles and because they can see how much it impacts on the children.*

The headteacher's message to other schools was that using the garden was an overwhelmingly positive initiative: *'I would just say that for any school that is contemplating this, to go with it... taking that opportunity and growing, pardon the pun, with the children is fantastic'*. The example of this school's successful development of shared garden spaces demonstrates that these initiatives require strong leadership, a clear strategy and underlying principles, and a willingness to delegate and spread responsibility, taking a 'community' approach to the shared space.

### 9.2.6. High Leverage Practices - Student Teachers, Schools and ITE

Teachers and student teachers were asked about innovative ways that school garden spaces could be integrated into the curriculum. They provided a number of examples for bringing aspects of the curriculum into the activities taking place in the gardens. In the main, they referred to Maths and Literacy links, but also touched on the creativity and flexibility inherent in doing whole term projects in the garden space. Teachers discussed how the process of the children harvesting the crops they had grown led quite naturally to conversations in the class about topics like climate change and sustainability. Discussions about recycling, preventing global warming and eating locally-produced food were common and led the children to believe they were 'making a difference' in their local community and in society. Discussions around sustainability also involved considering how the school could be made eco friendly, encouraging the children to consider ways in which they could live more sustainably.

T: *Teaching about sustainability to them, we could start and grow our own fruit and veg and use them in school. Last year they grew lots of lettuce and rocket, so they put that into the school dinner hall, so people were able to go and help themselves at lunchtime. So, yes, it's fun, but there's actually a purpose to it as well, we're making our school a bit more sustainable, a bit more environmentally friendly, we grew our own compost.*

Along with curriculum innovation, teachers also spoke about the transformational change that student teachers could help to instigate and develop at schools. Students and NQTs were viewed as drivers of change, and the gardens spaces as a means of embedding new practice and fostering creativity in terms of pedagogy.

DHT: *For a long, long time outdoor learning has been on the agenda and I don't think it's really been done properly. And I think that student teachers are key to making it be done properly, because teachers that have been in schools for X number of years, to get them to change their ways is quite a tricky thing. If we've got motivated enthusiastic student teachers that really want to come and share their knowledge and passion, that can only be a good thing.*

At several schools teachers discussed the potential of students coming in on placement and assisting with teaching in the school gardens, bringing new ideas and adding greater focus to activities. One class teacher who had a student teacher working with her on placement talked about the positive impact of collaborative teaching in the garden.

T: *They come in fresh with new ideas that maybe you haven't thought of, or different ways that you could do things. It's just nice to share ideas together.*

The student teachers, for their part, spoke of a willingness to instigate innovative change and viewed the school garden spaces as a means to achieve this. They felt, however, that a lack of input on outdoor learning and garden spaces on their ITE course, coupled with some resistance they had encountered at placements schools towards innovation with regards to school gardens, would prove challenging for transforming practice. Any engagement with outdoor learning or related concepts on their course had been standalone sessions, a day at the beach or the park, rather than something integrated into the course.

ST2: *The only thing we had in Uni was that day... where we went to the beach. Which was great, but maybe we can have another session of looking at what we can do at school.*

ST3: *Yeah, it was fun. It was quite useful, but then to be honest... you never thought about it again.*

ST4: *I think like the ideas they brought that day, it was one lesson and that was it, but this [the garden project] has got more, it's ongoing.*

This fed into plans for the online workshop for student teachers, which was organised in a way to provide deeper engagement with concepts of shared learning, in the gardens and in other spaces, and develop new ways of thinking and strategies, or high leverage practices, for student teachers to support transformational change in schools.

### Key findings from case study 2:

- Teachers perceived the potentiality of the gardens for raising pupil achievement; attainment was thus re-conceived as a set of capabilities instead of isolated cognitive gains, including observational, communication, practical and organisational skills.
- As in SLS, participating in the Shared Garden Space created opportunities for pupils to take on the role of expert and lead learning, increasing confidence and a sense of self-worth that visibly fed into other aspects of their learning.
- Engaging in the garden space also benefited the physical and emotional health and wellbeing of pupils, teachers and their parents; it raised awareness of healthy eating and sustainability, and fostered a sense of resilience and community spirit.
- Student teachers were enthusiastic about the potential of school gardens as inclusive spaces, and were viewed by school staff as vital to facilitating transformational change; however, strong leadership, strategy and creating a 'community' approach in schools was required to effectively support and sustain shared garden spaces and realise their potential.

### 9.3. Case Study 3 – Shared Hybrid Spaces

#### 9.3.1. Designing and Developing Inclusive Shared Spaces

In the online workshop, students engaged in a number of interactive sessions on the themes of agile learning, spatial literacies and pedagogies, shared garden spaces and utilising new and emerging technology for shared learning. The workshop brought together elements and considerations of the first two case studies into one forum.

The final session offered students the opportunity to learn from and interact with pupils from a Primary School, and their teacher and headteacher, who had developed the Primary 6 classroom into an agile and flexible learning space. The layout was designed by the P6 pupils and included agile furniture such as cushions, bean bags and more traditional seating and desks, with the designation of different learning and safe spaces within the room.

The headteacher and teacher from the school, discussing the space in the workshop with student teachers, felt that the flexible space afforded opportunities for pupils to choose how they learn. The class teacher admitted feeling a bit nervous about using the flexible space for the first time, but found that it effectively promoted pupil voice, giving children ownership of the space as well as choosing how and where to learn. In a similar fashion to primary pupils' ownership of the school garden spaces, and the secondary pupils taking on the role of experts in the SLS, the primary 6 pupils at this school highly valued the opportunity they had been given to take charge of the layout and design of the space, and engaging in the process from the very beginning.

P: *It's important because we got to choose everything, it's all of the things that we want... and we chose where to put them, and that's I think the way we want it to be.*

P: *I think it was important because everyone has a different opinion, so we got to like agree on stuff that we wanted and where we wanted to put it.*

Similar to the learning environment in the school gardens, the flexible learning space was credited with nurturing a calming atmosphere with a focus on learning and exploring. This was perceived as a noticeable difference from other learning environments.

T: *I think the biggest difference that anyone can walk in and instantly see... it really helps in creating a relaxed and calming atmosphere in the class, and it helps the kids to engage and focus on their learning.*

The class teacher also touched on how the flexible learning space had impacted upon pupils who had barriers to learning. The headteacher and class teacher explained that inclusivity and creating an equitable space for all learners had been a main driver behind rolling out the initiative.

T: *It was really important that all children were included and had that space within the class to feel included. I've noticed a huge difference in a few children who do have barriers to learning, in that they have a space to either break out and to relax and to take a moment, or to go to another area of the classroom and work with another adult, or their peers. Those things just wouldn't be possible in the traditional layout of a classroom, with fixed seating and fixed desks and things.*

The Primary 6 pupils spoke about how the flexible environment of their classroom allowed them to move into safer or calmer spaces if they wanted to.

P: *I think the best thing about our learning space is the teepee, because if you feel sad or a bit angry, you can go in there to relax.*

Another of the pupils, now learning at home due to the COVID-19 pandemic, picked up on this theme and explained how the environment of the flexible learning space had led them to consider safe and calming spaces in their own house.

P: *When I want to be by myself I can go to my room... and I can play my violin and that calms me down.*

The class teacher spoke about how the agile learning space in the Primary School also fostered creativity and flexibility. Each piece of furniture had a home space, where it should be returned to at the end of the class, but during the lesson pupils could configure the space in any way that they saw fit. The layout involved a tier system, with bean bags and lower seating towards the front of the class. As the teacher explained, this allowed pupils to create their own mini-spaces within the class, and choose where to locate themselves in order to get support from the teacher or peers, or to share learning, or to work more independently. The flexible learning space mimicked how children would learn at home, or in more informal settings, promoting independent learning and creative thinking:

T: *When we're at home or when we're outdoors or in another setting, you have so much choice about how you want to sit, where you want to sit, do you want to lie down, do you want to have something on your lap, do you want to be using cushions. So the space mimics how children will learn independently.*

One of the pupils spoke about how experiences in the agile learning space in school had encouraged him to take ownership of the layout of his own home. Currently learning at home during the COVID-19 lockdown, the pupil had designated different areas in his own home and looked to recreate some of his favourite safe spaces from the classroom.

P: *So in one room we have a reading room, and in the other we have a writing room, and in another a Maths room... there's a chair in the corner that's really nice and there's also my room [where I can feel calm].*

This discussion and interaction with the pupils and teachers had a clear impact on the student teachers, as evidenced in comments and survey responses during the sessions, and in the online questionnaire completed following participation in the workshop sessions.

### **9.3.2. High Leverage Practices - Awareness and Understanding of Spatial Literacies**

A poll of student teachers capturing their views of the design, planning and impact of shared learning spaces revealed strong agreement that shared learning can impact on pupil achievement in physical, cognitive and social ways.



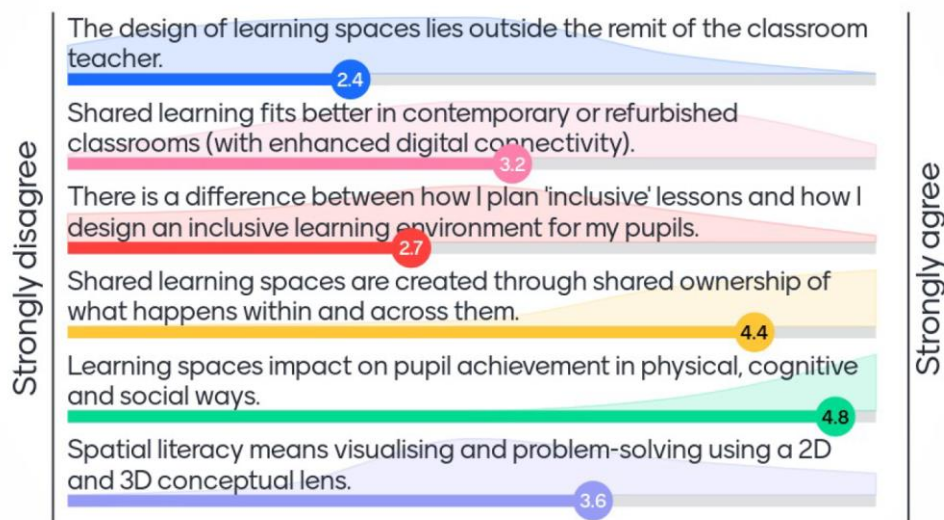


Figure 2: Mentimeter poll results to Q: Views on shared learning spaces

Discussions on spatial literacies enabled student teachers to consider the pupil perspective, and explore potential opportunities for pupils to articulate their needs, feel safe, engaged, and involved in the decision-making process. A consideration of space was seen as helping remove barriers to learning and placing pupils in a position where they felt a shared sense of ownership and belonging.

ST: *If the pupils feel calm and comfortable in their learning environment then they will be more 'ready to learn'.*

ST: *There is potential to have an impact on attainment if the space (social, cognitive & physical) are used to their best potential in providing a safe, secure, calm, inspiring, stimulating learning environment.*

Several students stated that an awareness and knowledge of spatial literacies made it possible for both pupils and teachers to reflect and assess how their learning environments impacted upon them.

ST: *It enables children to grow awareness of the environment changes and changes in themselves when the space they are in changes. Once the self-awareness is set up within them, higher-level thinking can be generated.*

ST: *Pupils and teachers are more aware of how their environment impacts on learning, teaching and emotions. Better able to design a space that is inclusive and meets everyone's needs by supporting pupils to articulate needs and teachers to pick up on them.*

ST: *Spatial Literacies helps teachers to consider pupil perspectives in the classroom and this helps pupils to feel safe, engaged and involved in classroom learning. It also helps pupils to understand how space can be used in the class and what areas of the classroom can help with or hinder learning.*

Considering how an awareness of spatial literacies may impact on their practice as they prepare to enter schools, several student teachers focused on how knowledge and understanding of space could assist in creating inclusive learning atmospheres where pupils felt empowered to lead the learning.

ST: *It will help me to empower pupils to take control over their own learning and decide what works best for them.*

ST: *I definitely feel like this is an important area I want to learn more about and incorporate into my thinking about classroom design, layout and planning for teaching and learning. Need to do all of this with involvement and co-planning with my pupils.*

Looking ahead to starting in schools that would be opening after enforced closure due to the COVID-19 pandemic, some students considered how the new reality of hybrid learning could incorporate shared spaces, and the benefits and challenges this may produce. Development of shared learning spaces with pupils was also seen as having the potential to help with transitions to new classrooms.

ST: *I wonder if we are going to meet our classes for the first time online if we can work on creating learning spaces at home. How do we navigate inequalities in access to home spaces?*

ST: *This makes a really good transition exercise so that children moving to a new classroom can have a voice in how it is organised, and also think about how their learning needs change as they move to a new stage.*

During and following the workshop, student teachers were asked to develop their own designs of shared learning spaces and shared garden spaces. Below we provide two illustrative examples of space design (Figures 3 and 4). Figure 3 refers to a shared learning space design; Figure 4 relates to a shared garden space design. When considered together, both drawings show awareness of space as giving the opportunity for children's movement and positional change. Children can 'move' between different areas with each one affording the chance for different, *place-sensitive* opportunities for learning. So embodied learning becomes memorable as it is developed hand in hand with physical and affective states.

In addition, it is notable that both drawings include natural features – 'in the company of nature' – as a means for pupils to experience wellbeing and attention-restoration (e.g. see Figure 3 mention of 'Biophilia'). Such features are enhanced in Figure 4, in which we note the 'additional' features marked in red pen and related to enhancing space for inclusion. In the garden space, pupils have the opportunity to experience their own learning alongside learning of and about other species; it is such bio-diversity that sits at the core of sensorial diversity enhancing learning opportunities for all children accessing the space. Space diversity is in this sense directly correlated to a co-produced and co-located curriculum for social and ecological justice.

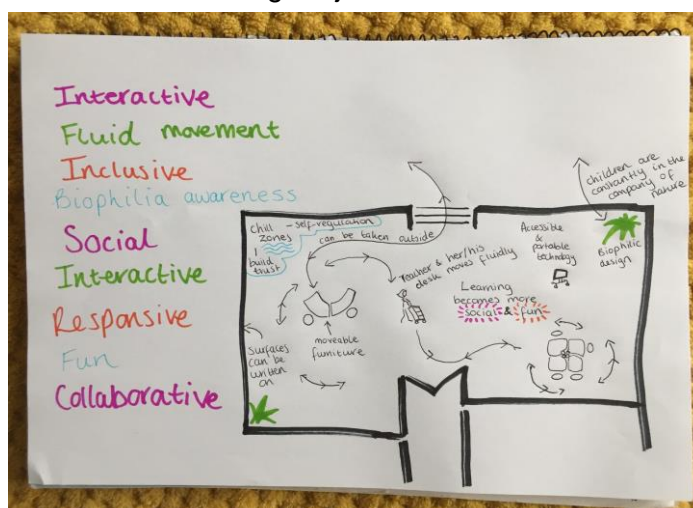


Figure 3: Student Teacher Shared Learning Space Design

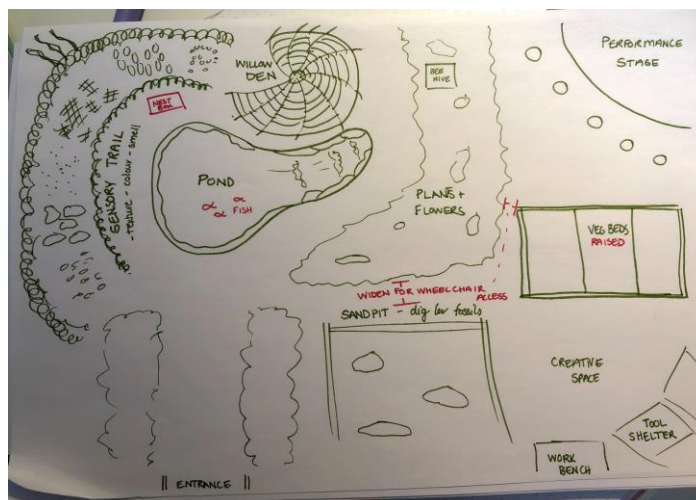


Figure 4: Student Teacher Shared Garden Space Design

The workshop sessions prompted students to ‘dig deeper’ to acknowledge space and its impact on learning. It also created an environment in which the students were encouraged to propose, discuss and examine innovative practice and how this could link to the curriculum.

### 9.3.3. High Leverage Practices - Curriculum Innovation

When student teachers were asked for specific examples of themes or topics that could help promote integration between school gardens and the curriculum, many pointed to Literacy, Numeracy and sustainability and Health and Wellbeing. This was similar to the examples of curriculum innovation provided by headteachers and teachers working at schools with shared garden spaces.

ST: *Literacy - writing stories about the garden and nature; Maths - Measuring areas for plants/fences. Using data handling to keep track of the plants/foods the children are growing; HWB - learning about fruit and vegetables that can be grown in a garden and enjoying the outdoors.*

Some suggestions touched on links that could be drawn to other curricular areas, for example Science, expressive arts and art and design, and topics related to social studies and social justice such as world poverty and fair trade. Students also proposed cross-curricular and interdisciplinary learning that could take place through the shared garden spaces.

ST: *Interdisciplinary learning by having lessons outside in the garden or by using the resources in the garden to help teach. For instance... in a science lesson looking at the biology of the plant or even looking at the origins of certain plants as part of a case study on another country can help foster global citizenship in the pupils.*

Students also gave clear examples for how linking with other sites through shared learning and new and emerging technology could enhance pupils’ experiences and sense of achievement. They spoke about how SLS provided pupils with a means to access different learning spaces across the world and experience things they might not otherwise see. Furthermore, 90% of the student teachers responding to the online questionnaire, strongly agreed or agreed that ‘experimenting with digital tools could transform my classroom into a space enhancing global citizenship.’

ST: *Inspires pupils to want to know more about other places. Some children may not have experienced spaces beyond their local area and this could provide opportunity to explore this digitally in the classroom; Develops digital literacy.*

ST: *Can help pupils to self-reflect on their own learning and have the opportunity to work with a range of communities, networks, peers and staff. It can help to increase pupil's self-esteem, confidence and problem solving skills.*

Many respondents thought linking with external sites would provide pupils space from the usual classroom setting, stating that a change of environment and engagement with other people outside their immediate environment could motivate and inspire them.

ST: *Enriched learning environment with different stimuli. Inspired motivation for learning. A sense of understanding that learning doesn't stop with the classroom, that it can take place anywhere.*

ST: *Allows pupils to enter into a new environment without leaving the classroom – could be really exciting and inspiring.*

These experiences were seen as opportunities to deepen learners' understanding of global citizenship and add meaning to the subjects pupils were being taught. By providing an environment that facilitates the co-creation of learning between and within SLS sites, pupils would further develop skills in cooperation, negotiation, and self-reflection. Taking ownership of one's learning could lead to a sense of achievement, self-value, purpose and empowerment. Shared Learning and utilising new and emerging technologies were also viewed as a means to increase accessibility, ensuring that learning spaces were inclusive for all learners.

ST: *Providing every child the same opportunity no matter their social or economic background. Opportunities to share/work together.*

ST: *Ability and capacity [of technology] to create solutions to remove barriers for children with certain disabilities and impairment, which will be really helpful in setting up a truly inclusive classroom. I cannot wait to try more!*

At the same time, student teachers conceived several challenges they may face when trying to develop shared spaces in their future schools. Many responses highlighted potential lack of resources and funding restrictions. Others mentioned the need to maintain both the shared space, such as a school garden, and the motivation surrounding it. Several students spoke about barriers in terms of buy-in and support from school leadership and staff as crucial in developing shared spaces.

ST: *For a growing project I think the main barrier would be lack of support from other staff. I also see an issue as a probationer as the project likely needs to be time bound so you couldn't guarantee others taking it on.*

ST: *The commitment from other members of staff, finding solutions for year-round care when taking into consideration school holidays etc.*

Furthermore, 80% of student teachers (online questionnaire) strongly agreed or agreed that 'the potential of shared learning spaces cannot be realised without the support of colleagues and the headteacher.' Again, a case was made for strong leadership in schools to facilitate and support opportunities for transformational change.



### 9.3.4. High Leverage Practices - School and ITE Leadership

During the online workshop, the headteacher of the Primary School with an agile learning space in the P6 classroom talked about opportunities and challenges for extending the initiative across the school. While recognising that there was not enough funding to develop a flexible learning space in all classes, the headteacher explained the P6 classroom was acting as a trial and a P2 class had made several visits to the space with the intention of adopting some of the same approaches.

When asked by student teachers about tips or hints for creating agile learning spaces, the headteacher touched on the approaching challenges of funding in the next academic year and the impact of COVID. However, she felt that despite these challenges and restrictions it was possible to develop many different forms of agile learning no matter what resources are available.

HT: *It's about looking at what we've got as a school and being really flexible with that, but also understanding pupil voice in that. It's so important about the children having total ownership of that space, and you can do that even if you have 30 desks and 30 chairs, you can still use that in a really innovative and really flexible way.*

The student teachers in the online workshop wanted to know how the P6 pupils would react to leaving the flexible learning space, and whether their experience would lead them to feel empowered to assess and challenge the next learning space that they encountered. The headteacher explained that the P7 space, which was in a separate wing of the school, was developed in such a way as to aid transition from Primary to Secondary School. However, the decision had been taken to allow the P6 pupils to identify one thing in their current flexible learning space that they would then be allowed to replicate elements of this in the new P7 classroom. For example, one pupil was very enthusiastic about the teepee because it gave him space and time out from the usual classroom environment. The school leadership committed to exploring ways to implement and replicate certain design elements that were valued and chosen by pupils in the new classroom space.

HT: *The children will probably see the difference going into the new Primary 7 environment, but we would be trying to incorporate some of their views into that. And we would be making sure that the new Primary 7 team involves the children in classroom design and layout, because regardless of whether you've got beautiful new furniture or older furniture, it's about making the best of what you've got.*

Strong leadership at a Higher Education level to facilitate change also emerged as a theme from post-workshop questionnaires. The student teachers felt that consideration of spatial literacies and shared learning was important to include in ITE programmes. For example, one student commented: *'I would love to see this thinking as a key part of ITE programmes in the future'*. Students recommended that spatial literacies be embedded within ITE programmes through providing more practical workshops on learning spaces design, and using shared learning spaces as an opportunity to look at classroom design more critically. They recommend raising awareness and support for an ITE programme that fully incorporates and embeds spatial literacies at the heart of its curriculum.

ST: *It has the potential to completely change how a person views a classroom space. For myself personally, it really reaffirmed the importance of pupil voice and how our space in the classroom sets the tone of how we want our learners to perform.*



Some learning spaces within the University were seen as restrictive and student teachers felt that it would be very valuable if there could be a dedicated agile shared learning space with flexible furniture, examples of biophilic design and technological facilities that they could use to practise configuring the space in different ways, especially when they had opportunities to create an authentic shared space with schools.

ST: *We do not have a "sample classroom" on site. To be able to go in and arrange a classroom, discussing as groups the pros and cons of different layouts, imagining scenarios where classes are made up of different numbers, needs and age groups, would be fantastic. We are often asking for practical guidance over theory, experience that will help with the practicalities of managing a classroom. This would be an opportunity to do that.*

### Key findings from case study 3:

- Participation in the online Shared Hybrid Spaces workshop raised student teachers' awareness of the impact of space on learning and teaching, and the kind of high leverage practices they could employ to develop and design inclusive learning spaces in their schools.
- The case of an agile learning Primary classroom and an opportunity to engage with pupils and teachers involved in this initiative prompted the student teachers to explore how to utilise space in new ways in their classrooms, to promote pupil agency, ownership and achievement.
- The involvement of student teachers in the design of an 'agile' and shared garden space indicated growing awareness of student teachers' understanding of connecting curriculum subjects to concrete experiences, and to bring together learning of concepts with values of social and ecological justice.
- Student teachers drew on their explorations of futures thinking in the workshop to consider 'curriculum innovation' as inextricably linked to 'space creation', and called for the incorporation of concepts of spatial literacies in the school curriculum and on ITE programmes.
- The workshop raised student teachers' awareness of the learning potential of making visible the connectivity between the design of lessons and the design of learning spaces.

## 10. Conclusion

Using a relational and spatial approach to curriculum, our study set out to explore ways in which reconceptualising attainment through *shared spaces* can promote pupil achievement, health and wellbeing. Set within the context of the Scottish Government's attainment challenge, three case studies documented the development and impact of shared spaces from multiple perspectives, involving pupils, teachers, student teachers and teacher educators. Each case study identified a particular spatial strand to experiment alternative learning design which enables a more holistic understanding of the impact of learning spaces on pupil achievement and well being. Case study 1, explored the value of linking learning spaces for genuine co-constructed equitable learning. Case study 2, focussed on co-creating curriculum-making through merging the human and non-human to grow pupil achievement and wellbeing. Case study 3 challenged student teachers to reconsider social justice-oriented teaching practices through a spatial lens highlighting the value of spaces and their potential integration in creating rich learning ecologies.

The strands permeated the case studies, gathering participant conceptualisations of attainment and achievement through the design and development of inclusive shared spaces using an ecological lens. Across the case studies, shared spaces promoted co-ownership of learning and the growth of pupil confidence, agency and leadership, providing 'safe' spaces for participant learners underpinned by values of social justice, inclusion, health and wellbeing. Moreover, the fundamental importance of high leverage practices emerged including the need for strong leadership at all levels both in school and university across ITE programmes as well as openness to curriculum innovation and exploratory practices for enabling pupil-led achievement. The findings across the case studies emphasise, however, the need to underpin high leverage practices with an awareness and understanding of spatial literacies for all those involved, ensuring that student teachers are equipped with the necessary skills and experiences during their ITE programme.

Consistent across the case studies were examples of pupils leading learning, demonstrating increasing ownership for independent learning and developing a sense of self-value and confidence. When spaces encouraged pupils to become experts, extending their skills (e.g. observational, communication, practical) and exploring shared learning with 'less accessible' others, then the concept of physical, social and cognitive spaces merged into learning ecologies across indoor, outdoor, digital, virtual and connected sites. Pupils openly demonstrated a sense of achievement.

Moreover, **the urgent need** to raise student teacher awareness of spatial literacies and explore ways in which the concept of shared learning spaces impacts on learning and teaching was addressed through considering hybrid learning spaces. Student teachers reaffirmed the need to start the process by analysing physical spaces as an entry point to more holistic ideas of shared learning spaces inextricably embedded in pupil thinking and learning. Examples of high leverage practices were explored with student teachers: (i) 'disrupting' student thinking by facing up to classroom practices manifesting injustice and exclusion in terms of achievement; (ii) considering the potential of co-creating hybrid spaces, including the 'safe' and the challenging, involving the indoors, outdoors, digital and virtual, to redress the imbalance and create socially just learning communities; (iii) investigating innovative practices for curriculum-making through shared and reflective experiences so that all learners feel valued and have a sense of purpose and wellbeing. Fundamentally, the key message emerging from the research is a radical rethinking of the importance of involving pupils in 'space creation' as fundamental to learning design

and lesson planning, and fundamental to meet the newly emerging and changing needs of pupils.

In conclusion, we are not suggesting these small case studies provide answers to complex well-documented educational challenges. However, we do suggest they evidence a steer for further multilevel thinking which pushes the boundaries of learning beyond the norms of the school classroom. There were many lessons learned as the cases evolved, which have provided us with useful feedback in refining ideas and practices. However, the need to bring about change, to transform attainment into a genuine sense of achievement for all learners through disrupting the status quo, and to grow hybrid forms of shared learning spaces, suggests a more radical approach to understanding learning spaces. As Massey (2005, p. 9) points out '*we recognise space as always under construction, always in the process of being made*'. Space is '*a product of relations-between, relations which are necessarily embedded material practices which have to be carried out*.' By challenging notions of learning spaces as static and seeing these as dynamic, emergent and participatory, then a relational understanding of space '*invites thinking and practising outside the well-established separations and divisions that currently define the learning space—education practice relationship*' (Mulcahy and Morrison, 2017, p. 751). The voices in our study, we believe, have outlined an unrecognised transformative agenda.



## 11. Taking Ideas Forward

Based on the research evidence and our key findings, we recommend:

- Build on the increasing awareness of life spaces in our COVID-19 world, ensuring that learning spaces are not limited to the physical, but are conceptualised by schools and universities as dynamic and integral to the quality of learning.
- Design Initial teacher education programmes to include the introduction and exploration of spatial literacies in primary and secondary schooling and their impact on learning for all pupils.
- Challenge student teachers to engage in learning space design as an overarching concept for developing Curriculum for Excellence e.g. by unravelling further the concept of shared learning across outdoor, indoor, and virtual spaces and experimenting with Architecture and Design Scotland's interdisciplinary toolkit<sup>5</sup> across a range of schools.
- Provide practical guidance on space design as inextricably connected to curriculum design, which demonstrates how design awareness can lead to curricula that meet all students' needs.
- Develop through partnership networks the use of multilevel participatory action research involving student teachers, early career and experienced teachers, pupils and educators to build a bank of case study materials based on manageable, 'here-and-now' resources (e.g. garden spaces).
- Disseminate key messages concerning the impact of spatial literacies in a COVID-19 world through practitioner research, professional reports, webinars and other means.
- Connect stakeholders (professional, academic and business communities) to ensure investment in rethinking learning spaces from a multilevel, interdisciplinary perspective to inform policy and practice.
- Conduct further longitudinal scientific research, supported by the Scottish Government, to carry out an exploration into the impact of shared spaces on learning, which is under researched and under-theorised (e.g. building on the innovative work in Australia and New Zealand).

---

<sup>5</sup> The toolkit is still in development and available upon request.

## 12. References

- Anderson, C., et al. (2017). How effectively are mainstream teachers prepared to meet the needs of learners for whom English is an additional language? In L. Florian, & N. Pantić (Eds.), *Teacher Education for the Changing Demographics of Schooling: Issues for Research and Practice*. Springer.
- Barrett, P. S., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of class-room design on pupils' learning: Final results of a holistic, multi-level analysis, *Building and Environment*, 89, 118-133.
- Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research, *Journal of epidemiology and community health*, 60(10), 854–857.
- Bergmann, M. et al. (2012). *Methods for transdisciplinary research: A primer for practice*. Frankfurt am Main: Campus.
- Berris, R & Miller, E. (2011). How design of the physical environment impacts early learning: Educators and parents perspectives, *Australasian Journal of Early Childhood*, 36(4).
- Black-Hawkins, K., Florian, L. and Rouse, M. (2007). *Inclusion and Achievement in Schools*. London: Routledge.
- Boddington, A. & Boys, J., (2011). *Re-Shaping Learning: A Critical Reader*. Sense Publishers: Rotterdam, Netherlands.
- Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Byers, T. & Imms, W. (2016). *Does the space make a difference? Anglican Church Grammar School, Empirical Retrospective of the impact of the physical environment on teaching and learning evaluated by the New Generation Learning Spaces Project (Technical Report)* DOI: 10.13140/RG.2.1.3720.1040
- Calabrese Barton, A., Tan, E., & Birmingham, D. J. (2020). Rethinking High-Leverage Practices in Justice-Oriented Ways. *Journal of Teacher Education*. <https://doi.org/10.1177/0022487119900209>
- Charmaz, K. (2006). *Constructing Grounded Theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: Sage.
- Chawla, L., Keena, K., Pevec, I., & Stanley, E. (2014). Green schoolyards as havens from stress and resources for resilience in childhood and adolescence. *Health and Place*, 28, 1–13.
- Christie, B., Higgins, P., King, B., Collacott, M., Kirk, K., & Smith, H. (2019). From rhetoric to reality: Examining the policy vision and the professional process of enacting Learning for Sustainability in Scottish schools, *Scottish Educational Review*, 51(1), 44–56.
- Clark, A. (2010). *Transforming children's spaces: Children's and adults participation in designing learning environments*. London: Routledge.
- Comber, B. & Nixon, H. (2008). Spatial Literacies, Design Texts, and Emergent Pedagogies in Purposeful Literacy Curriculum, *Pedagogies: An International Journal*, 3:4, 221-240.
- Coyle, D., & Al Bishawi, R. (2016). *The TePL Initiative*, Final Report, University of Aberdeen.
- Dewey, J. (1922). *Human nature and conduct: An introduction to social psychology*. Henry Holt and Company.



- Goodyear, P., Ellis, R. A. & Marmot, A. (2018). Learning Spaces Research: Framing Actionable Knowledge. In Spaces of Teaching and Learning. Understanding Teaching-Learning Practice in Ellis, R. A. & Goodyear, P. (eds) *Spaces of Teaching & Learning, Integrating Perspectives on Research & Practice*, 221-238.
- Gray, D., Colucci-gray, L., Donald, R., Kyriacou, A., & Wodah, D. (2019). From Oil to Soil. Learning for Sustainability and Transitions within the School Garden: a project of cultural and social re-learning, *Scottish Educational Review*, 51(1), 57–70.
- Green, M. (2014). Transformational design literacies: children as active place-makers. *Children's Geographies*, 12:2, 189-204.
- Green, M., & Duhn, I. (2015). The Force of Gardening: Investigating Children's Learning in a Food Garden, *Australian Journal of Environmental Education*, 31(1), 60–73.
- Grundy, S. (1987). *Curriculum: product or praxis?* Lewes: Falmer Press.
- Hand, V. (2012). Seeing power and culture in mathematics learning, *Educational Studies in Mathematics*, 80(1), 233–247.
- Haraway D. (1991). *Simians, cyborgs, and women: the reinvention of nature*. London: Routledge.
- Ivinson, G. M. (2014). Skills in motion: boys' trail motorbiking activities as transitions into working-class masculinity in a post-industrial locale, *Sport, Education and Society*, 19(5), 605-620.
- Kollor, I., Pilz, F., & Fisher, F. (2014) Why it is hard to make use of new learning spaces: a script perspective, *Journal of Technology, Pedagogy & Education, Vol 23 (1): Designing Physical & Digital Learning Spaces for the Future*
- Lampert, M., Franke, M., Kazemi, E., Ghouseini, H., Turrou, A., Beasley, H., & Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education*, 64(3), 226–243.
- LfS National Implementation Group. (2016). *Vision 2030+. Concluding report of the Learning for Sustainability National Implementation Group*.
- Massey, D. (2005). *For space*. London: Sage Publications.
- McCluskey, G. (2017). Closing the attainment gap in Scottish schools: Three challenges in an unequal society. *Education, Citizenship and Social Justice*, 12(1), 24–35.
- McIntyre, A. (2008) *Qualitative Research Methods: Participatory action research*. Thousand Oaks, CA: SAGE Publications, Inc.
- McNeil, J. & Borg, M. (2018). Learning spaces and pedagogy: Towards the development of a shared understanding. *Innovations in Education and Teaching International*, 55:2, 228-238.
- Mulcahy, D & Morrison, C. (2017) Re/assembling 'innovative' learning environments: Affective practice and its politics, *Educational Philosophy and Theory*, 49:8, 749-758.
- Mulcahy, D., Cleveland, B. & Aberton, H. (2015). Learning spaces and pedagogic change: envisioned, enacted and experienced, *Pedagogy, Culture and Society*, 23(4), 575-595.
- Müller, L. M., & Goldenberg, G. (2020). *Education in times of crisis: The potential implications of school closures for teachers and students*. Chartered College of Teaching.  
[https://my.chartered.college/wpcontent/uploads/2020/05/CCTReport070520\\_FINAL.pdf](https://my.chartered.college/wpcontent/uploads/2020/05/CCTReport070520_FINAL.pdf)
- National Research Council (2006). *Learning to Think Spatially*. Washington, DC: The National Academies Press.

OECD Report (2013). *Innovative Learning Environments*. <https://bit.ly/3dIEgT1>

Rubel, L. (2017). Equity-directed instructional practices: Beyond the dominant perspective. *Journal of Urban Mathematics Education*, 10(2), 66–105.

Salah, A. & Bista, K. (2017). Examining Factors Impacting Online Survey Response Rates in Educational Research: Perceptions of Graduate Students, *Journal of MultiDisciplinary Evaluation*, 13(29).

Scottish Government. (2017a). *Scottish Attainment Challenge*.  
<http://www.gov.scot/Topics/Education/Schools/Raisingeducationalattainment>

Scottish Government, T. (2017b). *Science, Technology, Engineering and Mathematics (STEM) Evidence Base*.

Sekayi, D., & Kennedy, A. (2017). Qualitative Delphi Method: A four round process with a worked example, *The Qualitative Report*, 22(10), 2755-2763.

Thompson, J., Windschitl, M., & Braaten, M. (2013). Developing a theory of ambitious early-career teacher practice. *American Educational Research Journal*, 50(3), 574–615.

Timeto, F. (2015). *Diffraction Techno-spaces*. London: Routledge.

UNCRC (2020). *The Committee on the Rights of the Child warns of the grave physical, emotional and psychological effect of the COVID-19 pandemic on children*. <https://bit.ly/31u0aHb>

United Nations (2020). Policy Brief: The Impact of COVID-19 on children, 15 April.  
<https://bit.ly/3dKUhrN>

White, M. P., Alcock, I., Grellier, J. et al. (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing, *Sci Rep*, 9, 7730.

Williams, R., Karousou, R., & Mackness, J. (2011). Emergent learning and learning ecologies in Web 2.0, *The International Review of Research in Open and Distributed Learning*, 12(3), 39-59.

