



DENTINE: gamification strategies in pediatric dentistry

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ABSTRACT

Introduction: The promotion of oral health literacy at early ages is recognized as a determining factor in the adoption of sustainable preventive behaviors. At the same time, the increasing integration of digital technologies into children's daily lives opens new opportunities for innovative educational strategies. In this context, Digital Dentistry and Gamification emerge as promising fields, enabling the development of interactive tools tailored to the cognitive and behavioral characteristics of children aged 3 to 5 years. The creation of a mobile application in a serious game format can address the need for more engaging, accessible educational interventions adapted to the preschool developmental stage.

Objectives: This study aimed to present a digital educational application — DENTINE — as a complementary tool for education and prevention in pediatric dentistry.

Methodology: The serious game was developed using the Unity engine, selected for its optimization for mobile devices, high resource compression capacity, and extensive tool library, facilitating both design and programming. The application architecture is based on an interactive narrative structured into three progressive levels. The first level addresses the distinction between healthy and cariogenic foods, using a drag-and-drop mechanic that requires active cognitive engagement and promotes knowledge retention. The second level simulates toothbrushing,

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integrating device sensors to implement a “shake” mechanic, simulating rinsing and promoting physical-digital interaction. The third level aims to demystify the dental office environment through a hidden items game using tapping mechanics, encouraging visual exploration and reducing fear. At the end of each level, an interactive quiz with a visual and auditory reward system was incorporated. The application was designed according to gamification principles described in the literature, incorporating immediate feedback and reward systems that have previously been associated with increased motivation, engagement, and knowledge retention in children's health education.

Results: The DENTINE project resulted in the development of a functional prototype of a mobile educational application based on serious game and gamification principles for children aged 3–5 years. The prototype integrates three educational modules focused on healthy eating, toothbrushing, and familiarization with the dental environment, incorporating interactive mechanics, sensorimotor activities, and a reward-based feedback system. The application was designed according to the cognitive characteristics of preschool children and constitutes the basis for a future pilot study aimed at evaluating its usability, acceptability, and potential impact on oral health literacy. The modular architecture also enables future refinement and implementation in educational and clinical settings.

Conclusion: The DENTINE represents an innovative prototype that combines Digital Dentistry and gamification to support oral health education in preschool children. The application provides a structured educational resource specifically designed to promote interactive learning and complement conventional oral health education strategies. Although no usability or effectiveness testing has yet been conducted, the prototype establishes the foundation for future pilot studies to evaluate user experience, acceptability, and its potential contribution to oral health literacy and preventive behaviors in pediatric dentistry.
