Taking science outside: Supporting primary teacher trainees' skills in effective outdoor learning and teaching

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Abstract

Outdoor learning offers a wide range of benefits for children, from enhancing their physical and mental health, to enhancing creativity, to improving their social skills and sense of place (Whewell & Allan, 2023). However, many primary trainee teachers feel hesitant about teaching science outside the classroom due to concerns about safety, limited resources and the challenges of planning for outdoor learning.

This participatory action research (PAR) project was a partnership between the University of Northampton and Teach Outdoors Ltd., an industry partner supporting this research endeavour. Teach Outdoors Ltd. aims to provide schools and educators with the training and support that they need in order to ensure that all children can reap the benefits of the outdoor environment. Together we sought to address these concerns by helping primary Initial Teacher Education (ITE) students to build the confidence and skills needed to make outdoor learning a natural part of their science teaching.

The programme combined practical workshops and online training, followed by the students leading an outdoor learning session during school placements. The training provided participants with the tools that they needed to navigate challenges, such as risk assessments and managing behaviour in outdoor settings. By exploring creative ways in which to use outdoor spaces, the training empowered students to see the unique opportunities that these environments offer to engage and inspire learners.

After completing the training, participants reported feeling more prepared and enthusiastic about taking their science teaching outdoors. They also experienced how outdoor learning helps children to develop essential skills such as problem-solving, resilience and creativity. By incorporating outdoor learning into teacher training, this project demonstrated how we can prepare future educators to create meaningful, memorable learning experiences that go beyond the classroom walls and focus upon eco-centric educational experiences.

Keywords
Outdoor learning, confidence, participatory action research (PAR), initial teacher education, early childhood studies, experiential learning, science education

Introduction

Outdoor learning offers significant benefits for children, including improvements in physical development (BERA/TACTYC, 2014; Fjørtoft, 2004), creativity, physical and mental wellbeing (Knight, 2011; Sutterby & Frost, 2006), and language development (Richardson, 2014; Richardson & Murray, 2016). Despite this, many educators lack confidence in teaching outside the classroom due to concerns about safety, resource availability and planning (Barrable *et al,* 2022). This project aimed to address these barriers by providing education students with a training programme designed to build their knowledge, skills (disciplinary and pedagogical) and, ultimately, confidence in utilising outdoor spaces effectively.

This project introduced 17 primary ITE students to practical strategies for outdoor learning. These were designed with the students by Teach Outdoors Ltd. The training was designed using data from pre- and post-training surveys and focus groups with the participants. The goal was to empower future teachers to integrate outdoor learning into their professional practice and create enriching, real-world learning experiences for children. This paper focuses upon the teaching of science outdoors as part of a larger project that offered training and experience in a range of primary curriculum areas.

Context and challenges

The science National Curriculum for primary school-aged children in England encourages teachers to ensure that their provision *'allows children to experience and observe phenomena, looking more closely at the natural and humanly-constructed world around them'* (DfE, 2013, p.5) and that *'most of the learning about science should be done through the use of first-hand practical experiences'* (p.5).

Outdoor learning in science offers an opportunity to move beyond the transactional delivery of curriculum content and engage children in transformative, experiential learning. Specifically, in primary schools in England, children should be taught substantive and disciplinary knowledge (Ofsted, 2021) throughout their learning, for example using their local environment throughout the year to observe and name a variety of plants, trees and animals in their locality. They should engage in activities that allow them to understand habitats and changes over time in plants and animals, encouraging 'working scientifically' in their thoughts, questions and exploration of their local environment.

In England, outdoor learning is not consistently integrated into the curriculum, particularly beyond early years education (Leather, 2018). Many schools struggle with limited outdoor space, resources and tight timetabling schedules that further restrict opportunities for outdoor learning (Davy, 2016). Additionally, educators may lack the training and confidence needed to address logistical and safety concerns, manage behaviour, and align outdoor learning with curriculum goals (Gill, 2010).

This project's training programme addressed these challenges by equipping ITE students with practical tools, pedagogies and strategies to plan, lead and evaluate outdoor learning activities. It emphasised the importance of overcoming barriers and highlighted the potential of outdoor learning to enhance student subject knowledge (DfE, 2013), engagement and wellbeing (Waite & Pratt, 2017).

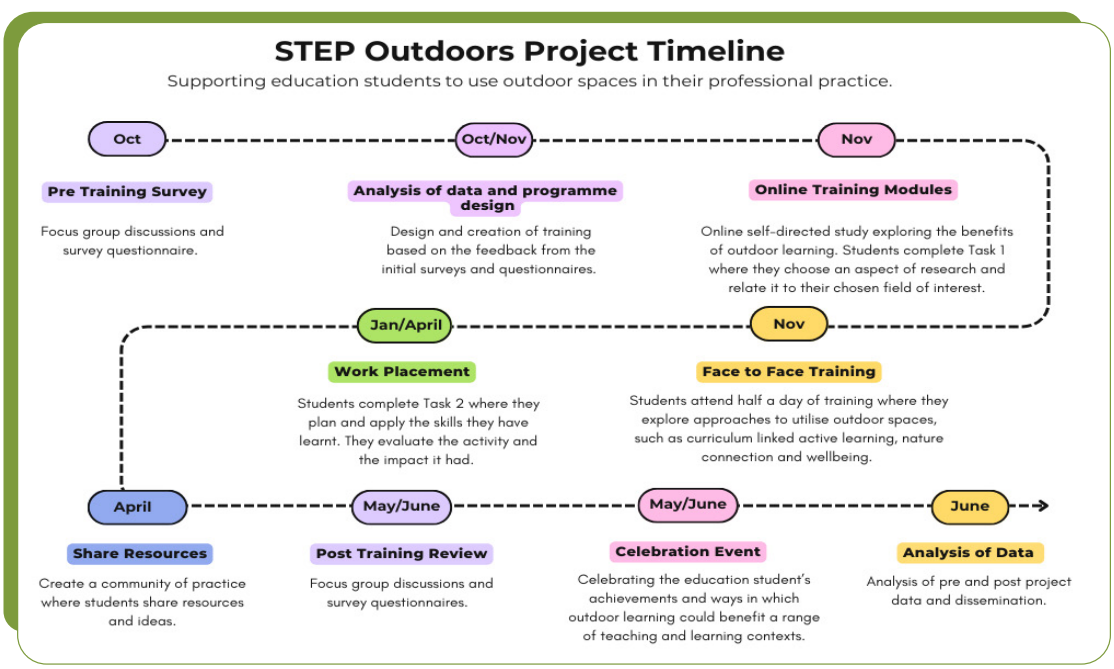
Training approach

The project adopted a participatory action research (PAR) approach, engaging 17 ITE second-year students as active participants in designing and refining the training programme (Robson, 2024). The 17 students responded to a call for volunteers from the second year of the BA Primary Education degree programme. The second years have compulsory placements in the summer term, which aligned well with the project timeline. PAR prioritises collaboration, in this case between the project team and the ITE students. This methodology removes power relationships and values all participants' input in any research, with the aim of improving practice through iterative feedback and mutual learning (Kindon *et al,* 2010). PAR studies of this type use self-reported data, and this has challenges based on an individual's prior experiences and contexts. Although not widely generalisable, they provide suitable and helpful data for a study of this type.

The training included:

- An initial focus group to identify participants' concerns and prior experiences with outdoor learning (Figure 1);
- A blended training course featuring online modules and hands-on practical workshops led by Teach Outdoors Ltd.; and
- Opportunities for students to implement their training during school placements, followed by reflective focus groups to evaluate their experiences and offer suggestions for the next iteration of the training programme.

Figure 1 Timeline and design of the project.



Pre-training findings (survey and focus group)

The focus group and survey included questions relating to general outdoor learning principles and then specific questions related to the primary education subjects, mathematics, English and science. Initially, we asked the trainees to rate their general confidence in outdoor learning. Tables 1 and 2 demonstrate that participants indicated a general lack of confidence in taking teaching and learning outside and the planning required to do so.

Table 1 How confident are you to take teaching and learning activities outdoors generally?

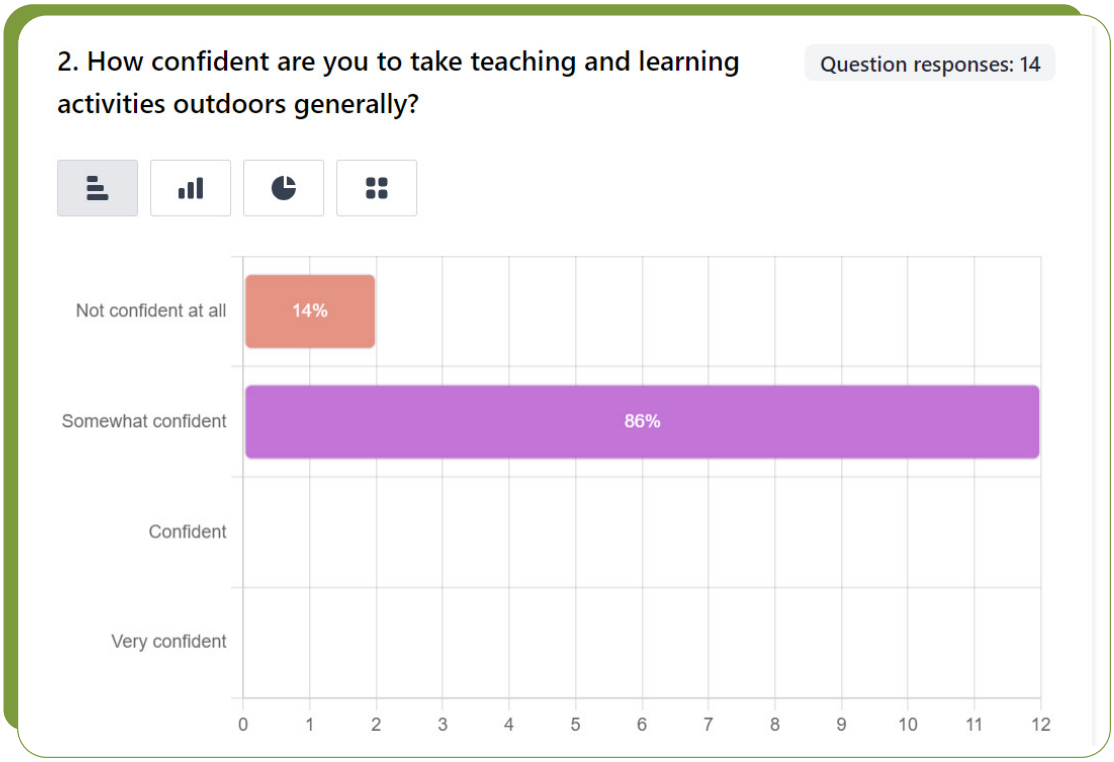
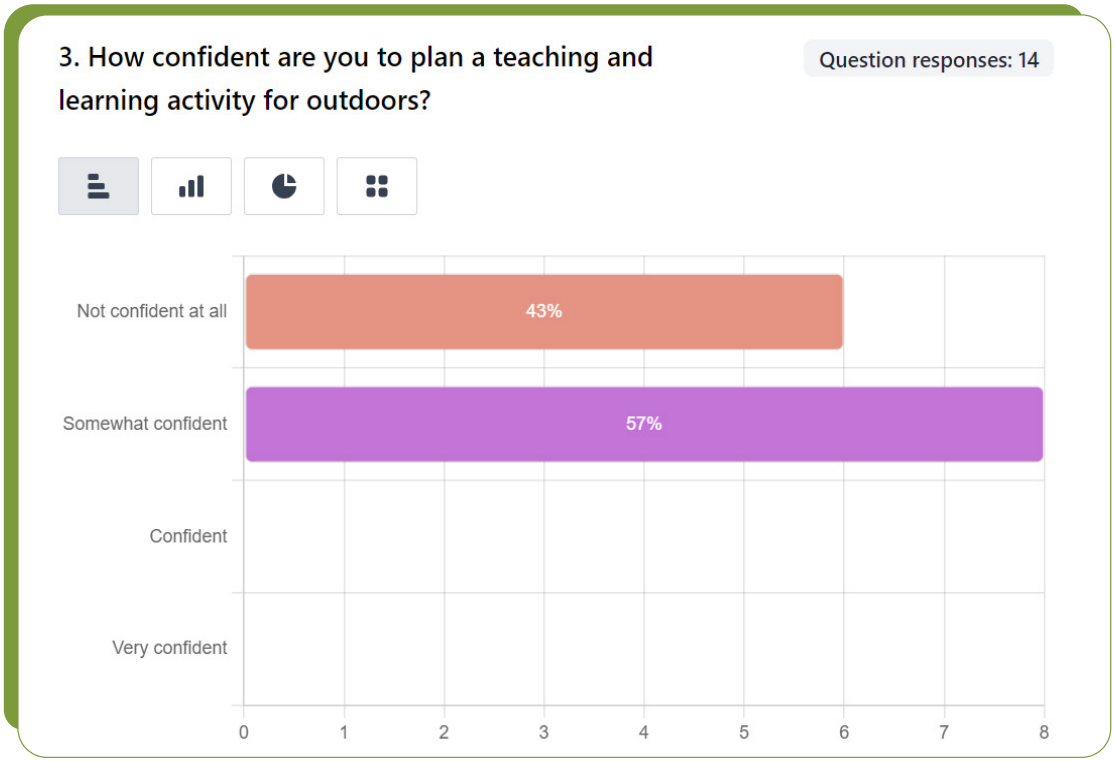
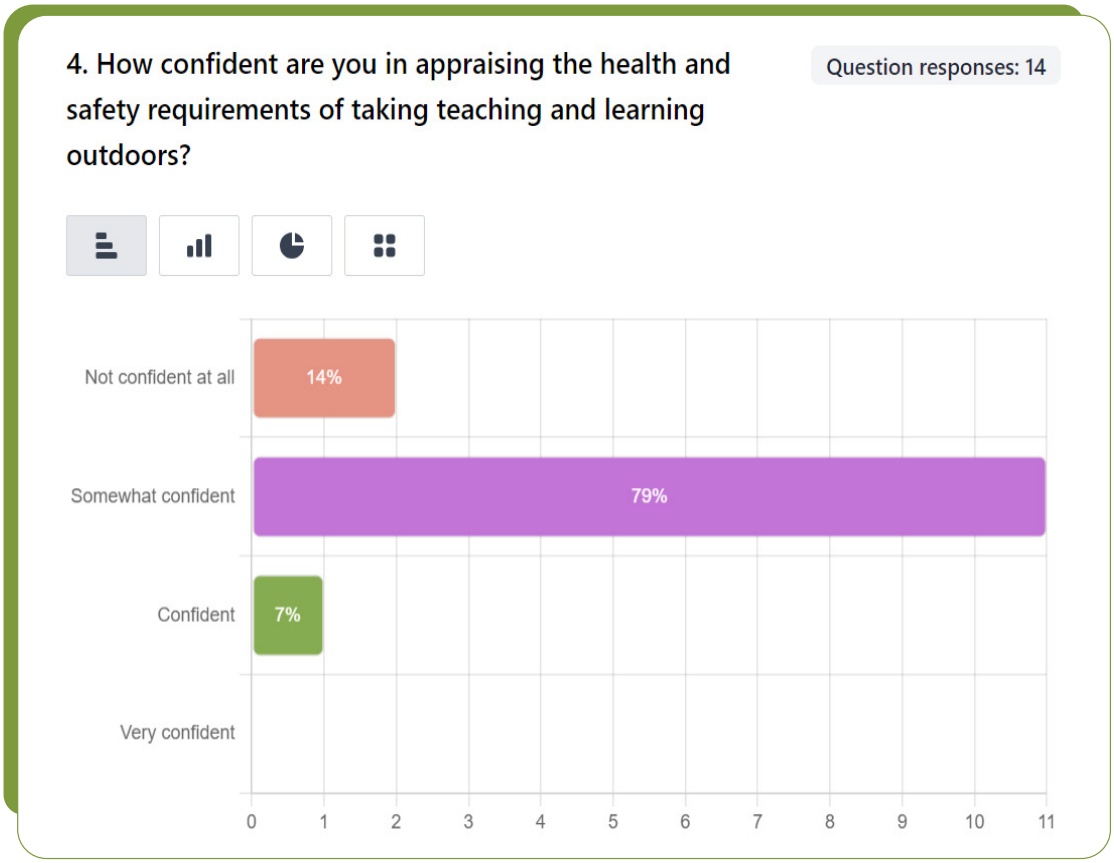


Table 2 How confident are you to plan a teaching and learning activity for outdoors?



Before training, students expressed concerns about leading outdoor activities, managing behaviour and ensuring safety (Barrable & Lakin, 2020).

Table 3 How confident are you in appraising the health and safety requirements of taking teaching and learning outdoors?



Participants were particularly apprehensive about balancing curriculum demands with the practicalities of outdoor learning (Table 3). For example, participants largely rated themselves as 'not at all confident' or 'somewhat confident' relating to the health and safety requirements of outdoor learning. Participants noted:

> *'How you deal with those kind of like loose cannons…'*
> *'I didn't actually say whether children could go, so when they went to do an activity, they all just spread like eagles.'*

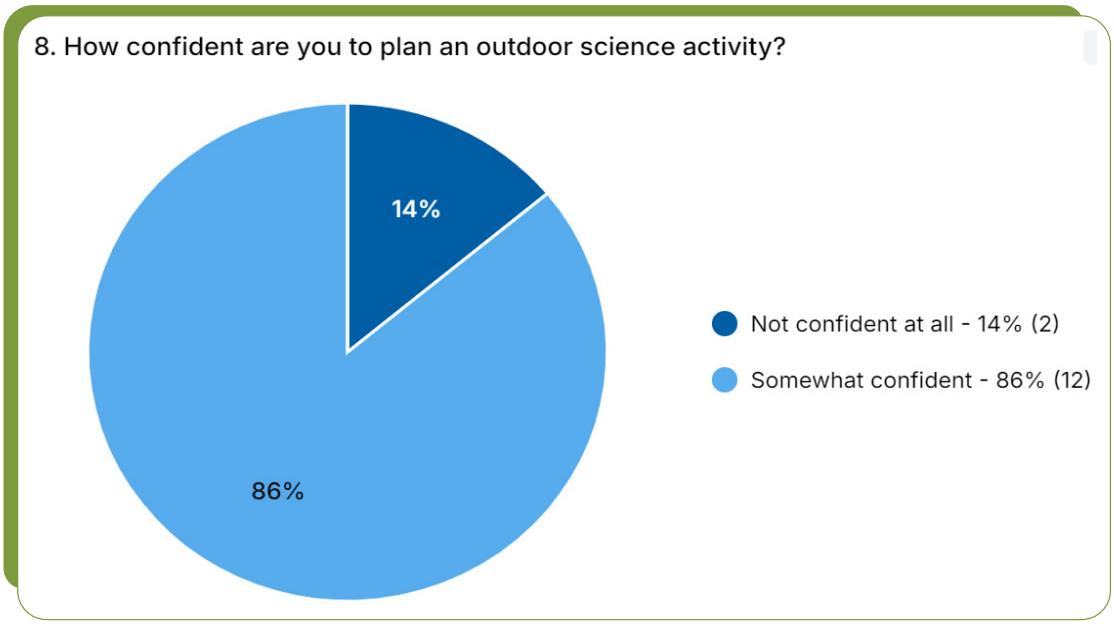
These concerns mirror findings in existing research, highlighting the perceived risks and challenges associated with outdoor learning (Catling & Willy, 2018).

When asked specifically about their experience of taking their science teaching outside, students described what they had observed in schools:

> *'Our second placement last year, we were learning about living things and their habitats and science. So we actually took the children outside to walk around the school grounds to find living things, and we found that it was more interactive for them rather than stating this is a living thing.'*
> *'I think my main concern would just be having the confidence to like be able to deliver like a session just completely by myself or like with teaching assistants.'*

They recognised the benefits and were keen to have a go but, when asked, identified a lack of confidence in planning for outdoor learning in science (Table 4).

Table 4 How confident are you to plan an outdoor science activity?



Bespoke training programme

Participants received guidance on addressing logistical challenges, managing safety (Beames *et al*, 2012), and integrating outdoor learning across subjects such as science, English and mathematics. They also explored ways to use the outdoor environment creatively and spontaneously. The training programme consisted of four units:

- **Unit 1**: Online self-directed study explored the benefits of outdoor learning. The participants chose an aspect of research and related this to their chosen field to explore how an outdoor environment could enrich and support their area of interest, for example, child development, nature awareness, or self-regulation.
- **Unit 2**: Face-to-face training – the participants explored approaches to utilising outdoor spaces, such as active learning, nature connection and wellbeing.
- **Unit 3**: Participants applied the skills that they had learned through demonstrating a practical example of how they used the outdoor space and then evaluated the activity.
- **Unit 4**: Evaluation of the activity. Participants shared their outdoor activities and photos on a Padlet. They also summarised their key learning from the project.

Example training activities

The face-to-face training included activities specific to science teaching and working scientifically.

Figure 2 ChatterPix Kids.

Using the application ChatterPix Kids (Figure 2) *(ChatterPix Kids can make anything talk. Take a photo, draw a line to make a mouth, and record your voice)*, participants tried a Year 1 (age 5-6 years) activity: identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. The participants choose a living thing and talk in the first person, describing key features, their habitat, or their survival needs.

Figure 3 A 3D food web.

Figure 4 Exploration of 'living, dead, never been alive'.

Using an activity from Learning through Landscapes (ltl.org.uk/outdoor-learning-training), the participants explored a Year 4 (age 8-9 years) activity based on the National Curriculum requirement that children should construct and interpret a variety of food chains, identifying producers, predators and prey, alongside recognising that environments can change, which can sometimes pose dangers to habitats. Participants used string and name tags to build a 3D representation of a food web and explore the challenges of pesticides and over-farming (see Figure 3).

Using an activity from TeachOutdoors (teachoutdoors.co.uk), participants engaged in a Year 2 (age 6-7 years) activity: explore and compare the differences between things that are living, dead and things that have never been alive. By collecting items from the grounds, they categorised them into 'living', 'dead', 'never been alive'. The participants then engaged in exploratory talk about how they knew that they were living/dead/had never been alive (Figure 4).

"Post-training surveys and focus groups revealed notable improvements in the confidence levels of the participants' understanding and use of learning outside the classroom for science."

Post-training findings

The students, having completed their outdoor learning sessions in a range of settings, reflected on their experiences. Post-training surveys and focus groups revealed notable improvements in the confidence levels of the participants' understanding and use of learning outside the

classroom for science. Participants felt better equipped to plan and lead outdoor sessions, with one participant stating that *'It's [taking children outside to learn] easier than I thought it would be'.*

Participants reported that they noticed that outdoor learning enhanced children's engagement, collaboration and wellbeing:

> *'Seeing just how much enjoyment they get out of being outside. That's something that, when I was a child, I loved all my outdoor lessons. They're the ones I remember the most'.*

Mygind (2007) highlights the positive effects of outdoor learning on children's physical fitness and concentration. Participants also recognised the value of outdoor learning in fostering creativity, resilience and problem-solving skills in children (Wood & Haddon, 2021):

> *'After getting outside with the children I am more open-minded about the impact it has'.*

The training helped participants to recognise the value of experiential learning and the potential for spontaneous, meaningful teaching moments. For example:

> *'They [the children] were all collaborative in some way as well. So, it wasn't really like independent work. They also had their peers to kind of bounce off'.*

These reflections align with Vygotsky's (1962) social-constructivist framework, emphasising the role of active, context-based learning in cognitive development. While some challenges, such as limited outdoor space, remained, students learned to adapt creatively. For example:

> *'My school didn't have tons of outdoor space [but] it's easier than you think it is to do something outside'.*

Participants in urban settings utilised small playgrounds or nearby parks. They also developed strategies to address logistical concerns, such as planning for diverse needs and incorporating risk assessments into their practice (Catling & Willy, 2018).

Experiential learning emerged as a cornerstone of the training programme's success. By engaging in hands-on outdoor activities themselves, participants experienced first-hand the challenges and rewards of outdoor learning. This approach aligns with Ryan and Deci's (2008) self-determination theory, which emphasises the importance of autonomy, competence and relatedness in fostering intrinsic motivation and confidence.

Participants observed that children displayed higher levels of engagement and collaboration during outdoor lessons. They also noted improvements in behaviour, with one student commenting:

> *'I thought the children would be really overstimulated from it. And I didn't find that to be the case at all. In fact, they were quite chilled when they came back in'.*

These observations support findings by Whewell and Allan (2023), who argue that outdoor learning can positively impact both academic outcomes and emotional wellbeing and regulation strategies.

"Participants observed that children displayed higher levels of engagement and collaboration during outdoor lessons. They also noted improvements in behaviour..."

Recommendations

Recommendations from this small-scale study are three-fold: firstly, the importance of embedding science learning outside the classroom opportunities in ITE. This should encompass both procedural and substantive curriculum knowledge and practical application. This would support students to develop the skills and confidence needed to integrate outdoor learning into their science teaching during their school placements and Early Career Teacher years. This could include acknowledgement of behaviour management strategies to enhance logistical and safety considerations, including risk assessments, that are useful in the outdoors.

Secondly, we recommend that support whilst on school placement includes opportunities to practise outdoor learning, with guidance from experienced mentors and practitioners/mentors who have undertaken outdoor learning training. Placement schools could offer their outdoor spaces and resources to foster an environment where trainees can experiment and refine their approaches.

Finally, ITE can promote a transformational mindset that encourages trainees to view outdoor learning as an integral part of their pedagogical toolkit for science, highlighting its role in fostering creativity, resilience and working scientifically in children.

Conclusion

This project demonstrated that targeted training could transform ITE students' perspectives on outdoor learning, shifting their focus from their perceived logistical challenges to its transformative educational potential. PAR methodology embraces participants as researchers and allows shared knowledge creation and action; it is this that made this study unique and successful.

The importance of embedding outdoor learning into teacher training programmes addresses practical concerns and, through projects such as the one described in this article, we can empower students to build their confidence in taking their science teaching outside. By equipping future teachers with the confidence and skills to embrace outdoor learning, we can foster richer, more engaging educational experiences for children.

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REFERENCES

Barrable, A. & Lakin, L. (2020) 'Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: an empirical study', *Journal of Adventure Education and Outdoor Learning,* **20,** (3), 189–201. https://doi.org/10.1080/14729679.2019.1609999

Barrable, A., Toloumakos, A. & Lapere, L. (2022) 'Exploring Student Teachers' Motivations and sources of confidence: The Case of Outdoor Learning', *European Journal of Education,* **3,** (45), 356–372

Beames, S., Higgins, P. & Nicol, R. (2012) *Learning Outside the Classroom: Theory and Guidelines for Practice.* Oxon: Routledge

BERA/TACTYC (2014) ***Early years policy advice: Learning, development and curriculum.*** [Online]. Available at: http://tactyc.org.uk/wp-content/uploads/2013/11/Early-Years-Summary-Learning-Development-and-Curriculum.pdf Accessed 23.07.24

Catling, S. & Willy, T. (2018) *Understanding and teaching primary geography (2nd edition).* London: Sage Publications

Department for Education (2013) *National Curriculum in England: Science programmes of study.* Crown Copyright

Davy, A. (2016) *Provision for learning outdoors for under 5's: state of the nation survey.* [Online]. Available at: earlychildhoodforum.org/uploads/EYFS_Outdoors_Final_Report.pdf Accessed 23.07.24

Fjørtoft, I. (2004) 'Landscape as playscape: The effects of natural environments on children's play and motor development', *Children, Youth and Environments,* **14,** (2), 21–44

Gill, T. (2010) *Nothing Ventured: Balancing risks and benefits in the outdoors.* English Outdoor Council

Kindon, S., Pain, R. & Kesby, M. (Eds.) (2010) *Participatory action research approaches and methods: connecting people, participation and place.* Abingdon: Routledge

Knight, S. (2011) *Risk and adventure in early years outdoor play: learning from forest schools.* London: Sage Publications

Leather, M. (2018) *Outdoor education in the National Curriculum: the shifting sands in formal education.* Abingdon: Routledge

Mygind, E. (2007) 'A comparison between children's physical activity levels at school and learning in an outdoor environment', *Journal of Adventure Education and Outdoor Learning,* **7,** (2), 161–176

Ofsted (2021) *Research Review Series: science* [online]. Available at: www.gov.uk/government/publications/research-review-series-science/research-review-series-science

Richardson, T. (2014) *Speech and language development in a forest school environment: an action research project,* London: SAGE Research Methods Cases. [Online] Available at: http://srmo.sagepub.com/view/methods-case-studies-2013/n342.xml Accessed 23.07.24

Richardson, T. & Murray, J. (2016) 'Are young children's utterances affected by characteristics of their learning environments? A multiple case study', *Early Child Development and Care,* **187,** (3-4), 457–468

Robson, C. (2024) *Real World Research, 5th edition.* Chichester: Wiley and Sons

Ryan, R.M. and Deci, E.L. (2008) 'Self-determination Theory and the Role of Basic Psychological Needs in Personality and the Organization of Behavior'. In: *Handbook of Personality: Theory and Research,* pps. 654-678, John, O.P., Robins, R.Q. & Pervin, L.A. (Eds.). New York: Guilford Press

Sutterby, J. & Frost, J. (2006) 'Creating play environments for early childhood: indoors and out'. In: *Handbook of Research on the Education of Young Children, 2nd edition,* Spodek, B. & Saracho, O. (Eds.). Mahwah NJ: Lawrence Erlbaum Associates

Vygotsky, L. (1962) *Thought and Language.* Cambridge: MIT Press

Waite, S. & Pratt, N. (2017) 'Theoretical perspectives on learning outside the classroom: relationships between learning and place'. In: *Children Learning Outside the Classroom: from birth to eleven, 2nd edition,* pps. 7–22, Waite, S. (Ed.). London: Sage Publications

Whewell, E. & Allan, J. (2023) 'Building success through outdoor adventure', *Physical Education Matters,* Autumn 2023

Wood, M. & Haddon, N. (2020) *Secondary Curriculum Transformed, Enabling All to Achieve.* Oxon.: Routledge