

AI–Powered Chatbot for Emotional Well–Being in Tunisian Primary Schools: CareCube

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ABSTRACT

The emotional well-being of primary school students is often neglected, particularly in low-resource settings where mental health support is scarce. In Tunisia, where academic stress exacerbates anxiety among young learners, scalable, culturally adapted tools are urgently needed. This study presents CareCube, an AI-powered chatbot designed to monitor emotional states, provide real-time support, and guide students through evidence-based exercises during high-stress periods like exams. Using a mixed-methods approach, the research evaluates CareCube's impact on anxiety reduction and emotional regulation among students aged 10–13. An experimental group using the chatbot is compared to a control group receiving traditional support. The study also examines the role of teacher training in health education on implementation outcomes. Findings suggest that AI-based emotional support tools, when tailored to local contexts and supported by trained educators, can enhance student well-being and offer a viable solution for mental health challenges in educational systems with limited resources.

INTRODUCTION

In every classroom, some students silently bear the weight of their emotions—struggling with academic anxiety, social isolation, or the inability to express their feelings, especially during the critical developmental stage of late childhood and early adolescence. Globally, mental health conditions affect an estimated 970 million individuals, including 58 million children and adolescents (World Health Organization [WHO], 2023). This burden is disproportionately felt in low-resource settings, where 76%

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to 85% of mental health needs remain unmet due to critical shortages of mental health professionals (Naslund & Deng, 2021).

In Tunisia, the situation is particularly alarming. Recent research shows that 79.1% of adolescents experience depressive symptoms (Amara et al., 2023), yet schools often lack access to psychological services. Teachers—who frequently serve as the first line of emotional support—are expected to identify, manage, and address students' emotional needs, often without specialized training or formal resources. While some educators receive health education or emotional pedagogy instruction, many confront these challenges without structured support, contributing to uneven and reactive interventions across classrooms.

In this context, artificial intelligence (AI)-driven chatbots have emerged as promising tools for scalable emotional support. Grounded in cognitive behavioral therapy (CBT) frameworks, these systems can deliver accessible, personalized guidance for students struggling with stress, anxiety, and emotional dysregulation. Meta-analyses support their effectiveness, showing significant reductions in anxiety symptoms (Hedge's $g = -0.19$, 95% CI: -0.29 to -0.09) (Lin et al., 2024). However, the well-documented “empathy gap”—referring to the limited emotional resonance in AI-generated responses—remains a key concern. There is increasing evidence that integrating AI with human facilitation may bridge this gap (Kurian, 2024), yet empirical studies examining the role of educators in such blended interventions are limited.

This research seeks to fill that gap by evaluating the impact of *CareCube*, a culturally adapted, AI-powered emotional support chatbot designed specifically for use in Tunisian primary schools. Unlike generic tools, *CareCube* uses age-appropriate language, dialect-sensitive responses, and a scoring-based emotional adaptation engine. The system is deployed through an educational platform and supports both students and teachers through real-time analytics and emotional scaffolding.

This chapter directly contributes to the Encyclopedia's focus on *AI-driven innovations for global health equity* by presenting *CareCube* as a scalable model for mental health support in under-resourced educational systems. By documenting the chatbot's culturally adapted design, evidence-based outcomes, and ethical implementation framework, the study offers a replicable blueprint for deploying AI tools that: (1) address critical gaps in child mental health services, (2) integrate with existing educational infrastructures, and (3) prioritize context-specific needs—core principles emphasized across the Encyclopedia's interdisciplinary health-technology discourse. The findings particularly resonate with the Encyclopedia's mission to bridge theoretical AI advancements with practical, equity-focused applications in low-resource settings.

The research seeks to address the following core questions:

1. To what extent does *CareCube* improve students' anxiety and emotional regulation?
2. How does the impact of the chatbot vary depending on whether the classroom teacher has received training in health education?

Using a factorial mixed-methods approach, the study combines pre/post standardized assessments (RCADS, PANAS-C, CAMM), qualitative interviews, chatbot interaction data, and comparative analysis across teacher profiles. The findings aim to provide actionable insights for scaling emotionally intelligent technologies in low-resource school systems, while underscoring the important role of teacher preparedness in optimizing AI-based mental health interventions.

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