THE ROLE OF MOBILE APPLICATIONS IN DEVELOPING HYGIENIC COMPETENCIES AMONG STUDENTS

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Abstract: *This article analyzes the pedagogical and information-communication foundations of using mobile applications to develop hygienic competencies among students. The introduction highlights the importance of hygiene culture, the potential of mobile learning, and the relevance of digital health. The methods section describes the use of integrative and normative-comparative analyses, as well as approaches for developing a competency model. The results outline the structural components of hygienic competence, the requirements for the content and functionality of mobile applications, evaluation criteria, and methods for integrating them into the educational process. The discussion compares the findings with international experience and pedagogical theory. The conclusion emphasizes that mobile applications can effectively foster hygienic competencies when aligned with scientifically grounded pedagogical design.*

Keywords*: hygienic competencies; mobile learning; mHealth; persuasive technology; COM-B; instructional design; gamification; information security; evaluation criteria.*

INTRODUCTION

Hygienic competencies represent a set of knowledge, skills, and values that enable modern students to maintain a healthy lifestyle, reduce the risk of infectious and non-infectious diseases, preserve psychophysiological stability, accurately assess environmental factors, and develop a responsible attitude toward public health. In recent years, society's deep integration into digital infrastructure, the global experience gained during the pandemic, and the widespread access to mobile devices and the internet have necessitated a reevaluation of the tools for shaping hygiene culture. From this perspective, mobile applications are recognized as a modern, flexible, and highly effective didactic technology for promoting students' health-related behaviors. International organizations (UNICEF, WHO Digital Health Guidelines) assess mHealth technologies as strategically important for prevention, monitoring, behavior management, and improving the efficiency of healthcare services. In education, the mobile learning environment is viewed as a pedagogical model that supports "anytime, anywhere" learning, promotes student engagement, and facilitates the use of multimodal information. However, fostering sustainable hygienic behavior through mobile applications is a complex systemic process, closely linked to the pedagogical design of educational materials, mechanisms motivating internal student engagement, gamification elements, individualized learning paths, feedback systems, as well as information security and privacy guarantees. Effective approaches in this area require

integrating not only scientific and theoretical foundations but also behavior change psychology (Behavior Change Theory), health promotion models, and digital pedagogical innovations. The educational value of mobile applications manifests in three main facets: Personalized information and instruction — content adapted to user needs, interactive training, adaptive algorithms; Real-time monitoring and feedback — activity indicators, dynamic tracking of health-related behaviors, progress mapping; Behavior-changing incentive technologies — gamification, badges and reward systems, motivational reminders, push notifications, social comparison mechanisms. The aim of this article is to substantiate the pedagogical and didactic potential of mobile applications in shaping hygienic competencies among students, systematize key principles and evaluation criteria for designing mobile applications, and propose effective conceptual and practical scenarios for integrating such applications into higher education.

METHODS

The study was conducted using an integrative analytical approach. This approach allows combining theoretical and practical sources from various scientific paradigms, identifying their conceptual commonalities, and systematically assessing the role and mechanisms of mobile applications in developing hygienic competencies. The sources included strategic reports of international organizations on digital health, mHealth, and education (WHO, UNESCO), leading theories of behavior change (Fogg Behavior Model; COM-B and Behavior Change Wheel — Michie et al.; Reasoned Action Theory — Fishbein & Ajzen), fundamental research on mobile learning (Kukulska-Hulme & Traxler; Berge & Muilenburg), and comprehensive literature on health promotion pedagogy (Glanz et al.). Selection criteria for sources were: (a) Published between 2003–2019 and recognized by the scientific community as fundamental or normative; (b) Covering mobile learning, mHealth, behavior change psychology, health promotion, and competency-based approaches; (c) Including perspectives on instructional design, digital pedagogy, information security, and ethical-legal interpretation. Analysis algorithm: Conceptual mapping: Developed a compatibility map between the structure of hygienic competencies (knowledge, skills, behavior, motivational-axiological components) and the didactic functions of mobile applications (information provision, training, monitoring, incentives, self-management); Analyzed the relationship between behavior change factors (triggers, motivation, opportunity — COM-B model) and the interface and functional features of mobile technologies. Design criteria synthesis: Motivation and gamification elements (achievement badges, progress bars, social comparison, habit-building triggers); Personalization (adaptive learning, individualized tips); Usability (UX/UI principles); Feedback and monitoring mechanisms (self-tracking indicators, real-time alerts); Scientific validity and reliability of content; Information security and privacy requirements. Evaluation and integration approaches: Used didactic models for integrating mobile applications into higher education (blended learning, classroom + mobile support, task-based mobile modules); Systematized outcome measures (cognitive competencies, practical skills, self-regulation, positive

hygienic attitudes, healthy lifestyle decision-making); Developed indicators and rubrics for evaluating the effectiveness of mobile learning components.

RESULTS

Structure of hygienic competencies among students is grouped into five main areas:

Knowledge: scientifically grounded information on hand hygiene, personal hygiene, environmental hygiene, food and drink safety, screen time and eye health, sleep hygiene, physical activity, and stress management. Practical skills: correct handwashing techniques, proper use of disinfectants, maintaining hygiene at educational and living environments. Attitudes and values: responsibility for personal and public health, preventive orientation, and using reliable information sources. Self-regulation and reflection: daily habit monitoring, goal-setting, habit stabilization techniques, applying situation-appropriate strategies. Digital health literacy: identifying reliable sources, online safety, maintaining privacy, evaluating and applying information from mobile apps. Content and functional requirements for mobile applications: Content: short, modular, multimedia (infographics, short videos), scientifically sourced.

Functional features: Personalization: scenarios tailored to student knowledge level, schedule, and health goals;

Reminders and feedback: prompts for handwashing, hydration, sleep, breaks, eye rest; Gamification: points, badges, streaks, team challenges; Learning tasks: real-life missions (analyzing information gaps, creating hygiene checklists, campus hygiene audits);

Offline and localization: functionality without internet, full Uzbek language support;

Privacy and security: minimal data collection, transparent permissions, local encryption, clear privacy policies.

Behavior change mechanism: Strategic use of incentive technologies is essential. According to Fogg, behavior occurs when motivation, ability, and triggers coincide. The COM-B model emphasizes the interaction between capability (C), opportunity (O), and motivation (M). Therefore: Knowledge and skills via content (C), Conditions and environment via the app (O), Internal and external incentives via gamification and personal goals (M).

Intent is a key precursor to behavior; subjective criteria are integrated into personalization strategies.

Evaluation and monitoring: Multilevel assessment is recommended in higher education: Pre- and post-tests: short quizzes for knowledge assessment; Practical checklists: handwashing, workspace disinfection, screen time hygiene tasks; Self-report: daily habit logs; Reflective essays: attitudes and values assessment;

Instructor assessment: competency-based rubrics.

All measurement tools are based on clinical recommendations and anonymized according to personal data protection rules.

Integration into the learning process: Optimal scenario — blended learning:

Classroom: hygiene case studies, skill exercises, discussions;

Mobile platform: microlearning modules, tasks, reminders, gamification, feedback;

Project work: campus hygiene audits, proposal development, targeted communication campaigns;

Mentoring: instructor or peer mentor support, personalized plans.

This approach aligns with UNESCO mobile learning guidelines and WHO principles for digital interventions in health systems.

Information security and ethical considerations:

Applications for students should collect minimal data, offer transparent solutions, require user consent, consider age restrictions, and assess risks from a youth psychology perspective. Over-collection of data should be avoided; internal audits and external expert reviews are recommended.

DISCUSSION

The integrative analysis demonstrates that mobile applications can be a powerful pedagogical tool for developing hygienic competencies in students. Their effectiveness depends on how well the app is integrated into the overall educational architecture and aligned with scientifically grounded behavior change models. Although mobile learning environments facilitate rapid information delivery, knowledge deepening and value formation require classroom and collaborative activities. Blended learning designs offer both didactic and socio-psychological benefits: students learn from each other, and instructors can calibrate personal learning pathways. International recommendations emphasize that digital interventions should complement health systems rather than function independently. In pedagogy, mobile applications should be part of the curriculum rather than standalone solutions. The COM-B and Fogg models highlight that motivation (M), capability (C), and opportunity (O) must coexist to ensure sustainable behavior change.

Example: Developing a handwashing habit via an app: Short videos and checklists improve knowledge and skills (C); Disinfectant dispensers and visual cues on campus provide opportunity (O); Gamification and social recognition reinforce motivation (M).

If any of these three elements is missing, the habit will not stabilize.

Content quality and reliability are critical. As WHO and Glanz et al. emphasize, educational health materials should be based on scientific evidence, clear preventive recommendations, and individual and social dimensions of the problem. UNESCO guidelines call for localization, inclusivity, and infrastructure considerations; thus, fully functional apps in Uzbek, operable offline and on low-power devices, are essential.

Gamification plays a distinct role. While effective for short-term attention, it alone is insufficient for long-term value and responsibility development. Combining gamification with reflection tasks, collaborative activities, and service learning increases effectiveness. According to Fishbein & Ajzen, subjective criteria, self-regulation, and supportive environments convert intent into action; therefore, peer challenges and endorsements within the app strengthen intent.

CONCLUSION

Developing hygienic competencies in students is a strategic direction for promoting health protection and social responsibility in higher education. This process not only reinforces theoretical knowledge but also develops practical skills, stabilizes habits, and fosters a personal culture of healthy living. Mobile applications accelerate and individualize this process: through rapid information delivery, real-life tasks, regular feedback, and motivators, hygienic habits are formed and consolidated. For effectiveness, integration with the curriculum, scientifically grounded behavior change models (Fogg Behavior Model, COM-B, Reasoned Action Theory), information security, and localized content are essential. International recommendations emphasize that digital interventions should be planned as an integral part of the system and closely linked to pedagogical objectives. In higher education, applying blended learning, competency-based rubrics, and inclusive design principles fosters sustainable development of hygienic competencies. Furthermore, these approaches enhance students' digital health literacy, promote independent learning, and cultivate hygiene culture through collaborative activities, contributing to long-term healthy lifestyles and social responsibility.

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