

## EDITORIAL

# Gender-based differences in gamification and mobile learning

Education in health careers is changing drastically aligning itself with a more patient-oriented approach.<sup>1</sup> The use of valid and reliable instruments to assess these new skills, such as communication or ability to think critically, essentially ensures the quality of emerging professionals. Gamification has emerged as an innovative approach to enhance learning experiences by integrating game mechanics into educational settings. By incorporating rules, competition, conflict, challenge and storytelling, gamification creates an engaging and immersive environment for learners.<sup>2</sup>

Within this evolving landscape, students have embraced the use of mobile applications (apps) as valuable tools for accessing educational materials, study aids, and patient-care resources. These apps empower students to engage in flexible and personalized learning experiences, allowing them to learn at their own pace and convenience.

It has been repeatedly demonstrated that the spatial abilities associated with success in the educational and professional fields of Science, Technology, Engineering, and Mathematics (STEM) are gendered, with males demonstrating clearly superior spatial abilities to females.<sup>3</sup>

Despite the potential benefits, there is still a lack of research examining the impact of apps on education in health careers. Studies in university students, have observed gender differences, such as in the mediating role of the exercise environment in the relationship between exercise engagement and exercise adherence, not existing in male university students, while it does in female university students.<sup>4</sup>

Within the context of education in health careers, the impact of mobile apps in classrooms on student satisfaction and academic performance has been a subject of several investigations. Students who utilized mobile health applications not only rated themselves favorably but also felt better prepared to collaborate with individuals from other disciplines compared to their peers who did not use such apps. Alhaddad in 2018 reported that students who engaged with a mobile app for drug calculation practice experienced significant enhancements in their performance

relative to counterparts relying on conventional paper-based methods.<sup>5</sup> Most recently, in 2022, Fathelrahman et al. demonstrated that students who accessed course materials and quizzes via a mobile app expressed greater satisfaction with their learning experience than those who did not utilize such technological tools.<sup>6</sup>

Male students showed greater improvement in learning outcomes compared to female students. This is somewhat surprising given previous research on gender differences in learning styles and preferences. The inclusion of gamification features seems to have the potential to increase user engagement, particularly among males, who have been historically identified as a challenging demographic to effectively involve and retain.<sup>7</sup> Gender differences have been observed in the mediating effect of brand attitude. The main gender difference was that the male group does not have a mediating pathway through the brand-self connection, while the female group does. Gender differences must be taken into account when developing sensory marketing strategies. Especially for women, creating sensory brand experiences that elicit strong emotional connections has positive effects on brand loyalty. This brand loyalty can be extrapolated to loyalty to traditional education.<sup>8</sup>

Measuring addiction to Internet use, a study from Egypt and Saudi Arabia revealed that males are more likely than females to use the Internet problematically, as is the case with addictive behaviors in general. This increased use of the Internet may also make the use of mobile applications easier for males.<sup>9</sup>

It has been observed that in other areas of education such as mathematics, emotional perceptions of information can have profound effects on attitudes toward mathematics, which, in turn, can lead to decreased mathematics achievement. Numerous investigations have documented that females have fewer positive attitudes and more negative affectivity toward mathematics than males. One study examined appraisals of the emotional valence of mathematics-related verbal stimuli among adults and conducted pioneering research on gender differences in emotional perceptions, noting how negative affective

valence is related to mathematical information, especially among women.<sup>10</sup>

Gender differences in motivation and response to gamification elements suggest that men may be more receptive and motivated by game-like features compared to women. Nevertheless, women demonstrated a higher favorability toward mobile apps in terms of perceived usability. The effectiveness of mobile apps as a teaching tool may depend on various factors, including subject matter, type of app used, and individual student's learning styles.<sup>11</sup>



The gamification elements used in our app might have a stronger appeal to male students than to female students. Given these findings, tailoring gamification tools to the target audience by considering gender-specific preferences is essential for optimizing user engagement.<sup>7</sup> Upon examining the outcomes of this study, the educational method employing a mobile application appears to be beneficial. However, the evidence suggests that a combined approach, utilizing both traditional methods and the mobile application, may be the most advisable course of action. In addition to exploring gender differences, future research needs to investigate the long-term impact of gamification on student learning outcomes and retention. While short-term improvements in performance are evident, assessing whether these gains persist over time and contribute to enhanced knowledge retention and transferability of skills is imperative. Longitudinal studies that track students over an extended period will be invaluable in determining the durability and long-term benefits of incorporating gamification in educational interventions. Moreover, future research should explore the specific aspects of gamification that are most effective for different genders, aiming to create more inclusive and effective educational strategies.

## AUTHOR CONTRIBUTIONS

All authors have contributed equally in each section.

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