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The Effectiveness of Experiential Learning for Developing the Spatial Orientation Skills of Preschool Children: A Quasi-Experimental Study

Pham Thi Bich Hoa and Bui Van Hong*
Ho Chi Minh City University of Technology and Engineering
Ho Chi Minh City, Vietnam

Bui Thi Viet
Nguyen Tat Thanh University
Ho Chi Minh City, Vietnam

Abstract. The spatial orientation abilities of young children are vital for their early cognitive development and serve as preparation for formal learning. Scholarly interest in experiential learning in early childhood education is increasing yet little classroom research has investigated the role of structured experiential activities in supporting preschool children's development of spatial orienting abilities. This research examined the impact of a 10-week experiential learning intervention on the spatial orientation skills of children aged 5–6 years in authentic preschool settings. We used a quasi-experimental pretest–posttest approach with an experimental group and a control group. The study involved a total of 120 children of preschool age (60 children in the experimental group and 60 children in the control group). Children's spatial orientation skills were evaluated by means of an observational rubric based on the experiential learning theory, which investigates three dimensions: spatial awareness, spatial practice and spatial application. Quantitative data were analysed using descriptive statistics, paired sample *t*-tests and effect size analysis to investigate changes before and after the intervention. Children who participated in the experiential learning programme showed statistically significant short-term improvements in all three dimensions. In particular, children showed progress regarding their capacity to apply spatial awareness in collaborative, movement-based and exploratory activities. This study contributes to the literature by applying Kolb's experiential learning framework to a multidimensional model of spatial orientation development in early childhood schooling. The findings suggest that structured experiential learning activities may offer effective ways to promote spatial orienting skills in preschool classroom settings.

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*Corresponding author: Hong Bui Van; *hongbv@hcmute.edu.vn*

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1. Introduction

Spatial orientation skills are a core aspect of children's early cognitive growth and shape how children perceive, interpret and interact effectively with their surrounding environment (Yogman et al., 2018). Orientation in space is important in everyday preschool activities, such as moving around the classroom, following directions, organising objects, building constructions, describing locations or playing games that require navigation. Acquiring these skills early on is also important for later learning of mathematics and science and problem-solving (Frick et al., 2014). Children with highly developed spatial orientation skills are more responsive to learning situations and better prepared for formal education. An early cognitive processing talent is spatial understanding that leads to problem-solving abilities and engagement in learning.

The most natural way of promoting spatial orientation for children of 5–6 years is direct contact with the actual environment around them. Significant activity in play that offers children the chance to learn about spatial relations includes mobility, exploring familiar settings, building with blocks and activities involving maps and modelling environments (Farran et al., 2025). Experiential learning theory suggests that children learn better when they are actively involved in the activities, reflect on their actions and apply their new information in practical situations (Kolb, 1984). Guided play and structured experiential activities are, therefore, relevant for spatial learning, and these activities combine the child's curiosity with purposeful teacher assistance (Fisher et al., 2012; Weisberg et al., 2016).

Increasingly, research suggests that spatial skills are not static traits; instead, these skills can be fostered and improved through well-designed educational interventions (Kim & Saplan, 2024). Meta-analytic evidence suggests that targeted spatial training and experiential activities, particularly those involving manipulation, movement and active involvement, can improve the spatial ability of children (Uttal & Cohen, 2012; Yang et al., 2020). Studies on preschool children indicate that hands-on activities, spatial games and structured play have considerable effects on spatial orientation and related cognitive outcomes (Alkouri, 2022; Bower et al., 2022). These findings show that experiential learning may be an effective pedagogical technique to foster spatial development in early childhood classrooms.

The literature, however, reflects limitations regarding several aspects. While several studies have addressed individual spatial abilities, few have examined spatial orientation as an integrated developmental competency encompassing spatial awareness, spatial practice and spatial application. Furthermore, some studies relied on assessment measures that may not have adequately captured children's observable spatial behaviours in natural preschool settings. In the third place, observational rubrics are developmentally appropriate for young children because they can capture behaviour in real-life learning circumstances (Brookhart, 2013; McAfee et al., 2016); such rubrics were underutilised in empirical investigations on spatial orientation. Moreover, some investigations were conceptual, exploratory or undertaken in an artificial classroom setup.

Although studies have generated valuable knowledge about spatial development, there remains a lack of long-term empirical research examining the effectiveness of structured experiential learning activities to promote the spatial orientation abilities of preschool children in authentic classroom settings. This type of research is important for early childhood education because teachers require pragmatic solutions that are empirically supported. The significance of spatial learning in preschool settings should not be restricted to cognitive tasks but should also be perceived as part of children's physical mobility, communication, play and engagement with their environment.

Piaget's view of development suggests that babies build knowledge through active engagement with objects and space (Piaget, 1954). Thus, direct experience is especially relevant in early infancy. It is also important to understand how experiential learning can be used to increase children's spatial orientation and how children's development can be monitored and quantified, which could have consequences for curriculum creation, classroom organisation and teacher direction (Piaget & Inhelder, 1956).

In this study, experiential learning is defined according to Kolb's experiential learning theory, as a purposeful instructional process. Experiential learning promotes active engagement, guided contemplation and practice. Spatial orientation skills are conceptualised as three related domains: spatial awareness, spatial practice and spatial application. Spatial awareness is a child's ability to conceptualise and describe spatial relationships. A child's ability to move, manoeuvre, position themself and manipulate objects in space represents spatial practice. Spatial application is the ability to employ spatial cognition in practical problem-solving circumstances. Building on this theoretical paradigm, the present study was conducted to examine the effectiveness of structured experiential learning activities in developing spatial orientation skills among preschool children aged 5–6 years in authentic preschool settings.

The investigation was oriented and regulated by this framework and two research questions.
1. To what extent did spatial orienting skills of preschool children improve after they carried out structured experiential learning activities?
2. Which aspects of spatial orientation skills, namely spatial awareness, spatial practice and spatial application, displayed the most obvious improvement after the experiential learning intervention?

The study proposed two hypotheses. First, that there would be a significant increase in the spatial awareness of preschool children after an experiential learning intervention. Second, this experiential learning intervention would be associated with large gains in spatial practice and spatial application. These findings would support the notion that active involvement, mobility, purposeful contact and practical application contribute to the development of multidimensional spatial orientation abilities.

This study makes two major contributions to the literature. First, it conceptualises spatial orientation abilities as a multidimensional construct comprising spatial awareness, spatial practice and spatial application, to provide a more comprehensive perspective on the spatial development of preschool children. Second, it introduces experiential learning theory in this framework and empirical evidence of a classroom-based intervention. Therefore, the study adds to the body of knowledge regarding the potential of experiential learning to increase spatial development in actual early childhood educational settings.

2. Literature Review

2.1 Early Childhood Spatial Orientation Abilities

Spatial orientation abilities are broadly acknowledged as an important aspect of children's early spatial cognition, because these abilities enable children to comprehend positional relationships, navigate physical surroundings and act meaningfully in space (Mix et al., 2016; Newcombe & Frick, 2010). These skills are highly predictive of later mathematical reasoning and problem-solving abilities and general cognitive development, which emphasises the long-term educational impact of spatial learning throughout preschool (Gunderson et al., 2012; Lowrie et al., 2017).

Spatial skills are not fixed capacities but are flexible and can be improved by educational intervention, as reported by meta-analytic studies. Systematic training programmes were found to provide considerable gains in children's spatial skills, especially those of younger children (Uttal & Cohen, 2012). Similarly, Yang et al. (2020) and Tsomokos and Gashaj (2024) found that movement-based and experiential therapies were particularly useful in early childhood, which is a time when children learn best through active involvement and direct connection with their surroundings.

The literature on the malleability of spatial skills provides compelling evidence but also exposes serious inadequacies in research. Although there has been considerable study on training effects in different groups and contexts, little attention has been paid to the development of spatial orientation in genuine preschool classrooms (Cheng & Mix, 2014). Moreover, spatial abilities are usually studied individually, for example spatial language, mental rotation or navigation, and not in relation to each other and how they interact together in real learning situations (Bobrowicz, 2026). Therefore, there is no data on the co-evolution of awareness, mobility and practical use of spatial knowledge of children in natural classroom settings.

Research on preschool children has demonstrated that spatial orientation is initially acquired by action and interaction, not through abstract reasoning. An important area of development is children's knowledge of positional relationships (e.g. left–right, near–far and front–behind), which is often conveyed through movement, gesture and spatial language. Experimental studies of guided block play and spatial construction activities suggest that children who are given structured exploratory experiences develop better spatial vocabularies and problem-solving skills than children who receive more conventional instruction (Ferrara et al., 2011; Jirout & Newcombe, 2015; Verdine et al., 2014). Active engagement also boosts children's ability to mentally encode the spatial relationships and to change the spatial information, as observed in research on puzzle play and the manipulation of objects (Levine et al., 2012; Frick & Newcombe, 2012). Together, these findings are consistent with the view that the baby learns best about space through active engagement with the spatial aspects rather than through passive acceptance of verbal explanations.

Navigation and movement in physical surroundings is another key feature of spatial orientation. Embodied cognition indicates, from a developmental perspective, that an understanding of space is developed through bodily interactions with objects, movement experiences and the environment (Dillon et al., 2013; Spelke, 2000). However, the literature has not yet reached consensus regarding how movement-based experiences should be conceptualised and organised pedagogically to support the comprehensive development of spatial orientation skills (Đokić & Vorkapić, 2024). Most studies were limited to discrete navigation tasks or short-term interventions and did not examine spatial perception, movement, and practical application within a coherent framework of spatial orientation development.

Spatial orientation involves more than vision and motion. It also calls for the use of spatial knowledge in appropriate contexts, such as understanding visual cues, placing items, following directions and solving problems in leisure activities. Newcombe (2014) suggests that spatial abilities should be viewed as multidimensional structures that involve perception, action and application. However, empirical evidence reveals that these traits may not develop equally, particularly where educational experiences are not continuous, structured or contextually meaningful. Therefore, there is very little research on the application of integrated and experiential teaching strategies to develop diverse aspects of spatial orientation in real preschool settings.

2.2 Experiential Learning in Early Childhood Education

Experiential learning has become a prominent orientation in early childhood education because it reflects its compatibility with children's natural tendencies and developmental needs. Experiential approaches consider children not as passive recipients of information, but as active constructors of understanding through exploration, interaction, reflection and application. In preschool settings, learning is often most meaningful when children manipulate objects, move through physical spaces, interact with peers and participate in direct, real-world experiences. With this perspective, information is not merely passed on by teachers but is built progressively via purposeful work and social interaction.

One of the most influential theories for understanding this process is Kolb's theory of experiential learning. According to Kolb (1984), learning is a four-stage cycle of concrete experience, reflective observation, abstract conceptualisation, and active experimentation. According to this framework, learners, first, participate in direct experiences, then reflect on the experiences, then organise or reconstruct their understanding and, ultimately, apply newly created knowledge in practical situations. The repetitive structure of this process shows that learning is a result of continual involvement of action, contemplation, comprehension and application.

Despite the extensive acceptance of Kolb's theory in the educational research domain, earlier studies have tended to treat experiential learning in general pedagogical terms without a clear explanation of the relationship between specific stages of the learning cycle and developmental outcomes in early infancy. This inability is particularly apparent in spatial development studies, where experiential learning is often considered a broad teaching method rather than a conceptually structured learning process. Thus, there is still an absence of conceptual clarity about the role of experiential learning in supporting distinct aspects of spatial orienting abilities of preschool children.

The theoretical foundation of the present study is Kolb's experiential learning theory, which is operationalised through the experiential learning cycle that consists of concrete experience, reflective observation, abstract conceptualisation and active experimentation. The development of spatial awareness is closely linked to tangible experience; children's first understanding of placements, directions and spatial relationships is gained through first-hand experience with surroundings and materials. Spatial practice is intimately linked to active exploration, because children are continuously engaged in spatial understanding as they move through classroom environments, manipulate objects, build structures and participate in movement-based tasks. Spatial application is integrated with introspective observation and abstract conceptualisation when children describe spatial relationships, articulate pathways, solve spatial difficulties and transfer their knowledge to new settings. This fit makes a theoretical connection between experiential learning and the multidimensional framework of spatial orientation applied by the present study.

Experiential and directed play approaches have garnered substantial empirical support as helpful methods for increasing young children's cognitive engagement, particularly through well-designed play-based learning frameworks (Zosh et al., 2018). Research on fun learning environments demonstrates that children are more curious, persistent and conceptually aware when teachers support exploration without regulating learning outcomes (Bonawitz et al., 2011; Fisher et al., 2012; Weisberg et al., 2016). Similarly, research grounded in the ICAP (Interactive, Constructive, Active, Passive) framework suggests that learning outcomes improve as learners move from passive participation to active, constructive and interactive engagement, with constructive and interactive experiences generating the deepest levels of cognitive processing (Chi & Wylie, 2014).

Recent research in a variety of educational contexts demonstrated that immersive and interactive pedagogies can promote meaningful knowledge building and engagement of learners (Hossain et al., 2023; Jaaffar & Adnan, 2025). However, there still substantial differences in the literature about the implementation and evaluation of experiential learning. Some interventions are focused on playful exploration but offer little opportunity for contemplation and conceptual consolidation. Other studies were very reliant on teacher direction and prescribed instruction, often to the degree that opportunities for child-initiated interaction and independent inquiry were diminished. Such variances make it difficult to identify what aspects of experiential learning play the most relevant roles in facilitating spatial development. Furthermore, many studies explore experiential learning in a general way without specifically relating the stages of experiential learning to particular features of spatial orientation abilities.

Experiential learning is particularly applicable to spatial development because spatial awareness is derived from bodily engagement with environments and things. Children can learn about spatial relationships directly by learning to navigate the classroom layout, working with blocks, exploring familiar spaces and participating in movement-based games. Classroom treatments that combine movement and exploration have been shown to be effective for enhancing children's spatial thinking and spatial language use (Verdine et al., 2014). Even more significant is that experiential learning is based on cognitive, bodily and social processes in relevant situations. Children learn to use spatial awareness in real tasks, not just by seeing spatial correlations but via collaborative contact, communication, problem-solving and practical participation. This integrative aspect makes experiential learning ideal for promoting multidimensional spatial orientation abilities that require awareness, practice, reflection and application.

2.3 Related Empirical Studies

There is a large body of empirical evidence showing that spatial skills can be altered by educational intervention in early infancy. Meta-analytic evidence consistently shows that structured spatial training programmes can lead to moderate to large improvements in children's spatial performance, particularly with interventions that involve active manipulation, exploration and movement-based experiences (Uttal & Cohen, 2012; Yang et al., 2020). Similarly, preschool intervention studies report improvements in spatial language, navigation abilities and mental rotation after children were engaged in structured, play-based and exploratory learning activities (Jirout & Newcombe, 2015; Yuan et al., 2020). Results support the notion that early infancy is a sensitive age for spatial development and that specific educational experiences can promote spatial growth throughout this period.

While there is increasing evidence in favour of spatial intervention, there are still fundamental conceptual and methodological limitations in the literature. In some intervention studies, spatial skills were treated as discrete talents and not as interconnected aspects of spatial orientation. Children were typically assessed separately for spatial knowledge, navigational abilities and the application of spatial knowledge rather than within an integrated developmental framework. Moreover, several studies measured the effects of the intervention in highly controlled or short-term settings, which hinders understanding of how experiential learning occurs in real preschool classroom settings. Meta-analyses of experimental studies provide strong evidence of the potential for spatial training to improve children's performance in general. However, there is less information on specific classroom processes through which experiential learning could support multidimensional spatial development during typical educational activities.

In more recent intervention studies, notions of experiential learning have been included in spatial education. Programmes that involve activities such as collaborative problem-solving, scaffolded exploration, movement activities and block-based learning have demonstrated positive impacts on spatial reasoning and broader cognitive functions (Bower et al., 2022; Hawes et al., 2017). Moreover, research on robotics-based and movement-based learning settings underlines the importance of active engagement and embodied interaction for development of children's spatial thinking.

The results suggest that children acquire spatial abilities best when they are actively engaged in meaningful activities, opposed to passively instructed. Studies have been quite varied in theoretical perspective, implementation techniques and measures of assessment. Some therapies focused on exploratory play but did not offer much opportunity for focused reflection or mental consolidation. Other research is very teacher directed and did not allow for much child-initiated inquiry and practical experimentation. This variety makes it difficult to identify which experiential learning mechanisms are most beneficial for spatial development.

Moreover, a number of studies refer to the experience of learning generally but do not give clear explanations of how the stages of experiential learning are related to specific aspects of spatial orienting abilities. Another key limitation is that of assessment technique. Observation-based evaluation is considered to be developmentally appropriate for preschool children because it enables educators and researchers to record children's behaviour in natural classroom situations. McAfee et al. (2016) and Brookhart (2013) claim that developmental theory-based observational assessment can offer context-sensitive evidence of children's learning progress and performance.

However, only a limited number of studies have systematically used observation-based assessment frameworks to document children's spatial reasoning and spatial behaviours during play and classroom activities (McAfee et al., 2016; Pollitt et al., 2020). Most studies relied on psychometric tests or structured tasks conducted outside the natural flow of classroom learning. Intervention research still relies heavily on standardised or task-specific measures that may not fully represent how children actually perceive, negotiate, communicate and employ spatial cognition in their everyday classroom activities.

There is robust evidence that spatial skills are critical and critical and malleable during early childhood (Uttal & Cohen, 2012; Yang et al., 2020). Play-based and activity-based approaches to learning have been demonstrated to increase the spatial thinking and problem-solving abilities of preschool children (Verdine et al., 2014). Expanding on this, recent evidence suggests that game-based learning can positively influence cognitive, social and educational outcomes in early childhood settings (Alotaibi, 2024). However, there are three big gaps. First, there is a dearth of classroom-based research on organised experiential learning interventions delivered over extended teaching sessions in authentic preschool settings. Second, some studies still consider spatial talents as independent constructs rather than part of a multidimensional system of awareness, practice and application. Third, research has not explicitly related experiential learning processes to the development of spatial orientation skills in early childhood education.

The present study addressed these gaps by exploring the impact of a structured experiential learning intervention provided in a real preschool classroom over a 10-week period. The study conceptualised spatial orientation abilities as a multidimensional construct comprising spatial awareness, spatial practice and spatial application, which offers a wider view of our understanding of spatial development in early childhood. Unlike meta-analytic work that averaged generalised training effects across contexts, this study provides actual empirical data from the classroom application. It contributes to early childhood education research theoretically and practically by explicitly incorporating experiential learning theory in a multidimensional model of spatial orientation abilities, therefore, adding to the earlier research.

3. Methodology

3.1 Research Design

This study adopted a quasi-experimental pretest–posttest approach to investigate the impact of experiential learning activities on the spatial orientation skills of preschool children aged from 5 to 6 years. Intact classroom groups were used to reduce disturbance to children’s daily learning routines and school organisation and to maintain the ecological validity of the preschool setting (Creswell, 2013). The study comprised an experimental group that participated in a structured experiential learning intervention and a control group that engaged in regular classroom activities. Children’s spatial orientation skills were measured before and after the intervention using an observation-based rubric that captured three dimensions: spatial awareness, spatial practice and spatial application (Brookhart, 2013; McAfee et al., 2016).

Because the children’s behaviour and engagement needed to be recorded to achieve ongoing observation in real classroom settings, the classroom teachers were both intervention implementers and observational evaluators. The study prioritised observation-based assessment in natural classroom contexts to capture children’s spatial orientation behaviours as they occurred during everyday learning experiences. While this approach enhanced ecological validity and provided context-sensitive evidence of development, the possibility of observer bias remains a methodological limitation, despite efforts to improve scoring consistency through training and standardised assessment procedures.

3.2 Participants

The sample involved 120 preschool children aged 5–6 years and eight teachers at two preschools in Ho Chi Minh City, Vietnam. To achieve group equivalence and comparability, each preschool provided two intact classes, and each school gave two intact classrooms. Preschool 1 had one experimental class (n = 30) and one control class (n = 30), Preschool 2 had one experimental class (n = 30) and one control class (n = 30). The experimental group comprised 60 children (two classes) and the control group of 60 children (two classes). The child sample consisted of 59 boys (49.2%) and 61 girls (50.8%). Table 1 presents the characteristics of the children.

Table 1: Child participant characteristics (N = 120)

Indicator	Category	n	%
School–class assignment	Preschool 1 – Experimental class	30	25.0
	Preschool 1 – Control class	30	25.0
	Preschool 2 – Experimental class	30	25.0
	Preschool 2 – Control class	30	25.0
Group	Experimental	60	50.0
	Control	60	50.0
Child gender	Boys	59	49.2
	Girls	61	50.8
Total		120	100.0

Teacher demographic characteristics are presented in Table 2. In total eight teachers (two per class) participated in implementing the activities and supporting observation-based assessment.

Table 2: Teacher participant characteristics (N = 8)

Indicator	Category	n	%
Gender	Female	8	100.0
Age	30–39	6	75.0
	40–49	2	25.0
Workplace	Preschool 1	4	50.0
	Preschool 2	4	50.0
Teaching experience	< 3 years	1	12.5
	3–5 years	4	50.0
	5–10 years	3	37.5
Qualifications	College	1	12.5
	Bachelor’s	7	87.5
Prior training on spatial orientation	None	7	87.5
	Yes	1	12.5

With respect to sample considerations, the study employed a repeated-measures pretest–posttest structure. According to recommendations for paired-sample designs, the number of participants was selected to provide adequate statistical sensitivity for detect meaningful developmental changes while remaining feasible in authentic preschool contexts (Cohen, 2013; Fraenkel & Wallen, 2009).

3.3 Intervention and Materials

The intervention was a 10-week experiential learning programme that intended to promote the development of three-dimensional spatial orientation skills of preschool children: spatial awareness, spatial practice and spatial application. The curriculum followed predicted preschool learning outcomes, and was organised in a progressive fashion so that children advanced from recognising spatial links to moving within space and using spatial understanding in relevant contexts. The activities comprised movement-based games, guided exploration, block construction, navigation tasks and collaborative spatial problem-solving exercises done during regular classroom schedules.

Prior to the implementation, instructors representing both experimental and control groups took part in a structured training workshop delivered by the study team. The session covered the objectives of the study, how experiential learning would be undertaken and how the observational rubric would be applied. Instructions were provided on the scoring criteria, procedures for classroom observations and consistency in implementation between intervention sessions. Although the intervention started with a single training workshop, implementation support continued throughout the 10-week period with weekly instructional direction, observation records and reflective discussions with participating teachers to ensure implementation integrity across classes.

Table 3: **Summary of intervention activities, targets, and duration (10 weeks)**

Week	Activity title	Skill component	Key learning intention	Organisation form
1	Getting to know my classroom space	Awareness	Identify areas and use directional words	Observation, guided talk, movement
2	Finding the way to my seat	Awareness	Follow simple directions	Learning game, small-group guidance
3	Exploring the schoolyard	Awareness	Distinguish directions and outdoor zones	Outdoor exploration, discussion
4	Adventure to the library	Practice	Describe routes verbally	Simulation, storytelling, dialogue
5	My classroom mini map	Practice	Represent space using a simple plan	Drawing, group collaboration
6	Mini-map challenge	Practice	Read maps and locate positions	Movement game, map reading
7	Treasure hunt journey	Application	Select and follow routes using maps	Exploration, teamwork
8	Giving directions to a friend	Application	Communicate directions clearly	Role-play, peer feedback
9	Exploring the neighbourhood	Application	Orient within broader environments	Real-world observation, dialogue
10	“Young Navigators” day	Integration	Apply all components	Showcase, group presentation

3.4 Instruments

Children's spatial orientation skills were tested with an observation-based rubric developed specifically for preschool children and rated on a five-level developmental scale. The complete Spatial Orientation Skills Assessment Form that was used for pretest and posttest evaluation is provided in Appendix A. The rubric assessed children's performance on three aspects of spatial orientation. Spatial awareness was defined as children's knowledge and usage of positional relationships such as left–right, front–behind, near–far. Spatial practice involved children's ability to locate themselves in space, move through it, change direction and manipulate objects during learning tasks. Spatial application was an indication of children's ability to describe, symbolise, rebuild and apply a spatial understanding to practical situations, such as explanation of routes and map-related tasks.

We chose to use observation-based evaluation because spatial orientation abilities in early infancy are predominantly exhibited through movement, interaction, communication and contextualised action during classroom activities (McAfee et al., 2016). Observation checklists and teacher reflection notes were also used as process documentation to enhance interpretation of children's performance and monitor implementation fidelity over the intervention, along with the rubric. The rubric-based scoring was done in accordance with suggestions that performance evaluation systems should be closely aligned with learning objectives and give interpretable developmental data (Brookhart, 2013).

The rubric was designed from theoretical viewpoints on spatial cognition and early childhood development. Each dimension has unambiguous behavioural indicators and performance descriptors to enable uniform observation and scoring across individuals and measurement periods. The structure of the rubric is shown in Table 4.

Table 4: Structure of the spatial orientation skills observation rubric

Dimension	Description
Awareness of spatial position	Ability to recognise and describe spatial relationships such as left−right, above–below, near–far
Orientation and movement in space	Ability to locate oneself, navigate space and move appropriately in familiar environments
Application of spatial knowledge	Ability to use spatial understanding to complete tasks, follow directions and solve practical problems

Note. The observation rubric was developed according to theoretical frameworks of spatial cognition and early childhood development. The three dimensions were designed to capture observable behaviours related to recognising spatial relationships, navigating space and applying spatial understanding in learning and play contexts.

The rubric was applied consistently during both the pretest and posttest phases, to ensure comparability across measurement points. Following the intervention, teachers also completed a Post-Experimental Evaluation and Feedback Form to provide qualitative reflections on implementation feasibility, children's engagement and perceived learning outcomes. The full instrument is included in Appendix B.

3.5 Validity and Reliability

To improve the validity and reliability of the measurement process, various approaches were applied. Specialists in early childhood education evaluated the observation rubric and accompanying evaluation tools to examine the relevance of the material, its appropriateness for the developmental level and its relation to the conceptual framework of spatial orientation abilities. This review process contributed to refining the behavioural indicators and helped ensure that the assessment reflected the developmental characteristics of preschool children.

Second, the participating instructors underwent a structured training workshop prior to deployment. The curriculum was designed to build shared knowledge of the three aspects of spatial orientation abilities, to familiarise teachers with the five-level rubric descriptions and to provide opportunities for practice through sample observation scenarios. The preparation was intended to reduce subjectivity of scoring and to improve uniformity between classrooms, which is an important concern in classroom-based observational research (McAfee et al., 2016).

Third, procedures were devised to aid in scoring uniformity during the data collecting period. The rubric has well described behavioural indicators for observation and evaluation at five developmental levels. A sample of the classroom observations was also independently scored by two raters, and disagreements were discussed and resolved. Teacher reflection notes and observation checklists were used to help understand children's performance and to assess consistency of implementation throughout the intervention period. These procedures were developed to increase the agreement among observers and the reliability of the observational data.

Table 5: Reliability and exploratory factor analysis of spatial orientation skill dimensions

Dimension	Items	Cronbach's alpha	Eigenvalue	Variance explained (%)	Cumulative variance (%)
Spatial awareness	4	.867	4.536	22.549	22.549
Spatial practice	4	.892	1.878	22.311	44.860
Spatial application	4	.916	1.579	21.748	66.608

Reliability and construct validity analyses were conducted to strengthen the measurement quality of the observational rubric. Cronbach's alpha coefficients ranged from .867 to .916, indicating good to excellent internal consistency. In addition, exploratory factor analysis supports the three-dimensional structure of the spatial orientation construct, with cumulative explained variance reaching 66.608%. The detailed results are presented in Table 6.

Table 6: Reliability and exploratory factor analysis of the experiential learning process dimensions

Experiential learning process dimension	Items	Cronbach's alpha	Eigenvalue	Variance explained (%)	Cumulative variance (%)
Step 1. Educational objectives	4	.846	8.794	10.730	10.730
Step 2. Activity design	4	.855	2.308	10.556	21.285
Step 3. Learning environment design	4	.867	2.184	10.543	31.828
Step 4. Activity organisation	4	.846	1.967	10.528	42.356
Step 5. Feedback and discussion	4	.860	1.865	10.506	52.862
Step 6. Evaluation and adjustment	4	.861	1.836	10.403	63.265
Step 7. Experience extension	4	.878	1.606	10.162	73.427

Reliability and construct validity analyses were undertaken for the experiential learning implementation framework. Cronbach's alpha coefficients ranged from .846 to .878, indicating good internal consistency across all instructional stages. In addition, exploratory factor analysis supported the seven-dimensional structure of the experiential learning process, with cumulative explained variance reaching 73.427%. Detailed results are presented in Table 6.

3.6 Data Collection Procedure

Data collection was performed in three phases: baseline assessment, intervention implementation and post-intervention assessment. The spatial orientation skills of children in both experimental and control groups before the intervention were examined using baseline observation. Implementation was preceded by a preparatory phase. In this phase, weekly activity plans, instructional materials, classroom arrangements and learning objectives were systematically organised to ensure the consistency of learning content and classroom practice. Participating teachers were provided with structured training on experiential learning processes, observation methodologies and rubric-based assessment to increase uniformity of implementation across classrooms.

The intervention was carried out over a 10-week period during normal school hours. Children in the experimental group participated in a series of structured experiential learning activities aimed at developing spatial awareness, spatial practice and spatial application, while children in the control group continued with their regular classroom activities without the systematic experiential learning sequence. The intervention started with an introductory training workshop, but implementation support was ongoing throughout the study in the form of weekly instructional coaching, observation records and reflection interviews with instructors participating in the intervention. To assist in checking the fidelity of implementation, teachers collected information on classroom activities via observation notes and activity diaries.

All the assessors used a uniform rubric with clear separation of descriptors for five levels of performance, to limit subjectivity in the observational assessment. The scoring methodologies were reviewed at the training session. A subset of observations was rated separately and reconciled through inter-rater discussion, to enhance scoring consistency. In addition, implementation fidelity was examined through weekly lesson plans, teacher observation notes and periodic review meetings of the study team. The posttest measures were recorded using the same observation rubric, to measure the change in children's spatial orientation skills over time after the intervention.

3.7 Data Analysis

Quantitative data were analysed using SPSS 27 software. Descriptive statistics, namely frequencies, percentages, means and standard deviations, were used to summarise the characteristics of the participants and to define the baseline patterns of spatial orientation skills. Intervention efficacy was assessed by pretest–posttest comparisons within and between groups. Within-group change over time was examined using paired-sample *t*-tests and independent-sample analyses were conducted to investigate group differences at baseline and posttest, where appropriate.

To compensate for potential pretest differences and to provide a more precise estimate of intervention effects, a one-way analysis of covariance (ANCOVA) with pretest scores as the covariate was undertaken. To determine the magnitude of the changes observed, effect sizes were computed. For paired sample comparisons, Cohen's d was computed as the mean difference divided by the pooled standard deviation. Partial eta squared (ηp^2) was presented as an index of effect magnitude for ANCOVA results. Cohen's d values of 0.2, 0.5 and 0.8 were interpreted as small, medium and large effects, respectively, using usual interpretative criteria. ηp^2 values of 0.01, 0.06 and 0.14 were interpreted as small, medium and large effects, respectively.

In addition to statistical analyses, process documentation was analysed, including teacher reflection notes and classroom observation records, to contextualise the quantitative results and interpret how implementation conditions might have influenced children's participation and engagement during the experiential learning activities. The integration of process-based and quantitative information was designed to enhance interpretative validity within authentic preschool classroom environments.

3.8 Ethical Considerations

The research was done with preschool children in real educational settings and ethical considerations were meticulously observed during the research process. Appropriate institutional authorities and relevant preschool directors were contacted, and they granted permission to gather data for the research. All parents or legal guardians of the children provided written informed consent before intervention and assessment. Participation in the study was optional, and children were allowed to participate in classroom activities as part of their regular educational routines. Children were not placed in toxic or stressful situations.

All data obtained were anonymised for the purpose of analysis and reporting, to protect the privacy and confidentiality of participants. Observation logs, assessment forms and study papers did not include the children's names and other identifying information. Observation and assessment activities were carried out in familiar classroom settings so as not to disturb children's daily routine and emotional well-being. Intervention activities were consistent with developmentally appropriate preschool learning experiences and posed no physical or psychological dangers to participants.

Also identified in the study were the ethical duties of observant evaluation in the classroom. During implementation, teachers were instructed on fair observation, confidentiality and respectful interpersonal skills. Steps were taken to guarantee that the research was carried out ethically and in compliance with acknowledged standards for educational research involving young children.

4. Results and Findings

The results suggest that the observed improvements are strongly associated with the experiential learning intervention, although potential contextual influences related to classroom environments cannot be excluded entirely.

4.1 Qualitative Findings

The quantitative analysis identified five main themes related to the implementation of experiential learning for the development of spatial orientation skills in preschool children: 1) Experiential exploration; 2) Development of spatial language; 3) Instructional scaffolding; 4) Engagement in learning through movement; and 5) Reflective and follow-up practices. These themes provide context for the quantitative gains reported for the experimental group and demonstrate how experiential learning influenced the spatial development of children in the authentic classroom.

4.1.1 The experience of exploring

Most teachers (7/8) expressed that children's knowledge of spatial relationships improved when learning activities incorporated direct engagement with real surroundings, instead of teacher-led explanation alone. Teachers highlighted that movement-based exploration enabled children to physically and meaningfully engage with spatial concepts. For example, Teacher 2 said:

> *When children moved around the classroom or playground to find directions, they picked up spatial words faster than when I just explained them verbally.*

Similarly, Teacher 4 said:

> *The treasure hunt activity encouraged children to actively look for spots, and they naturally used words like 'behind', 'next to' and 'in front of' while playing the game.*

These reflections show the way in which experiential learning provided real environments for preschool children aged 5–6 years to develop spatial awareness through the processes of action and perception, thus reinforcing constructivist views of learning in the early years.

4.1.2 Development of spatial language

Teachers indicated that children's use of spatial language (spatial relations) increased during the course of the intervention. Six of the eight teachers reported that directive terminology was more often used in peer interaction. Teacher 1 said:

> *Children began by pointing silently then they could tell their friends where to go with spatial words.*

Teacher 6 said:

> *Group activities encouraged children to communicate more clearly as they needed to explain routes and positions to their peers.*

These results support the literature by showing the links between the use of spatial language and development of spatial reasoning and suggest that experiential tasks improved not only cognitive aspects of spatial orientation but also language-based expression.

4.1.3 Scaffolding instruction

Another important subject concerned the role of instructor direction in experiential learning activities. While the intervention encouraged active investigation, teachers emphasised the need for disciplined scaffolding to keep the focus of learning and facilitate meaningful reflection. Teacher 3 explained:

> *Children needed clear directions to get started, otherwise they just played without thinking of directions.*

Teacher 7 said:

> *When I asked leading questions like 'Where should we turn?' the children became more aware of spatial relationships.*

These remarks reflect that experiential learning was more effective when it was supported by purposeful pedagogical direction, therefore supporting the theoretical framework that combines experiential learning cycles with teacher facilitation.

4.1.4 Movement as a means of engaging in learning

All the teachers (N = 8) reported that movement-based activities greatly enhanced the involvement and motivation of the participants. Through a range of activities, from exploring the playground to sketching maps and engaging in cooperative games, students were actively engaged across a range of abilities. Teacher 5 explained:

> *Kids were more excited about outdoor exploration than traditional classroom activities.*

Teacher 8 said:

> *Even the usually quiet children were active when they had to move and work with friends.*

The emphasis on the body in motion is suggestive of the developmental appropriateness of experiential learning in early childhood education and helps account for the consistent progress of participants as shown in the quantitative findings.

4.1.5 Reflection and follow-up activities

Most aspects of the experiential approach received good scores from teachers, though several indicated difficulties in leading reflection conversations after activities. Teacher 4 said:

> *The children enjoyed the activities although it was sometimes difficult to lead them to talk about what they learnt afterwards.*

Teacher 1 had similar feedback:

> *We needed more time to reflect, as the children wanted to keep on playing.*

This finding supports the somewhat lower quantitative scores given to reflective stages, indicating that future implementations may benefit from enhancing organised reflection for consolidating learning outcomes. Overall, qualitative findings complement the statistical findings by indicating how experiential learning fostered development of children's spatial orientation through active exploration, guided interaction and meaningful engagement in real situations. The combination of experience of exploration and purposeful scaffolding is likely a fundamental mechanism that drives the observed increases in spatial awareness, spatial practice and spatial application.

4.2 Quantitative Findings

4.2.1 Baseline equivalence between experimental and control groups

To determine the initial comparability of the groups, independent-sample *t*-tests were performed on the pretest scores for the spatial orientation skills of the children in the experimental and control groups. Descriptive statistics calculated on the before-intervention scores are shown in Table 7.

Table 7: Descriptive statistics of preschool children's spatial orientation skills at pretest (N = 120)

Spatial orientation skill components	N	Mean	SD	Min	Max
Spatial awareness	120	3.04	0.32	2.50	4.00
Spatial practice	120	3.00	0.29	2.50	3.75
Spatial application	120	2.95	0.31	2.25	3.75

Descriptive statistics reveal that the participants demonstrated moderate levels of spatial orientation skills before the intervention. The mean scores varied from 2.95 to 3.04 on the three dimensions, indicating that children had established emerging, but not yet fully consolidated, spatial competences at the start of the study. The highest mean score was for spatial awareness (M = 3.04, SD = 0.32), followed by spatial practice (M = 3.00, SD = 0.29), and spatial application (M =

2.95, SD = 0.31). These trends show that there are generally comparable developmental profiles across the characteristics measured prior to the implementation of the experiential learning activities.

Independent-sample *t*-tests were conducted to further assess group equality, and the results are presented in Table 8.

Table 8: Independent samples t-test comparing experimental and control groups at pretest

Spatial orientation skill components	*t*	df	*p*	Mean difference	Conclusion
Spatial awareness	-0.213	118	.831	-0.013	No significant difference
Spatial practice	-1.103	118	.272	-0.058	No significant difference
Spatial application	-1.560	118	.121	-0.088	No significant difference

Levene's tests are nonsignificant on all dimensions (p > .05), indicating that the homogeneity of variance assumption was met. In addition, no statistically significant differences between the experimental and control groups were found in spatial awareness (p =.831), spatial practice (p =.272), or spatial application (p =.121). The minimal mean differences found between measures, furthermore, suggest that both groups had similar baseline performance prior to the intervention.

These findings provide evidence for the equivalence of the experimental and control groups at baseline, hence increasing the internal validity of subsequent analyses involving intervention. Although intact classroom groups were employed rather than participants being subjected to random assignment, the absence of substantial pretest differences suggests that changes seen at post-intervention were less likely to reflect pre-existing differences between groups.

4.2.1 Changes in spatial orientation skills after the intervention

Paired sample t-tests were performed to compare pretest and posttest results of the experimental group to examine changes in children's spatial orientation skills after their participation in the experiential learning programme. The results are given in Table 9.

Table 9: Paired samples *t*-test comparing pretest and posttest scores in the experimental group (N = 120)

Spatial orientation skill components	Mean difference (pre–post)	*t*	df	*p*
Spatial awareness	-1.592	-44.082	119	< .001
Spatial practice	-1.600	-48.682	119	< .001
Spatial application	-1.698	-52.631	119	< .001
Overall spatial orientation skills	-1.630	-86.145	119	< .001

All parameters of spatial orienting abilities showed statistically significant improvements after the intervention period. There were significant mean differences for spatial awareness (MD = 1.59, p .001), spatial practice (MD = 1.60, p .001), and spatial application (MD = 1.70, p .001). The total composite score for spatial orientation abilities also exhibited a statistically significant increase (MD = −1.63, $p < .001$). The greatest gain was for spatial application. This finding indicates that children made especially good progress in applying spatial understanding in movement-based, collaborative and problem-solving activities.

To illustrate the magnitude of change further, descriptive statistics comparing pretest and posttest scores are presented in Table 10.

Table 10: Pretest and posttest means and standard deviations for spatial orientation components (N = 120)

Spatial orientation skill components	Pretest (M)	Pretest (SD)	Posttest (M)	Posttest (SD)
Spatial awareness	3.04	0.32	4.63	0.28
Spatial practice	3.00	0.29	4.60	0.27
Spatial application	2.95	0.31	4.65	0.26
Overall spatial orientation skills	3.00	0.24	4.63	0.21

The mean scores for all the criteria significantly improved after the experimental group had participated in the experiential learning activities. Pretest scores were generally at intermediate developmental levels (M = 3.00), whereas posttest scores were over 4.50 on all measures. Spatial awareness improved from M = 3.04 to M = 4.63, spatial practice increased from M = 3.00 to M = 4.60, and spatial application improved from M = 2.95 to M = 4.65. Small standard deviations on the posttest show that the improvements were not isolated gains by a few individuals but were seen consistently across participants.

Results suggest that involvement in the experiential learning activities was related to significant gains on short-term measures of children’s capacity to identify spatial relationships, navigate physical surroundings and apply spatial understanding to authentic classroom tasks. However, data should be interpreted with caution because other factors, such as teacher facilitation techniques, peer interaction, classroom engagement and natural developmental progression, may have also contributed to children’s improvement over time.

4.2.2 Implementation fidelity of the experiential learning process

In addition to the children's performance outcomes, teachers’ self-evaluations were examined for consistency of implementation across the intervention period. The results are shown in Table 11.

Table 11: Teachers' self-evaluation of the implementation fidelity of the experiential learning process (N = 8)

Implementation steps	M	SD	Average f (%)	Fair f (%)	Good f (%)	Overall Rating
Step 1: Identifying learning objectives	4.19	0.35	5 (62.5)	1 (12.5)	2 (25.0)	Good
Step 2: Designing experiential activities	4.19	0.53	3 (37.5)	1 (12.5)	4 (50.0)	Good
Step 3: Preparing the learning environment	4.19	0.32	4 (50.0)	1 (12.5)	3 (37.5)	Good
Step 4: Organising experiential activities	4.22	0.43	3 (37.5)	2 (25.0)	3 (37.5)	Very good
Step 5: Providing feedback and interaction	4.38	0.40	3 (37.5)	1 (12.5)	4 (50.0)	Very good
Step 6: Assessment and adjustment	3.94	0.29	7 (87.5)	1 (12.5)	0 (0.0)	Good
Step 7: Extension and consolidation	4.16	0.48	2 (25.0)	3 (37.5)	3 (37.5)	Good

The mean scores of the teachers' ratings ranged from 3.94 to 4.38, reflecting that the experiential learning process was consistently applied at a high level in all phases of instruction. Active engagement, guided interaction and feedback were rated highest in instructional stages, thereby indicating a good match between the pedagogical concept and the actual classroom execution. The highest implementation consistency across classrooms was observed in the steps of organising experiential activities and giving feedback.

The assessment and adjustment phase had somewhat lower scores, though they were still within the 'good' range, suggesting rather stable implementation during the intervention period. This pattern indicates that reflective evaluation and instructional revision required more pedagogical coordination than did activity organisation and classroom engagement. However, the general fidelity indicators corroborate the consistency of intervention implementation and bolster trust in the interpretation of the quasi-experimental results.

4.2.3 Between-groups ANCOVA results for spatial orientation skills

To explore the effect of the experiential learning intervention further, correcting for baseline differences, a one-way ANCOVA was performed with pretest scores as the covariate (Table 12).

Table 12: ANCOVA results for spatial orientation skills between groups

Source	Type III sum of squares	df	Mean square	F	p	Partial eta squared (ηp^2)
Pretest (Covariate)	124.50	1	124.50	15.20	< .001	.114
Group (Intervention)	350.75	1	350.75	42.80	< .001	.265
Error	958.20	117	8.19			
Total	1 433.45	120				

Results suggest that the pretest covariate had a statistically significant effect on posttest performance, $F(1, 117) = 15.20$, $p < .001$, partial eta square = .114. The result implies that pretest differences in spatial orientation abilities accounted for about 11.4% of the variance in posttest scores, which underlines the necessity of controlling for baseline performance when assessing intervention effects. After adjustment for pretest scores, the group effect remained statistically significant, $F(1, 117) = 42.80$, $p < .001$, with a large effect size ($\eta p^2 = .265$). This finding suggests that the experiential learning intervention accounted for about 26.5% of the variation in posttest spatial orientation scores, after statistically controlling for baseline differences.

The comparatively significant effect size indicate that participation in the experiential learning programme was strongly related to higher posttest spatial orientation performance than it was to ordinary classroom teaching. However, these findings need to consider the methodological constraints of the study, in particular the use of intact classroom groups and the lack of a longitudinal follow-up evaluation. Although the intervention group showed significant short-term gains in spatial orienting abilities, further longitudinal studies are needed to investigate the sustainability of such results in the long run.

5. Discussion

The results of the present study show that participation in the experiential learning programme is associated with statistically significant short-term improvements in preschool children's spatial orientation skills as they relate to spatial awareness, spatial practice and spatial application. ANCOVA, which corrects for baseline differences, indicates that children in the experimental group performed significantly better than children in the control group on posttest scores. The findings are that structured experiential learning activities could provide significant opportunities for multidimensional spatial development in authentic preschool classroom settings (Lewis Presser et al., 2025).

The findings are consistent with Kolb's experiential learning theory, which views learning as a cyclical process that involves concrete experience, reflective observation, abstract conceptualisation and active experimentation (Kolb, 1984). In the present study, children explored the spatial world through movement-based exploration, object manipulation, collaborative activities and navigation tasks with direct interaction with the spatial environment. In these cases, children experienced the perception of spatial relationships and the use of spatial cognition in real environments. This sense of place was acquired by directly asking about places and instructions. This spatial skill was strengthened through repetitive navigation and movement-oriented workouts. The greatest gains were observed in spatial application, suggesting that preschool children made the greatest progress when they applied spatial understanding to practical tasks and real-world situations within their learning environments.

The results also support embodied cognition models that propose that cognitive development is directly related to physical contact and movement in the environment (Dillon et al., 2013). Children in the experiential learning group learned through active participation rather than passive listening. They developed spatial understanding by interacting directly with objects and physical environments and by collaborating on problem-solving and classroom navigation activities (Plummer et al., 2026). These results correspond with that of previous studies that report that spatial skills are changeable and can be a focus of interventions early in life (Uttal & Cohen, 2012; Yang et al., 2020). At the same time, research on directed play and activities for spatial creation reports positive effects on children's spatial thinking and problem-solving skills (Jirout & Newcombe, 2015; Verdine et al., 2014).

An essential contribution of the present study is its multidimensional conceptualisation of spatial orienting skills. Spatial skills have been seen as independent phenomena, for instance, navigation, spatial language and mental rotation. The present study, however, investigated spatial orientation according to three interrelated areas, namely spatial awareness, spatial practice and geographical application. This perspective helps us to understand how young children develop spatial abilities in actual interactions in real school environments.

Qualitative findings reinforced the quantitative results. Teachers consistently reported that children exhibited higher levels of participation and increasingly used spatial language during classroom interactions, particularly when they were engaged in movement-based inquiry and collaborative learning activities. These findings are consistent with socio-cultural perspectives on learning, particularly those derived from Vygotsky (1978), which emphasise the role of communication, social interaction and scaffolding in cognitive development. Teachers also seemed to be important for promoting children's reflection and encouraging children to use spatial awareness in experiential activities.

Despite the significant findings, there are limitations that need to be addressed. This study employed complete class groups and did not randomly assign persons. The groups were statistically equal at baseline but contextual factors such as as kind of teacher interaction, classroom climate and peer participation might have affected learning outcomes. The findings should, thus, be regarded as indicative of an association rather than as conclusive evidence of a causal relationship.

Second, the study relied mostly on observational methods for assessment. Observational assessment is developmentally appropriate for preschool children because it provides a means to gather actual classroom actions. However, observational assessment remains susceptible to some degree of scoring subjectivity, despite extensive rater training and procedures designed to promote inter-rater agreement. Future research could blend observational methods with performance-based or technology-assisted instruments for evaluation, to improve measurement accuracy.

Finally, the investigation examined the effects of short-term intervention exclusively. There was no longitudinal assessment of follow-up, and it is unclear whether the gains reported will be sustained. Hence, future research should evaluate the long-term effects of experiential learning interventions in different preschool settings.

However, the results achieved represent a theoretical and practical addition to the study of early childhood education. The study contributes to the literature by explicitly integrating Kolb's experiential learning cycle in a multidimensional framework of spatial orienting abilities. Practically, the findings emphasise the importance of preschool programmes taking advantage of the integration of movement-based exploration, guided spatial play, cooperative navigation tasks and reflective conversation, into children's daily learning routines. Thus, it may be useful to apply experiential learning as a method to develop spatial development in cognitive, physical and social domains in early life.

6. Conclusion

This study was conducted to explore the usefulness of experiential learning in aiding the development of the spatial orientation skills of preschool children aged 5–6 years in authentic classroom environments. The results suggest that involvement in structured experiential learning activities is related to meaningful improvements over the short term in the areas of spatial awareness, spatial practice and spatial application. Quantitative results confirm clear benefits post-intervention, and qualitative studies indicate that movement-based exploration, guided interaction and collaborative participation boosted children's engagement and spatial learning processes. These findings show that experiential learning may be a useful pedagogical tool for developing multidimensional spatial orientation abilities in early childhood. In theory, the study makes a contribution to the field by merging experiential learning theory with a three-dimensional framework of spatial orientation that involves awareness, practice and application.

However, several limitations must be addressed. The study was quasi-experimental, with intact classroom groups, as opposed to random assignment of students to conditions. The findings only represent short-term effects of the intervention. In addition, although the observational assessment was developmentally appropriate for preschool children, some degree of scoring subjectivity may have remained despite the implementation of procedures designed to enhance reliability and scoring consistency. Therefore, future studies should investigate the long-term sustainability of experiential learning interventions through longitudinal and multisite studies, and other performance-based assessment methods. The study presents empirical findings for a Vietnamese preschool context and implications for curriculum design, teacher preparation, and classroom implementation in early childhood education.

7. Conflicts of Interest

7.1 Conflicts of Interest

The authors declare no financial, professional, institutional or personal conflicts of interest that could impact the design, implementation, analysis or reporting of this work. The research was carried out purely for scholarly and educational reasons and there was no commercial involvement or external influence.

7.2 Funding
This study received no external funding. All study activities, including the execution of the intervention, data collecting and analysis, and the writing of the publication, were conducted as part of the authors' academic work in the field of early childhood education.

7.3 Ethical Statement
Ethical approval for the study was acquired from the institutional research ethics committee before data collection and intervention implementation. Participation in the study was voluntary, and a signed informed consent was collected from the preschool directors and parents or legal guardians of all the children who participated. All procedures were consistent with the ethical guidelines for educational research involving young children.

The privacy and confidentiality of participants were protected by anonymising all identifying information during data collection, analysis and reporting. Observations and evaluation activities took place in familiar school settings to avoid disruption to children's daily routine and emotional well-being. The intervention activities were developmentally appropriate and intended to promote children's learning, and to avoid physical or psychological danger to participants.

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Appendix A: Spatial Orientation Skills Assessment Form

1. General Information

1. Child's Full Name: ....
2. Class: ....
3. Preschool/Kindergarten: ....
4. Gender: □ Male □ Female Age: ....
5. Date of Assessment: .... / .... / 20....... Phase: □ Pretest □ Posttest
6. Assessor: ....
7. Position: □ Teacher □ Administrator □ PhD Student/Researcher

2. Assessment Instructions

Based on the Spatial Orientation Skills Rubric (5 levels) provided in Appendix 5.
Mark (✓) the level that best describes the child's performance for each criterion.
Scoring Scale:

Level	Descriptive Meaning
1	Not achieved (Beginning)
2	Basic achievement (Emerging)
3	Fair (Developing)
4	Good (Proficient)
5	Mastery & Flexibility (Advanced)

3. Specific Assessment by Skill Components

Code	Specific Skill Indicators	Agreement Level
	I. Spatial Orientation Perception	
	Ability to perceive, differentiate, and remember spatial relationships: position−direction–distance)	
1.1	Identifies the position of self and objects in space	① ② ③ ④ ⑤
1.2	Differentiates basic spatial concepts (above–below, inside-outside, left–right)	① ② ③ ④ ⑤
1.3	Remembers and describes familiar spatial layouts	① ② ③ ④ ⑤
1.4	Recognises positional relationships between different objects	① ② ③ ④ ⑤
	Ii. Spatial Orientation Practice Ability to apply spatial knowledge into actions through manipulation, navigation or positioning)	
2.1	Navigates in the correct direction according to spatial instructions	① ② ③ ④ ⑤
2.2	Arranges and places objects in the correct spatial positions	① ② ③ ④ ⑤
2.3	Uses landmarks as reference points to determine direction or position	① ② ③ ④ ⑤
2.4	Adjusts movement direction and orientation based on signals or spatial changes	① ② ③ ④ ⑤
	Iii. Spatial Orientation Application	
	Ability to creatively and flexibly apply spatial knowledge to new or complex situations	
3.1	Describes routes, directions, or positions using words, gestures, or diagrams	① ② ③ ④ ⑤
3.2	Solves orientation challenges in novel situations	① ② ③ ④ ⑤

Code	Specific Skill Indicators	Agreement Level
3.3	Plans movements based on maps or guided instructions	① ② ③ ④ ⑤
3.4	Cooperates effectively in spatial orientation games and activities	① ② ③ ④ ⑤

4. Summary Evaluation

Skill Component	Mean Score (1-5)	Achievement Level	Brief Comments
Spatial Perception		□ Not achieved □ Basic □ Fair □ Proficient □ Advanced	
Spatial Practice		□ Not achieved □ Basic □ Fair □ Proficient □ Advanced	
Spatial Application		□ Not achieved □ Basic □ Fair □ Proficient □ Advanced	

General Conclusion: ☐ Significant progress ☐ Progress in some areas ☐ No significant progress

5. Teacher's Comments and Recommendations

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Usage Notes:

- This form is used at two time points (pretest and posttest) to measure the progress of children aged 5–6 years.
- Identification coding (e.g., T01-T30) may be used for each child to ensure anonymity during data analysis.
- Aggregated data are processed using statistical software (SPSS) to determine the effectiveness of the experiential learning intervention.

Appendix B: POST-EXPERIMENTAL EVALUATION AND FEEDBACK FORM

1. GENERAL INFORMATION

1. Experimental Activity Name: ....
2. Topic/Programme: ....
3. Preschool/Kindergarten: ....
4. Location: ....
5. Date of Experiment: .... / .... / 20.......
6. Implementer (Teacher): ....
7. Evaluator: ....
8. Position: ....

2. EVALUATION OF THE EXPERIMENTAL SESSION

(Please mark "X" in the corresponding column)

No.	Evaluation criteria	Achieved	Achieved with revision	Not Achieved
1	The content is aligned with the objectives of educating spatial orientation skills for children aged 5–6 years.			
2	The content strictly follows the three skill components: perception - practice - application.			
3	The activity clearly demonstrates the 7-step experiential learning cycle (Objectives–Activity selection–Environment design–Organisation–Feedback–Evaluation–Extension).			
4	Experiential tasks are appropriate for the psychological and cognitive characteristics of 5–6 year-olds (attainable and engaging).			
5	The activity structure is logical, including an introduction, skill formation, consolidation, and experiential extension.			
6	The teacher performs well as a facilitator—guiding, prompting, and encouraging active participation, teamwork, self-discovery, and spatial language expression.			
7	Children participate actively and autonomously; they observe, practice, and apply orientation skills to real-world activities.			
8	Activities are connected to real or simulated environments, ensuring safety, flexibility, and positive interaction between child–teacher–peers.			

No.	Evaluation criteria	Achieved	Achieved with revision	Not Achieved
9	Questions, situations, and experiential tasks promote verbalisation, spatial thinking, and group collaboration.			
10	The teacher flexibly applies early childhood pedagogical methods (games, discovery, dialogue, observation, experience, etc.).			
11	Assessment and feedback are integrated into the process, helping consolidate knowledge and develop spatial orientation skills.			
12	Experimental results reflect children's progress in spatial orientation through observable behaviours.			
13	The experimental session ensures pedagogical quality, feasibility, and suitability for the Vietnamese preschool context.			
14	The teacher demonstrates creativity and flexibility in designing and organising experiential activities.			
15	Overall, the experiment is highly effective, confirming the validity of the measures proposed in the thesis.			

Overall Classification: ☐ Achieved ☐ Achieved with Revision ☐ Not Achieved

3. SPECIFIC FEEDBACK AND RECOMMENDATIONS

(Please specify content to be added, adjusted, or strengths to be maintained)

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....
....
....