Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation

Nurul Farhana Jumaat*, Zaidatun Tasir*

**Department of Educational Sciences, Mathematics and Multimedia Creative, Faculty of Education, Universiti Teknologi Malaysia, UTM, Johor Bahru, 81310, Johor, Malaysia

Abstract

A widespread use of mobile devices such as smartphones, iPad, and Android tablet were known as rapidly growing trends among students in higher education. With thousands of applications or apps that are available via Apps Store and Google Play market, there are wide variety of applications or apps that meeting the vast needs among learners nowadays. Yet, it is quite a challenge for instructional designer to adapt with specific instructional learning setting in the design and development of mobile apps. This article focuses on integrating project-based learning environment into the design process and development of mobile apps for learning 2D-animation.

Keywords: Mobile learning; project based learning; instructional system design ; R2D2 model

1. Background of Study

With the abundant of apps in the App stores and Google Play, the effectiveness of those apps towards students’ learning is questionable since learning is closely related to the instructional design of learning materials. It marks the importance for instructional designer to begin with well-structured learning materials by incorporating the learning objectives and teaching strategies as suggested previously by Moore and Kearsley (1996). This paper focuses in integrating project based learning environment into the design and development of mobile apps for learning 2D animation. We believe that, mobile apps that promote learning in the current market are highly

* Corresponding author. Tel.: +607-5534453; fax: +607-5534884.
E-mail address: p-zaida@utm.my
beneficial to the students. It support self-paced learning environment where students could learn anywhere and at anytime according to their own preferences. In this paper, the apps are mainly developed for masters’ students who are enrolled in Educational Technology programme in one of the university in Southern Peninsular of Malaysia. Students in the programme are required to complete one subject that will be exposed them with knowledge and skills in developing 2D-animation or multimedia applications using Adobe Flash software.

On the other hand, we are also aware that integrating project based learning environment means to offer authentic learning experience among students in which it proposes students to learn by taking part on every project or tasks provided. Besides, as nature of most authoring-based subject, it highly requires students to participate and involved in ‘hands-on’ activities as this subject require them to establish their technical skills rather than on theory basis.

1.1. Project based learning environment

Project based learning involved authentic learning environment (Eskrootchi & Oskrochi, 2010) that enables learners to construct knowledge in authentic context (Papanikolou & Boubouka, 2010). Such learning environment is highly believed to be the best approach that could facilitate learners to have full control throughout their learning process. It requires students to complete certain tasks and exposed them to investigate possible ways to complete the task (Kwok & Tan, 2004). From such experience, students are able to generate their own thinking skills and make them realize that there are few alternative ways to solve a problem. Present study incorporated project based learning environment in the design and development of mobile apps for students whereby the apps act as an educational tool that reflects task based on project. The apps consist of step-by-step video tutorial of practical and technical skills in developing 2D animation with Adobe Flash software. Project-based learning is actually reflects the Theory of Constructivism by John Dewey (1916). It explains how learners construct knowledge by getting involved in the process of learning and experience it at the first place.

1.2. Mobile apps for learning

The use of mobile devices has transformed the way people communicate, access, and giving information (Bolorizadeh, Brannen, Gibbs & Mack, 2012). The rapid developments of apps have shifted the way information delivered especially in educational field to adapt with the current technology and to be used in teaching and learning. Interestingly, one study reported that student preferred to use mobile devices as technology supported educational tool because it is more accessible, more portable and newer technology (Sung & Mayer, 2012). Undoubtedly, there are numbers of apps that have been developed as a technology tool to support learning nowadays. Present report by NMC Horizon stated that mobile apps are the fastest growing trends in mobile technology in higher education (Johnson, Adams & Cummins, 2012).

2. Design and Development of Mobile Apps

Mobile apps for learning 2D animation is a mobile tutoring apps that provide users with information, interactive examples and step-by-step self designed video tutorial that will assist students on creating and developing 2D animation tools and creating multimedia courseware applications with Adobe Flash software. In this study, we plan to develop four apps that assist students in learning. The apps are mainly developed for Master’s students who were enroll in Educational Technology programme in which most of them are teachers and part-time students. They are expecting such mobile apps in which they can have access anywhere and at anytime.
In this study, the R2D2 model was used as instructional guideline in the design and development of learning 2D animation apps. R2D2 stands for Recursive, Reflective Design and Development model developed by Willis (1995). This instructional design model lies on the constructivist principle. It is a non-linear model compared to ADDIE model and Morrison, Ross and Kemp model in terms of its flexibility. In this sense, it allows the designers to acknowledge the relationship between each stage of the design process and enable them to revisit each step in regulatory order (Willis, 1995). It is fluid and versatile model (Beldarrain, 2008). The R2D2 model had also been revised by Willis and Wright (2000). R2D2 is the suitable model as this model was based from constructivist theory of learning.

The R2D2 models developed by Willis (1995) offered a constructivist development model that is an alternative to the traditional model. Unlike the other model, R2D2 proposed a recursive approach, allowing the instructional designers to examine the development process in any order. They may revisit the process and make decision and make amendment and changes if needed (Chen & Toh, 2005). It is also a reflective model by means the designer must seek and consider feedback from other sources. The last principle is the participatory design in which this model offers both experts and users to contribute to the development process.

The main components of this model consist of three focal points:

i. Define Focus,
ii. Design and Development Focus, and
iii. Disseminate Focus.

The components of R2D2 are as appear in Fig 1. It shows that this model has no beginning or ending and there is continuous interaction between those three focal point (Dick & Carey, 1996). It also shows that R2D2 is a non-linear process; it is a spiral process in which the tasks will be addressed many times.

2.1. Define Focus

Unlike the traditional instructional design, there is no need to establish an objective at first point because to Willis (1995), what is more important is to involve end users, the teachers and students in the design process. Define focus has three activities including, a) Creating and Supporting a Participatory Team, b) Progressive Problem Solution, and c) Developing Phronesis or Contextual Understanding.
2.2.1 Selection of Development Environment

The development environment consists of three main characteristics: a) Power, b) Flexibility and c) Accessibility. As for the tool of the design, current software programs, Adobe Flash Professional CS5.5 were selected as the development environment. The software includes 2D authoring tool that support for creating interactive and dynamic multimedia content and also provide support for publishing mobile applications or apps for iOS and Android market. The software also provides powerful and accessible programming language, known as Actionscript. This programming language is easily accessible even to those who are not familiar with coding opens to develop the project with the software. Thus, this development environment is adequately powerful, flexible and accessible for experimentation and exploration of alternatives. In this study, Adobe Flash Professional CS5.5 was selected as development environment to create iPad apps that serve as a technology tool to support students in learning Authoring System subject. Adobe Flash Professional CS5.5 provides support for publishing mobile for iOS platform. Designer need to modify the publish setting and select AIR for iOS.

Then, a researcher will continue with the design process. Firstly, it started with the components of learning environment such as preparing the storyboard, the interface and also the instructional strategies. Table 1 indicates the outlines of each developed apps and its descriptions on learning topic, project based tasks and integration of project based learning criteria by Larmer (2012), embedded for each app.

Table 1. An example of a table

<table>
<thead>
<tr>
<th>Apps</th>
<th>Learning Topic</th>
<th>Project Based Learning Criteria</th>
<th>Project Based Task</th>
<th>Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Adobe Flash</td>
<td>• The project sets up a scenario or simulation that is realistic.</td>
<td>• Interactive example of several interaction elements in Adobe Flash such as the use of button, hotspot, drag and drop activity and types of text in Adobe Flash.</td>
<td>• Students are exposed with the basic understanding of Adobe Flash for instance, the software interface, the tools include and each function. Students also are given with comprehensive information of types of interactivity offers in Flash, and various examples of multimedia applications that can be developed with Flash.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drawing in Flash</td>
<td>• The project meets real world situations beyond the classroom setting, or the products that students create can be used by real people.</td>
<td>The tasks involved the students to produce several products including:</td>
<td>At the end of the activities, students will be able to construct their creativity by developing their own products based from the information and video tutorials embedded in the apps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The project focuses on a problem, issue or topic that is relevant to learning content.</td>
<td>• Drawing a building.</td>
<td>Students are able to identify tools and appropriate drawing techniques and skills needed upon completion from these authentic tasks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The project sets up a scenario or simulation that is realistic.</td>
<td>• Drawing a cartoon.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The project involves tools, tasks or processes in real settings.</td>
<td>• Drawing a company logo.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Drawing menu buttons.</td>
<td></td>
</tr>
</tbody>
</table>

*The apps contain information of Introduction to Adobe Flash CS3. Several topics covered in the apps such as Flash’s Interface including its tools and functions, Example of applications in Flash, Types of Interactions in Flash and requirements needed in learning Adobe Flash CS3. |

*The apps contain information and step-by-step video tutorial of Drawing tools and drawing techniques in Adobe Flash CS3. Several topics covered in the apps such as Basic Drawing: Creating Simple object & text, Basic Colouring and Drawing button in Adobe Flash CS3.
3 Creating Animation
- The apps contain information and video tutorial on basic tools and functions in creating animation with Adobe Flash CS3. Topics covered including types of symbols and various types of animation techniques that can be developed with Adobe Flash CS3. This app basically exposed learners on how to animate an object or graphic in Flash.

- The project meets real world situations beyond the classroom setting, or the products that students create can be used by real people.
- The project focuses on a problem, issue or topic that is relevant to learning content.
- The project sets up a scenario or simulation that is realistic.
- The project involves tools, tasks or processes in real settings.

- The tasks involved the students to produce several products including:
  - Creating a movie clip of butterfly flipping its wings
  - Paper aeroplane flying in specific path
  - Simple animated cartoon

- At the end of the activities, students will be able to construct their creativity by developing their own products based from the information and video tutorials embedded in the apps.
- Students are able to identify tools and appropriate animation techniques and skills needed upon completion from these authentic tasks.

4 Application of Interactivity
- The apps contain information and video tutorial on types of applications that can be develop using Adobe Flash CS3. This topic expose learners to develop interactive applications based on Flash core language that is Actionscript.

- The project meets real world situations beyond the classroom setting, or the products that students create can be used by real people.
- The project focuses on a problem, issue or topic that is relevant to learning content.
- The project sets up a scenario or simulation that is realistic.
- The project involves tools, tasks or processes in real settings.

- The tasks involved the students to produce several products including:
  - Creating simple quiz
  - Creating drag and drop activity
  - Creating simple educational courseware

- At the end of the activities, students will be able to construct their creativity by developing their own products based from the information and video tutorials embedded in the apps.
- Students are able to developed simple multimedia applications and practice the techniques and skills needed upon completion from these authentic tasks.

Upon the completion of preparing the learning materials, instructional designer will proceed with producing a single path prototype. The single path prototype examines the operational and navigational structure of the apps. A researcher had developed a simple prototype of the apps to ensure that the program runs smoothly from the beginning to the end. A researcher than proceed with alpha version, a completed apps that soon be provided to the students to provide feedback. In this study, a researcher had conducted a preliminary investigation (PI) whereas the apps were distributed to the students and a set of open-ended questions were prepared for students to provide feedbacks and opinion regarding the contents of the apps, the operational features and also the navigational structures. Feedbacks and opinions were gathered and several changes have been made before proceed to beta version. For example, in alpha version, the apps were embedded with video tutorial to assist student in learning, however students suggested providing a video tutorial with playback button. This will enable them to have full control over the video. For instance they would play, pause, stop and repeat the video according to their preferences. The alpha version was revised and with beta version, the apps were introduced as Version 1.0.0.

2.2.2 Cooperative inquiry

In R2D2 model, team members could cooperatively discuss and gathered materials in order to improve and enhance the learning environment. This continuous process requires members to reflect together and providing feedback based from their own experience because each member, the designer, subject expert, instructor and
students will reflect based from their own point of view. In present study, each student’s opinion and feedback on alpha version of the apps were reviewed and several changes have been made to suits student’s need. This is known as one-on-one evaluation. Same goes to subject matter expert, who have a done a review on the accuracy and comprehensiveness of the contents delivered in the apps. These are all important to assured that the materials being prepared are in accordance with student’s preferences.

2.2.3 Product design and development

In this study, four iPad apps were developed as instructional tool to facilitate students learning in Authoring System subject. As mentioned earlier, these apps were developed with Adobe Flash Professional CS5.5. In R2D2 model, Willis (1995) had listed out several components involve in the product design and development including: a) surface design, b) interface design and c) instructional strategies. The surface design refers to several aspects like the typography, language and graphics used in the study.

Besides focusing on the surface design, project designer also focuses on the aspects of interface design. The interface design highlights several criteria including the ‘cosmetic’ part of the project, usability, user interaction, navigation, user experience and also system support. For example, the use of text, button and graphics to show learners which section they are in. Adams et al. (2008) stated that the interface design is as important as it will support general features as example, to make a simulation engaging and easy to use for the users, and the types of controls that could enhance students’ engagement in learning. Moreover, Oppermann (2002) also agreed that the presentation of the content is important as it will permit the learners to interact with content efficiently.

![Interface design](image1.png)
![Main Menu](image2.png)

Fig. 2. (a) Interface design; (b) Main Menu

The apps also embedded with a step-by-step video tutorial along with audio narration to assist students in learning Authoring System subject. The playback button were provided for the video tutorial so that the students will be able to navigate the video according to their preferences whether to play, pause, stop or replay the video. Fig 3. shows the example of embedded step-by-step video tutorial.
2.2. Disseminate Focus

Dissemination focal point in R2D2 model focuses on the final packaging, diffusion and adoption of the iPad apps. This step is about distribution the apps to the students and it is essential to ensure that technical components in the apps are functioning. Diffusion and adoption is about helping the teachers and students to adapt the material to the local context.

3. Conclusion

This paper provides a comprehensive overview of the design and development of learning 2D-Animation apps that is convincingly expected to supplement the learning of developing animation among novice learners. The learning 2D animation apps is designed and developed in an organized and systematic process within the context based on R2D2 model. The integration of project-based learning in the design and development of the apps suggests that it could facilitate learners to have a dominant control of their own learning process.
Acknowledgements

The authors would like to thank the Universiti Teknologi Malaysia (UTM) and Ministry of Higher Education (MoHE) Malaysia for their support in making this project possible. This work was supported by the Research University Grant [Q.J130000.7131.00H17] initiated by UTM and MoHE.

References