# Chapter 3
# Enabling Training in Orthodontics Through Mobile Augmented Reality: A Novel Perspective

**Gururajaprasad Kaggal Lakshmana Rao**
*Universiti Sains Malaysia, Malaysia*

**Yulita Hanum P. Iskandar**
https://orcid.org/0000-0002-8037-5800
*Universiti Sains Malaysia, Malaysia*

**Norehan Mokhtar**
*Universiti Sains Malaysia, Malaysia*

## ABSTRACT

*Orthodontic education, which currently emphasizes a didactic and apprenticeship approach, is facing numerous pedagogical challenges that affect knowledge delivery and instruction. This chapter discusses the challenges and limiting factors that affect orthodontic training and proposes the use of mobile augmented reality (MAR) to create a platform for effective learning, visualization, deliberate practice, effective feedback, and a personalized learning environment. MAR, with its visually enriched clinical simulations and ubiquitous learning, can effectively reduce cognitive dissonance and improve overall retention and skill gain by students. However, MAR has its limitations, as the technology is still new and limited evidence is available to back up the claims of knowledge and skill gain in the health professional's education. This chapter also provides future directions for exploring and enabling MAR so that it can become an efficient tool for learning and instruction across all faculties of education.*

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## INTRODUCTION

Clinical education using computer-based simulation training has served as an adjunct approach in health profession education (Katoue, Iblagh, Somerville, & Ker, 2015). The advances in technology combined with enhanced applicability have yielded various learning elements, including real-life clinical training in a variety of disciplines (Harder, 2018). Factors such as deliberate practice, student-centred learning, safe and ethical learning, and the learning happening at the student's desired pace make simulation-based training promising. Simulation-based training, with its variations in presentation, can be either human-based or computer-based. Computer-based simulation, specifically mobile augmented reality (MAR), is the scope of this chapter.

MAR research shows that its development and usage will increase greatly with the education and healthcare sectors becoming the huge benefactors of this progression. The education sector is estimated to have around 7 million users of AR and MAR by 2020 (Statista, The Statistics Portal, 2018). The same trend is predicted for MAR technology, which is currently one of the most explosive of AR applications. MAR is predicted to transform educational practices by opening new pathways that involve interactive and intelligent systems. MAR can function ubiquitously as the hardware required to implement an application is available in the form of either a smartphone or a tablet computer. The ability to experience MAR is becoming more common, as the sensors, processing, and display features necessary for AR applications are already widely available and form the core of mobile devices. These gains in power and features enable learning to become cost-effective. MAR applications already have been integrated into the fields of engineering (Bazarov, Kholodilin, Nesterov, & Sokhina, 2017), tourism (Tussyadiah, Jung, & tom Dieck, 2018), marketing and advertising (Scholz & Smith, 2016), navigation (Houser, 2019), medicine (Hamza-Lup, Rolland, & Hughes, 2018; Jung, Lee, Biocca & Kim, 2019), and dentistry (Kwon, Park, & Han, 2018; Llena, Folguera, Forner, & Rodríguez-Lozano, 2018; Milovanovic, Moreau, Siret, & Miguet, 2017).

In education, MAR has been found to have several advantages over conventional methods of training. It supports millennial students' needs for knowledge assimilation, dissemination, and retention through three dimensional (3D) real-world visualisation and haptic sensing. MAR also provides a suitable platform for building enhanced learning systems for orthodontic training. The platform helps educators create a scenario for any learning task by providing a learning mechanism for excellent visualisation and psychomotor skill acquisition. In addition, MAR's ability to deliver learning content in an effective and easy-to-use format overcomes the challenges