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IMPACT OF SPATIAL NAVIGATION ON VISUO-SPATIAL WORKING MEMORY IN CHILDREN WITH AUTISM:

Assessing the mediating role of navigational autonomy.

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Abstract: *Wayfinding significantly influences spatial cognition and environmental interaction of autistic children; however, it remains underexplored within inclusive education systems. This study examines the effects of spatial navigation on visuo-spatial working memory (VSWM) among autistic children in two primary schools with a 'Special Unit' in Negombo, Sri Lanka. Adopting a mixed method approach, the research evaluates cognitive performance through pre and post intervention VSWM assessment using Corsi Block-tapping task under two navigation conditions: Assisted Wayfinding and Unassisted Wayfinding. The study involves 23 autistic students, while navigational difficulties are assessed using a structured questionnaire. Wayfinding behaviours and spatial interactions were examined through behavioural mapping and parametric observations supported by photographic documentation. Results showed a decline in post-task accuracy in both navigation conditions, with smaller reductions in unassisted tasks. Recall times increased during assisted navigation but slightly improved in unassisted tasks. Error rates also decreased modestly in independent navigation tasks. Case 02 demonstrated higher spatial anxiety, persistent distance-estimation difficulties, and reduced orientation ability. Behavioural observations showed preferences for direct routes, shaded green spaces, and enclosed spaces that aid sensory regulation. However, both environments lack effective architectural wayfinding cues to reduce cognitive load, highlighting the need for autism-responsive strategies in inclusive design and further research on navigating environments.*

Keywords: *Autism Spectrum Disorder; Spatial Navigation; Visuo-Spatial Working Memory; Wayfinding.*

1. Introduction

Individuals with autism spectrum disorder (ASD) exhibit distinct differences in neurological processing that fundamentally alter their sensory and spatial interactions with the built environment (Munshaw, 2015). These differences manifest as sensory processing difficulties that profoundly shape how autistic individuals perceive and navigate architectural spaces.

Autistic Individuals demonstrate atypical sensory processing, characterized by hyper or hypo sensitivity to environmental stimuli, which disrupts spatial perception and environmental engagement (Munshaw, 2015; Donohue et al., 2016). These sensory processing differences are associated with elevated anxiety and emotional dysregulation, further compounding spatial navigation challenges (Tavassoli et al., 2014). Consequently, conventional built environments typically designed for neuro typical sensory profiles impose disproportionate perceptual barriers for autistic individuals, transforming routine spatial transitions into cognitively taxing experiences.

Navigation through the built environment presents distinct cognitive challenges for autistic individuals, particularly in allocentric spatial processing. While egocentric navigation remains relatively preserved (Feigenbaum & Morris, 2004; Goodrich-Hunsaker et al., 2010), allocentric memory formation is impaired due to relational memory deficits (Bowler et al., 2014). The relational binding hypothesis posits that autistic individuals struggle to integrate disparate spatial elements into coherent cognitive maps (Bigham et al., 2010; Bowler et al.,2014; Cooper et al., 2015), resulting in navigational inefficacies.

These wayfinding demands directly affect Visuo-spatial working memory (VSWM), which autistic children rely upon and deplete during environmental navigation. Although visual memory strengths may support landmark recognition (Mottron et al., 2006), recent evidence reveals poorer VSWM performance compared to typically developing peers (Lin et al., 2025). Structured visual cues can mitigate these demands (Schmidt et al., 2011), yet complex environments remain cognitively depleting.

The dynamic establishes the central research problem that school environments that tax VSWM during navigation leave autistic children with diminished cognitive resources for learning tasks. The present study addresses this identified research gap by examining pre and post navigation VSWM changes, establishing a direct empirical link between architectural design, cognitive depletion, and learning readiness in ASD.

1.1. NEED FOR RESEARCH

Most existing literature conducted related to these study areas often focuses on other aspects such as colour, lighting, material etc. (Munshaw., 2015). Further limited research has been conducted related to educational settings focused on children; the study aims to relationally understand the dependency of the built environment towards the effects of memory and navigation specially focusing on VSWM.

2. Review of Literature

The built environment plays a critical role in shaping the quality of life for individuals with autism. A discrepancy between spatial needs and architectural design can limit the ability of individuals with autism to independently interact with their surroundings, as highlighted by Terzi (as cited in Tola et al., 2021), a view further supported by Imrie and Kullman (as cited in Tola et al., 2021). Recent research further emphasizes that environmental characteristics such as spatial organization, predictability, and sensory conditions affect autistic individuals.

Studies indicate that poorly designed environments can increase sensory overload and reduce independent navigation, whereas structured and predictable spatial layouts can improve environmental interaction and autonomy (Mostafa, 2015; Gaines et al., 2016). Moreover, contemporary studies show that sensory stimuli, including intensity, density, and spatial configuration within the built environment can directly influence the sensory perception, well-being, and environmental adaptability of autistic individuals (Randell et al., 2022; Passarello et al., 2022).

Autistic individuals experience differences in neurological processing, particularly in how they perceive and respond to sensory stimuli (Munshaw, 2015; Donohue et al., 2016). These sensory challenges, such as hyper- or hypo-reactivity, can result in adverse responses to textures, sounds, and light, as outlined in the DSM-5 (APA, 2013), which often constrict their behavior and movement in typical spaces.

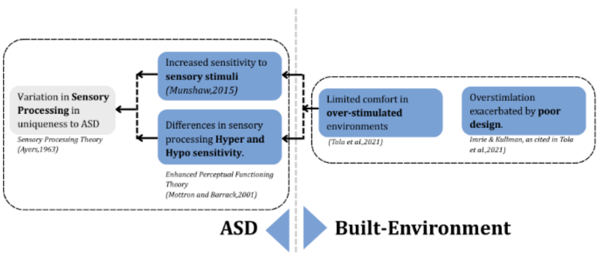

Figure 1: Relationship between ASD and Built-Environment
(Source: Author)

2.1. AUTISM AND WAYFINDING CHALLENGES

Research highlights that individuals with autism may possess strengths in wayfinding due to cognitive traits such as strong short- and long-term memory (Siegel & White, 1975), adaptive problem-solving abilities (Golledge & Stimson, 1997), and enhanced visual perception aiding landmark recognition (Mottron et al., 2006). However, Smith (2015) notes that despite these strengths, many autistic individuals face difficulties in real world navigation; and recent studies indicate that these challenges are often linked to allocentric spatial processing and relational memory, which affect the ability to form cognitive memory maps (Lin et al., 2025; Zhang et al., 2020). Since wayfinding relies on encoding, storing, and manipulation of spatial information, it suggests a direct relationship to VSWM, which plays a key role in supporting navigational tasks. Further, navigational behaviour has a direct influence, where assisted navigation relies on external guidance, reducing active spatial encoding, while unassisted navigation involves exploration and decision-making, promoting stronger encoding within visuo-spatial working memory (VSWM). This suggests that greater navigational autonomy may enhance spatial memory formation (Ishikawa et al., 2008).

2.2. ARCHITECTURAL PARAMETERS FOR WAYFINDING THAT AID ASD

The built environment significantly influences the wayfinding abilities of individuals with autism, highlighting the need for architectural interventions that support spatial navigation. Several key design factors have been identified:

- Clear visual cues help reduce confusion and anxiety due to difficulty interpreting abstract signage (Michaels et al., 2018).
- Predictable layouts support cognitive mapping and spatial understanding (Alves et al., 2020).
- Sensory-friendly environments reduce overload that can impair navigation. (Mostafa, 2015; Gaines et al.,2016)
- Personalized pathways enhance comfort and engagement (Hodgetts & Nussbaum, 2018).
- Lighting and colour sensitivity can affect orientation, requiring careful design (Liddiard et al., 2019).
- Quiet retreat spaces aid in emotional regulation (Smith et al., 2015).
- Flexible spaces support autonomy and reduce stress (Stewart et al., 2016).

2.3. WAYFINDING ASSESSMENT TOOLS

Wayfinding performance is often assessed through task-based measures such as completion time, distance travelled, error frequency during navigation tasks (Bowman et al., 2001; Elvins et al., 2001). Recent studies have further incorporated factors such as hesitation, route choice, stopping frequency etc. to better understand navigation processes and spatial decision making in complex environments (Lim et al., 2023; Musonera, 2024). Behavioural mapping, developed by Henry Sanoff and Garry Coates (1971), records user movement and interactions with spatial settings. This method helps identify user patterns, sensory challenges, and user needs which will be precursive in understanding the settings.

2.4. VISUO-SPATIAL WORKING MEMORY (VSWM)

Lohman (1996) describes visuo-spatial abilities as the capacity to generate, retain, retrieve, and manipulate structured visual images. Similarly, Yang et al. (2021) explain that visuo-spatial memory involves remembering spatial relationships between objects as well as their locations within an environment, which is fundamental for spatial understanding and navigation.

Logie (1995) identifies certain factors that contribute towards complex spatial processing and identifies spatial memory as a multi-component system that includes spatial sequential memory, simultaneous memory, location memory, and spatial working memory. Hegarty and Waller (2005) further highlight the importance of visuo-spatial working memory (VSWM) in facilitating spatial reasoning and environmental cognition.

Recent studies have expanded this perspective by identifying the role of neural systems, particularly interactions between the hippocampus and parietal regions, that support VSWM and navigation-related tasks (Koshino et al., 2005; Lin et al., 2025). Consequently, VSWM in wayfinding research is evaluated through tasks designed to measure different aspects of spatial processing, including sequential and simultaneous processing as well as active and passive engagement during tasks.

2.5. ASSESSMENT TOOLS FOR VISUO-SPATIAL WORKING MEMORY (VSWM)

Studies reveal a range of VSWM tasks - The Mental Rotation Task evaluates active simultaneous VSWM, which assesses object orientation, the Copying Tasks assess the simultaneous processing of static layouts, Spatial Problem Task involves active engagement in efficient navigation. For the study, VSWM was assessed using Corsi Block Tapping Task, a widely recognized neuropsychology test for evaluating spatial memory capacity. The Corsi Block Task assesses sequential VSWM through passive spatial recall, which is crucial for remembering route steps, hereby measuring short-term spatial recall and working memory performance (Corsi, 1972; Baddeley, 2003).

The Corsi Block task, with a slight adjustment of a tapping task, supports in using children for the study. Participants were presented with a sequence of tapping tasks (tapping on number cards placed on a table guided by the sequences presented by the teacher), which they were to repeat from memory after performing wayfinding tasks (before and after).

2.6. CO-RELATIONSHIP BETWEEN ASD, WAYFINDING, AND VSWM

Wayfinding is a complex cognitive process that involves the integration of spatial information, memory retention, and problem-solving abilities. Effective navigation involves individuals to encode, store, and manipulate spatial information while simultaneously making decisions about routes and environmental cues. In this scenario, VSWM plays a crucial role, as it supports temporary storage and active processing of spatial information required for orientation and route planning (Logie, 1995). Beyond navigation, VSWM is also linked with academic performance, including mathematical reasoning, reading comprehension, as well as social functioning and coordination (Alloway, 2010).

For individuals with ASD, variations in VSWM may influence their wayfinding performance. Although some studies indicate strengths in visuo-spatial tasks, research shows lower performance in spatial memory tasks, which can affect their ability to encode and manipulate spatial layouts during navigation (Zhang et al., 2020). Recent research further states that differences in relational memory and cognitive map formation may contribute to difficulties in navigating complex environments for individuals with autism (Lin et al., 2025). Reduced VSWM capacity has also been associated with increased cognitive load and spatial anxiety in demanding environments (Baddeley, 2003; Mostafa, 2015).

The relationship between ASD and navigation was further studied through theories such as the Weak Central Coherence model, which suggests a tendency to focus on local details rather than integrating global spatial information (Sheppard et al., 2009). Similarly, the Executive Function Deficit theory links challenges in working memory, planning, and cognitive flexibility to difficulties in navigation and spatial decision-making (Happé & Frith, 2006). Additionally, emerging studies indicate that sensory characteristics and the complexity of the environment can further influence navigation performance.

Collectively, these relationships highlight the interconnected nature of wayfinding processes, VSWM functioning, and cognitive characteristics associated with Autism.

2.7. RESEARCH FRAMEWORK

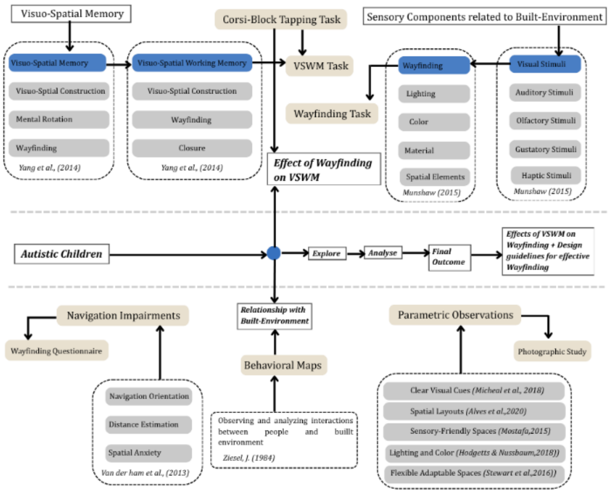

Figure 2: Relationship between factors affecting Human Spatial Navigation
(Source: Author)

3. Scope and limitations

The original study intended to include special schools, but the limitations of access due to time constraints and delayed approval led to a focus on ‘Special Units’ within primary schools. Participant numbers were reduced due to these constraints, and schools were selected from a single geographical area. However, since the research was conducted during school vacations, daily school activities and the full environmental context were limited. Moreover, the structured nature of the tasks and small sample size limit the generalizability and do not fully replicate the complexity of real-world wayfinding scenarios.

4. Research Design

This investigation is on how wayfinding and architectural parameters within school environments influence the visuo-spatial working memory (VSWM) of autistic children in ‘Special Units’. Grounded in literature and prior research, the study uses tools to assess outcomes.

4.1. RESEARCH METHODOLOGY

This research adopts a mixed-method approach, combining quantitative and qualitative data collection and analysis.

The quantitative component involves a wayfinding task assessed using pre- and post-tests of Visuo-Spatial Working Memory (VSWM) to measure its correlation with wayfinding ability.

- Independent variable: Wayfinding/Spatial Navigation
- Dependent variable: Visuo-Spatial Working Memory

The qualitative analysis includes behavioural mapping by observers, teachers, and students, and a photographic parameter study to identify environmental features that support wayfinding. A standardized Wayfinding Questionnaire (WQ) that was adjusted to autistic kids due to their cognitive challenges is also used to evaluate spatial navigation impairments. Data were analysed using ANOVA and manual coding to extract key findings and inform design recommendations for autism-friendly school environments that support the development of VSWM. A pilot study was conducted to define the route, and sequences. Recall sequences were recorded using structured tables.

4.2. ETHICAL CLEARANCE PROCESS

Since the study involved the participation of children with autism, the ethical procedures established by the university were thoroughly followed. The ethical clearance process was followed while ethical clearance was obtained from the Ethical Clearance Board of the University of Moratuwa (Ethics Declaration Number: EDN/2025/009, dated 02 June 2025).

Before commencing the study, participants, legal guardians, and the teachers of the corresponding classes of the ‘Special Unit’ were informed about the objectives, potential risks, and benefits of the study through an information sheet, and informed consent was obtained accordingly.

The research was conducted with minimal intervention from the researcher. The primary facilitator was the teacher who carried out the tasks to ensure familiarity and comfort in the learning environment. Time limits were carefully structured, laying out the tasks across multiple days to ease the cognitive strain upon the participants, and the level of task difficulty was reduced in order to adapt to the environment. Further, the questionnaire was reduced from a 7-point Likert scale to a 5-point Likert scale to improve comprehension among participants, reducing the time span and increasing understandability.

4.3. PARTICIPANTS OF THE STUDY

A sample of 23 clinically diagnosed autistic students (25% male and 75% female) was selected from two selected schools, with the assistance of the teachers. However, the tasks required were only completed by 20 participants. While gender was recorded, the sample size (n=20) precluded statistical comparison; however, navigation patterns appeared consistent across groups. All the participants were formally diagnosed based on the SCGC-assessments (School counselling and guidance committee) and clinical assessments (medical professionals), indicating mild to moderate levels of autism. They were also considered suitable for mainstream placement at schools, ensuring cognitive readiness. Such selection criteria are consistent with those commonly adopted in previous research involving individuals with autism spectrum disorder (ASD).

4.4. CHOICE OF APPROPRIATE CASE STUDIES

Negombo was selected due to accessibility, availability to primary schools with 'Special Units' and the logistical feasibility within the given time frame. To minimize variables affecting outcomes, with criticality on participant availability, schools with 'Special Units' were selected for this study. District-level schools were selected due to higher attendance in 'Special Units' at the primary level. Both selected primary schools had mixed-gender student populations, with gender considered as a relevant factor.

4.5. DATA COLLECTION TOOLS

This study employs both quantitative and qualitative data collection tools. The primary quantitative measure is the VSWM task assessment, analysing pre- and post-wayfinding effects. Secondary instruments include wayfinding questionnaires evaluating wayfinding ability in familiar contexts, behavioural mapping, and photographic studies that assess user behaviour and environmental parameters pertaining to the study.

Table 1: Quantitative Data Collection Methods (Source: Author)

Parameter	**Investigative Parameter**	**Method of Investigation**
Visuo-Spatial Working Memory (VSWM)	Investigate the effects of 'Wayfinding' on 'VSWM'	Pre and Post VSWM tasks (Task Implemented - 'Corsi Block Tapping Task')
Wayfinding	Investigate and measure wayfinding using three subscales (Navigation & Orientation, Distance Estimation and Spatial Anxiety)	Wayfinding Questionnaire (WQ) Standard Questionnaire (Likert scale reduced from 7 to 5 considering the subjects ability to respond)

Table 2: Qualitative Data Collection Methods (Source: Author)

Parameter	**Investigative Parameter**	**Method of Investigation**
Wayfinding	Investigate the behavioural patterns of wayfinding.	Behavioural Maps (Observer/Teacher /Students)
	Investigate and identify parameters of Wayfinding that aid in effective Wayfinding.	Parametric Observation through Photographic Study

4.6. DATA COLLECTION

Data were collected manually through direct observation, with teachers in the 'Special Unit' closely monitoring the students. The pre and post wayfinding tests were organized around four scenarios, conducted across four sessions in four days. Each session followed a three-step sequence, starting with the Corsi Block Tapping task (VSWM test), which was then directed to the wayfinding task and finally the VSWM task repeated again to record any changes following the navigation task. Both assisted and un-assisted tasks were implemented with each scenario repeated for two consecutive days. Additionally, students engaged in behavioural mapping with the teachers to record spaces that facilitated better wayfinding.

5. Data Analysis and Presentation

5.1. CASE STUDY 01 - WP/NG/SEEDUWA METHODIST PRIMARY SCHOOL, SEEDUWA

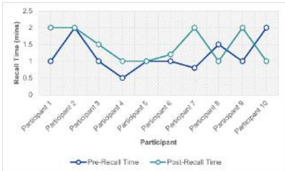

Figure 3: Participant Accuracy - Assisted (CS-1) (Source: Author)

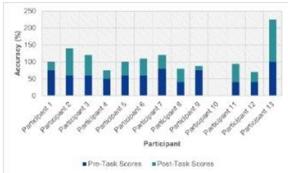

Figure 4: Pre vs Post Recall Times - Assisted (CS-1) (Source: Author)

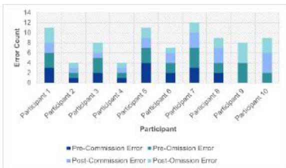

Figure 5: Omission and Commission Errors - Assisted (CS-1) (Source: Author)

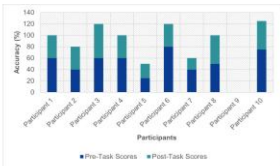

Figure 6: Participant Accuracy - Unassisted (CS-1) (Source: Author)

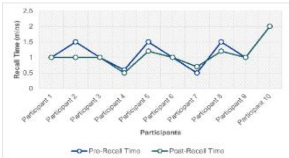

Figure 7: Pre vs Post Recall Times - Unassisted (CS-1) (Source: Author)

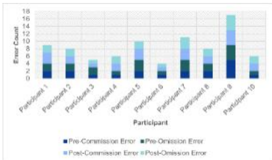

Figure 8: Omission and Commission Errors - Unassisted (CS-1) (Source: Author)

5.1.1 Discussion

Table 3: Case 1 Wayfinding Task (Assisted vs Unassisted) Findings
(Source: Author)

Parameter	Assisted Wayfinding Task	Un-assisted Wayfinding Task
Pre VS Post Accuracy	Pre-intervention mean accuracy (55.7%) Post accuracy decline by 18.46%	Moderate mean accuracy of 49% Pre-intervention. Post-intervention, performance declined significantly to a mean of 36.5%.
Recall Time Change	Longer recall times post intervention (imply on cognitive load). Stable at times (no change in performance)	Pre-intervention recall times showed quicker responses; post-intervention recalls times increased (heightened cognitive load).
Omission VS Commission Errors	Omission errors increased post-intervention (suggest low accuracy – Retention difficulty). Commission errors were less frequent and varied inconsistently.	Varied errors pre-intervention. Post-intervention, omission and commission errors remained consistent or worsened.

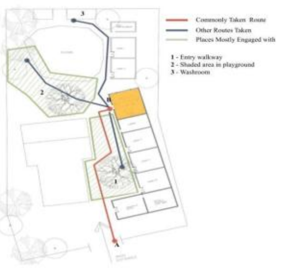

Figure 9: Behavioural Mapping - Investigator's Perspective (CS-1)
(Source: Author)

Figure 10: Behavioral Mapping - Teacher's Perspective (CS-1)
(Source: Author)

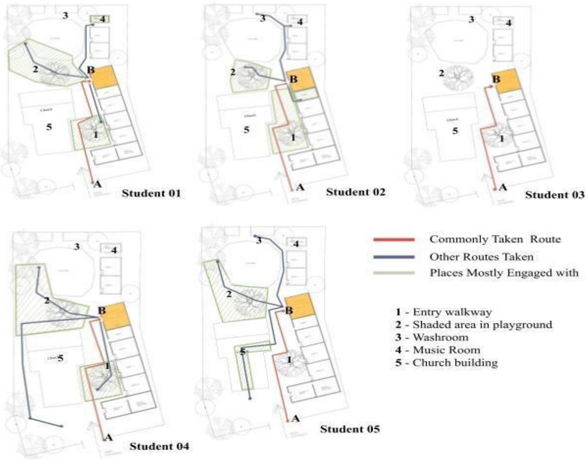

Figure 11: Behavioural Mapping – Student's Perspective (CS-1)
(Source: Author)

The 'Behavioural Mapping' reveals all students primarily used a defined route from the entrance to the classroom indicating reliance on structured circulation patterns, their secondary spatial preferences varied based on individual activity level and sensory regulation—some gravitated toward shaded, green areas, while others preferred quieter, enclosed spaces. Active students (e.g., Students 1 and 2) engaged more with open, semi-structured environments and less active students sought refuge in quieter, more isolated settings. These behaviours indicate that navigation is primarily route-based, shaped by limited environmental cues that restrict the development of exploratory cognitive mapping (Siegel & White, 1975). Secondary spatial choices further suggest adaptive, self-regulatory responses to sensory and social demands within the built environment.

The 'Parametric Observation' reveals the following findings. The school provides some basic spatial support, such as a clearly defined path from entry to the classroom. However, visual cues are minimal, sensory design is lacking—bright blue tones and concrete floors may cause discomfort, and sound control is minimal and a huge lack in personalized zones or quiet escape spaces. This aligns with Mostafa's (2015) Autism-Friendly Architecture principles emphasizing sensory zoning and controlled complexity.

The 'Wayfinding Questionnaire' revealed significant wayfinding challenges among autistic students. 70% were impaired, demonstrating difficulty with route recognition and spatial representation. In the spatial anxiety subscale, 100% of participants scored above the critical threshold. In distance estimation, 80% were impaired, showing struggles with spatial reasoning.

5.2. CASE STUDY 02 - ST. FRANCIS DE SALES PRIMARY SCHOOL – KATTUWA

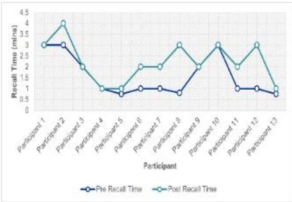

Figure 12: Participant Accuracy - Assisted (CS-2)
(Source: Author)

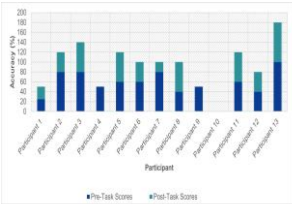

Figure 13: Pre vs Post Recall Times - Assisted (CS-2)
(Source: Author)

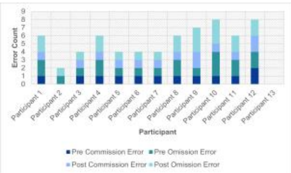

Figure 14: Omission and Commission Errors - Assisted (CS-2)
(Source: Author)

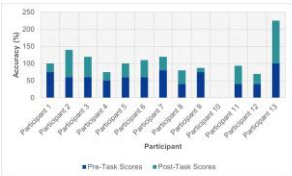

Figure 15: Participant Accuracy - Unassisted (CS-2)
(Source: Author)

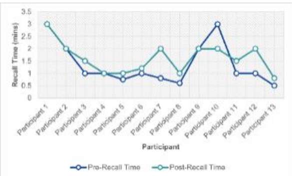

Figure 16: Pre vs Post Recall Times - Unassisted (CS-2)
(Source: Author)

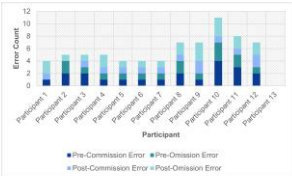

Figure 17: Omission and Commission Errors - Unassisted (CS-2)
(Source: Author)

5.2.1 Discussion

Table 4: Case 2 Wayfinding Task (Assisted vs Unassisted) Findings
(Source: Author)

Parameter	**Assisted Wayfinding Task**	**Un-assisted Wayfinding Task**
Pre VS Post Accuracy	Pre-intervention mean accuracy reduced 55.77% to 37.31% post-intervention	Mean accuracy dropped from 49% to 36.5% in mean score denoting an overall performance regression.
Recall Time Change	Increased Recall times post-intervention, from a 1–2-min range to 2–3 min, implying greater cognitive load. Increase recall time correlate between time and accuracy.	Post-task recall times remained within 0.5 -- 2 mins and many indicated improved efficiency. But decrease in time taken.
Omission VS Commission Errors	Frequent omission errors than commission errors, reflecting retrieval struggles. Persistent errors or increased errors post-intervention.	High pre-task omission and commission errors, showing recall and attention difficulties.

Figure 18: Behavioural Mapping - Investigator's Perspective (CS-2)
(Source: Author.)

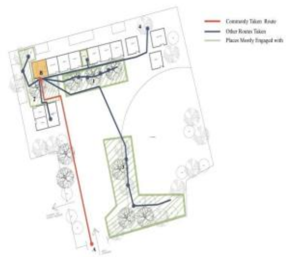

Figure 19: Behavioural Mapping - Teacher's Perspective (CS-2)
(Source: Author)

Figure 20: Behavioural Mapping - Students Perspective (CS-2)
(Source: Author)

The Behavioural Mapping reveals that Autistic students primarily followed a consistent route (A-B) from the entrance to the special unit. Minimal movement outside the classroom. Teacher observations confirmed that students gravitated toward quiet, bounded spaces. Student interviews supported this, with many showing a likeness to quiet spaces. These behaviours can be understood through spatial cognition theory. Siegel and White (1975) explain that limited environmental cues reinforce route-based navigation rather than exploratory cognitive mapping.

The Parametric Observation reveals the following findings. The school provides minimal support with spatial design and wayfinding. With only a linear path directing to the unit, which lacks clarity and intuitiveness. Students' navigation is based on familiarity without any clear visual aids. Little to no effort was demonstrated in making spaces 'autistic friendly'.

The Wayfinding Questionnaire revealed that all participants exhibited impairments in navigation orientation (NA), scoring below the threshold (≤ 23). Spatial anxiety (SA) was expectantly high, with scores between 80% -92.5%, demonstrating emotional stress due to navigation. Distance estimation (DE) responses varied, showing a general difficulty in route planning.

5.3. COMBINED ANALYSIS OF BOTH CASES

The combined Analysis of both cases 01 and 02 reveals certain findings;

- Assisted Wayfinding Tasks

  In both cases, the 'Assisted wayfinding' task revealed significant VSWM declines, post task imposing external guidance imposes a high cognitive load, depleting VSWM capacity.
- Unassisted Wayfinding Tasks

  The study reveals higher baseline accuracy (Case 2 superior), with milder post-task declines, revealing that autonomy and familiarity preserving VSWM capacity.
- Comparison of Assisted vs. Unassisted Wayfinding

  Unassisted wayfinding showed milder VSWM declines, stable recall times, and lower error rates compared to assisted navigation's steep accuracy drops and slower recall. These findings suggest that autonomy and familiar enhance adaptability and support efficient memory processing during wayfinding.

6. Conclusion and Future Recommendation's

The empirical results provide direct evidence supporting the central thesis: *declining VSWM accuracy post navigation indicates cognitively demanding environments deplete learning resources, while autism friendly design function as an external cognitive aid preserving VSWM capacity.*

Key findings:

- The findings directly confirm that VSWM performance decline serves as a sensitive marker of environmental cognitive demands. Navigation through the school environment depletes executive cognitive resources essential for learning, as hypothesized.
- Unassisted navigation further validates the thesis, autonomy and familiarity reduce cognitive strain, preserving VSWM functioning demonstrating that intuitive environments mitigate resource depletion.
- Autistic children selected simple, predictable, central paths avoiding complex routes, validating the need for predictable layouts as cognitive aids. Patterns such as shaded green areas, classrooms, and minimal social route intersections suggest that sensory-sensitive environments reduce cognitive loads, supporting VSWM.
- Absence of wayfinding aids and sensory overload elements, these architectural shortcomings caused observable VSWM depletion further supporting the hypothesis.

6.1. RECOMENDATIONS

The findings unequivocally establish that wayfinding constitutes a memory-intensive cognitive process where environmental design directly determines VSWM preservation. Schools lacking autism-friendly features systematically deplete cognitive resources critical for learning, while strategic design interventions can function as external cognitive prosthesis, maintaining VSWM capacity for academic engagement.

Table 5: Proposed Recommendations along with Findings (Source: Author)

	Elements	Recommendation
Based on Direct Finding's.	Simplified Navigation	Use straightforward layouts that are predictable, with clear primary pathways. Incorporate color-coded or high-contrast visual cues for navigation.
	Incorporate Landmarks	Use of recognizable landmarks such as Trees, murals or any distinguishable marker to support the autistic students in establishing spatial identity as they often remember space through distinctive visual cues.
Based on Literature – Factors (not directly	Sensory-friendly Environments	Use of muted colours, natural lighting, and soundproofing could be integrated to improve environments for user

studied within the scope of this study)		needs. Sensory-regulating elements like textured walls or adjustable lighting can be suggested to enhance user comfort and adaptability (Mostafa, 2015).
	Personalized and Flexible Spaces	Personalized zones (e.g. sensory gardens and quiet corners) to which the children can move to regulate themselves. Use of flexible layouts and furniture for varied activities (Mostafa, 2015; Gaines et al., 2016).
	De-escalation Spaces	Provision of quiet, enclosed spaces for sensory regulation is necessary while providing calming visuals and tools (Mostafa, 2015)

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