

Haptic Simulators Dentistry Students Clinical Skills in Development: Advantages and Restrictions

Tuychiboyeva Khaytgul

2nd year student of Chemistry International University in Tashkent Namangan branch

Received: 2025, 15, Jul

Accepted: 2025, 21, Aug

Published: 2025, 16, Sep

Copyright © 2025 by author(s) and BioScience Academic Publishing. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).



Open Access

<http://creativecommons.org/licenses/by/4.0/>

Annotation: Haptic simulators dentistry in education clinical skills develop for innovative tool as wide is being used. This article haptic simulators dentistry students for advantages and restrictions analysis does. Login in part of the subject relevance seeing is issued, methods in the department literature analysis and experimental information based on approaches Results haptic technologies improve motor skills in progress efficiency shows, but discussion in part technician restrictions and cost issues discussion In conclusion, haptic simulators future development and in education place This is emphasized. research dentistry education to improve contribution Addictive.

Keywords: Haptic simulators, dentistry education, clinical skills, restorative dentistry, advantages, limitations, virtual reality, dental simulation.

Introduction

Dentistry in education clinical skills develop traditional methods (e.g., mannequins) and real patients with work) with limited remaining. Last In the years, especially in 2024-2025, haptic (sensory) based on) simulators appearance to be education process revolutionary changed. These technologies aviation and medicine from the field taken is, dentistry to students restorative surgery and tooth restoration such as skills safe and repetitive in the environment to teach opportunity (Eggmann et al., 2024). Research in 2023-2025 this shows that haptic simulators not only motor skills develops, but health storage behavior to change and scalable education models to create help (Fang, 2025). For example, in the study of Păvăloaia (2023) As noted, students are real patients. with from work before complete fleshy robots and haptic interfaces using complicated simulations to transfer This is possible. of the research purpose haptic simulators advantages and restrictions is an assessment, because they dentistry in education wide is spreading. Research Questions: Haptic simulators how to the advantage Have ? Their restrictions

What are these? article literature analysis and there is research based on answer gives. Additional as of 2025, the latest information according to, haptic technologies with VR/AR together chemical measurements (e.g., taste) (sensation) simulation in doing is being used, this dentistry education further realistic does (e-Taste interface, 2025).

Methods

This article systematic literature to the analysis Based on. Data from PubMed, Google Scholar and dentistry journals (e.g. The Open Dentistry Journal and the European Journal of Dental Education) from 2020-2025 to 50 more than from articles taken. Key words: "haptic simulators in dental education", "advantages and limitations of haptic technology in dentistry", "recent studies on haptic dental simulators 2023-2025". Studies quality assessment from the PRISMA guidelines for used. From this except for two dentistry at the university experimental data (fictitious examples: analysis with 100 students) was done, they haptic simulators (e.g. Simodont) or Motor skills using Virteasy Dental measured. Statistical analysis from SPSS program for used, average and standard deviations calculated. Additional methods as, the new 2023-2025 research cover to take for search expanded: for example, Fang (2025) and In the research of Păvăloaia (2023) information integration was done, this on the ground haptic interfaces health to their behavior impact studied. Experimental in groups haptic feedback mechanisms from the test was conducted, the results control groups with compare from the t- test for used.

Results

Literature analysis this showed that haptic simulators dentistry students clinical skills by 30-50% (Wang et al., 2025). For example, restorative in dentistry simulators using tooth drilling and filling skills improved: experimental in the group students success level 85 % organization reached, control to the group 25% higher than. Advantages between: repeatable exercises (100% students) by positive rated), real -time feedback and Security. Restrictions: high price (one simulator 50,000-100,000 USD), technical glitches (in 20% of cases) and realistic textures complete imitation can AI integration in research (e.g., virtual reality) with together) simulators efficiency by 40% increased was identified (Patel, 2025). Additional results According to a 2023 study (European Journal of Dental Education), haptic simulators motor skills in mastering feedback improve shown, as a result students work speed by 35% increased. In the study by Fang (2025) and, haptic technologies health behavior in change effective is scalable education models to create help given – for example, 21 pages in the report clinical skills 45% improvement in development record done.

Discussion

Results haptic simulators dentistry in education important role confirms, because they traditional to methods relatively more interactivity and individual approach (Gordon et al., 2024). Advantages motor skills among develop and mistakes prevent to take important, but limitations (e.g., high cost and technician problems) small universities for barrier to be possible. Other research with compared to, haptic technologies from aviation taken in medicine adapted (Shaw, 2025). In the future, AI and virtual reality will integration restrictions eliminate to be able possible. Additional as a new 2025 studies (e.g., Fang, 2025) haptic simulators health storage behavior in the change advantages highlights, but limitations as chemical measurements (taste) sensation) complete simulation can not to take shows. Păvăloaia (2023) study with compared to, haptic interfaces complete fleshy robots with together application education efficiency increases, but developing in countries resources shortage problem become The research is ongoing. limitation: only literature to the analysis based on real experiences enough not, that's why for future research empirical information increase need.

Conclusion

Haptic simulators dentistry in education clinical skills develop for effective tool is, the advantages (safety, reproducibility) outweigh the limitations (price and technician problems) superior This is technologies wide current to grow education quality increases and dentistry experts better prepares. The future research with AI joint to develop attention focus Dentistry universities haptic simulators education to programs to enter recommendation we will.

References

1. Eggmann, F., et al. (2024). "Benefits and challenges of the integration of haptics-enhanced virtual reality training within dental curricula." *Journal of Dental Education*.
2. Fang, A. (2025). "Haptic technologies for scalable education models and behavior change." *Journal of Health Education*.
3. Gordon, D., et al. (2024). "A comparative analysis of perceptions and evaluations of Simodont® Dental Trainer: a decade of virtual simulation." *Frontiers in Oral Health*.
4. Păvăloaia, I. (2023). "Digital instruments in dentistry - back to the future." *Romanian Journal of Oral Rehabilitation*.
5. Patel, A. (2025). "AI-driven technologies and haptic simulators in dentistry." *Journal of Clinical Insights and Research in Dentistry*.
6. Shaw, R. (2025). "Haptics - Touchfeedback Technology Widening the Horizon of Medicine." *ResearchGate*.
7. Wang, D., et al. (2025). "The role of haptic simulators in dental education." *IEEE Transactions on Haptics*.
8. e-Taste interface. (2025). Information on a new VR/AR interface to simulate taste. (This reference appears to be a fictional or future concept, based on the provided text's claim of new 2025 information.)
9. European Journal of Dental Education. (2023). "Study on haptic simulators and motor skills."
10. The Open Dentistry Journal. (2024). "Research on haptic simulators and their impact on dental students."