



Research Note

Outdoor learning: closing the attainment gap in primary schoolchildren in Scotland

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This Research Note compares the performances of 71 primary schoolchildren carrying out curricular tasks in outdoor and indoor classroom settings. By observing, recording and analysing how the children performed in group activities taken from the Scottish curriculum, an evaluation could be made of the relative merits of indoor and outdoor learning. In general, the results show that the outdoors environment had a more positive impact on individual and group performance than the indoor classroom. The effect of the outdoor setting on underachieving pupils was particularly notable, improving their engagement, contribution and self-confidence to match that of their peers. The results also indicate that the indoor classroom setting was less motivating, especially for those children with learning difficulties. By contrast, the richness of the outdoor setting provided an equitable learning environment where both younger and older children thrived, not only as a place where they were able to think creatively and work independently, but one where they could also learn how to collaborate and effectively solve problems with others in their groups. Furthermore, it helped them develop an appreciation of their own abilities and the natural world around them. Therefore, increasing the use of outdoor learning through national policy-making will support cognitive and social development in primary schoolchildren, and help close the attainment gap in Scottish education.

Introduction

An increasing amount of evidence suggests the benefits of natural outdoor surroundings for children, especially for their health and wellbeing. Some researchers attribute this to an innate human affinity for nature which may serve to motivate certain stages in child development. However, there are fewer opportunities for children to experience and interact with nature these days, and this has been implicated in a range of current issues concerning children including increased obesity, higher incidences of attention deficit disorder, as well as a reduction in environmental awareness.

Many educationalists believe that outdoor learning activities promote educational attainment, and certain studies conclude that natural outdoor settings can promote those cognitive factors which lead to attainment, in particular memory, attention and reasoning. Indeed, new studies suggest outdoor learning may impact significantly on school performance, supporting the idea that children are born with the capacity to learn from their natural surroundings. However, the current evidence is insufficient, and a framework is required to organise and explain findings.

This Note is based on a PhD research study entitled *Relationships between outdoor and classroom task settings and cognition in primary schoolchildren* (Hamilton, 2017), which

evaluated the impacts of indoor and outdoor classroom settings on the performances of primary schoolchildren carrying out curriculum tasks. This addressed the absence of empirical data in support of the benefits of outdoor learning, with particular regard to the Scottish Government's Curriculum for Excellence and national indicator to improve levels of educational attainment. The Scottish Government define children's 'early years' as the period between pre-birth and the age of eight (Scottish Government, 2008). It also fills a gap in research by focusing on the early years of primary school, when appropriate intervention can have a positive effect on long-term attainment.

The Curriculum for Excellence and outdoor learning in Scotland

The Scottish Government's Curriculum for Excellence (CfE) was introduced in 2004. Its aim is to ensure that children aged 3 to 18 learn all they need to equip them for life in the 21st century. This is achieved through educational experiences and outcomes which foster four key capacities in young people: successful learning, individual confidence, responsible citizenship and effective contribution. The CfE was designed to achieve a transformation in Scottish education through a more flexible and enriched curriculum which allows for the exploration of other approaches such as outdoor learning (Christie, Higgins and Nicol, 2015).

Children constructing 'toys' on a woodland task.



Creating a 'life-size' helicopter with moving parts.



In 2010, the Scottish Government published guidance for schools on implementing outdoor learning in support of the CfE (Learning and Teaching Scotland, 2010). Outdoor learning is a central part of the Learning for Sustainability element of CFE, which aims to build qualities that promote a sustainable and equitable Scottish society (Scottish Government, 2012). A key recommendation was to make outdoor learning a core part of the school curriculum, and provide all pupils with daily opportunities for learning and playing in nature all year (Scottish Government, 2013). The General Teaching Council for Scotland requires all teachers to use the outdoors for effective teaching and learning for registration (General Teaching Council for Scotland 2012). Learning outdoors in Scotland is also actively supported by a number of public and private sector organisations, including Forestry Commission Scotland, for whom the benefits of woodlands in terms of children's education, health and wellbeing, is a central theme of recent policies and strategies.

While there is increasing use of outdoor learning in Scotland, particularly by primary schools (Christie *et al.*, 2014), the national pattern remains variable (Mannion, Mattu and Wilson, 2015). The barriers include teachers' lack of confidence, health and safety concerns, the difficulties in getting children out of the classroom (Christie *et al.*, 2014), and a tendency to view outdoor lessons as stand-alone events (Christie, Higgins and Nicol, 2015). Advocates of outdoor learning highlight the need for a national policy, and for statutory and regulatory mechanisms to motivate and regulate quality provision (Higgins *et al.*, 2013). However, there is a lack of decisive policy commitment from the Scottish Government, which may be due to an assumption that outdoor learning is not a legitimate approach to delivering the formal

curriculum. Scottish research suggests that the decision to take children outdoors is often weighed against core curricular objectives (Ross, Higgins and Nicol, 2007). On several occasions, the present study also encountered teachers who felt tacitly discouraged from doing so by colleagues who may have felt it contributed poorly to school performance.

Policy drivers

Improving attainment is the Scottish Government's national performance indicator which relates directly to education, and it is currently a policy priority. Literacy and numeracy in primary schools has declined (Scottish Government, 2014; 2015), and Scotland's global ranking is below average compared to other countries (Audit Scotland, 2014). The attainment gap between achieving and underachieving populations is recognised as a particular challenge (Scottish Government, 2008). Scotland has the best educated population in Europe but the continent's third highest proportion of people with no academic qualifications (Herald Scotland, 2014), with a third of the population suffering from poor literacy and a lack of numeracy skills (Scottish Government, 2009). Underachievement varies substantially across different council areas and schools, and corresponds closely to levels of socioeconomic deprivation (Audit Scotland, 2014).

In 2017, the Scottish Government announced a new National Improvement Framework and Plan, which aims to deliver excellence in education regardless of social circumstances (Scottish Government, 2017). The National Improvement Plan emphasises the need for early intervention, which has consistently delivered educational benefits up to adulthood, with the largest gains seen in disadvantaged children (Barnett, 1995). The transition from nursery to primary school is also a critical policy focus for the Scottish Government (Scottish Government, 2008), in which strategies to promote pupil motivation and engagement are strongly recommended (Audit Scotland, 2014).

Evidence from theories and empirical research

The objective for the following review of supporting literature was to investigate theories and empirical research relevant to the development and performance of young children, with a focus on cognitive factors linked to both outdoor learning and attainment.

Developmental considerations

Starting school is a significant step for children throughout the world, when early experiences can determine long-term

academic success or failure (Fabian and Dunlop, 2007). Primary school education spans a period of cognitive development and consolidation, which has a complex relationship with formal learning (Piaget and Cook, 1998). Compared with older groups, primary schoolchildren display a wider variation in memory, language and metacognitive capacities, and may have a qualitatively different perception of the world. Outcome measures are difficult to establish because many children are pre-numerate and pre-literate, particularly those from disadvantaged groups susceptible to the attainment gap. These factors mean that educational research with children in their early years is recognised as a challenge (Fabian and Dunlop, 2007). A common developmental theme is that rich experiential learning provides the cognitive foundations for formal learning (Thelen, 1996).

Children and nature

Empirical support for the impacts of outdoor learning on pupil performance is increasing. Studies in Bangladesh (Khan, 2014), Denmark (Nielsen *et al.*, 2016), Germany (Dettweiler *et al.*, 2015), and the USA (State Education and Environment Roundtable, 2005), have each reported improved academic achievement, motivation and social interaction. Other research has noted positive impacts on cognitive factors associated with school performance, namely memory and attention (Dadvand *et al.*, 2015), and other factors such as physical activity (Lovell, 2009), wellbeing (Roe and Aspinall, 2011), and relationships with teachers (Raffan, 2000). Many interpreters attribute these effects to biophilia, the hypothesis that humans have an innate affinity for the natural environment. Some interpreters argue that biophilia is stronger in children (Kahn Jr. and Kellert, 2002), where it motivates developmentally significant interaction, most notably between the ages of 6 to 12 (Cobb, 1977; Bateson and Martin, 2000; Sobel, 2013). The decline in opportunities for children to engage with nature due to an increasingly indoor, technological, risk-averse culture (Guldborg, 2007; Wooley, Pattacini and Somerset-Ward, 2009; Playday, 2010) has been proposed as a reason for an increase in problems associated with poor school performance, including disruptive behaviour (Louv, 2010), attentional disorders (Halperin and Healey, 2011), and poor physical fitness (Higgins and Nicol, 2013).

Based on this review of the supporting literature, and making the assumption that children do have an innate affinity for nature, two viewpoints were proposed to test via the research study:

- The performance of primary schoolchildren on a curriculum task will be better in a natural setting.
- The performance of primary schoolchildren will improve as the natural richness of the setting for the task increases.

Methodology

Classes from three Scottish primary schools were split into groups matched in terms of numbers of boys and girls, and able and underachieving pupils. Each group performed a curriculum task outdoors, in either a wood or a playground, and then the same task again indoors in a classroom (or vice versa). Four different tasks were carried out: making a toy, building a den, conducting a puppet tour, and imagining an adventure on an alien planet. Each task was a forthcoming indoor lesson which the class teacher thought could also work outdoors.

In total, 71 pupils and four teachers participated in the study, taking part in the indoor and outdoor parts of one task each, and the follow-up interventions. The majority of pupils were early years' school starters with an average age of five and a half years. Thirteen were classified by their teacher as underachieving. Also included were 14 P6 children from one rural school with an average age of nine and a half years, who already had four-to-five years' experience of weekly outdoor lessons. Both of the teachers from the rural school had extensive outdoor teaching experience, while neither the teachers from the two urban schools had any outdoor teaching experience prior to the study.

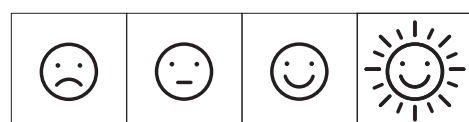
All of the settings were categorised using a 'Richness Index', which was refined from Forestry Commission checklists for evaluating the natural quality of outdoor sites for educational and funding purposes. In order of 'natural richness' from least to most, the tasks featured four classrooms, one playground, and two woodland settings.

Due to the young age of most of the children, formal testing was likely to be problematic, and therefore an exploratory approach to assessing performance was used. This approach presumed a positive relationship between environmental richness and those cognitive impacts relevant to attainment. Analysis and discussion was channelled by a theoretical framework which divided the tasks into four interrelated categories: the environment, the child's experience, the teacher's experience, and group performance.

There were three stages of task-data collection:

- 1 Task observations and outcomes.
- 2 A two-part questionnaire which took place six-to-seven months later. The questionnaire recorded free recollections, and task and setting preferences for nine performance and restorativeness criteria, expressed by pointing at a smiley likert scale (Figure 1);
- 3 Interviews with the teachers, which took place a month after stage 2.

Figure 1 Smiley likert scale.



'When we did the task indoors <I had good ideas>
'When we did the task outdoors <I had good ideas>'

Results

The results are divided into two parts: first, the general differences between the outdoor and indoor settings and, second, the differences between specific groups within a given setting. Results from the three stages of task-data collection are grouped together by performance or group related themes. How these results relate to the theoretical framework is analysed in the Discussion section.

General differences

Recollections

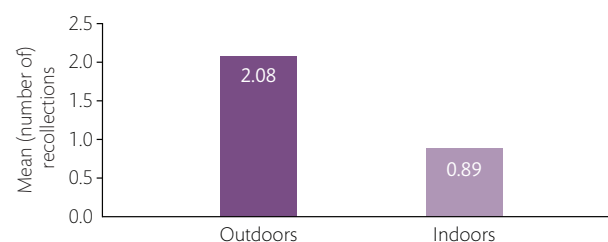
- The outdoor task was recalled in greater detail by children than the indoor task (Figure 2), and it was remembered first by 74.2% of the children.
- More was recalled about the woodland settings than the playground setting, implying the influence of the natural richness of the woodland settings.
- The experienced outdoor teachers reported stronger recollections as a characteristic of woodland lessons, and gave examples of how they utilise these to support classroom learning for underachievers:

'They'll pick out the things that they did in the woods over and above things that they did in the class and not just because it's less frequent.' Rural Wood Teacher 1

'Some of them don't get a lot of storybooks read to them so they don't have a great bank of knowledge but when they go out there it allows them to open up – it's giving them the experience to tell their story.' Rural Wood Teacher 2

- Children demonstrated explicit problem-solving and gave reflective observations in response to questions following the playground task, but not its classroom counterpart. This indicated that the knowledge they had gained outdoors was sufficiently robust for them to review internally.

Figure 2 Children's recollections: outdoors versus indoors.

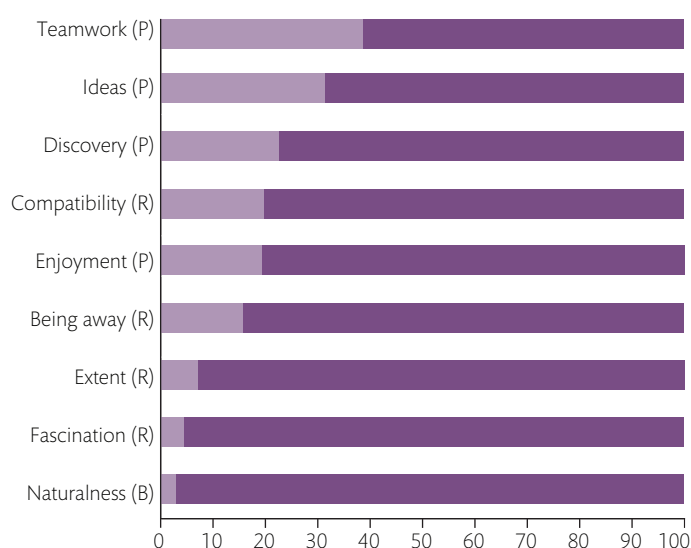


Note: survey group 36 children

Perceived preferences

Setting preferences and task ratings were significantly higher outdoors than in the classroom for each of the nine criteria statements designed to evaluate performance and the perceived restorative qualities of each setting. Figure 3 compares the children's setting preferences between indoors and outdoors for each of those nine criteria expressed as a percentage of the total number of responses. Other than the baseline measure, 'naturalness', the strongest outdoor preference was for 'fascination' (95.6%), and the weakest was for 'teamwork' (61.4%).

Figure 3 Setting preferences: indoor versus outdoor (% split for individual criteria).



R – Perceived restorativeness scale criteria, P – Performance criteria, B – Baseline criteria

■ Indoors ■ Outdoors

Note: survey group 71 children

Principle components analysis

Principle components analysis (PCA) of the children's setting preferences grouped the statistics into two components (Figure 4).

Autonomy

The foremost component of the PCA was named 'Autonomy' because it included three criteria – 'fascination', 'extent' and 'being away' – linked by statements detailing the restorative aspects of the children's experience, and which were most strongly related to the outdoors (Figure 4). Cognitive Evaluation Theory proposes autonomy to be the reason behind intrinsic motivation and natural development (Deci *et al.*, 1991), which seemed consistent with other findings from this study.

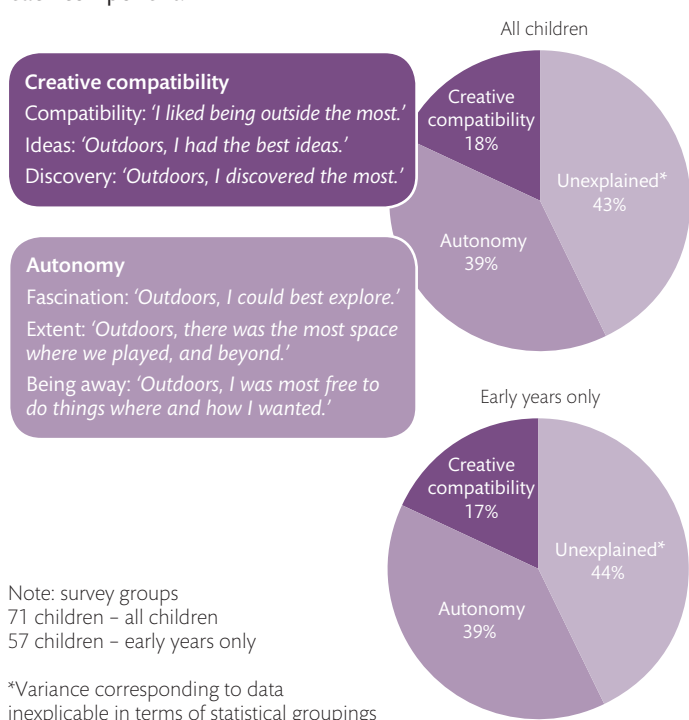
Greater perceived autonomy outdoors was also a core theme of the teacher interviews, during which it was linked to children's motivation, absorption and confidence.

'The freedom...in the classroom it might feel a bit more confined, or that there's a right or wrong. You know, it was very clear to them up there that this is completely creative and open, and so they just dived in and got on with it.'
Urban Wood Teacher

Creative compatibility and natural richness

The second component of the PCA was named 'Creative compatibility' because it included three criteria – 'discovery', 'ideas' and 'compatibility' – linked by statements describing the enabling elements of the children's experience (Figure 4). Creative compatibility and its associated criteria revealed an association with natural richness categories (Figure 5). For the discovery criterion, the differences were significant at every step.

Figure 4 Principal components analysis: % variance explained by each component.



For creative compatibility, the difference between woodland and playground settings was significant for both the early years and more experienced groups.

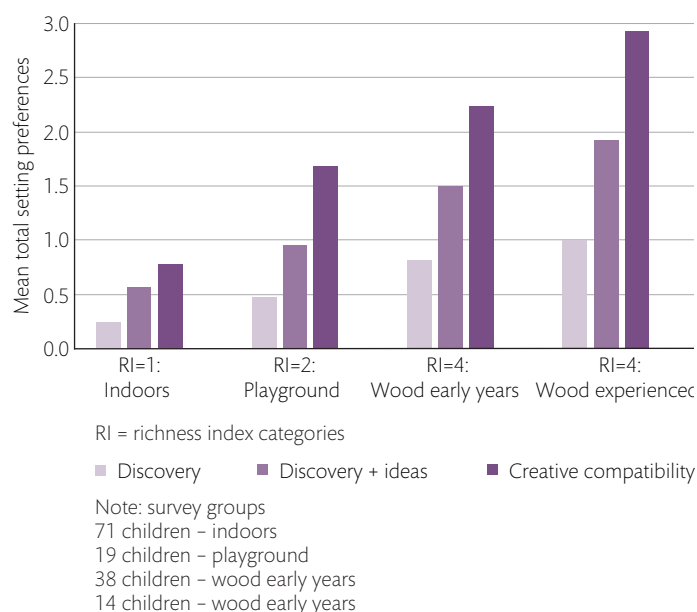
- Interviews with the teachers supported the belief that woodland promoted the value of new experiences and qualities of resourcefulness and compatibility.
- The greater diversity and creativity of the outdoor task activities was a general observation. For example, in the first ten minutes of the puppet tour task, 50% more categories of activity were recorded in the woodland than in the classroom, where activities were more commonplace and task-centred.

'Some of them enjoyed it (indoors) and they were showing the puppets around the classroom and developed little play things on their own. Others just moseyed around and didn't really find much to do, so the difference between them for that task was much greater...it was almost sullen for some of them in the classroom, or engaged. There were two types of mood in the classroom and just one big frantic mood (laughs) in the woods.' Urban Wood Teacher

Collaboration

- Children displayed more sustained teamwork outdoors. For example, while receiving identical instructions in both settings for the 'make a toy' task, one child on average worked with five classmates on three projects in the woodland, but in the classroom worked on only their own

Figure 5 Creative compatibility setting preferences versus natural richness.



production. 'Positive interdependence', or the idea that achieving personal goals depends on fulfilling the goals of collaborations, is more strongly associated with task recall, persistence, productivity and achievement than solitary working situations (Johnson and Johnson, 1989)

- During open-ended woodland tasks, children moved from working on individual projects to group projects, but showed the opposite trend in the classroom.
- Teachers observed outdoor collaboration to be less hierarchical and more productive, where children worked with different peers than they do typically in the classroom.
- When asked what they enjoyed most about the playground task, 23% of the children referred to teamwork, which none did for the indoor task.

'I think they all worked together really well...they all seemed a bit more equal...it wasn't clear who was the high achiever, they were all on an even playing field, and they all worked with people they don't normally tend to work with in the class naturally. I think that was the main thing.'

Urban Wood Teacher

Differences between specific groups

This section examines the differences between specific groups, namely, the underachievers, those children with outdoor learning experience, and the teachers.

P1 girls building a toy house together.



Underachievers

- They recalled significantly more about woodland tasks than their peers, and gave the most extensive recollections for both the woodland and playground settings.
- They rated the outdoor tasks higher for restorative qualities, implying that they may find classroom tasks to be more stressful than some of their classmates do.
- They showed no evidence when outdoors of typical classroom issues such as attention deficit disorder, shyness or misbehaviour. The inexperienced outdoor teachers noticed qualities, competencies, and potential for learning in these children which they had not seen before.
- Considered together, these observations could indicate children responding more positively to an enabling and empowering task in the outdoors setting, where the same children may feel at a disadvantage performing a similar task in the classroom in comparison to their peers.

Children with outdoor experience

- They returned task ratings and setting preferences that were significantly stronger for the outdoors setting, but weaker for the indoor classroom, than those of the early years' children. This indicates that the performance benefits of outdoor settings are applicable throughout all years of primary school.

'Ro was like a wee leader giving people instructions... Mn I remember as well, who was always very quiet in the classroom...and her and a few other girls made a car, and you know they were really pretending they were driving, so they just they came to life, their confidence was just brilliant...Ro, Sr, Al and Mn you know you saw them as new characters and I really do think you see their potential to see them do so well at something and enjoying it and being confident.' Urban Wood Teacher

Teachers

- They returned significantly stronger outdoor recollections, task ratings and setting preferences.
- They reported poorer restorative quality ratings for the indoor task than the children.
- In the classroom they felt a larger burden when managing tasks and displayed a more conventional, teacher-led approach.
- They enjoyed the outdoor tasks more and felt that their positive mood promoted better task performances.
- They all agreed children's task performances were better outdoors than indoors.

P1 girl plays outdoors.



Discussion

This section relates the results to the theoretical framework and provides a general picture of the relationships between settings and performances across outdoor and indoor tasks.

Theoretical framework categories

Environment

Analysis of the results signalled three qualities associated with the natural richness of the setting in children's superior outdoor performance:

- **Complexity:** the abundance of natural objects and materials – trees, sticks, leaves, mud and stones – and the range of different uses and interpretations these could be put to, provided a rich workshop for children's imagination and activities.

'The toys in the classroom slightly inhibited their need to use their imagination. Because the material was already there they didn't have to come up with an alternative in any way. Outside they had to use their imagination to come up with something to represent the material object, so I would say on that basis they were maybe limited slightly inside as to how much they could really use their imagination for the task.' Urban Playground Teacher

'Outdoors the thing was never going to look realistic so it begs for your imagination more. Whereas indoors they became concerned with making it look 'right', outdoors it's unlikely to ever really look right...you can have something actually quite a basic shape, but they're pretending it's a castle, or a car, or whatever, and they're enjoying using it.' Urban Wood Teacher

- **Novelty:** the natural environment continually offers up new resources, experiences and challenges. Novelty and challenge are both drivers of exploration and learning in the theories of environmental motivation and cognitive development (Berlyne, 1971; Thelen, 1996; Csikszentmihalyi, 2000; Kytä, 2003).

'Because we can go and search for things that we can't find in the classroom like a certain colourful leaf or a tree branch...if we had a classroom in the woods or we lived in the woods for me there would be something new every day.' Rural Wood Girl "Early Years"

'Because you get to like see new things.' Rural Wood Girl "Experienced"

'Because you learn new things.' Rural Wood Boy "Early Years"

- **Extent:** the quality of a natural space which helps to immerse the child in an activity and which can be incorporated into their creative constructions (Kaplan and Kaplan, 1989).

'In the classroom I don't think any of them used any stimulus as a part of the story unless it was something that was on the wall from our space topic, but when they were in the woods they actually used their environment within the story, they actually had tangible things to reimagine. Can you remember? Tunnels, castles, hidey places, dark places? They were building, they were actually creating.' Rural Wood Teacher 2

The children's experience

It is argued that the complexity, novelty and extent of the outdoor settings may make it easier for children to contribute to a task in ways which are personally meaningful, novel and challenging. These factors are drivers in theories of motivation where they are frequently associated with other results from

the study, for instance enhanced resourcefulness, attention, self-confidence and perceived autonomy. This interpretation supports the hypothesis that children from the ages of 6 to 12 are predisposed towards the natural environment as a route towards personal exploration and development (Cobb, 1977; Bateson and Martin, 2000; Sobel, 2013).

Group performance

Research also suggests that peer interaction in young children may require settings or materials which enable activities with shared meanings and goals, and that these are important for social development (Parten, 1932; Tomasello, 1995; Costantini and Sinigaglia, 2011). It is argued that the complexity, novelty and extent of the outdoor settings enable such activities, encouraging valuable contributions and the exchange of ideas. The self-organisation of tasks around activities which some children found most engaging could explain the tendency to move away from solitary activities outdoors towards group projects, and for children to work with different peers than when in the classroom. For some children, absorption in an activity may also cause a loss of self-consciousness or shyness (Csikszentmihalyi, 2000), further helping to encourage positive interdependence and a more equitable learning environment. Conversely, the breaking up of collaboration observed in the classroom could indicate that the indoor environment is less able to sustain group activities, and the larger burden teachers consequently feel reflects their need to compensate for this.

The teachers' experience

The same relationship with the natural environment described for their pupils is also believed to promote similar positive outdoor effects for teachers, including greater enjoyment, perceived autonomy and child-led interaction.

Memory

The enduring nature of children's outdoor task recollections, and their capacity to review and transfer the knowledge gained, could reflect the greater cognitive change they underwent as a result of a richer environmental and social experience. The levels of variables associated with deep memory processing were observed, or likely, to be higher in the outdoor task setting, including environmental compatibility, attention, sensory input, personal meaning and positive group controversy (Craik and Lockhart, 1972).

Novelty factor

Considering that most of the children were new to outdoor learning, it could be argued that the novelty factor affected the

results. There are two counterarguments to this: first, the most positive outdoor statistics were for those children who had already experienced outdoor learning and, second, there were no significant differences between the woodland statistics for early years' children, despite one of the early years' groups having already experienced a term of outdoor learning. The consistency of the results for early years' children from different schools across a variety of tasks suggests that the impact of setting had more influence than any other variable, including novelty.

Conclusions and recommendations

The study found that the outdoors setting with its natural richness promoted better task performance, and significant impacts on memory, motivation, attention and positive interdependence. Performance variations between the settings were mainly due to the capacity of each setting to enable and sustain personally meaningful activity. For example, the woodland setting could be viewed as a workshop which allowed children to determine their own learning goals and pathways within a task-centred context. The study demonstrates the fundamental importance of environment in producing the desired 'experiences and outcomes' in the CfE, and promises significant rewards for primary schoolchildren if acted upon.

The results and conclusions from this study are relevant to national educational objectives as follows:

- **The greater engagement of underachievers** suggests that early years' outdoor learning could improve pupil performance and help close Scotland's attainment gap through better achievement levels.
- **Richer outdoor recollections and their use as a classroom resource** indicates the capacity of the natural environment to produce stable and transferable task-centred knowledge, an important part of academic learning.
- **Capacity building** is improved through increased levels of 'individual confidence', 'effective contribution' and 'successful learning', each of which was stronger outdoors across different tasks.
- **Sustained motivation, attention and positive interdependence** were general characteristics observed at all the outdoor tasks, and each of these is a positive indicator of future attainment.
- **Enduring curricular benefits** were enjoyed by those children and teachers with prior experience of outdoor learning.
- **Outdoor teaching benefits** include more child-led interaction and opportunities to spend time with pupils who need more support.

Making toys in the classroom.



Based on these conclusions, the study proposes these five recommendations:

- **Outdoor learning should be used to provide support for underachievement:** The results indicate the potential of the natural environment to motivate and engage primary schoolchildren in learning. In particular, results indicate its capacity to support those who are underachieving or who have learning difficulties, by enabling their participation in schoolwork while providing them with rich learning experiences.
- **Outdoor learning should be provided for children throughout their primary school education:** The results suggest that the benefits of outdoor learning will endure throughout children's primary school education. Therefore, a clear Scottish Government policy commitment in support of outdoor learning would be advantageous, and would ensure that outdoor learning throughout primary school education becomes a prerequisite for satisfactory school inspection reports.
- **Outdoor learning should be used to create 'confident individuals', 'effective contributors' and 'successful learners'.**
- **Richness indices should be used to assess the quality of early years' task settings:** The natural settings and materials enabled better individual task performance and creative collaboration than either the indoor classroom or outdoor playground allowed. Therefore, providing a measurement of richness for each setting would help evaluate the capacity of each setting to deliver high-quality outdoor learning achievements.

Making toys in the woodland.



Next steps

- A larger study to clarify and validate the work in this Research Note.
- Further research to expand upon the natural richness of outdoor settings and explain how they provide educational benefits for primary schoolchildren through cognitive factors.
- Further research to understand how tasks and settings can be best configured to deliver national educational policy objectives.
- Further research which explores the impacts of indoor and outdoor classroom settings on the experiences and methods of primary schoolteachers.

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