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Wilderness Schooling: A controlled trial of the impact of an outdoor education programme on attainment outcomes in primary school pupils

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Gaps in education attainment between high and low achieving children in the primary school years are frequently evidenced in educational reports. Linked to social disadvantage, these gaps have detrimental long-term effects on learning. There is a need to close the gap in attainment by addressing barriers to learning and offering alternative contexts for education. There is increasing evidence for beneficial impacts of education delivered outdoors, yet most programmes are un-structured, and evidence is anecdotal and lacks experimental rigour. In addition, there is a wealth of social-emotional outcomes reported yet little in the way of educational attainment outcomes. The current study explores the educational impact of a structured curriculum-based outdoor learning programme for primary school children: 'Wilderness Schooling'. A matched-groups design: Wilderness Schooling (n=223) and conventional schooling (n=217), was used to compare attainment data in English reading, English writing and maths, collected at three time-points: Pre- (T1) and post-intervention (T2) and at a 6-week follow up (T3). Data show that children in the Wilderness Schooling group significantly improved their attainment in all three subjects compared to controls. Trajectories of impact indicated attainment continued to increase from baseline in the following weeks after the intervention concluded. These results allow the case to be made for the core curriculum to be conducted outdoors to improve children's learning. However, it is important to consider that there are likely to be various components of the intervention that could form a theory of change essential to reported outcomes.

Keywords: education; outdoor; attainment; deprivation

Introduction

In the UK, as in other developed countries, there is an increasing interest in evidence-based or informed practice as a means of improving the experience and outcomes of children. This has long been a feature of healthcare provision but over the past decade has come to the fore, as witnessed by the development of the Campbell collaboration (www.campbellcollaboration.org/), the What Works

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Clearinghouse (www.w-w-c.org/) and the educational corollaries of the Cochrane Collaboration (www.cochrane.org). Recent years have seen the development of the Education Endowment Foundation (EEF) (educationendowmentfoundation.org.uk/) and the Early Intervention Foundation (EIF) (www.eif.org.uk/), the former funding randomised trials of educational interventions and the latter disseminating the best available evidence in a number of domains to the commissioners of service in the education, health and social sectors. While the principles of evidence-based practice have been accepted in many areas of education, they are not universally accepted (Clegg, 2005). A number of systematic reviews have been published focusing on specific outcomes, for example speech and language (Law *et al.*, 2003) or mental health (Adi *et al.*, 2007). However, one of the key issues not yet addressed is whether interventions can be shown to reduce educational inequalities. Indeed, the EEF cites its primary objective as being 'dedicated to breaking the link between family income and educational achievement, ensuring that children from all backgrounds can fulfil their potential and make the most of their talents'. Educational attainment gaps between children during primary school years are frequently evidenced in Department for Education reports (www.gov.uk/government/publications) referencing stark differences between high and low achievers. Gaps in attainment are closely linked to social disadvantage, including rates of Education Health and Care Plans (EHC), Free School Meals (FSM) and degree of area deprivation and poverty. In addition, gaps in attainment are associated with Special Education Need (SEN), and these difficulties impact on children's long-term attainment throughout primary school and secondary school. In 2015, a gap in achievement of 44.9 points between pupils with and without special educational needs was reported (DfE, 2015). The North East of England has one of the most unequal educational achievement profiles between key stages of education, and the achievements of 16-year-olds overall are among the lowest of any region (DfE, 2016). Government and local authorities in the North East of England place raising the attainment of disadvantaged pupils as a priority for the future, supported by the release of Pupil Premium funding (Office for Standards in Education, Children's Services and Skills, 2014). Indeed, the North East of England has recently become a focus of the EEF's Primary Literacy Campaign (educationendowmentfoundation.org.uk/campaigns/north-east-literacy-campaign/), which has a view to addressing these issues. A report from the National College for Teaching and Leadership (NCfTL, 2014) describes good practice in closing the gap that includes the themes of addressing the barriers to learning, building resilience and improving literacy. The report also highlights the effectiveness of multi-sensory approaches (pp. 8–10) using kinaesthetic resources in small group settings. The research base of the toolkit for schools developed by the Education Endowment Foundation and the Sutton Trust (educationendowmentfoundation.org.uk/toolkit/toolkit-a-z/) describes the most effective strategies for raising the attainment of disadvantaged pupils as those involving collaborative learning, feedback, mastery, meta-cognition and self-regulation. Most teachers and school leaders will recognise the challenge of translating these findings into realistic whole-class and whole-school strategies that remain distinctive and effective in the context of a highly pressured environment. For example, intervention strategies for English and maths outlined in the National Literacy and

Numeracy Strategies (UK) guidance (DfES, 2002) set out protocols in tiers of (a) differentiation of taught material, (b) small group support and (c) individual focus, without any guidance on the approaches mentioned above. There is, therefore, good reason to suggest that a new presentation of the curriculum (one that prioritises evidence-based approaches to narrowing the attainment gap) would do better outside the school context, in the outdoor environment.

The place of the outdoor environment as an alternative context for wider education is increasingly accepted by schools across the UK, but evidence is equivocal on the matter of whether the outdoor context is a decisive factor in raising school attainment. Currently, a range of initiatives are offered to both primary and secondary schools in and out of school time (Rickinson *et al.*, 2004), and these represent a spectrum of learning programmes from those that are tailored towards educational topics and the core curriculum, and broader programmes using the natural environment as a context for experiential purposes, engagement and socio-emotional wellbeing. Outdoor learning programmes vary in delivery time, with most programmes lasting from a few hours to a full day; others such as forest or residential programmes last multiple days. Therefore, with such variability, there is little consensus on what defines an outdoor learning programme, and a corresponding lack of clarity on what the elements of an effective programme are. Increasing interest in the educational and therapeutic possibilities of the natural and outdoor environment has resulted in varied attempts to produce meaningful outcomes on measures of education and mental health (Neill, 2003). In October 2015, the Blagrave Trust released a report of existing evidence about the effectiveness of outdoor learning. The systematic and meta-analysis studies included in the Blagrave Report each point towards a wealth of socio-emotional wellbeing outcomes, including health and self-esteem (Hattie *et al.*, 1997; Higgins *et al.*, 2013), self-awareness, self-responsibility and teamwork (Neill, 2008), curiosity, relationship with nature and leadership (Rickinson *et al.*, 2004). However, the same multiple areas of wellbeing are reported across the majority of studies, and evidence is repeated amongst systematic reviews rather than strengthened by supporting research. It was further highlighted that there is little in the way of educational curriculum-based outcomes within existing the literature. In addition to outcomes reported in the Blagrave Report, existing evidence for the positive impact of outdoor education is anecdotal and lacks experimental rigour, as opposed to quantitative measurement of effect (Randler *et al.*, 2005; Bowker, 2007; Hamilton-Ekeke, 2007; Karpinnen, 2012; Christie *et al.*, 2014). Adding to this, and as stated above, the majority of outdoor programmes are delivered on single, sporadic days rather than consecutive multiple days, owing to restrictions on travel and costs faced by schools. Yet one clear outcome of the Blagrave Report is the greater value of longer interventions; 'overnight and multi-day activities had a stronger effect than shorter ones'. The literature surrounding outdoor education for children is therefore weak in experimental design and measurement, and outcomes are limited by qualitative report bias. In addition, although evidence supports the increase of children's learning through outdoor experience, there appears to be little in the way of targeted delivery of core curriculum areas and comparative assessment of pre- and post- intervention impacts or long-term impacts on children's educational attainment. There is, therefore, a gap

in outdoor learning research for more rigorous experimental investigation of the impact of outdoor learning on academic attainment.

Currently, there exists no agreed theory for how the outdoors may improve children's wellbeing and/or academic attainment. An appropriate theory of change must accommodate factors contingent to the intervention whilst also considering the impact of confounding psychological effects of observation, selection and expectation—including the 'Hawthorne' (French, 1953) effect that simply being studied causes improved performance, the 'Pygmalion' effect (Rosenthal & Jacobson, 1968) where teachers' expectations of pupils can strongly affect the amount of development they show, as well as placebo and generalised participation effects (Draper, 2016). The potential for increased academic attainment using the outdoors may be influenced by several 'active ingredients' or components of the Wilderness Schooling (WS) programme that form an explicit programme theory of how the intervention may lead to a chain of intermediate results and to the intended outcome, increased attainment (Funnell & Rogers, 2011). Components that differ from conventional classroom-based learning include group size, teacher approach, curriculum presentation, curriculum application, the outdoor context and selection effect. The outdoor environment has unique characteristics and is richly resourced in materials that can be used as tools for learning. It is multi-sensory, enabling learning to take place through engagement of the senses—sight, touch, feel and smell. Carried out in group-work, outdoor learning increases the opportunity for peer-to-peer cooperative learning, which has a wealth of evidence for efficiency in improving children's academic achievement, peer relationships and self-esteem (Slavin, 1990; Zammuner, 1995; Terwel *et al.*, 2001). There is a suggestion that children's metacognition (their knowledge, awareness and control of their learning processes) is improved in outdoor learning, as the outdoor context encourages them to 'learn to make decisions, solve problems and grow in confidence in their own abilities outdoors… they will make predictions about what may happen based on their previous play experiences and test out these ideas and theories' (EYFS, 2007). The components of WS which could act as ingredients for change will be addressed in greater depth in the discussion.

Alternative components of interventions based outdoors mean it is potentially well placed to address the underachievement of children in classes where the difference in attainment is a marked characteristic. Such an intervention would need to integrate three elements: the environment, styles of delivery shown to be effective and the core curriculum in maths, science and English. The latter being the way attainment is measured in English schools. Being effective in addressing underachievement means being clear about which pupils in which schools to target; low attainment is predicted by prior achievement, socio-economic class and special educational needs (Dunne *et al.*, 2007). Such constraints increase the likelihood of children underperforming in school, even where there are exemplars of achievement and a culture of high expectation. Despite variability in attainment scores being a feature of most schools, schools in areas of low socio-economic status (those with high rates of SEN and a high disparity between the attainment levels of pupils) will be where an intervention would seek to be effective. Finally, because of the predictive effects of low attainment, it makes sense that intervention is implemented at an early stage where pupils are able to be

formally graded according to attainment. This grading will first happen in Key Stage 1, but patterns become entrenched in the years leading up to the Year 6 SATS.

The current study

The current study explores the effectiveness of an outdoor education programme for primary school children (aged 8–11 years) called 'Wilderness Schooling' at improving educational outcomes (in English reading, English writing and maths). Designed for the current study, the WS programme aims to target children's underlying cognitive mechanism for learning, making use of 'active ingredients' for learning that differ from conventional classroom-based learning. The key research question for the current study is: *Does Wilderness Schooling improve educational attainment in children aged 8–11 years old compared with conventional schooling?*

The study extends existing research in the following ways:

- The education programme is targeted towards core curriculum areas.
- Assessment includes measurement of attainment at pre-, post- and follow-up time points.
- The study employs a matched-groups design to enhance interpretation.

Methodology

Design

A matched-groups design was implemented, whereby one group received the WS intervention and a comparison group remained in school and received conventional classroom-based learning.

Recruitment

Schools were approached for participation in the project via an email sent to the school's head teacher from the project lead. The email detailed that the project aimed to recruit around 30 children (per school) aged between 8 and 11 years old to investigate the impact of a six-week outdoor learning programme on children's educational attainment progression. Schools were informed that participation would involve the selection of children who would be allocated into either the six-week WS outdoor learning programme or a comparative control group who would receive conventional schooling with the curriculum delivered as normal by a teacher in the classroom. In addition, schools were informed that taking part in the study would involve the collection of educational attainment data in English reading, English writing and maths at three time points: pre-intervention (T1), post-intervention (T2) and at a follow-up time point six weeks after the WS programme (T3).

Group assignment

Children were assigned to either the WS group or the control group by their teachers. Teachers were asked to divide their class of 30 children as evenly as possible into two

groups. In classes that were smaller than 30 children, teachers were told to divide the class as evenly as possible. In dividing their class, teachers were also asked to place as even a number of males and females in each group as possible. WS groups were therefore half the size of a conventional classroom group size (15 children per group as opposed to 30 per group). One half of the class was assigned to group 'A', which represented the WS group, and the other half was assigned to group 'B', the conventional schooling control group. Teachers were blind as to which group, 'A' or 'B', represented the WS or control condition. There was no cross-school mixing of groups—each school recruited completed WS individually. Groups from each school were also children of the same age, as they had been selected from the same year group class. A baseline assessment of attainment was then carried out to ensure that both groups were comparable in ability. The results of this are reported below.

Ethical considerations

The intervention team were guided in appropriate methodological design, permission protocols and every aspect of school and pupil contact by the British Educational Research Association's ethical guidelines (https://www.bera.ac.uk/wp-content/uploads/2014/02/BERA-Ethical-Guidelines-2011.pdf). In applying these guidelines with schools, care was taken to obtain informed consent within the normal school procedures for additional educational activities. This involved the distribution of project information letters and consent forms (co-written by each school's head teacher and the research team). These documents informed parents about what the project involved and that any data collected would be kept confidential through a unique ID. In addition, parents were made aware that they could opt out at any time. Parents were asked to provide written consent for their child to take part. No parent asked for their child to be excluded from the programme. Risk assessments were conducted for every set of school visits, and programme delivery was conducted to the professional standards set out in the WS Child Safeguarding Policy.

Participants

In total, nine schools were recruited into the WS project. There was a total of 223 children in the WS group, and 217 in the conventional schooling control group. There were 218 males and 222 females. Table 1 displays the number of children

Table 1. Number (*n*) of children receiving WS and conventional schooling within each cohort

Cohort	Number of schools recruited	WS (*n*)	Conventional schooling (*n*)
1	2	36	38
2	2	38	39
3	4	53	53
4	6	96	87
Total	9*	223	217

*Some schools in more than one cohort.

recruited into each cohort, and Table 2 displays the proportion of free school meals within each school.

Tables 1 and 2 show that the numbers of children across schools and groups were relatively evenly distributed. The proportion of free school meals in each school varied, however. Two of the schools had FSM rates slightly below or above the national average of 15.6% (DfE, 2015). Three of the schools had much higher rates (>60%.) The degree of deprivation across recruited schools was therefore mixed.

Baseline attainment levels of the WS and control groups

Educational attainment data in English reading, writing and maths were collected for children in both groups prior to the start of the intervention (Time 1/T1/baseline time point). These data were used not only to track progress over the course of the intervention, but also to compare children's abilities to ensure both groups were appropriately matched on ability. Obtained from school teachers, these data were naturally occurring 'level' scores. Children at Key Stage 2 were expected to have attainment scores at Level 4 (equal to 25 in numerical value) or above. Mean scores for the current groups of children showed that children were on average scoring below this expectation (ranging from 22.05 to 22.91, Table 3). This therefore confirms that targeted schools included children whose attainment was lower than expected for their age, perhaps affected by constraints of social deprivation. However, groups were comparable in their attainment across all subjects at baseline and were not statistically different from each other. This indicated that the groups were successfully matched on ability.

Table 2. Proportion of free school meals within each school

School (1–9)	Cohort(s)	Proportion of free school meals (%)
1	1	49.0
2	2/3	18.2
3	3	69.2
4	3/4	27.3
5	4	12.3
6	4	19.4
7	4	32.1
8	4	68.0
9	4	73.5

Table 3. Mean attainment scores at the pre-intervention (T1 baseline) time point in English reading, writing and maths for both groups

Curriculum area	WS	Conventional schooling
Reading	22.13	22.91
Writing	20.05	20.68
Maths	21.74	21.50

Procedure

Children who had been chosen to receive WS visited a National Trust site one day a week for six consecutive weeks (36 hours in all for each child), whilst the comparison conventional schooling group remained in school during these six weeks with no additional intervention. After the WS programme, schools were contacted by email to collect post-intervention (T2) attainment data. Six weeks after the end of the WS, schools were again asked to provide final follow-up (T3) attainment data.

The WS outdoor programme

Wilderness Schooling is a manualised programme of lesson plans and activity resources to guide a programme of curriculum delivery lasting six days. Each WS programme is delivered by two Wilderness Practitioners (WPs), one of whom is a qualified primary or secondary school teacher and the other an assistant. The WPs were recruited in response to an advertisement in the North-East press that invited applications from teachers and assistants with interest and experience in working outdoors with children. Following shortlisting and interviews, a small group of teachers and facilitators was given two days of training in the WS delivery materials.

During WS intervention days, children took part in several different tasks outdoors. Days were structured to each have an individual curriculum flavour; two days were science days, two English and two maths. Curriculum content had been agreed with the class teacher and pitched at the appropriate differentiated level. A typical structure for the day would be as follows. Introduction to the day with circle-time activities to promote group bonding. Identification of a curriculum question, leading straight on to tasks invariably conducted outdoors—searching, gathering data, measuring or collecting experiences and sense-impressions in note form. These data (whether maths, science or English) were then applied to the curriculum question and the learning formalised in a written record. This process might continue beyond lunch, after which the children are taken outdoors for creative expressive time that might include a presentation of group learning from the curriculum task. Campfires, storytelling and art activities all feature. Tasks were delivered by two WPs. A staff member from the school—the children's teacher—was also present during WS days.

The WS days focused on either maths, science or English, with activities structured in a consistent way throughout the programme. On arrival the group was greeted and taken to an indoor learning space where cooperative and competitive games were played prior to the introduction of the learning tasks for the day. These games involved sharing experiences—useful for group bonding and rule enforcement (in the sense that they provide an applied setting for addressing negative comments and activity-wrecking behaviours). The curriculum tasks were set up as a problem to be solved through the collection of sense-data objects and measurements in the natural environment. This data-gathering to inform a hypothesis or illuminate a question was conducted in groups of five children working with an adult for the rest of the morning. Returning for lunch, the groups then worked on a presentation of their data as a response to the problem posed in the morning. The entire group then made their way to an outdoor space, where the children sat around a campfire and made group

presentations. Children who were not assigned to WS received conventional schooling, therefore on intervention days these children remained in school and did not complete any outdoor learning activities.

Analytical approach

The analysis of attainment scores was carried out by a researcher who was blind as to which group, 'A' or 'B', was the intervention group. Each child in each group was assigned a unique ID code; this was placed into an Excel spreadsheet, against which data would be entered. Attainment scores for each child were entered into the spreadsheet and group mean scores at each time point, as well as changes in scores over time (gain scores), were calculated. Attainment scores were tested for normal distribution using the Shapiro–Wilk statistic in SPSS version 22 and were found to be skewed (p=0.000). As data were non-parametric, a Mann–Whitney U test was used to test group differences in educational attainment gain scores (T1–T3). Gain scores were chosen to be used in statistical analysis to test progression in attainment over the course of the delivery, whilst also taking into account between-group differences in attainment level at the T1 baseline. In addition to statistical analysis of group differences, mean attainment scores in all three subjects were plotted onto graphs to establish the trajectory of progression of ability over the three time points; pre-intervention (T1), post-intervention (T2) and follow-up (T3). This allowed for examination of the pattern of improvement in attainment; whether there were any noticeable 'spikes' in the data, or whether improvement was more gradual.

Results

Table 4 displays the mean change in attainment scores (between T1 and T3) for both the WS and conventional schooling groups, and results of the Mann–Whitney U analysis alongside confidence intervals.

Table 4. Mean change in attainment between T1 and T3 time points for WS and conventional schooling (CS) groups, standard deviations (SD), Mann–Whitney U significance value and 95% confidence intervals (CI)

Curriculum area	Change score T1–T3 (SD)	Mann–Whitney U significance value	95% CI
Reading			
WS	4.30 (2.94)	0.000	1.49, 1.95
CS	1.39 (1.93)		
Writing			
WS	2.70 (1.62)	0.002	1.41, 1.69
CS	1.37 (1.47)		
Maths			
WS	3.45 (2.11)	0.047	1.61, 1.98
CS	2.21 (1.82)		

Observing the mean and change-over-time scores, there is a notable improvement in the performance of the intervention group compared with that of the control group, particularly in English reading. Statistical analysis indicates that the gain in mean scores in the intervention group was significantly different from controls across all three core subjects. As stated above, groups were comparable in attainment at baseline. These outcomes are therefore most likely to be attributed to the impact of the intervention, rather than differences in children's educational learning ability.

Trajectories of impact across time

Figures 1–3 indicate that although both groups improved in ability over time, the steeper incline of scores for the WS group indicates that these children improved at a faster rate than the control group, most noticeably in English writing. Importantly, there were no 'spikes' in the data where children declined or 'levelled off' in attainment immediately after the intervention (T2). Instead, patterns show a consistent increase in scores. This suggests that WS may have had a beneficial impact on children's long-term learning.

Discussion

The key research question for the current study was: *Does Wilderness Schooling have a positive impact on educational attainment in children aged 8–11 years old compared with conventional schooling?* The results indicate that children who participated in the WS outdoor learning programme increased their attainment in English reading, writing and maths significantly more than children who received conventional classroom-

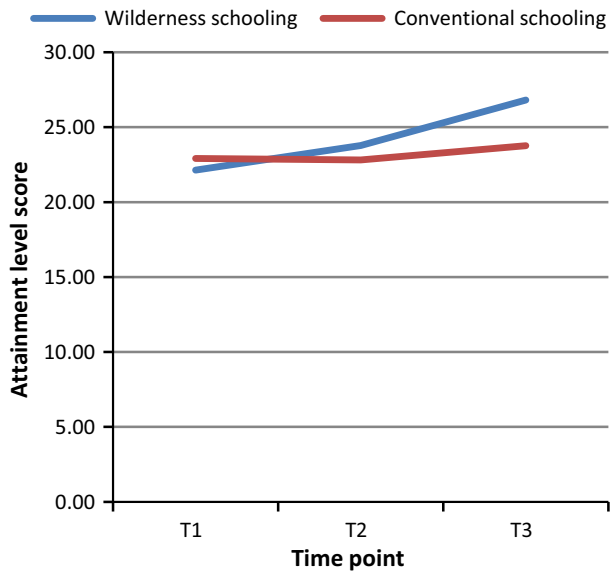

Figure 1. Mean attainment scores across pre-intervention, post-intervention and follow-up time points in English reading for both groups. [Colour figure can be viewed at wileyonlinelibrary.com]

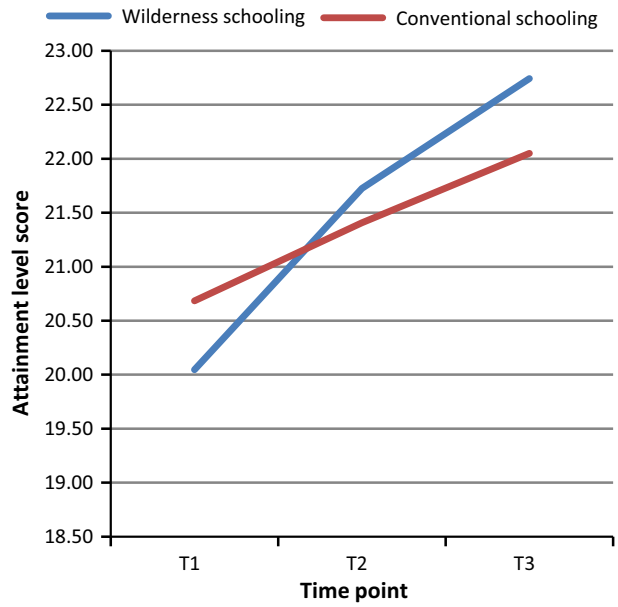

Figure 2. Mean attainment scores across pre-intervention, post-intervention and follow-up time points in English writing for both groups. [Colour figure can be viewed at wileyonlinelibrary.com]

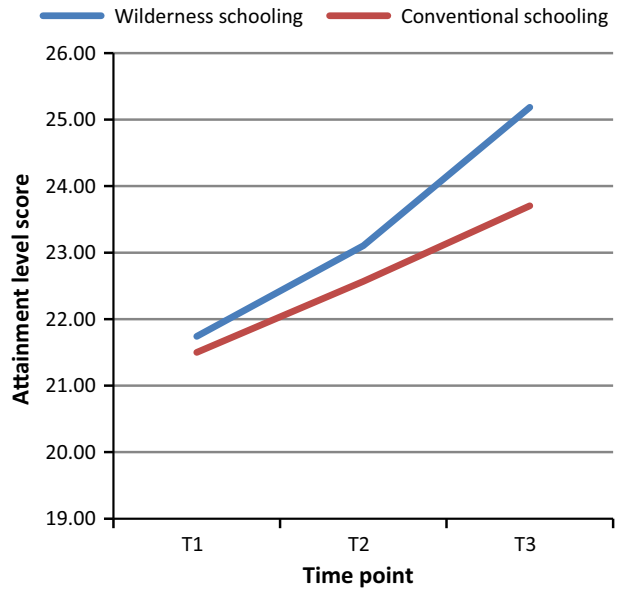

Figure 3. Mean attainment scores across pre-intervention, post-intervention and follow-up time points in maths for both groups. [Colour figure can be viewed at wileyonlinelibrary.com]

based schooling. Of particular interest is the uniformity of the attainment gains: in each curriculum area, the data show children in the intervention group learning at a faster rate than the controls, evidenced by greater increments of scores over time. A comparison of mean scores between the pre-intervention and follow-up time points

shows notable progress, particularly in English reading, for WS children. In addition, this progress in learning appears to continue longer term; where we may expect 'spikes' in attainment data at the post-intervention time point, and perhaps for increments in attainment to diminish or 'level off' again when children return to the classroom, data indicates the contrary. Increased learning appears to carry on beyond the WS intervention.

The uniformity of these data is striking and the statistically significant difference between gains in WS and conventional schooling groups suggests a robust benefit for those participating in the WS sessions. However, in common with all benign social interventions, and as mentioned above, any theory of change must accommodate factors contingent on the actual intervention: as well as the novel presentation of curriculum material and the practical application to the outdoor environment, there are the confounding effects of observation, selection and expectation (Draper, 2016) that must be controlled or accounted for when establishing causal links between educational benefit and programme content. In the first instance, this study's controlled methodology (that ensured parity between WS and conventional schooling participants at baseline) mitigates against confounding variables. Further clarification of the causal links suggested by the study might be achieved by isolating WS components (group size, outdoor setting, practical application of curriculum, pedagogic approach, formative feedback) from non-content components [teacher charisma, selection effects, Hawthorne effects, general participation effects (Draper, 2016)] for discussion, with possible implications for future research.

Wilderness Schooling is a complex social educational intervention in the sense that there is no restriction on the programme in applying effective approaches to engage and deliver benefit to children within the parameters of an outdoor delivery of the curriculum. However, the components of WS are in line with best practice outlined in the National Literacy and Numeracy Strategies (UK) guidance for intervention strategies (DfES, 2002), which specify the importance of differentiation of taught material, small group support and individual focus, and while the outcome gains reported here can rightly be attributed to a systematisation of accepted good practice (with accompanying logic models and theory of change), the striking differences between the groups and their perseverance over time suggest additional factors at play.

For instance, it is considered essential that the WS group sizes are smaller than conventional classroom sizes (15 compared with 30, respectively). This creates the opportunity for increased engagement from the children (with less distraction from peers and more focus on the teacher), as well as opportunities for scaffolding to occur between peers, enabled by the free-roaming, practical nature of WS. In addition, smaller group size is likely to lead to increased attention from the WS teacher and facilitator, with increased opportunities for direct interaction and the experience of being valued as a contributing member of the group. The small group setting gives WPs a context for formative feedback, with high levels of positive reinforcement focusing on children's strengths and building competencies directed to each individual child on a personal level. Working with a full class, it is a reasonable assumption that these methods of enhancing learning are not as prevalent in school as in WS, however, group size alone as an explanation of current reported results is insufficient.

The presentation of the curriculum in WS is also different from classroom-based presentation, taking on a much more practical and interactive approach. Children have a greater opportunity to actively participate in learning, and share their thoughts, ideas and reflections with their peers as well as the WS teacher and facilitator. Therefore, the application of the curriculum occurs in an environment where children can roam and interact; they are freed from the confinements of a classroom desk, which may hinder and present as a barrier to peer interaction and the sharing of ideas. Most notably, the WS programme differs from conventional classroom-based learning in context; it is situated outdoors. The constant intention of the WS teacher is to ground maths, science and English in the practicalities of the outdoors, and in doing so, to provide another means through which curriculum material can be represented internally by the child in a learning process. This is another way of learning, aimed to activate the kinaesthetic and multi-sensory factors highlighted by existing research and reports as effective (NCfTL, 2014). Placing children in the outdoors for learning allows for increased engagement of the senses—engaging sight, sound, smell and touch. This may allow for more attentive, and richer, learning.

The WS teacher and facilitator are significant factors in delivering programme outcomes, with the possible implication that the WS effect is in fact a teacher effect. However, the extent to which WPs have skills in some way more advanced than their school-based colleagues is not established: they were recruited from the same pool as school staff and selected for experience and/or enthusiasm for working outdoors with children, not for any 'outstanding' teaching qualification. WS teachers are an integral part of the intervention: in education, the teacher is a major cause of learning (as opposed to medicine, where measurements are of the 'treatment' regardless of who administers it), but there is no reason to expect variations in personal style and charisma amongst teachers to differ amongst WPs. It is more likely that the context (small groups, etc.) facilitate the sort of open and exciting learning that energises teachers of all sorts.

Finally, the WS programme outcomes are potentially confounded by the effects of participation and observation as summarised by Draper. While it is true that children are likely to feel excited at being selected for WS (and have a sense of being 'special', so they turn up to WS excited, happy and ready to learn, and this effect will not be present in the conventional schooling group), the same could be said for any out-of-school experience that includes a subset of the population of a year group, in which case you might expect this effect to be substantiated by published evidence and systematically used to increase attainment in school. As it is, the evidence for Hawthorne, Pygmalion, placebo and generalised participation effects in education is inconclusive (Draper, 2016); indeed, the recent Blagrave Report struggles to find any effect of school trips to the outdoor environment on attainment. Given the methodological design, and overall attention in the reported study to controlling extraneous variables, it is reasonable to argue that factors of participation are not as strong as the components of WS in affecting academic attainment.

As highlighted above, currently there is little in the way of curriculum-based outcomes in the existing outdoor-learning research literature, and many studies are weak in experimental design, lacking experimental rigour and relying on anecdotal report data as measurement of effect. Obtaining such positive educational outcomes based

on quantitative data, the use of a comparative control group therefore bridges these gaps and represents strengths in the current methodology. That both groups were shown to be comparative at baseline in their attainment indicates that potential selection bias from teachers was not a confounding factor. The concurrent validity of the attainment data is, in addition, considered to be high; the scores taken from standardised tests and therefore not subject to reporter bias. It was also identified that the majority of existing outdoor programmes are delivered in single days, yet the Blagrave report indicates the greater value and impact of multiple-day delivery. The six-day structured WS programme supports this and has demonstrated that multiple-day delivery not only allows for significant change in children to occur, but for this change to be reliably captured (in comparison with cross-sectional report data). A particular strength of the WS programme is its ability to improve the learning of children who are underachieving at school. However, the programme has been shown to be beneficial to children of all ability—those regarded as underachievers as well as high-achievers—as well as to children of all ages between 8 and 11 years old. These aspects are strengths of the WS programme, since they demonstrate that the programme is beneficial to the majority population of upper-primary school children; it is not limited to children with specific characteristics or abilities, yet has the potential to help underachievers increase their attainment levels. Future analysis of current data may involve the exploration of whether outcomes may be differentiated between low-attaining children or already high-attaining children, or by degree of school deprivation. In addition, the current data does not allow us to measure which of the numerous components of WS contribute most to increased attainment outcomes, therefore future research may focus on exploring the various impacts of these components in greater depth.

Conclusions

These data are encouraging and allow the case to be made for the core curriculum to be conducted outdoors to improve children's learning. However, it is important to consider that aspects of the programme—such as multiple-day delivery on consecutive weeks and targeted curriculum activities—are likely to provide for these positive outcomes. That is, outcomes are likely to be specific to the WS programme and may not be replicable under less rigorous outdoor-learning delivery. Outcomes are particularly relevant when considering the need to close the attainment gap between underperforming children and their equally intelligent peers. With an increasing concern in schools, reflected in school policy and at national level, over the unfulfilled potential of children from all backgrounds, WS could be a useful tool for the school system in addressing this need. The results from this study give a clear indication that the WS concept has considerable potential, especially for those who are disengaged with schooling. There is also a good case for the effects of WS to be explored more widely across a variety of different contexts, with children of different ages and from different social backgrounds, and with an enhanced set of outcomes (e.g. mental health). Finally, there is a need to evaluate the key components of the WS programme to further explore and develop a theory of change.

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References

Adi, Y., Killoran, A., Janmohaned, K. & Stewart-Brown, S. (2007) *Systematic review of the effectiveness of interventions to promote mental wellbeing in children in primary education. Report 1: Universal approaches (non-violence related outcomes)* (Coventry, University of Warwick).

Bowker, R. (2007) Children's perceptions and learning about tropical rainforests: An analysis of their drawings, *Environmental Education Research*, 13(1), 75–96.

Christie, B., Higgins, P. & McLaughlin, P. (2014) 'Did you enjoy your holiday?' Can residential outdoor learning benefit mainstream schooling?, *Journal of Adventure Education and Outdoor Learning*, 14(1), 1–23.

Clegg, S. (2005) Evidence-based practice in educational research: A critical realist critique of systematic review, *British Journal of Sociology of Education*, 26(3), 415–428.

DfE (2015) *Statistical first release*: *GCSE and equivalent attainment by pupil characteristics, 2013 to 2014* (revised). Available at: www.gov.uk/government/statistics/gcse-and-equivalent-attainment-by-pupil-characteristics-in-england (accessed 5 February 2016).

DfE (2016) *Local authority interactive tool*. Available at: www.gov.uk/government/publications/local-authority-interactive-tool-lait (accessed 5 February 2016).

DfES (2002) *Targeting support: Managing NNS/NLS intervention programmes. A guide for headteachers and senior managers*. Available at: webarchive.nationalarchives.gov.uk/20110506045358/https://consumption.education.gov.uk/publications/standard/Teachingandlearning/Page10/DfES%200669%202002 (accessed 5 February 2016).

Draper, S. W. (2016) *The Hawthorne, Pygmalion, placebo and other effects of expectation: Some notes*. Available at: www.psy.gla.ac.uk/~steve/hawth.html#teacher (accessed 24 October 2016).

Dunne, M., Humphreys, S., Sebba, J., Dyson, A., Gallanaugh, F. & Muijs, D. (2007) *Effective teaching and learning for pupils in low attaining groups*. Research Report DCSF-RR011 (London, Department for Children, Schools and Families).

Early Years Foundation Stage (EYFS). (2007). *Effective Practice: Outdoor Learning. Report Number 00012-2007CDO-EN*. [Online]. Available online at: http://outdoormatters.co.uk/wp-content/uploads/2011/03/EYFS-Effective-PracticeOutdoor-Learning.pdf (accessed 12 November 2016).

French, J.R.P. (1953) Experiments in field settings, in: L. Festinger & D. Katz (Eds) *Research methods in the behavioral sciences* (New York, Holt, Rinehart & Winston), 98–135.

Funnell, S. C. & Rogers, P. J. (2011) *Purposeful program theory. Effective use of theories of change and logic models* (San Francisco, CA, Jossey-Bass).

Hamilton-Ekeke, J. (2007) Relative effectiveness of expository and field trip methods of teaching on students' achievement in ecology, *International Journal of Science Education*, 29(15), 1869–1889.

Hattie, J., Marsh, H.W., Neill, J.T. & Richards, G.E. (1997) Adventure education and Outward Bound: Out-of-class experiences that make a lasting difference, *Review of Educational Research*, 67(1), 43–87.

Higgins, S., Katsipataki, M., Kokotsaki, D., Coe, R., Major, L.E. & Coleman, R. (2013) *The sutton trust-education endowment foundation teaching and learning toolkit: Technical appendix* (London, Education Endowment Foundation).

Karpinnen, S.J.A. (2012) Outdoor adventure education in a formal education curriculum in Finland: Action research application, *Journal of Adventure Education and Outdoor Learning*, 12(1), 41–62.

Law, J., Garrett, Z. & Nye, C. (2003) Speech and language therapy interventions for children with primary speech and language delay or disorder (Cochrane Review), *Cochrane Database of Systematic Reviews*, 3, CD004110.

NCfTL (2014) *Closing the gap with the new primary national curriculum*. Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/349288/closing-the-gap-with-the-new-primary-national-curriculum.pdf (accessed 25 October 2016).

Neill, J. (2008). Meta-analytic research on the outcomes of outdoor education. *6th Biennial Coalition for Education In The Outdoors Research Symposium*, Bradford Woods, IN, 11-13 January, 2002.

Neill, J.T. (2003) Reviewing and benchmarking adventure therapy outcomes: Applications of meta-analysis, *Journal of Experiential Education*, 25(3), 316–321.

Office for Standards in Education, Children's Services and Skills (2014) *North East, Yorkshire and Humber regional report 2013/2014*. Available at: www.ofsted.gov.uk/resources/140185 (accessed 5 February 2016).

Randler, C., Ilg, A. & Kern, J. (2005) Cognitive and emotional evaluation of an amphibian conservation program for elementary school, *Journal of Environmental Education*, 37(1), 43–52.

Rickinson, M., Dillon, J., Teamey, K., Morris, M., Choi, M.Y., Sanders, D. & Benefield, P. (2004) *A review of research on outdoor learning* (Shrewsbury, FSC Preston Montford).

Rosenthal, R. & Jacobson, L. (1968) *Pygmalion in the classroom: Teacher expectation and pupils' intellectual development* (New York, Irvington).

Slavin, R.E. (1990) Research on cooperative learning: Consensus and controversy, *Educational Leadership*, 47(4), 52–54.

Terwel, J., Gillies, R.M., Van den Eeden, P. & Hoek, D. (2001) Co-operative learning processes of students: A longitudinal multilevel perspective, *British Journal of Educational Psychology*, 71(4), 619–645.

Zammuner, V.L. (1995) Individual and cooperative computer-writing and revising: Who gets the best results?, *Learning and Instruction*, 5(2), 101–124.