

Changes in Dental Students' Perceptions and Educational Outcomes through Wheelchair Training: An Approach to Understanding the Perspectives of Wheelchair Users

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How to cite this paper: Oki, E., Takaya, T., Inou, T., Iwasaki, Y., Hung, Y.C., Tsunoda, Y., Kondo, A., Nezu, H., Kitamura, H., Kaneko, K. and Uchida, K. (2026) Changes in Dental Students' Perceptions and Educational Outcomes through Wheelchair Training: An Approach to Understanding the Perspectives of Wheelchair Users. *Open Journal of Stomatology*, 16, 157-165. <https://doi.org/10.4236/ojst.2026.167015>

Received: June 3, 2026

Accepted: July 13, 2026

Published: July 16, 2026

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Abstract

In an aging population, it is necessary for dentists to develop a thorough understanding of the physical and psychological limitations experienced by wheelchair users. This study enrolled 94 first-year dental students who participated in wheelchair training incorporating challenging experiences, such as self-propulsion, assisted propulsion, navigating steps, and being pulled backward. The educational effectiveness of this training was evaluated using text mining methods (*i.e.*, keyword association analysis). Analysis revealed that before training, expectations centered on acquiring operational skills; however, post training responses were dominated by keywords such as “challenging”, “difficult” and “inconvenient”. In addition to recognizing physical challenges, students increasingly referred to psychological aspects of wheelchair use, including users’ anxiety and fear, following these experiences. Students redefined wheelchairs not merely mobility devices but as essential tools supporting daily life while also recognizing the importance of “emotional care”, *e.g.*, verbal communication and maintaining eye contact. This training may be a useful educational approach for promoting awareness of wheelchair users’ perspectives.

Keywords

Wheelchair Training, Dental Education, Text Mining, Psychological Barriers, Mental Barrier-Free

1. Introduction

In an increasingly aging society, the need to support the elderly and individuals with disabilities who use wheelchairs is becoming more important. In particular, supporting the daily lives of elderly wheelchair users requires healthcare professionals to deepen their understanding of wheelchair operation and user experience [1] [2]. Wheelchairs serve as vital mobility tools for older individuals and those with disabilities, and their use requires careful consideration [3].

In this study, a practical training session was conducted for first-year dental students as part of early clinical education. The aim was to help them understand the perspectives and experiences of wheelchair users and to recognize their psychological and physical constraints through direct wheelchair experience. The study's overall objectives were to determine how students demonstrate consideration for wheelchair users and provide appropriate support through this training. The study also investigated how students recognize the physical and environmental constraints of wheelchair users through experiential learning and evaluated its educational effectiveness.

2. Practical Training: Objectives and Methods

We conducted wheelchair training for first-year students in the School of Dentistry at Matsumoto Dental University. The study participants included 94 first-year students in the School of Dentistry at the university (including 37 international students). Among these participants (hereafter referred to as “dental students”), 68 were males (72%; including 27 international students) and 26 females (28%; including 10 international students).

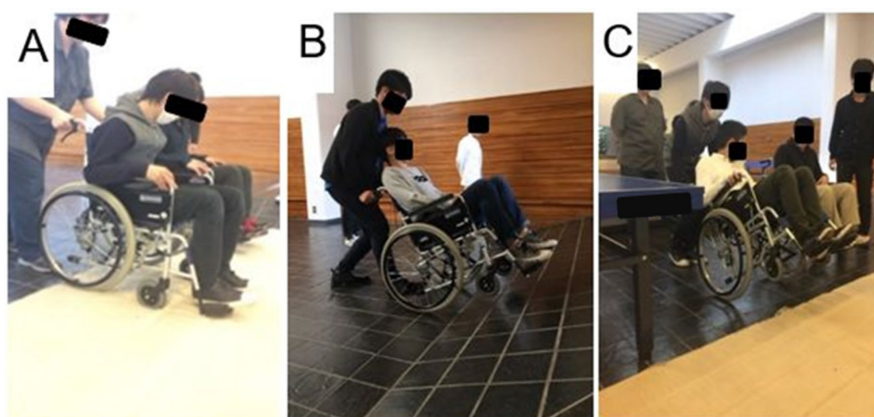
In the preliminary lecture, we explained the wheelchair structure, component names, operating methods, and essential safety checks. The practical training was conducted in a gymnasium, with one wheelchair assigned per group. Students were divided into two groups, with each group learning the wheelchair's parts and its operation from an instructor (**Figure 1**), after which they gained practical experience operating the wheelchair.



Figure 1. Representative image of the wheelchair training session.

The training content included the following items:

- 1) Basic wheelchair operation methods (self-propulsion and assisted propulsion).
- 2) Practice maneuvering the wheelchair while avoiding obstacles.
- 3) Navigating steps (**Figure 2(A)**) and ascending and descending slopes (**Figure 2(B)**).
- 4) Experiencing the fear and anxiety felt by wheelchair users when the wheelchair was pulled backward to tip it (**Figure 2(C)**).



(A) Maneuvering on a mat. (B) Maneuvering on a slope. (C) Tipping the wheelchair backward.

Figure 2. Wheelchair training.

Through this training, students learned support methods that extend beyond wheelchair operation to include consideration of wheelchair users' feelings. Additionally, pre- and post-training questionnaires were administered in a free-response format to assess changes in students' awareness and learning regarding wheelchair use. The questions were as follows:

- ① Pretraining questionnaire: "What I want to learn through this training" and "What I expect from this practicum."
- ② Postpracticum questionnaire: "What I realized during the wheelchair practicum" and "What I learned from this practicum."

A total of 94 pre-training questionnaires and 94 post-training questionnaires were collected and analyzed. All enrolled students completed both questionnaires, and no responses were excluded from the analysis. Although the same students completed both questionnaires, the pre- and post-training free-text responses were analyzed separately to examine overall changes in students' perceptions at the group level rather than changes in individual participants.

Participants' responses were analyzed via text mining, using Trend Search 2015 software (BellCurve) to perform keyword association analysis, *i.e.*, extracting and analyzing keywords from parts of speech in a set of documents (hereafter referred to as "text") through morphological analysis. All responses were written in Japanese. In the analysis process, unclear terms were organized based on extracted part-of-speech lists, stop words were removed (*i.e.*, words without contextual meaning), text was standardized (harmonized in style), and parts of speech con-

taining noninformative terms (e.g., organization names, personal names, and place names) were excluded. Orthographic variations (e.g., different spellings of the same word) were standardized before analysis. The importance score was automatically calculated by Trend Search 2015 based on the frequency and distribution of each keyword within the text [4].

Before the tipping-backward exercise, instructors explained the purpose of the activity, the potential risks, and the safety procedures. The exercise was conducted under faculty supervision in a spacious environment, with additional students monitoring the surroundings to ensure safety. Students were instructed to perform the maneuver only within a comfortable range, and the exercise was stopped immediately if the participant expressed fear or discomfort. Questionnaires were administered as part of the educational program. Questionnaire data were anonymized prior to analysis, stored securely, and managed in accordance with the protocol approved by the institutional ethics committee. Because this study involved no intervention beyond routine educational activities and no additional collection of data specifically for research purposes, individual written informed consent was not obtained. Instead, study information and an opt-out procedure were made available on the university website in accordance with the approved ethics protocol.

3. Results

In the preclinical training questionnaire, keyword association analysis was conducted regarding “what they wanted to learn through the training”. Results revealed that the top-ranked keyword was “wheelchair”, with the highest importance score of 4.16 and a frequency of 9. This was followed by “inconvenience”, “feelings” and “understanding”, with the 10th-ranked keyword “learn” having an importance score of 1.84 (**Table 1**).

Regarding “expectations for this practicum”, keyword association analysis showed that the top-ranked keyword was “wheelchair”, with the highest importance score of 5.81 and a frequency of 11. This was followed by “experience”, “myself” and “riding”, with the 10th-ranked keyword “be able to” having an importance score of 1.12 (**Table 1**). In the open-ended responses, comments such as “the difficulty of caregiving” and “the comfort of the wheelchair” were reported, with most focusing on experiences related to wheelchair use and handling.

In the post training questionnaire, keyword association analysis was conducted regarding “what was learned from the wheelchair training”. Results indicated that the top-ranked keyword was “difficult”, with the highest importance score of 4.53 and a frequency of 10. This was followed by “wheelchair”, “challenging” and “operating methods” with the 10th-ranked keyword “mobility” having an importance score of 1.15 (**Table 2**).

Regarding “what was learned in this training”, keyword association analysis indicated that the top-ranked keyword was “difficult”, with the highest importance score of 6.09 and a frequency of 14. This was followed by “wheelchair”, “incon-

venient” and “important” with the 10th-ranked keyword “how to use” having an importance score of 1.95 (**Table 2**).

Table 1. Prepracticum questionnaire. Note: Keywords reflecting the questionnaire wording or generic expressions (e.g., “older adults”, “how” and “feel”) were omitted from the displayed rankings for clarity.

Ranking	What I want to learn during wheelchair training			What I expect from the practicum		
	Keyword	Importance	Frequency	Keyword	Importance	Frequency
1	Wheelchair	4.16	9	Wheelchair	5.81	11
2	Inconvenience	2.63	5	Experience	2.8	10
3	Feelings	2.51	5	Myself	1.51	4
4	Understanding	2.44	7	Riding	1.49	2
5	Daily life	2.32	7	None	1.41	2
6	Perspective	2.27	6	Expectation	1.41	4
7	Difficult	2.06	5	Learn	1.39	5
8	Myself	1.97	8	Knowledge	1.29	4
9	Dealing with	1.97	3	Improve	1.28	2
10	Learn	1.84	5	Be able to	1.12	4

Table 2. Postpracticum questionnaire. Note: Keywords reflecting the questionnaire wording or generic expressions (e.g., “older adults”, “how” and “feel”) were omitted from the displayed rankings for clarity.

Ranking	What I learned during wheelchair training			What I learned during the practicum		
	Keyword	Importance	Frequency	Keyword	Importance	Frequency
1	Difficult	4.53	10	Difficult	6.09	14
2	Wheelchair	3.26	27	Wheelchair	4.44	19
3	Challenging	1.93	5	Inconvenient	4.1	7
4	Operating methods	1.88	3	Important	2.8	7
5	Reaching out	1.64	2	People	2.62	10
6	Feelings	1.34	5	Reaching out	2.56	5
7	Scary	1.27	3	Daily life	2.08	6
8	Important	1.2	3	Thinking	2.03	4
9	Inconvenient	1.17	2	Care	1.97	7
10	Mobility	1.15	2	How to use	1.95	3

These findings show that dental students developed a practical understanding

of wheelchair operation difficulties and challenges faced by users. In particular, many students reported that avoiding obstacles and navigating steps were more difficult than expected, prompting reflection on how to address the anxiety and fear experienced by wheelchair users. Before the practicum, numerous students viewed “wheelchairs as merely a means of transportation”; however, after the practicum, their perception shifted to recognizing that “wheelchairs are not merely a means of transportation but an important tool that affects one’s entire life.” Post-practicum responses indicated that many dental students recognized the importance of emotional care, such as “offering words of encouragement,” “providing appropriate guidance,” and “making eye contact,” rather than focusing solely on physical assistance for wheelchair users.

Representative comments from the free-response data further illustrated these changes in students’ perceptions. Before the training, students focused primarily on operational aspects, with comments such as “Wheelchair operation” and “Knowledge needed to assist older adults”. After the training, students’ responses reflected greater awareness of the users’ perspective, including comments such as “It was frightening when the wheelchair was moved suddenly”, “I learned the importance of speaking politely to the wheelchair user” and “I learned about the feelings of both caregivers and care recipients”.

4. Discussion

Through the acquisition of wheelchair operation skills during the practicum, the training conducted in this study provided dental students with valuable hands-on experience and served as an effective method for developing a deeper understanding of assistance techniques and psychological considerations. Although many students had a theoretical understanding of wheelchair use prior to the practicum, directly handling wheelchairs and performing driving and assistance tasks in various situations enabled them to acquire technical skills while recognizing practical challenges encountered in real-world settings. In particular, by experiencing both self-propelled and assisted movement, they gained firsthand insight into the physical strain and balance required when handling wheelchairs. Operating a wheelchair proved more difficult than expected, and experiencing the challenges of avoiding obstacles and navigating steps and slopes represented an important step toward considering how to assist patients in future clinical placements. Previous studies have emphasized that maintaining activity, independence, and adaptation to functional limitations are important factors influencing life satisfaction among older adults [5]. Through the present wheelchair training, students gained firsthand experience of the physical and environmental barriers that may affect these aspects of daily life. Regarding psychological considerations during wheelchair training, dental students were able to focus more closely on the experiences of wheelchair users. In particular, when the wheelchair was tipped backward without warning, they gained an immediate understanding of the anxiety and fear experienced by users. Students who directly experienced this psychological stress were able to re-

affirm the importance of ensuring safety through clear verbal communication when interacting with patients. Moreover, students appeared to become more aware of “invisible barriers”, such as steps and narrow passageways, that wheelchair users encounter daily. During training, students learned about navigation difficulties they would not typically notice and the barriers faced when maneuvering around obstacles. This experience provided an important opportunity to deepen understanding of these challenges and to consider how such insights should inform patient communication and medical care delivery.

As reflected in the post training survey, dental students began to consider “how to empathize with the feelings of wheelchair users and how to best support them” in their roles as caregivers, as well as the mindset required to provide support. In particular, those who assisted with wheelchair movement gained a clearer understanding of the caregiver’s responsibilities and the subtle considerations required during assistance. For example, many students developed a deeper appreciation of the principle that “rather than forcing assistance, one should respect the areas where the person can be independent and offer help only when it is needed”. Through this process, students recognized the importance of psychological support alongside physical assistance. Additionally, perceptions of wheelchair operation as “difficult” or “challenging” are consistent with findings reported by Urabe *et al.* [6], suggesting that this experience effectively enhanced understanding of wheelchair-related challenges. For wheelchair users, although assistance may sometimes be necessary, maintaining independence and autonomy remains important. Understanding how to respond appropriately to these complex psychological needs is a critical skill for future clinical practice.

The scenarios included in the wheelchair training provided a multifaceted learning experience. Simulating real-life situations, such as avoiding obstacles, navigating steps, and moving on slopes, served as a valuable educational tool for helping dental students gain insight into the experiences and perspectives of people with disabilities [7]. Prior reports also indicate that such experiential training enhances understanding among dental students [8]. Recent healthcare education studies have also highlighted the educational value of disability-awareness training [9].

After the training, students reported recognizing that “things they had taken for granted in their daily lives can be major obstacles for wheelchair users,” indicating that their awareness had increased. Furthermore, the program not only provided operational experience but also deepened understanding of “emotional accessibility” in interactions with wheelchair users. As awareness of psychological barriers, such as fear, anxiety, and loneliness, increased, students began to view assistance not merely as “physical support” but as “support that connects with the person’s emotional needs”. This shift in perspective may contribute to greater awareness of patient-centered care in future clinical practice.

Despite these benefits, aspects of the wheelchair training require further refinement. Although the training program provided opportunities to learn basic wheelchair operation and assistance, future educational programs should further pro-

mote understanding of both the physical and psychological meanings of wheelchair use in daily life, thereby helping students develop a more comprehensive perspective on supporting wheelchair users [10].

Furthermore, incorporating direct interaction with wheelchair users and visits to real-world care settings may further strengthen understanding. Beyond the wheelchair user's perspective, future training should also address the physical and psychological demands placed on caregivers. Developing a curriculum that integrates both user and caregiver perspectives would support more comprehensive learning of effective support strategies.

This study has several limitations. First, the participants were first-year dental students from a single institution, which may limit the generalizability of the findings. Second, the analysis was based on self-reported free-text responses, which may not fully reflect actual behavioral changes. Third, this study did not include a comparison group or a validated outcome measure. Therefore, the findings should be interpreted as exploratory evidence regarding changes in students' perceptions following wheelchair training.

5. Conclusion

The wheelchair training program provided dental students with a valuable experience that extended beyond technical skill acquisition, fostering greater awareness of the physical and psychological challenges experienced by wheelchair users. Through this training, students not only learned caregiving techniques but also gained a deeper understanding of the physical and psychological barriers encountered in daily life, reinforcing the importance of addressing these challenges. Moving forward, expanding practical training opportunities and developing educational environments that prepare students to respond effectively to diverse patient needs will be essential for improving the quality of healthcare professionals.

Acknowledgements

The authors have no acknowledgments to declare.

Declaration

The study complies with the Declaration of Helsinki and has been reviewed and approved by the Ethics Review Committee of Matsumoto Dental University (Approval Number: No. 0392).

Conflicts of Interest

There are no conflicts of interest to disclose regarding this study.

References

- [1] Bates, P.S., Spencer, J.C., Young, M.E. and Rintala, D.H. (1993) Assistive Technology and the Newly Disabled Adult: Adaptation to Wheelchair Use. *The American Journal of Occupational Therapy*, **47**, 1014-1021. <https://doi.org/10.5014/ajot.47.11.1014>

- [2] Dekker, J., Rijken, M., van Poppel, M. and de Bruin, A. (2003) The Possession of Technical Aids among Persons with a Somatic Chronic Disease. *Disability and Rehabilitation*, **25**, 393-398. <https://doi.org/10.1080/0963828021000058530>
- [3] Barker, D.J., Reid, D. and Cott, C. (2004) Acceptance and Meanings of Wheelchair Use in Senior Stroke Survivors. *The American Journal of Occupational Therapy*, **58**, 221-230. <https://doi.org/10.5014/ajot.58.2.221>
- [4] BellCurve Co., Ltd. Trend Search 2015. <https://bellcurve.jp/ts/>
- [5] Åberg, A.C., Sidenvall, B., Hepworth, M., O'Reilly, K. and Lithell, H. (2005) On Loss of Activity and Independence, Adaptation Improves Life Satisfaction in Old Age—A Qualitative Study of Patients' Perceptions. *Quality of Life Research*, **14**, 1111-1125. <https://doi.org/10.1007/s11136-004-2579-8>
- [6] Urabe, T. and Muraoka, N. (2014) The Effects of the Experimental Learning Program in the School of Social Work—Content Analysis of the Learning through Wheel Chair Experience. *Bulletin of Nagasaki Wesleyan Junior College*, **12**, 1-10. (In Japanese) <https://wesleyan.repo.nii.ac.jp/record/371/files/KJ00009338639.pdf>
- [7] Lupton, D. and Seymour, W. (2000) Technology, Selfhood and Physical Disability. *Social Science & Medicine*, **50**, 1851-1862. [https://doi.org/10.1016/s0277-9536\(99\)00422-0](https://doi.org/10.1016/s0277-9536(99)00422-0)
- [8] Tohara, H., Itoh, J., Minakuchi, S. and Uematsu, H. (2002) The Effect of the Internship for Predoctrinal Dental Students in Elderly Nursing Home—To Learn How to Care and Nurse the Dependent Elderly. *Japanese Journal of Gerodontology*, **17**, 168-176. (In Japanese) https://www.jstage.jst.go.jp/article/jsg1987/17/2/17_168/article/-char/ja/
- [9] Shishido, F., Toshima, K., Arikawa, T., Miyasaka, T., Sasaki, M., Watanabe, T., Itoh, K., Yonezawa, A., Ohno, I. and Nakamura, Y. (2023) Practical Report of the First-Year Experience Medical Students Using ICT: Trial of Online Disability Simulations. *Japan Society for Medical Education*, **54**, 80-85. (In Japanese) https://www.jstage.jst.go.jp/article/mededjapan/54/1/54_80/article/-char/ja/
- [10] Mochizuki, M., Yamazaki, Y. and Yamaki, C. (2012) The Meanings of Wheelchair Use to the Frail Elderly Living at Home. *Japanese Journal of Health and Human Ecology*, **78**, 127-138. (In Japanese) <https://doi.org/10.3861/jshhe.78.127>