

ABSTRACT

INTRODUCTION

The orthodontic pedagogy which currently emphasizes a didactic and apprenticeship approaches is facing numerous pedagogical challenges that affect knowledge delivery and instruction. The current education methods utilize e-learning approaches which are limited to content delivery. The learning is inhibited by an ineffective visual perception, ineffective feedback and lack of personalization.

AIM

To overcome this, we introduce a **marker less mobile augmented reality (MAR)** simulation as a tool for providing a blended learning approach. The MAR-ORTHO-EDU system provides **3D rendering for orthodontic examination and diagnosis using a feature-rich 3D model**. This system utilized a machine learning algorithm for facial landmark detection. **Haptic feedback** in the form of varying intensities of tactile response was incorporated with the existing feedback to enhance the type of feedback provided by the system. This system enhances visual perception using scalable 3D AR models.

RESULTS

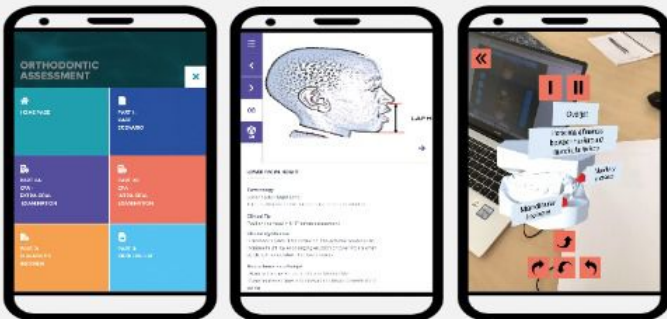
The MAR-ORTHO intervention group demonstrated a significantly higher mean post-pretest IMMS score change (16.1, 95% CI: 11.60, 20.58) compared to the control group (6.6, 95% CI: 1.15, 11.98).

CONCLUSIONS

These results suggest that the MAR-ORTHO intervention is effective in enhancing students' motivation and engagement in the learning process. MAR-ORTHO-EDU has shown a promising approach to support deliberate practice, safe and ethical student-centred learning. The learning happens at the student's desired pace making simulation-based training promising to create digital environments and helping them to achieve higher clinical competency.

OBJECTIVE

- ✓ To improve learning experiences and achieve higher clinical competency of dental students by introducing a novel markerless haptic enabled mobile augmented reality system for orthodontic education.
- ✓ To evaluate the effectiveness of a novel markerless haptic enabled mobile augmented reality system.



ADDED VALUES

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- The first hand-held interactive medical 3D AR simulation tool (app) for orthodontic training.
- Interactive interface with onscreen tools such as 360° rotation, ruler, hints (objects, text, sound and illustration).

USEFULNESS

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- Enhanced visual perception using feature-rich scalable 3D AR models.
- Effective feedback using onscreen hinting with sound, colour and illustrations.
- Personalisation of learning environment through ubiquitous (anywhere, anytime and any pace) learning.
- Overcoming cognitive dissonance through 3D MAR by combining real-world and digital world learning.
- Supports single (hand-held) and/or multiple (projection onto a bigger screen) users.

COMMERCIALIZATION POTENTIAL

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- Can be licensed to the public and private dental universities
- Can be licensed to specialized industries for further development and on-site research
- The application can be combined with a learning module (in print) and digital (e-book) as a package.
- Can be marketed as a standalone app for students and faculty and other general users.

RECOGNITION

Patent search

Patent Search Report by Tee intellectual property.
Title of the invention – Mobile Augmented Reality for Orthodontic Education – 18/02/2020. The invention was found to be novel, inventive and industrially applicable.

Intellectual Property

1. Copyright on 3D Facial Construction for Mobile Augmented Reality System. Application number LY2021P04292. Date of filing 20/10/2021.
2. Copyright on Orthodontics Examination and Diagnosis E-module. Application number LY2021P04313. Date of filing 20/10/2021.

Grant

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