

# Implementation of a Participatory Design Process in Designing an Educational Mobile Game for Primary School Students: A Case Study in Malaysia

**Rozana Ismail**

Advanced Informatics School,  
Universiti Teknologi Malaysia,  
Kuala Lumpur, Malaysia  
rozanaresearcher@gmail.com

**Roslina Ibrahim**

Advanced Informatics School,  
Universiti Teknologi Malaysia,  
Kuala Lumpur, Malaysia  
irolina.kl@utm.my

## ABSTRACT

Over the years, the technology integration has been increasingly evident in the higher education institutions. Nevertheless, traditional teaching and learning methods are still largely implemented in the primary schools of the developing countries. Despite the teachers and the students being technology savvy, passive learning is still being practiced in the primary schools of Malaysia. The digital educational game is one of the alternative assessment options capable of enhancing the learning experience of the students. The educational game design is crucial in attracting the attention of the students while fulfilling their learning needs. This research, therefore, aimed to identify an optimal participatory design (PD) process with a suitable mobile game design framework. This research is now at its third phase. All the inputs have been conceived from the previous phase into this phase. Purposive sampling and interview have been done in the first phase and the input for the following phase of the game workshop setting has been delivered. In the third phase, the participants will design an educational game based on the input from the second phase, where the data were qualitatively collected using observation, picture and field notes. Finally, to map the findings from the third phase to the final stage, it was suggested that a game design document (GDD) should be incorporated in the future research works as the final input to complement the game prototype phase.

## Author Keywords

Participatory Design Process; Game Design Framework; Educational Mobile Game; Prototype.

## ACM Classification Keywords

H.5.2 [Human-Centered Computing]: Interaction Design, Interaction Design Process and Methods, Participatory Design.

## INTRODUCTION

Over the past few decades, technology has developed rapidly with an unprecedented impact on various aspects of human life including the education for the younger generations. The advancement of new technology has transformed the educational landscape profoundly and the integration of technology into the existing education system

has become increasingly crucial. While the technology evolution is evident in the higher education institutions, the traditional teaching and learning via textbooks and blackboard remain the key components in the primary school system, especially in the developing countries [1]. Despite the success of the traditional education method in shaping the minds of many influential people in history, changes in the mode of education are incredibly important in this era of advanced technology.

The traditional forms of education are bound to fail in stimulating the learners if it remains inert for decades. For example, the traditional printed textbooks present material in an elaborated form in which the important information is often obscured by extraneous language and formalism. Such material is traditionally used in the classroom where students take the passive role while the teacher delivers a lecture based on the textbook [2]. Considering the accelerating pace of technology innovation, such learning style would be inadequate in this modern era to prepare the young people for the 21<sup>st</sup> century. The lack of change in the primary school system is, however, not due to the unfamiliarity of the teachers or students with the digital devices. In fact, the opposite is true. A report on the local newspaper of teachers teaching Arabic language revealed their use of technology in video and audio relevant to the subject [25]. The fact that technology is not employed in the classroom despite the familiarity of both teachers and students with the various modern innovations cannot be justified.

To shift the learning paradigm of the primary schools, the educational mobile game can be introduced as one of the alternatives to the conservative teaching method. The perspectives of the primary school students on the educational game are not clear. Nevertheless, it is obvious that game designs which are attractive and fun gain more attention of the children rather than the serious educational game [3]. To facilitate the students' learning via the interactive digital games, the game design is crucial [4]. As available in market, most of the educational games designed by the professional game designer. However, the perspective of a user being the game designer himself is also considered rare and unique [5]–[15]. Designing an educational game is not easy, especially to sustain the

attention of the students [16] and broadened their game experiences [17]. One of the ways to gain a deeper understanding of the students' learning needs is to adopt the co-design or also known as the participatory design (PD). The involvement of participants in designing a game has been prominent in the existing research works regarding PD. Nonetheless, the details of PD framework tailored to designing a game for the primary school children remain unavailable [14], [15], [18]–[20].

With regards to the above issues, two problem statements were generated: (1) what is the suitable PD process to design a digital game for the primary school students? (2) How to implement PD process in the educational digital game for the primary schools? To answer these research questions, this study intended to identify a suitable game design and PD process to be incorporated into the final process framework. The next part of this paper presented a summary of the work done in determining the suitable PD process and game design for the final framework. The findings obtained from the preliminary investigation based on the framework would create a lead to deploy the final PD process framework for the primary school case study.

## TOWARDS PD PROCESS FRAMEWORK

### MDA Game Design Theory

Designing a mobile game is challenging especially when it involves the primary school children. Several game design models and frameworks are available, among which is the Mechanics-Dynamics-Aesthetics (MDA) game framework [21], [22], that can be used for the educational purpose in the primary schools.

### PDEduGame Process Framework

Figure 1 presented a summarized diagram of the PDEduGame process framework. The standard PD process for an educational game has yet been extensively studied in the context of Malaysian primary school [23]. Based on a systematic literature review (SLR), there was a total of 21 articles and books relevant to the PD processes adopted in different fields of research. Four main phases were identified based on the PDEduGame process framework: 1) initial study, 2) game workshop setting, 3) game design workshop, and 4) game prototype. The phases of the research works were analyzed using the meta-analysis and categorized according to the suitable theme.



Figure 1. PDEduGame Process Framework [24]

## PHASE 1: INITIAL STUDY/INVESTIGATION

The preliminary investigation was conducted in the initial study phase with a purpose to support the later process of the game workshop setting. Based on the 2017 regional statistics of the primary school final examination, most students found the history subject difficult. Thus, the history topics for primary four and five were selected as the game content of this study. A total of 287 participants aged 10 to 12 years were recruited from three primary schools, which were all within two to three kilometers from the location of the design workshop. The participants were asked to answer a questionnaire which was divided into three main sections: 1) the student ownership and preferences for the game medium and tools; 2) the students' preferences for the educational mobile game and its practices and; 3) the PD meeting agreement and consent letter.

In addition, a brief personal interview was conducted with nine history teachers. As shown by the analysis of the transcript, all the teachers agreed that history subject requires a lot of memorizing. They further explained that engaging the students in learning via a mobile educational game in the classroom is usually not feasible due to the support constraints. Moreover, the class assessments commonly take place in the form of written exercises and quizzes which are time-consuming, leaving them with little or no time for an interactive game during the class. Nonetheless, all teachers agreed that the students could benefit from learning the history topics via the educational mobile game after school with the parental supervision.

## PHASE 2: DESIGN WORKSHOP SETUP

A descriptive analysis was performed on the data from the preliminary investigation. Purposive sampling was used to identify the eligible participants for the workshop. Almost 57% of the students from the survey agreed to attend the design workshop. Out of which, 22% of students were engaged with the online and mobile game on a daily basis. The participants for the PD process were selected based on their willingness to participate and involve in the design workshop. Each of the participants was required to adhere to the program template provided to them and their respective parents or guardians were asked to sign a consent letter. Based on which, 15 students were considered eligible for the design workshop, as their agreement to participate and the frequency of their game experiences were higher than the others. In addition, the students were selected specifically based on their performance in the history subject ranging from the lowest to the highest marks. Another input from first phase was the finding from the interview with the teachers who reported a deterioration of the students' performance in the history subject and, therefore, suggested to focus the game concept on the history topics. In this phase, triangulation was based on student's various performances in final examination and their experiences in digital game. Table 1 presented details on descriptive analysis as an input from initial study phase.

PHASE 1: INITIAL STUDY	FINDING WITH IDENTIFIED GAME ELEMENTS (MDA)	PHASE 2: GAME WORKSHOP SETTING
Inquiry Process <b>Method:</b> Interview	1) History education is one of the subjects suggested in designing the educational game. 2) Three teachers are willing to come and participate in the workshop.	<b>Input:</b> 1) The mock-ups based will be created based on the historical site. 2) Three teachers are also representative from each school will participate.
Inquiry Process to identify game Preferences <b>Method:</b> Questionnaires	<b>1) Game Genre Preferred (Identify the suitable Mechanic in each of the game below)</b> Puzzle 38% Maze 29.3% Board Game 24.1% <b>2) Game Characteristic Preferred (Dynamic)</b> Fun 47.7% Challenges 43.6% Beautiful Colors 27.9% <b>3) Reason for Gaming (Developed Aesthetic)</b> Bored 53.3% Fun 46.7% Challenging 45.6%	<b>Input:</b> 1) Game genre will be based on puzzle game. 2&3) To create fun educational game, facilitators will prepare all the tools needed so the students and design based on these criteria. Fun educational game is the most anticipated by the students, thus some tools such as Play Doh, color pen, color paper and other stationary would be helpful tools as input for Phase 3. Thus, we need to prepare these tools so it can cater 15 students.
Inquiry Process to identify 15 students to attend game design workshop <b>Method:</b> 1) Purposive Sampling 2) Document Review (Exam Result)	1) Students who wants to participate and volunteer to design game 2) Examination results for each student who volunteer to participate will be referred to get different background of student.	<b>Input:</b> 15 students were uniquely chosen based on their willingness to participate and design, and which have different perspective on learning and gaming. (Data from purposive sampling and document review for examination result will go through for triangulation process.

Table 1: Initial study phase inputs for the subsequent phase

### PHASE 3: GAME DESIGN WORKSHOP

In the design workshop, data were collected via observation, pictures, and field notes. There were three major parts: 1) Initial game concept; 2) Create game storyboard; 3) Develop game mock-ups. The workshop lasted for two days. On the first day, icebreaking activities were conducted and a briefing regarding the schedule was given prior to the development of the initial game concept. The PD coordinator, game developer, and teachers for time effectiveness, has provided three ideas earlier in the second phase of the PDEduGame process. The suggested ideas of background i.e. the city, the cave, and the pyramid were portrayed on three pieces of drawings. The students first labeled the drawings for different levels of the game according to their preferred sequence. After a voting process, it was decided that the sequence of the game background would be the cave, followed by the pyramid and lastly the city. The day ended with the second game design workshop where the students first created a game storyboard individually and then discussed as a group to produce one simple storyboard. The teachers and game developers also contributed to the discussion.

#### Prototype Model: Designing Game Mockups

On the second day of the design workshop, the coordinator and game developer created based mockups, including the cave, the pyramid, and the city. The participants were

required to design the game and educational activity based on the mockups. The game mockups completed with checkpoints, figures, and learning assessment would be the final game design before the prototype testing.

#### Testing the Prototype

Once the prototype model was finalized, the prototype for each game level was tested. The teachers performed an assessment by producing a question each time a student arrived at the checkpoint. The students were assessed according to the game level and the learning content. This assessment created a competition among the students, which motivated and challenged them to provide the best answer they could. The value of healthy competition among the students was recorded on the field note as a good attribute to be integrated into the educational games. In addition, aesthetic game features were identified via the prototype testing. Furthermore, both the teachers and the students experienced fun and enjoyed the challenges while enacting the play.

#### PD Process Analysis – The Feedback

The phases in PDEduGame framework process were a replicate extension of the basic PD processes. Each phase in the framework contributed an input to the subsequent phase as with the initial study where the participants and information were determined for the next phase of the workshop. The same happened in the second phase i.e. the game workshop setting, whereby the based mockups and game stages were prepared to ensure that the participants could gain maximum and desirable outcome from the design workshop. The prepared initial mock-ups and other information gathered from first and second phase shortened the design time and stimulated the participants to generate more ideas. Despite being tired from the workshop conducted in two consecutive days, the participants and the coordinator were satisfied with the outcome of the design workshop. It was shown that a good flow of PD could aid the students in designing an educational game without having had any previous experience in game designing.

#### CONCLUSION

The PDEduGame process framework was deployed based on the charted phases to design an educational game model. However the current PDEduGame framework model need to be refined, such as placing the available input in each process to the next subsequent process. This is to ensure the designing activity in the third and second phase will be conducted smoothly. The live testing was conducted with students, teachers and game developers. The reaction and responds during the testing shows one of the aesthetic components in game design. Nevertheless, the processes involved in this study required documentation in the game document design (GDD) to complement the PDEduGame process framework. The GDD should focus on mapping the output of third phase of game design workshop into fourth phase of game prototype. The PD process framework is currently applied to design educational game. However, future applications in the domain of online video and TV

applications can be explored, especially to foster learning and play [24].

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