Lorestan University of Medical Sciences

Khoramabad School of Nursing and Midwifery

Master's Thesis Pediatric Nursing

T*itle:*

Designing and Evaluating a Serious Game-Based Mobile Application for Teaching about Cybersecurity to Children

By:

Mohammad Mehdi Mansouri

Supervisor:

Dr. Fateme Valizadeh

Advisor: Dr. -----

Dr. Sayeda Fateme Ghasemi
Dr. Mahnaz Samdbig
Dr. Rasool Sadeghi

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Abstract

Background and Aim: Children are most recently spending more time than ever online, making them subjected to cybersecurity risks. The conventional methods attempted to keep children safe from the dangers of the virtual worlds that are merely based on limited access to the internet and technical use controls seem to be inadequate. In view of that, children should become self-aware of some tactics to protect themselves online and further gain the required skills that attach much importance to mutual growth as well as the practices of imagination and caring, critical, and creative thinking, and then improve their self-leadership. Thus, the present study was to design and evaluate a serious game-based mobile application (app) for teaching about cybersecurity to children.

Materials and Methods: This production study of the applied type was completed during four phases, namely, (1) the app content was initially developed by reviewing the relevant literature and then validated by 10 experts involved in childhood education, information technology (IT), and cybersecurity and computers based on the content validity ratio (CVR) and content validity index (CVI) values; (2) the app content and overview screen of the Snakes and Ladders board game along with texts, images, drawings, and attractive sounds were subsequently submitted to the app development team with graphics and computer programming expertise, and the app was designed using the Autodesk 3ds Max, Adobe Photoshop, Adobe After Effects, and Unity 3D software packages in the Android environment; (3) once the necessary arrangements were made, the app was installed and presented to 40 students (viz., 20 boys and 20 girls) aged 6-15 at the schools in the city of Eyvan, Ilam Province, Iran, in the 2023-2024 academic year, and asked to play the game for three days upon receiving instructions; and (4) the participants completed the modified System Usability Scale (SUS) for children created by Giannakas (2018) through interviews or self-reports on the fourth day. As the final point, the frequency, percentage, mean, and standard deviation (SD) indices together with the Chi-square test were utilized for data analysis.

Results: The app developed for teaching about cybersecurity to children in this study contained 52 messages under five categories, including (i) cyberbullying, (ii) internet fraud and identity theft, (iii) online deception, (iv) cyber-harassment, and (v) sexual abuse, explicit content, and pornography. The CVR and CVI values were also equal to 0.99 and 0.99, respectively. The Snakes and Ladders board game was further exploited in the app development. Upon installing and running the app, five islands could be seen, and the game could be played after clicking each one. During the game, the users might face some squares enclosing statements about the right or wrong behaviors related to cybersecurity, reinforced with conventional paintings and message readings. In this game, the users needed to avoid being bitten by the snakes through providing the right answer, climb up the shortcuts (or steps), reach the highest space, i.e., the square no. 100, and complete the five levels or islands included in the game. Of note, the users could start the game from the beginning by clicking the icon on the app main page. The study results generally revealed that 50% of the users reported the high usability of the app. The difference between the age groups in this respect, namely, those younger than 9 and the students aged 9 and older, was statistically significant ($p=0.001$).

Conclusion: This Android app, characterized by being installed on mobile phones and tablets, could teach Iranian children about cybersecurity based on the Snakes and Ladders board game, considering their Islamic culture. During the game, children could learn that they would be rewarded by choosing the right behavior in cyberspace, or play against punishment and hardship if they made a wrong choice. It was thus suggested to use this app at schools, especially for children aged 9 and older, collectively or individually, to teach them about cybersecurity. The app could also be of commercial use if supported.

Keywords: Risk, Cybersecurity, Education, Serious Game, Children