



m^d-Matrix: An assistive learning tool in blended project-based learning for mobile development course

Siti Mahfuzah Sarif and Norshuhada Shiratuddin

College of Arts and Sciences (Applied Science)

Universiti Utara Malaysia

This study reports on the use of project based learning (PBL) in a blended environment as key method for teaching practical mobile application development within the context of undergraduate program module in mobile programming course in Universiti Utara Malaysia. In support of the use of PBL, a prototype known as m^d-Matrix has been used throughout this study and will be proposed as the learning tool for mobile development course. The tool is designed and developed to assist students in choosing an appropriate development methodology based on their project requirements. Descriptions of how m^d-Matrix can be used in facilitating the learning process are described in this paper.

Keywords: Project based learning, blended learning, decision making, pugh matrix

Introduction

Mobile computing and its related development issues have received significant attentions in the academic and industrial research community these days. There is indeed high demand from the industry for graduates of this course (Varp, 2003; Gillespie, 2007). Thus, causes many computer science departments in various universities to start offering a graduate-level course on this field. But despite all the attentions, there is still inadequate research aimed to assist the novice developers in choosing an appropriate methodology to support development process of mobile applications (GI Dagstuhl Research Seminar, 2007). Many matured developers in the industry claimed that developing a mobile application is more challenging than traditional system as reported in (Heyes, 2002). Due to that, novice developers (particularly the students) will find it even more challenging to work on a development project without any proper guidance and tool to assist them.

Within this perspective, it is vital to prepare the students with relevant technologies and equip them with adequate skills in mobile development. Findings indicated that project-based learning (PBL) was superior when it comes to interdisciplinary focus, skill development and cooperative learning (Macías -Guarasa et al., 2006; Wolff, 2002). Decision making skill is one of the most significant life skills that can be developed through PBL. Students of mobile development course will most likely involve in a lot of decision making and problem solving in order to accomplish the project. Selecting an appropriate methodology is crucial since it can determine the success of the project. Moreover, adopting appropriate methodology improves project planning and control, and provides a better quality system resulting in a better end product, a better development process and a standardized process (Avison & Fitzgerald, 1990).

Methodology

Preliminary study

A preliminary study has been carried out to validate numbers of potential problems faced by students (novice developers) during the development project. The unit of analysis in this preliminary study is a typical novice developer (students). Twenty undergraduate students were randomly selected from different development courses offered in Universiti Utara Malaysia. A scenario has been set up, describing the approach of blended PBL for a general application development course. Based on the scenario, the students were asked to verify five identified potential problems in a development project. Most of the potential problems revolve around selection of a methodology for a development project which includes understanding the criteria, knowing the available options and knowing how to make

selection. These are derived from reports by (Bertini et al., 2006; Heikkinen and Still, 2005; Atkinson and Olla, 2004; Heyes, 2002; Afonso, Regateiro and Silva, 1998). The data collected from the preliminary study is depicted in Table 1.

Table 1: The potential problems that most likely to occur during the implementation of a blended project based for general application development course

Potential Problem #1	Yes	No	Maybe	Total
Unable to figure out the criteria of the methodology needed for the development project	8	2	10	20
Potential Problem #2	Yes	No	Maybe	Total
Unable to understand the criteria distinctively (in the context of the development process)	6	6	8	20
Potential Problem #3	Yes	No	Maybe	Total
Unable to evaluate the available development methodology for selection	9	4	7	20
Potential Problem #4	Yes	No	Maybe	Total
Unable to choose the right development methodology that suit the project requirements	14	3	3	20
Potential Problem #5	Yes	No	Maybe	Total
Unable to understand the selected methodology and implement it in the project	2	5	13	20

Results from the preliminary study shows high percentage of verifications of potential problems identified for selection of a development methodology. From the data collection it is clear that the students most likely to face difficulties in the essential parts of making a decision which are evaluating the available options and choosing one solution out of many (referring to Problem #3 and #4). Hence, a solution to this issue is proposed in the following section.

Design and development of m^d -Matrix

The proposed decision tool is named as m^d -Matrix, as a short for 'mobile development matrix'. The tool aims at assisting students to choose an appropriate methodology for their mobile development project. This decision tool is designed based on a simple yet powerful multi-attribute decision method introduced by Pugh (1991), known as Pugh Matrix. Many agree that the method is a simpler alternative to using complex decision analysis methods for performing tradeoff analysis (Adam & Humphreys, 2008; Mascitelli, 2004; Shillito & DeMarle, 1992; Walmsley, 2005).

The flowchart and screen designs of m^d -Matrix

Figure 1 displays the complete flow of how the selection process takes place in m^d -Matrix. Also included in the illustration are the screen designs for respective tasks.

Implementation of m^d -Matrix in blended project-based learning

The design approach of m^d -Matrix implementation in blended project based learning is adapted from design approach by Harper-Marinick (2001) with main focus only on the early stage of the project based learning; which is choosing the appropriate development methodology.

Project briefing

Students are assigned to group of 4 to 5. Each group will get the same instruction for the future project to be developed. Instructor will discuss project's requirements with all groups and give specific instruction to use one suitable development methodology in execution of the project. Students are presented with number of options.

Introducing m^d -Matrix

All groups are introduced to m^d -Matrix as learning and decision making tool. The tool aims to ease the process of methodology selection in each group and also making the process more efficient. Instructor will demo on how to use m^d -Matrix to the students and what do they expect students to learn from the tool.

Online collaboration

An online forum which is available under student learning portal (<http://www.learnare.uum.edu.my>) was used and students in the previously assigned group will analyze the available development methodologies together. Based on their prior knowledge, they determined the information they already had and what information that they will require to learn to complete the evaluation. During this collaboration, they

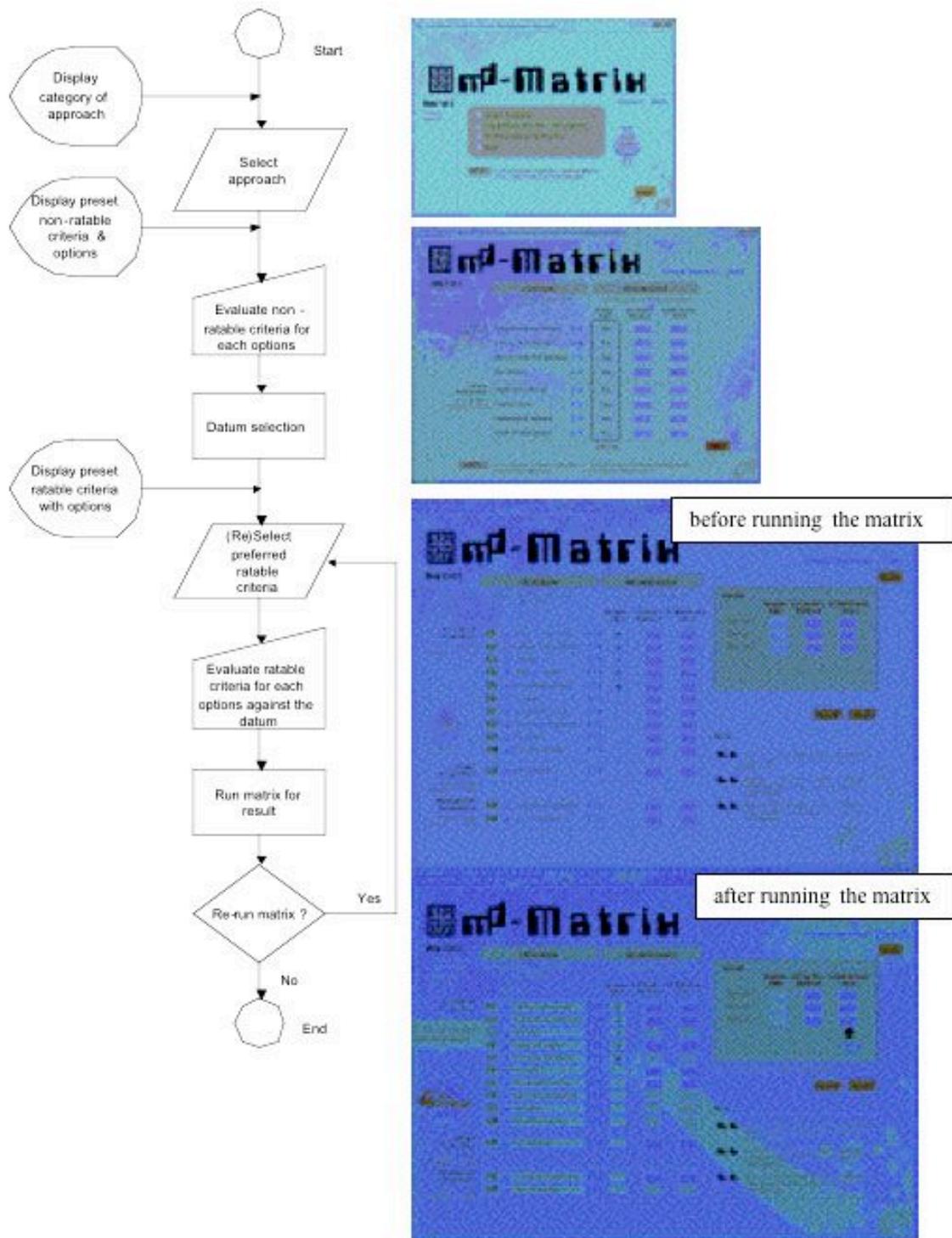


Figure 1: Flowchart and screen designs of m^d -Matrix

propose assumptions to the properties of the methodologies; generate learning issues that are required to solve; prioritize the learning issues, organize a plan of action required to tackle the related learning issues and assigning individuals to undertake defined tasks. Indirectly, learning will occur in an active and interactive environment. During the entire collaboration, the instructor will play the role of facilitating and monitoring the entire collaborative processes.

Online resource

Each individual student has his/her own responsibilities to do research on the learning issues that were assigned to him. In other words, he/she had to conduct independent studies outside the group on an individual basis. He is required to explore the online resources for new information pertaining to the

learning issues assigned to him/her. The independent study enabled the student to synthesize and construct knowledge and to bring decision to the problem in a way that meets the requirements of the set task (Orill, 2002). Students will have to find and evaluate the vast array of online resources needed for resolving the learning issues. Such an evaluation provides opportunity for them to develop the critical thinking and promoting the ability to “learn to learn” which is the essential part of PBL (Watson, 2001).

Follow up online collaboration

After the individual students had conducted independent online research on the designated tasks, the groups then gather again to continue the online discussion. In this follow-up collaboration, each student reported on the research that he/she had done, identifying the overlapping issues, reviewing information and reviewing the assumptions in accordance to the new information gathered by the group. Using this communication tool (online forum), the students will actively construct knowledge hence strengthening the understanding about concept and properties of a development methodology.

Utilizing m^d-Matrix for decision making

With adequate information from the online collaboration and online research, students will work in their group to complete the evaluation of the available development methodologies. The proposed electronic tool (m^d-Matrix) will assist them in this task. All they need to do to use the tool, is to determine the set of criteria needed, and complete the evaluation of each methodology using the information in hand. The selection process will be done automatically by the tool once all the previous tasks are completed. The instructor will monitor the process in a classroom environment.

Selection and class discussion

Students will choose the development methodology suggested from the selection process using m^d-Matrix. After decision has been made, all groups will have a classroom discussion with the instructor to clarify any more doubts before adopting the methodology in their project.

Conclusions

Mobile computing environment has brought new challenges to system developers. It is believed that the challenges faced by the new developers in developing mobile applications can be eased if they are appropriately educated about the importance of adopting a suitable methodology in their development process. The needs for an effective and helpful decision making tool among novice developers (students) have been proved through the preliminary study. Hence, an electronic decision matrix (m^d-Matrix) was proposed as a solution to the potential problems presented based on the scenario. The problems identified were derived from the most critical part of starting a project which is to adopt a suitable methodology. As a conclusion, the proposed decision tool can be considered as necessary to assist the students (novice developers) in choosing an appropriate development methodology for their project. The implementation of the tool in blended PBL will not only make the decision making process more effective but also help them with better learning.

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Authors: Siti Mahfuzah Sarif and Norshuhada Shiratuddin, Universiti Utara Malaysia.
Email: ctmahfuzah@uum.edu.my, shuhada@uum.edu.my

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