

Systematic Review Teaching Strategies and Mobility Orientation Skills For the Visually Impaired

Novriko Burhan*, M Arief Taboer, Hartini Nara

Universitas Negeri Jakarta, Indonesia

Email: akhnov.unj@gmail.com*

Keywords:	Abstract
orientation and mobility, blindness, non-visual skills, task-based training, haptic technology	Orientation and mobility skills enable individuals with visual impairments to travel safely and independently. However, conventional instruction may not adequately address diverse learner needs or incorporate emerging assistive technologies. This study aimed to review teaching strategies, nonvisual skills, accommodations, and technologies used in orientation and mobility training and to identify their effectiveness, challenges, and development opportunities. A systematic literature review was conducted using articles retrieved from Sage, Taylor & Francis, and Google Scholar. Studies were screened based on titles and abstracts according to predefined inclusion criteria, assessed for methodological quality, and examined through data extraction and thematic synthesis. Six studies were included. The findings showed that Structured Discovery Cane Travel, immersion training, role modeling, open communication, guided-touch demonstrations, and problem-solving activities supported practical skill development and learner confidence. Haptic and audio-based applications, as well as three-dimensional tactile maps, improved environmental understanding, cognitive-map formation, landmark recognition, and independent navigation. Combining tactile and auditory information was generally more effective than verbal explanations alone. Nevertheless, several technology-focused studies used small sample sizes, which limited the generalizability of their findings. In conclusion, effective orientation and mobility instruction requires adaptive and collaborative strategies that integrate nonvisual teaching methods with accessible technologies, while larger and more diverse studies are needed to confirm their effectiveness

INTRODUCTION

Orientation and mobility (OM) are fundamental skills that individuals who are blind or visually impaired must possess to live independently and actively participate in various aspects of life (Abidi et al., 2024; Bandukda et al., 2021; Kamali & Ashori, 2023; Lahav et al., 2015; Pissaloux & Velazquez, 2018). These skills include the ability to understand the physical environment, recognize safe routes, and navigate places effectively and efficiently. However, OM training for individuals with visual impairments presents several challenges, particularly in providing appropriate and adaptive instruction (Ghasemi Fard et al., 2023; Ghoneim et al., 2024; Grenier et al., 2025; Griffin-Shirley et al., 2023; Kacorri et al., 2017; Poggrund, 2018). Traditional OM training often relies on verbal instructions, tactile maps, or other physical methods that may not be optimal for every individual who is blind or visually impaired. Therefore, the development and utilization of innovative teaching strategies and emerging technologies are urgently needed to improve the effectiveness and efficiency of OM training (Middleton, 2020).

Research in this area has focused on various approaches to OM skill training, as demonstrated by several studies. In the article titled *Teaching Strategies and Nonvisual Skills Used by Orientation and Mobility Specialists Who Are Visually Impaired*, researchers explored the teaching strategies employed by OM specialists who are also visually impaired. This study provides insight into the role of lived experience among instructors who are blind in designing more relevant approaches for students with visual impairments. Meanwhile, the article *“Orientation and Mobility . . . What Is That Again?”* describes public perceptions of OM and highlights the importance of broader dissemination of information regarding the significance of OM skills.

Furthermore, the article *A Survey of Blind Orientation and Mobility Specialists about the Accommodations and Teaching Strategies They Use* presents empirical data on approaches used by blind OM instructors to accommodate students’ unique needs. In addition, the study *Exploiting the Haptic and Audio Channels to Improve Orientation and Mobility Apps for the Visually Impaired* demonstrates the potential of haptic and audio-based technologies in developing more intuitive OM applications for users with visual impairments. The study *Two Types of Demonstration Through Guided Touch with Cane: Instruction Sequences in Orientation and Mobility Training for a Person with Visual Impairments* introduces a touch-based instructional approach that provides sequential guidance for cane use, enabling students with visual impairments to gradually acquire practical skills. Finally, the article *Effects of Environmental Explanation Using Three-Dimensional Tactile Maps for Orientation and Mobility Training* examines the benefits of three-dimensional tactile maps as instructional aids in OM training, allowing students with visual impairments to develop a deeper understanding of environmental layouts and spatial configurations.

However, despite the growing body of research available, gaps remain in the literature regarding the effectiveness of OM teaching methods and strategies, particularly concerning their implementation and adaptation to the specific needs of students with visual impairments (Awang Zainal et al., 2026; Binlang & Donguiz, 2024; Diasse & Kawai, 2024; Ghoneim et al., 2024; Mitchell & Sutherland, 2020; Mpolomoka, 2025). Moreover, technological advancements, such as audio-based and haptic-based applications, require more comprehensive evaluation to determine their impact on improving OM skills. Therefore, a systematic literature review is needed not only to synthesize existing teaching methods but also to identify research gaps and future development opportunities that can support more effective and adaptive OM training.

This article aims to review the literature on teaching strategies and technologies used in OM training for individuals with visual impairments, with a focus on their effectiveness, implementation, and future development opportunities. Through this systematic literature review (SLR), the study is expected to provide a foundation for researchers and practitioners to develop more innovative approaches to OM training and generate new insights into effective methods for improving OM skills among individuals with visual impairments.

METHODS

This study employed a systematic literature review (SLR) approach to examine teaching strategies, nonvisual skills, and technology utilization in orientation and mobility (O&M) training for individuals with visual impairments. The SLR method was selected to

ensure that the findings were structured, focused, and supported by scientific evidence. The review process consisted of four main stages: (1) literature identification, (2) screening and article selection, (3) data extraction and analysis, and (4) synthesis of findings.

1. Literature Identification

The literature search was conducted using scientific articles retrieved from reputable databases, including Sage, Taylor & Francis, and Google Scholar. The keywords used in the search included “orientation and mobility training,” “teaching strategies for visually impaired,” “haptic technology for blind,” and “tactile maps for O&M.” Additional relevant references were identified from the selected articles to expand the literature sources. The search focused on publications from the previous five years to ensure the relevance and currency of the findings in the field of O&M training for individuals with visual impairments.

2. Screening and Article Selection

After the literature was collected, the articles were screened based on titles and abstracts to assess their relevance to the research topic. The inclusion criteria consisted of (a) studies focusing on O&M teaching strategies for individuals with visual impairments, (b) studies involving nonvisual assistive technologies, such as haptic and audio-based systems, and (c) research employing valid methodologies, including quantitative, qualitative, or mixed-method approaches. Articles that did not meet the inclusion criteria or demonstrated insufficient methodological quality based on the Critical Appraisal Skills Programme (CASP) assessment were excluded.

3. Data Extraction and Analysis

Articles that met the selection criteria were systematically analyzed. The extracted data included research objectives, study populations or samples, methodological approaches, teaching strategies or assistive technologies evaluated, and key findings from each study. The data extraction process was conducted by two researchers to improve the reliability and consistency of the extracted information.

4. Synthesis of Findings

The extracted data were synthesized to identify patterns, trends, and research gaps in O&M training for individuals with visual impairments. A thematic synthesis approach was used to summarize effective teaching strategies and assistive technologies. The synthesis also examined technologies, including haptic-based applications, audio-based systems, and three-dimensional tactile maps. The main findings of the included studies were presented in a summary table containing information on study methodologies and key outcomes.

Through this methodological approach, the study provided a comprehensive overview of O&M training approaches for individuals with visual impairments and identified potential opportunities and challenges associated with the implementation of assistive technologies to support orientation and mobility skill development.

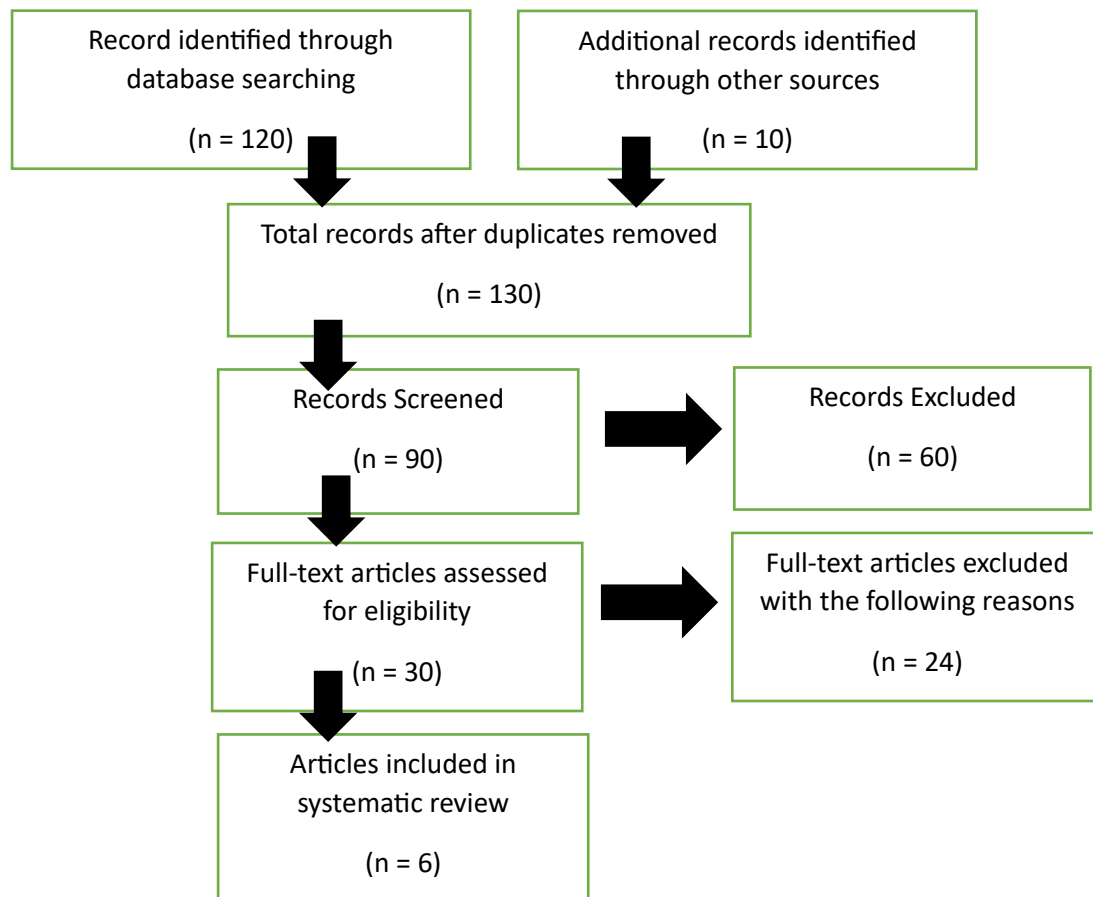


Figure 1. Inclusivity and Exclusivity based on the PRISMA flow

RESULTS AND DISCUSSION

Based on the literature selection process, six articles that met the inclusion criteria were analyzed comparatively. The following table summarizes the main characteristics of each article, including the title, authors, publication year, and key findings, to facilitate the identification of variations in teaching strategies, accommodation approaches, and technology utilization in orientation and mobility (O&M) training for individuals with visual impairments.

Tabel 1. Karakteristik Utama Artikel

Yes	Article Title	Author	Year	Key Results
1.	Teaching Strategies and Nonvisual Skills Used by Orientation and Mobility Specialists Who Are Visually Impaired	Nora Griffin-Shirley, Laura Bozeman, Phoebe Okungu, Chinomso Ihenagwam, and The Nguyen	(2023)	Thematic findings that emerged from the interviews included structured discovery learning and philosophy, monitoring and teaching strategies, equipment and materials, and accommodation. This is important when instructors with visual impairments give O&M lessons to students who are visually impaired. This study confirms and adds to the results of previous research regarding

			teaching strategies, equipment and materials, and accommodations used by O&M instructors who are visually impaired. Further information is also provided regarding teaching strategies (e.g. structured discovery learning and philosophy, monitoring). The results reported in this study can be used as guidelines for teachers of O&M personnel preparation programs that teach visually impaired students in blind limb or cane subjects. This research can also be used as a reference for students with visual impairments to facilitate accommodations with their university student disability offices to succeed in the O&M personnel preparation program.
2.	'Orientation and Mobility . . . What is that again?'	Katrina Blake (2021)	The three main themes identified are perceptions of Orientation and Mobility (O&M), deafness, and education for students with deafness. There is limited understanding from teachers and parents of O&M, deafness, and its impact on students' learning processes. They focus more on the visual and access aspects. The panel of O&M experts has a deeper understanding of O&M, the impact of deafness, and the approach needed in the O&M teaching and learning process. A more explicit understanding of O&M is needed among the general public and teachers to improve the integration of specialized services into the educational process. An educational culture that emphasizes academics such as reading and writing is less supportive of the O&M learning process. So in summary, this study discusses the perception and understanding of the general public and teachers towards O&M, the impact of deafness,

and the challenges to further improve the O&M learning process for students with deafness.

3.	A Survey of Blind Orientation and Mobility Specialists about the Accommodations and Teaching Strategies They Use when Providing Orientation and Mobility Services	Nora Griffin-Shirley ¹ , Laura Bozeman ² , The Nguyen ³ , Vitalis Othuon ⁴ , Anita Page ⁴ , Juhyun Hahm ⁵ , Juyoung Hahm ⁶ , and Jaehoon Lee ¹	(2021)	Characteristics of survey participants consisting of 15 blind O&M instructors. Most are male, white, and have total/near-total vision loss. Regarding the training in the preparatory program, most graduate in 1-2 years. There are an average of 4 blind instructors, and the average faculty:student ratio is 1:2 or 1:4. The program is 26.7% modified with course waivers, additional supervision, additional courses, or personal assistants. 100% of participants feel ready to become an O&M instructor after graduation due to hands-on training, non-visual skills, responsibility, and blind experience. 100% feel the program is open to blind people because of its focus on nonvisual training and blind instructors. Nonvisual teaching techniques include open communication, SDCT, O&M applications, and auditory/tactual. Learned in other blind programs and instructors. Some need professional development for demographic issues, new technologies, and the latest counseling. Suggestions for learning best practices of all programs and sharing to reinforce them. Also the importance of self-advocacy and student skills. So at the heart of the results is the identification of accommodations, teaching techniques, and suggestions for improving the training of blind O&M instructors.
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4.	Exploiting the haptic and audio channels to improve orientation and mobility apps for the visually impaired	Maria Teresa Paratore, Barbara Leporini	2023	The purpose of this study is to investigate whether GPS maps on smartphones enriched with haptic and audio cues can facilitate the formation of cognitive maps for blind users. A preliminary study has been conducted with two visually impaired volunteers using a prototype of a store space map. The results show haptic and audio cues are useful for improving spatial understanding. Then a new prototype was developed based on GPS maps with the GeoJSON standard and added accessibility metadata. Zoom features, category filters, and feedback preferences are installed. Testing was carried out with 7 volunteers, 5 women and 2 men aged 42-65 years with severe visual impairment or blindness. They often use onboarding and mobility apps. Most volunteers are able to complete tasks independently. Haptic and audio instructions are preferred when combined. Vibration patterns are difficult to remember but can be corrected with training. These maps are considered useful for initial exploration of the environment before a real visit, for example integrated into orientation and mobility applications. Preliminary conclusions suggest this approach is useful for aiding the formation of cognitive maps, but further testing is needed with larger audiences. So the core of the results is a study to develop a digital map that can provide location information and POI categories in a nonvisual way to help the visually impaired form a mental representation of the environment quickly.
5.	Two Types of Demonstration	Yasusuke Minami, Hiro	(2023)	The purpose of this study is to use haptic touch and audio to improve

	Through Touch with Instruction Sequences Orientation and Training for a Person with Visual Impairments	Guided Cane: in Mobility for a	Yuki Nisisawa, Mitsuhiro Okada, Rui Sakaida ³	GPS maps on smartphones to help form cognitive maps for blind users. A preliminary study was conducted using a prototype of a digital map of the shop space with two visually impaired volunteers. The results show haptic and audio clues are useful. Then a new prototype based on GPS maps with GeoJSON format and accessibility metadata was developed. Testing was carried out with seven volunteers, consisting of severely blind and blind. Some are able to complete tasks independently. Haptic and audio instructions are selected when combined. Vibration patterns are difficult to remember but can be improved with training. There are two types of demonstrations through guided touch, namely "achieving" and "learnable". The demonstration is "achieving" to assess performance, while "learnable" is imitated directly without verbal assistance. This approach is useful to help build cognitive maps, but further testing with larger samples is needed. So the core of the results is a study to develop a digital map approach that can provide clues to the location and category of POI nonvisually through touch and sound to help the visually impaired build a mental representation of the environment.
6.	Effects of environmental explanation using three-dimensional tactile maps for orientation and mobility training		Wataru Toyoda, (2020) Eiji Tani, Susumu Oouchi, Masaki Ogata	The aim of this study was to test whether 3D tactile maps on smartphones can help with environmental understanding for users with visual impairments. A preliminary study was conducted with two volunteers using a digital prototype and showed the benefits of haptic and audio cues.

Then a new prototype was developed based on GPS maps with GeoJSON and added accessibility metadata.

A trial was conducted with 7 volunteers, 5 women and 2 men aged 42-65 years with severe visual impairment or blindness.

Most volunteers are able to complete tasks independently. Haptic and audio instructions are preferred when combined.

This map is considered useful before a real visit, for example as a brief view in the orientation and mobility app.

The results suggest this approach is useful for aiding the formation of cognitive maps, but further testing is needed.

So the point is research to develop a 3D digital tactile map that can provide location and POI category information nonvisually through touch and sound to help form mental representations of the environment by users with visual impairments.

Overall, the six studies demonstrated that O&M training was supported by a combination of instructional strategies, nonvisual skills, and assistive technologies. Approaches such as Structured Discovery Cane Travel (SDCT), open communication, guided-touch demonstrations, and the utilization of haptic-audio channels and three-dimensional tactile maps expanded learning alternatives to support spatial understanding and mobility task performance. These findings also highlighted the importance of adaptive approaches that address learners' specific needs. However, several assistive technology studies involved limited participant numbers, indicating that their effectiveness requires further investigation using larger samples and more diverse training contexts.

CONCLUSION

In orientation and mobility training, appropriate instructional approaches and adequate support are required, including structured learning approaches such as Structured Discovery Cane Travel (SDCT), confidence-building strategies, the involvement of role models, and the implementation of appropriate accommodations. Effective O&M instruction also requires collaboration between O&M specialists and the school community. To achieve successful integration of O&M services within educational settings, a clear understanding of O&M concepts and practices is essential. Furthermore, effective O&M training requires immersion

training, the use of SDCT, the development of nonvisual skills, the application of blindfold training techniques, and the enhancement of students' problem-solving abilities.

In O&M instruction, students are also closely associated with the use of mobility canes. One instructional approach involving cane use is the guided touch technique. Two types of guided touch demonstrations have been identified: the “prove and achieve” approach and the “learnable” approach. Collaborative cane-touch experiences provide an effective way for instructors and students to explore and understand environmental features together. Touch can serve as a powerful communication medium, both instrumentally and interactively, allowing information about the environment to be conveyed to students with visual impairments without relying solely on verbal assistance.

O&M training is closely related to environmental orientation, as effective navigation depends on an individual's understanding of the surrounding environment. Therefore, environmental explanations supported by three-dimensional tactile maps are more effective than verbal explanations alone. These tactile maps help students with visual impairments better understand and retain environmental information. The combination of environmental explanations and three-dimensional tactile maps also enables students to navigate independently with fewer errors, reduced disorientation, and improved landmark recognition. In addition to tactile maps, another approach that supports O&M training involves the utilization of haptic and audio channels to improve the accessibility of GPS-based maps for users with visual impairments. This approach aims to enable users to develop an allocentric mental representation of physical spaces based on downloadable GPS maps.

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