

## **Mobile Learning Materials for Android Devices**

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### *Abstract*

Among the current trends in education is the mobile learning. Various tools are made available and used to develop electronic learning materials for learners. This study aimed to produce electronic learning materials and evaluate their quality based on the ISO 9126 model. Specifically, this study sought answers to the following questions: 1) what are the characteristics of the produced software as to functionality, usability, efficiency, and portability?, and 2) what is the evaluation of students on the quality of the produced software as to functionality, usability, efficiency, and portability? For software development, this study employed evolutionary prototyping while evaluation for the descriptive aspect of the study. The produced software was developed using the Adobe Flash Professional CS6. The produced materials provide additional benefits among Windows users as well as to Android enthusiasts. The overall evaluation of the students on the quality of the produced software was “good”.

### **Introduction**

To achieve a sustainable technological environment, John B. Lacson Foundation Maritime University committed itself to the development of electronic learning materials. In the early stage, the electronic materials were developed using MS PowerPoint, MS FrontPage, Adobe Dreamweaver, and Microsoft Visual Basic 6.0. The developed materials were presented in classes using the multimedia projectors provided for the teachers. At the same time, copies of the materials were made available in the library for reference of everybody. With the popularity of mobile devices especially those of Android operating system, the present development utilized Adobe Flash to cater various devices.

Adobe Flash Professional CS6 software is an authoring tool for creating animation and multimedia content. Created materials may be presented across multiple devices, including desktops, tablets, smartphones, and televisions (Adobe Systems Software Ireland Ltd., 2013). This software is bundled with a simulator to preview the material and an adobe integrated runtime (AIR) to create installers for different devices with varied operating systems.

This initiative aimed to produce software that will serve as an electronic learning material basically for tablets running in Android operating system. With the capability of the authoring tool used this extends to produce the corresponding files for devices running in Windows and may be used with non-mobile devices. Furthermore, this study determined the evaluation of students on the quality of the produced software based on the ISO 9126 model.

ISO 9126 is an international standard in evaluating software and is divided into four parts, namely: the quality model, external metrics, internal metrics, and quality in use metrics. The ISO 9126-1 software quality model identifies six characteristics namely: functionality, reliability, usability, efficiency, maintainability, and portability. Each characteristic is broken down into a total of 27 sub-characteristics of varying number for each main characteristic (Fahmy, et al., 2012).

Lincke (2007) provides the following definitions of the six characteristics. Functionality refers to *'how well software provides desired functions'*. It is divided into five sub-characteristics, namely: suitability, accurateness, interoperability, functional compliance, and security. Reliability pertains to *'how well software maintains the level of system performance when used under specified conditions'*. It is divided into four sub-characteristics, namely: maturity, fault-tolerance, recoverability, and reliability compliance. Usability covers on *'how well software can be understood, learned, used, and liked'*. It is divided into five sub-characteristics, namely: understandability, learnability, operability, attractiveness, and usability compliance. Efficiency involves *'how well software provides required performance relative to amount of resources used'*. It is divided into three sub-characteristics, namely: time behaviour, resource behaviour, and efficiency compliance. Maintainability means *'how well software can be maintained'*. It is divided into five sub-characteristics, namely: analyzability, changeability, stability, testability, and maintainability compliance. Portability is *'how well software can be ported from one environment to another'*. It is divided into five sub-characteristics, namely: adaptability, installability, co-existence, replaceability, and portability compliance.

#### *Statement of the Problem*

This study focused on the development of electronic learning materials and evaluation of their quality. Specifically, it sought answers to the following questions:

- 1) what are the characteristics of the produced software as to functionality, usability, efficiency, and portability?; and
- 2) what is the evaluation of students on the quality of the produced software as to functionality, usability, efficiency, and portability?

#### **Methodology**

This study utilized the evolutionary prototyping for the software development and evaluation for the descriptive study. Evolutionary prototyping is a software development model in which the prototype evolves and is refined until it becomes the final product (Masse, 1998). Evaluation aims to see if a given program is working according to the goals set for it (Best & Kahn, 2003).

### *Software Development*

In the development of the electronic learning materials, the researchers considered four major processes such as: understanding the system, designing and implementing an initial prototype, gathering inputs and refining the prototype, and completing and releasing the prototype.

Understanding the system was easier since the researchers are teachers. The system has to provide multimedia materials for student learning. This study only covered the seven subjects being offered during the first semester, academic year 2013-20104 for third year Bachelor of Science in Marine Engineering (BSMarE) students. The contents were based on the books authored by the faculty members of the University.

The design and the implementaion of the prototype made use of computer sytems running in Windows 7 and with the installed Adobe Flash Professional CS6. Faculty members who handled those subjects provided pertinent images and video clips. Each software was deployed with AIR 3.4 for Desktop and AIR 3.4 for Android. On one hand, the file produced with AIR 3.4 for Desktop has an extension of .exe intended for devices running in Windows. On the other hand, the file produced with AIR 3.4 for Android has an extension of .apk intended for devices running in Android.

The initial prototypes were presented to faculty members who handled the subjects. They examined the developed materials and provided suggestions and corrections. The materials were enhanced accordingly prior to completion and before releasing them to the students.

The completed electronic materials for the seven subjects, namely: Auxiliary Machinery, Electro Technology 3, Information Technology, Marine Pollution and Prevention, Mechanics and Hydromechanics, Shipboard Personnel Management, and World Geography were installed in the tablets of students. These using tablets were running in Android operating systems of different versions. Only two sections, namely: Polaris 3A and E-Cobalt were given the materials.

### *Software Evaluation*

At the end of the semester, 38 students from E-Cobalt were given the instrument and they have evaluated the quality of the produced software. The instrument contains 13 questions based on the ISO 9126-1 model.

Out of the six main characteristics identified in ISO 9126-1 there were only four characteristics covered in the instrument: functionality, usability, efficiency, and portability. The choice of the 13 items took into consideration those characteristics that may be clearly experienced by the students who served as evaluators. Four functionality sub-characteristics included: suitability, accurateness, interoperability, and functional

compliance. Four usability sub-characteristics included: understandability, learnability, operability, and attractiveness. Two efficiency sub-characteristics included: time behaviour and resource behaviour. Three portability sub-characteristics included: adaptability, installability, and portability conformance.

Corresponding statement was phrased for each sub-characteristic. Each statement is answerable by strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree with the weight of 1, 2, 3, 4, 5, and 6 respectively.

Mean was used to determine the students' overall evaluation and evaluation on quality of the produced software as to functionality, usability, efficiency, and portability. The descriptions of the quality were based on the following scale arbitrarily assigned by the researchers: "very poor" for a mean range of 1.00-2.25, "poor" for a mean range of 2.26-3.50, "good" for a mean range of 3.51-4.75, and "very good" for a mean range of 4.76-6.00.

## **Results and Discussion**

### *Software Characteristics*

**Functionality.** On suitability, the developed electronic learning materials included texts, images, video clips, animations, web links, menus, and navigation buttons. On accurateness, the texts were based on the printed books developed by the faculty members of the University; while the images, video clips, and animations were provided or confirmed by the faculty members who handled the subjects. On interoperability, web links were provided to supplement the learning of the students and were linked to relevant web pages and can be accessed with an Internet connection. In terms of conformance, the contents authenticated that of the course syllabus for each subject, including the sequence.

**Usability.** On understandability, data in the form of texts, images, video clips, and animation were incorporated. Menus allow jumping from one chapter to another; while, navigation buttons allow moving from one page to another within a topic. Video clip can be played and paused. On learnability, navigation buttons are labelled. Menus are named accordingly and web links are labelled correspondingly. On operability, the software can be used like any presentation package. Android users may click with a pointing device or tab on a touch screen to invoke the menus and buttons while Windows users, may invoke the menus by double-clicking or double-tapping them. In addition, to swipe on a touch screen is an alternative to navigate the system. On attractiveness, the software was built with relevant background and supporting frame.

**Efficiency.** In terms of time behaviour, it responds almost instantaneously. On resource behaviour, it consumes a very small amount of memory. The size of the deployed software ranges from 2MB to 80MB and 10MB to 100MB for .exe and .apk

files, respectively. Installers for Windows devices consume smaller size compared to installers for Android devices.

Portability. On adaptability, the software may be installed in devices of varying display size. The bigger the display, the larger texts appear. Installers may be installed in various Windows and Android versions. Installer for Windows has a file extension of .exe, while .apk file extension for Android. On installability, installing the software requires the following steps: 1) copy the installer to the storage of your device; 2) find the copied installer and double-click (for Windows) or click (for Android) it; 3) follow the installation process by clicking the corresponding buttons to confirm the installation; and 4) wait until the installation process is complete. On conformance, same software may run in different versions of Windows or Android.

### *Students' Evaluation*

Table 1 shows the evaluation of the students on the overall quality as well as the quality as to functionality, usability, efficiency, and portability of the learning materials.

Table 1  
*Evaluation of the Learning Materials*

Characteristic	Mean	Description
Overall	4.72	Good
Functionality	4.95	Very good
Suitability	4.95	Very good
Accurateness	4.82	Very good
Interoperability	4.23	Good
Compliance	5.56	Very good
Usability	5.53	Very good
Understandability	5.72	Very good
Learnability	5.74	Very good
Operability	5.15	Very good
Attractiveness	5.69	Very good
Efficiency	3.29	Poor
Time behaviour	3.59	Good
Resource behaviour	3.36	Poor
Portability	5.11	Very good
Adaptability	5.28	Very good
Installability	5.59	Very good
Conformance	5.08	Very good

Students' evaluation of the overall quality of the software garnered a "good" rating.

As to functionality, the students have evaluated the software as “very good”. This is constant to its sub-characteristics such as: suitability, accurateness, and compliance. However, its interoperability sub-characteristic was evaluated as “good” only.

As to usability, the students have evaluated the software as “very good”. This is consistent to all its sub-characteristics such as: understandability, learnability, operability, and attractiveness.

As to efficiency, the students have evaluated the software as “poor”. This is in conformity to its resource behaviour. However, its time behaviour sub-characteristic was evaluated as “good”.

As to portability, the students have evaluated the software as “very good”. This is true to all its sub-characteristics such as: adaptability, installability, and conformance.

Based on the mean evaluation of the students, the developed learning materials possess very good quality as to functionality, usability, and portability. Yet, the developed learning materials are poor as to efficiency.

### **Conclusions**

The result of this study which produced electronic learning materials using Adobe Flash Professional CS6 implies its capability in providing software that may be used in the academe in facilitating student learning. Such an authoring tool provides flexibility in terms of the operating system and display size of the target devices. Adequate experience of the said authoring tool would provide very good quality software. The results suggest the consideration of such tool in the jobs of information technology professionals and instructional materials developers.

The developed electronic learning materials have contributed and may continue to contribute to the present trends in education towards mobile learning. Specifically, this addresses the Windows and Android enthusiasts by providing additional features and benefits to their devices.

Nonetheless, the evaluation of the students implies the need to improve the materials notably its software’s quality as to efficiency. Such experience of poor efficiency might have contributed to their Android devices’ various specifications. The capabilities of the Android device depend on its brand and model. Another factor that might have contributed to their poor experience was the installed applications on their devices other than the learning materials.

In succeeding development, the feedback of the students should be taken into consideration. The follow up study shall deliberate the use of mobile devices running in

Windows. Other features like zoom to increase and decrease the sizes of the objects may be integrated.

### References

- Adobe Systems Software Ireland Ltd. (2013). *Adobe Creative Suite Family*. Retrieved July 15, 2013 from [http://www.adobe.com/mena\\_en/products/flash.html](http://www.adobe.com/mena_en/products/flash.html)
- Best, J. W. & Kahn, J. V. (2003). *Research in Education*. 9<sup>th</sup> Edition. USA: Pearson Education, Inc.
- Fahmy, et al. (2012). *Evaluating the Quality of Software in e-Book Using the ISO 9126 Model*. Retrieved May 25, 2013 from [http://www.sersc.org/journals/IJCA/vol5\\_no2/14.pdf](http://www.sersc.org/journals/IJCA/vol5_no2/14.pdf)
- Lincke, R. (2007, April 4). *Software Quality ISO Standards*. Retrieved May 25, 2013 from <http://www.arisa.se/compendium/node6.html>
- Masse, R. E. (1998, November 17). *Evolutionary Prototyping: "Add Later" Static Types for Python*. Retrieved April 16, 2016 from <http://www.python.org/workshops/1998-11/proceedings/papers/masse/masse.html>