Penerbit Akademia Baru

Journal of Advanced Research Design

Journal homepage:
https://akademiabaru.com/submit/index.php/ard
ISSN: 2289-7984


# Mobile Game-Based Learning on Personal Hygiene

Wan Abdul Rahim Wan Mohd Isa[1], Syazikri Saedi Idris[1], Indah Mohd Amin[2,*], Zulinda Ayu Zulkipli[3], Johan Eddy Luaran[3]

[1] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[2] Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Selangor Branch, Sungai Buloh Campus, Sungai Buloh, Selangor, Malaysia
[3] Faculty of Education, Universiti Teknologi MARA (UiTM) Selangor Branch, Puncak Alam Campus, Bandar Puncak Alam, Kuala Selangor, Selangor, Malaysia

**ARTICLE INFO**

***Keywords:***

Mobile Game-Based Learning, Mobile Learning and Technology

**ABSTRACT**

This study presents the design, development, and evaluation of BersihDiri, a mobile game-based learning application created to promote awareness and practice of personal hygiene. Guided by the Digital Educational Game Life Cycle (DEG) methodology, the project addressed four main objectives: identifying system requirements, designing, developing, and evaluating the application. The application integrates storytelling and interactive gameplay to teach daily hygiene routines such as body washing, handwashing, and toothbrushing. Gamification elements, including progress bars and task-based activities, were embedded to enhance motivation and engagement. User testing with eight participants confirmed that the system functioned as intended, with all tasks completed successfully and without technical errors. The evaluation results highlight the potential of the application as an effective learning tool that blends education and entertainment to reinforce healthy practices. Beyond individual benefits, the application contributes to community well-being by supporting parents and educators in instilling hygiene habits among children, particularly within indigenous and local communities. Future enhancements may include expanding hygiene practices, integrating additional gamification features, and incorporating multilingual options to broaden accessibility and impact.

## 1. Introduction

Mobile Games have been used in different locations and purposes, such as at museum visits for learning [1]. Mobile game-based learning contributes to the engagement and motivation of children [2]. Furthermore, lessons learned on engaging teenage visitors in museums with story-based and game-based strategies [3]. Mobile games may also enhance user experience in museums [4] as game-based assessment tools can enhance learning motivation and concentration [5].

Teaching cultural heritage is possible through a narrative-based game [6]. This is because the choice of game type influences the success of digital educational games (DEGs), where success is defined as significant domain-specific knowledge gain (learning outcome) with positive player experience [7]. In addition, the unique aspects of different places seem to require games of different characteristics, such as designing games for different places of cultural heritage [8]. Service providers

* *Corresponding author*
*E-mail address: indahma@uitm.edu.my*

need to improve users' experience to facilitate their adoption and usage of mobile games [9]. An enjoyable gaming experience largely depends on content quality [10]. Thus, suitable approaches for the game design within the context of the school may be prescribed [11].

Location-based mobile game seeks to inspire players to be more active, socialize physically and virtually, and spend more time outside [12]. The aspects of fun and rich experiences, usually required within the entertainment context, are easily overlooked in technologically driven system design [13]. Information and communication technologies have great potential to promote a greater awareness and appreciation of cultural heritage [14]. Digital games can help people, especially young people, get the most from cultural heritage [15]. In addition, augmented reality design based on adventure games can be treated as a solution to promote cultural heritage sites such as historic buildings [16]. Furthermore, games in everyday life make our lives more playful [17] as gamification supports learning outcomes [18] and creates benefits [19]. For example, the gamification of heritage supports the collaborative learning of young museum visitors [20]. There is a need for mobile applications to be developed for indigenous people and other local communities.

## 2. Methodology

The methodology involved using the adapted Digital Educational Game Life Cycle (DEG) [21] to suit the objectives of this study. The following are the objectives of this study.

i. To identify the system requirements of the BersihDiri mobile game-based learning application about maintaining personal hygiene.
ii. To design the BersihDiri mobile game-based learning application about maintaining personal hygiene.
iii. To develop the BersihDiri mobile game-based learning application about maintaining personal hygiene.
iv. To evaluate the BersihDiri mobile game-based learning application about maintaining personal hygiene.

This study adopted the methodology Digital Educational Game Life Cycle (DEG), which consists of adapting three processes: (i) design, (ii) game-based learning and feedback, (iii) game implementation and publishing phase.

## 3. Results and Discussion

### *3.1 Objective 1: To identify the system requirements of the BersihDiri mobile game-based learning application about maintaining personal hygiene.*

The functional and non-functional requirements are shown in Table 1 and Table 2, respectively.

**Table 1**
Application functional requirements

| Functional Requirements | Description |
|---|---|
| Storytelling | Players can experience the personal hygiene daily routine of Amran, who is a character in the game. |
| Game washing body | The user needs to wash the body of Amran to continue the flow of the game. The game contains a progress bar to let the user know that the game is finished. While they play the game, they could also learn that washing our bodies is an example of a method of maintaining personal hygiene. |

| | |
|---|---|
| Game washing hands | Users continue to play the game where the user needs to wash Amran's hands after eating. The game contains a progress bar to let the user know that the game is finished. |
| Game brushing teeth | Users proceed to play games while brushing Amran's teeth before going to sleep. The game contains a progress bar to let the user know that the game is finished. |

**Table 2**
Application non-functional requirements

| Non-Functional Requirements | Description |
|---|---|
| Platform compatibility | The Bersih diri mobile application needs to be able to run on Android-based mobile devices. |
| Performance and responsiveness | For the intended output, the mobile game-based application's reaction time correlates with the user's input behavior. |
| Usability | Clicking on the buttons allows the user to interact with them without difficulty. |
| Consistency | Each page's user interface design needs to be consistent. This application's interface should be user-friendly, simple to comprehend, and straightforward to use. |
| Reliability | This program may be used whenever and wherever. |

### *3.2 Objective 2: To design the BersihDiri mobile game-based learning application about maintaining personal hygiene.*

There is an interplay between the elements of features supplied in each system that has grown. The use case diagram was used for the BersihDiri mobile application to show how the user interacted with the program's features. Because this was a single-app user, the only player participating in this project was the user. As a result, the entire use case diagram is shown in Figure 1.

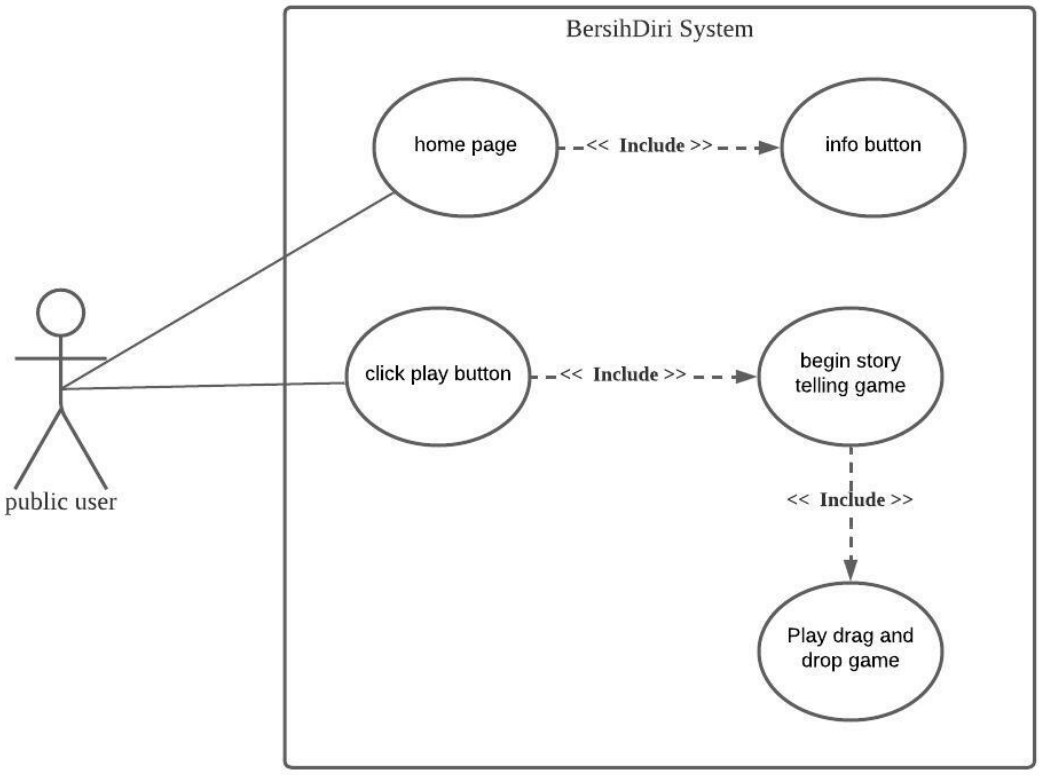


**Fig. 1.** Use case diagram.

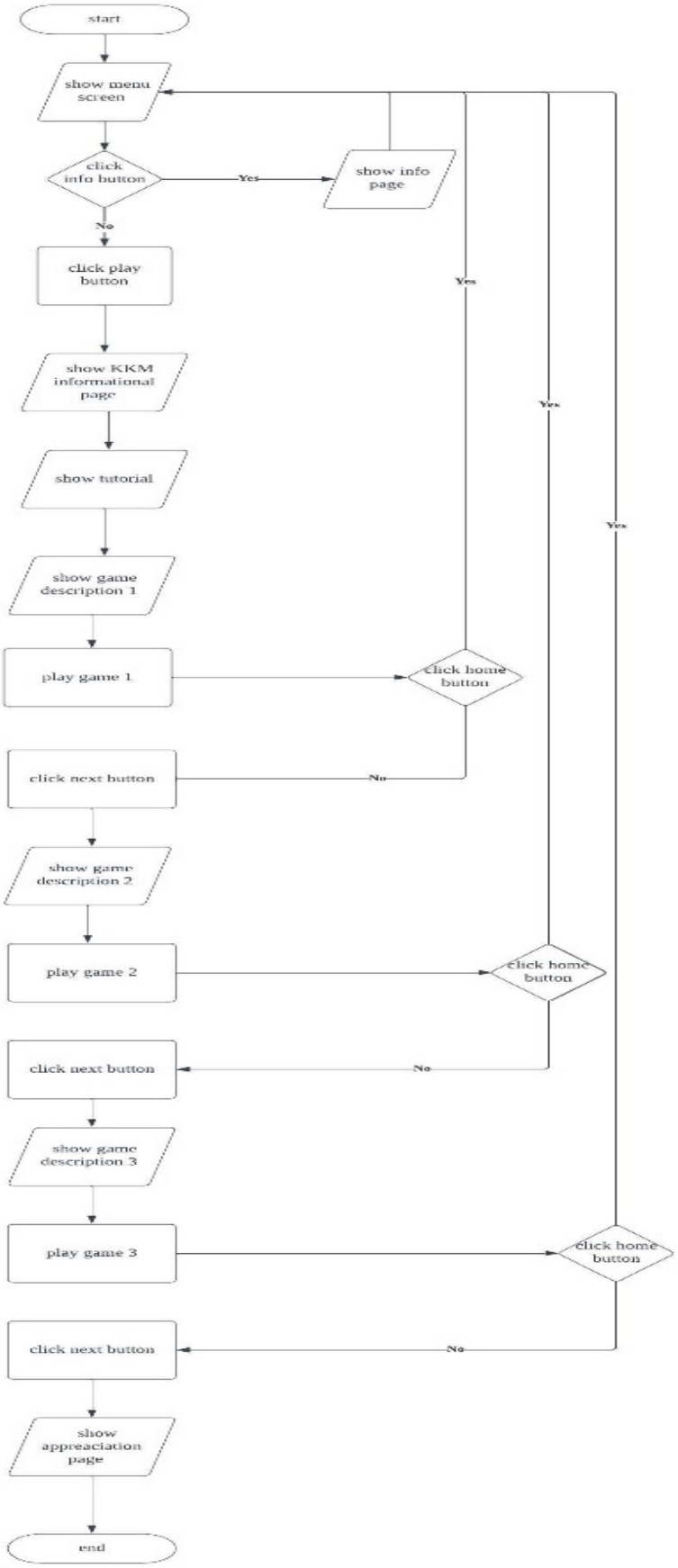


**Fig. 2.** Flowchart

The flowchart serves as a guide to the process flow of a system or software. It gives consumers a clear idea of how to operate the system appropriately. Figure 2 is a flowchart for this BersihDiri mobile application. First, once the user launches the application, the main page will display the info button and play button. The info button will show the information and synopsis about the game. Once the user finishes reading the info page, they can start playing the game by clicking the play button. The game provides gamification elements such as a storyline and a progress bar.

*3.3 Objective 3: To develop the BersihDiri mobile game-based learning application about maintaining personal hygiene.*

The development is a critical step for the BersihDiri mobile application since it ensures that all the needs established in the first goal are met, as well as that design specifications are effectively fulfilled and provided to the user. The project must still be checked to ensure that it runs smoothly without errors or glitches and displays the right results. Construct 2 and Android Studio were used to develop the BersihDiri Mobile Application. Figure 3 shows the prototype of the BersihDiri Mobile Application.


**Fig. 3.** BersihDiri Mobile Application

### *3.4 Objective 4: To evaluate the BersihDiri mobile game-based learning application about maintaining personal hygiene.*

The application was evaluated with eight users for game-based learning and feedback. Table 3 shows the task activity for the testing procedure.

**Table 3**
User testing

| Activity | User 1 | User 2 | User 3 | User 4 | User 5 | User 6 | User 7 | User 8 |
|---|---|---|---|---|---|---|---|---|
| Launch the BersihDiri mobile application. | functional | Functional | functional | functional | functional | functional | functional | functional |
| Click the info button. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch audio for the game. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the info page. | functional | functional | functional | functional | functional | functional | functional | functional |
| Click the play button. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the KKM page. | functional | functional | functional | functional | functional | functional | functional | functional |
| Click the next button. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the introduction character page. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the tutorial page. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the game descriptions 1,2 and 3. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the game stages 1,2 and 3. | functional | functional | functional | functional | functional | functional | functional | functional |
| Launch the appreciation page. | functional | functional | functional | functional | functional | functional | functional | functional |
| Click the home button. | functional | functional | functional | functional | functional | functional | functional | functional |

According to the findings of user testing, the application performs as intended. All the testers can complete the task successfully.

## 4. Conclusions

This study has demonstrated the design, development, and evaluation of the BersihDiri mobile game-based learning application, aimed at fostering awareness and practice of personal hygiene. By integrating storytelling and gamification elements such as progress tracking and interactive tasks, the application provides an engaging platform that enables users, particularly children, to learn hygiene routines enjoyably. The user testing results confirmed the application's functionality and effectiveness, highlighting its potential as a supplementary tool for health education. Beyond its immediate contribution to individual learning, the BersihDiri application offers broader social value by supporting parents and educators in promoting hygiene awareness within

indigenous and local communities. The findings underscore the capacity of mobile game-based learning to combine entertainment with educational objectives, thereby strengthening both knowledge acquisition and behavioral reinforcement. Future research should explore expanding the application with additional hygiene practices, multilingual features, and enhanced gamification strategies to increase user engagement and inclusivity. With these advancements, the BersihDiri application can evolve into a scalable and impactful resource for digital health education and cultural outreach.

**Acknowledgement**
This research is funded by the Geran Penyelidikan Khas 2020 (GPK), Universiti Teknologi MARA, Malaysia. (Project Code: 600-RMC/GPK 5/3 (127/2020)).

**References**

[1] Rubino, I., Barberis, C., Xhembulla, J., and Malnati, G. 2015. "Integrating a Location-Based Mobile Game in the Museum Visit: Evaluating Visitors' Behaviour and Learning." *Journal on Computing and Cultural Heritage*, 8, 3 (2015): 1-18. https://doi.org/10.1145/2724723
[2] Monteiro, I. T., Brilhante, M. Q. D. L., Santos, J. M. A. D., Oliveira, F. C. D. M. B., and Oliveira, A. C. B. D. "Mobile game-based learning with Opi app: Lessons learned with a children usability evaluation." In *Proceedings of the XX Brazilian Symposium on Human Factors in Computing Systems (IHC '21).* Association for Computing Machinery, New York, NY, USA, Article 39 (2021): 1–11. https://doi.org/10.1145/3472301.3484349
[3] Cesário, V. and Nisi, V. "Lessons Learned on Engaging Teenage Visitors in Museums with Story-Based and Game-Based Strategies." *Journal on Computing and Cultural Heritage*. 16, 2 (2023): 1-20. https://doi.org/10.1145/3575867
[4] Elesini, U. S., Miha, H., Kristan, D., Korošec, A., Protić, E., Učakar, A., Brodnjak, U. V. and Rugelj, J. "Mobile Serious Game for Enhancing User Experience in Museum." Journal on Computing and Cultural Heritage, 16, 1 (2022): 1-26. https://doi.org/10.1145/3569088
[5] Jo, J., Yi, E., Yang, Y. and Choi, S-H. "Game-based assessment tool using convergence of gamification and motivation theory in intelligent tutoring system." *Personal and Ubiquitous Computing*. 27, 3 (2021), 1149–1159. https://doi.org/10.1007/s00779-021-01523-6
[6] Malegiannaki, I. A, Daradoumis, T., and Retalis, S. "Teaching Cultural Heritage through a Narrative-based Game." *Journal on Computing and Cultural Heritage*. 13, 4 (2020): 1-28. https://doi.org/10.1145/3414833
[7] Heintz, S., and Law, E. L.-C. "Digital Educational Games: Methodologies for Evaluating the Impact of Game Type." *ACM Transactions on Computer-Human Interaction*, 25, 2 (2018): 1-47. https://doi.org/10.1145/3177881
[8] Antoniou, A., Lepouras, G., Bampatzia, S., and Almpanoudi, H. "An approach for serious game development for cultural heritage: Case study for an archaeological site and museum." *Journal on Computing and Cultural Heritage*, 6, 4 (2013). https://doi.org/10.1145/2532630.2532633
[9] Zhou, T. "Understanding the effect of flow on user adoption of mobile games." *Personal and Ubiquitous Computing*. 17, 4 (2013): 741–748. https://doi.org/10.1007/s00779-012-0613-3
[10] Fräntim, P. and Fazal, N. 2023. "Design Principles for Content Creation in Location-Based Games." ACM Transactions on Multimedia Computing, Communications, and Applications," 19, 5s (2023): 1-30. https://doi.org/10.1145/3583689
[11] Moser, C. "Child-centered game development (CCGD): developing games with children at school." *Personal and Ubiquitous Computing*. 17, 8 (2013): 1647–1661. https://doi.org/10.1007/s00779-012-0528-z
[12] Saaty, M., Haqq, D., Beyki, M., Hassan, T. and McCrickard, D. S. "Pokémon GO with Social Distancing: Social Media Analysis of Players' Experiences with Location-based Games." *Proceedings of the ACM on Human-Computer Interaction*, 6, 249 (2022): 1–22. https://doi.org/10.1145/3549512
[13] Manninen, T. "Contextual Virtual Interaction as Part of Ubiquitous Game Design and Development." *Personal and Ubiquitous Computing*. 6, 5-6 (2002): 390–406. https://doi.org/10.1007/s007790200044
[14] Ardito, C., Costabile, M. F., Angeli, A. D., and Lanzilotti, R. "Enriching Archaeological Parks with Contextual Sounds and Mobile Technology" *ACM Transactions on Computer-Human Interaction*, 19, 4 (2012): 1–30. https://doi.org/10.1145/2395131.2395136
[15] Fontanella, F., Molinara, M., Gallozzi, A., Cigola, M., Senatore, L. J., Florio, R., Clini, P. and D'amico, F. C. "HeGO, a Social Game as a Tool for Cultural Heritage Valorization: The Case Study of the Atina Historical Center." *Journal on Computing and Cultural Heritage*, 14, 2 (2021): 1–16. https://doi.org/10.1145/3431926

[16] Fazio, S. and Turner, J. "Bringing Empty Rooms to Life for Casual Visitors Using an AR Adventure Game: Skullduggery at Old Government House." Journal on Computing and Cultural Heritage, 13, 4 (2020): 1–21. https://doi.org/10.1145/3418037
[17] Zambetta, F., Raffe, W., Tamassia, M., Mueller, F. F., Li, X., Quinten, N., Patibanda, R., Dang, D. and Satterley, J. 2020. "Reducing Perceived Waiting Time in Theme Park Queues via an Augmented Reality Game." *ACM Transactions on Computer-Human Interaction*. 27, 1 (2020): 1-30. https://doi.org/10.1145/3361524
[18] Ahmad, A., Zeshan, F., Khan, M. S., Marriam, R., Ali, A. and Alia Samreen, A. "The Impact of Gamification on Learning Outcomes of Computer Science Majors." ACM Transactions on Computing Education. 20, 2 (2020): 1-25. https://doi.org/10.1145/3383456
[19] Marín, B., Frez, J., Cruz-Lemus, J. and Genero, M. 2018. "An Empirical Investigation on the Benefits of Gamification in Programming Courses." *ACM Transactions on Computing Education*. 19, 1 (2019): 1-22. https://doi.org/10.1145/3231709
[20] Nofal, E., Panagiotidou, G., Reffat, R. M., Hameeuw, H., Boschloos, V., and Moere, A. V. "Situated Tangible Gamification of Heritage for Supporting Collaborative Learning of Young Museum Visitors." *Journal on Computing and Cultural Heritage*, 13, 1 (2020): 1-24. https://doi.org/10.1145/3350427
[21] Aslan S. and Balci O. "Gamed: Digital Educational Game Development Methodology." *Simulation*, 91, 4 (2015): 307 – 319. https://doi.org/10.1177/0037549715572673