Development of Mobile Learning Framework for Vegetable Farming in Indonesia

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Abstract. Farmers face many problems related to seeds, pest and disease control, commodity prices, and marketing of produces. With the better penetration of the Internet to the villages and the wide availability of inexpensive mobile devices, mobile learning provides a good solution. This study is aimed to create a mobile learning framework that provides information and interactive communication about vegetable production. The method used was the Science Research Design Methodology (DSRM) with a framework approach to the instructional design of ADDIE (Analysis, Design, Development, Implementation, and Evaluation). Usability surveys of the proposed prototype to farmers, extension agents (field technical assistants), and researchers result in 79.4%, 87.3%, and 87% satisfaction rates, respectively, in information needs fulfillment. Based on the assessment by experts, 87.3% of them agreed that the mobile learning framework for vegetable farming could provide learning information about vegetable production.

Keywords: Mobile learning, Mobile learning framework, Mobile learning agriculture, Design Science Research Methodology (DSRM), Instructional Systems Design (ISD), ADDIE (Analysis, Design, Development, Implementation, Evaluation)

1 Introduction

In recent years, Indonesia is experiencing a decrease in the production of vegetables, due to the trend of excessive use of chemical fertilizers and pesticides, in addition to the problems of harvesting subsystems and post-harvest [1].

This problem is mainly due to the lack of appropriate agricultural information and innovations accessible to the farmers. Thus, we hypothesized that a mobile learning (m-learning) solution that provides the right information for the farmers is required.

The use of information technology based on a mobile device today has grown rapidly. More than six billion people have access to mobile devices connected to the Internet [2]. This fact is supported by the data from Gartner, Inc. which states that there has been an increase in sales of mobile devices (Table 1). Based on Table I, sales of desktop computers (Personal Computer / PC) have been displaced by the sales of tablets and smartphones.

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Table 1. Data sales of computer and mobile devices (thousands of units).

Sources: Gartner 2015

No	Devices	2014	2015	2016
1	PC	279	259	248
2	Tablet	216	233	259
3	Mobile Phone	1,838	1,906	1,969

Based on data from Table I, the sale of mobile devices (tablets and phones), every year are experiencing a raise. The development of the telecommunications industry moves more rapidly, ease of use without any limitation of space and time, an increasing number of ownership and use of mobile devices, and a more affordable price than a desktop computer application of mobile learning opportunities in support of the process of information dissemination.

Previous research conducted by Koole [3], more focused mobile learning models on education. Pursuant to the problems that have been described, the aim of this study is to propose a framework of mobile learning that provides a mechanism of the documentation and dissemination of vegetable agricultural information, to support the development of a sustainable vegetable farming.

2 Literature Review

2.1 Mobile Learning

Mobile learning can be defined as a learning process that occurs by utilizing mobile devices to support the learning process. The content on the mobile device can be in the form of a sound, image, and video [2].

2.1 Model FRAME

Koole [3] created a model of The Framework for the Rational Analysis of Mobile Education (FRAME) that describes that mobile learning is a result of the integration process between the mobile device technology (device), the capacity of human learning (learner), and social interaction (social).

1) *Aspect of device*
   The aspect of the device means functional characteristics, physical and technical from the mobile device.
2) *Aspect of learner*
   The aspect of learner takes into account the individual's cognitive abilities, memory, prior knowledge, emotion, and motivation.
3) *Social aspect*
   The aspect of Social takes into account the social aspects of the process of social interaction and cooperation. Individuals must follow the rules of cooperation to communicate to be able to exchange information, acquire knowledge, and maintain cultural practices.

4) *Device usability (DL)*
   This section is a slice between the device and the learner's aspect. This relates to the characteristics of mobile devices to help manipulate and store information related to cognitive tasks so that the user feels comfortable in using them.
5) *Social technology (DS)*
   This section is a slice between the device and the aspect of social interaction that explains how the devices facilitate communication and collaboration between learners in a system.
6) *Learning interactions*
   This section is a slice of the learning aspect and the social aspect.
7) *Process of mobile learning*
   This section is a slice between aspect devices, learners, and social. Mobile learning supports collaboration between learners, access to information, and more contextualization in learning.

2.1 ADDIE Framework

ADDIE is the most common model used to create teaching material. ADDIE is an acronym consisting of 5 phases contained in the model, that is, Analysis, Design, Development, Implementation, and Evaluation [7],[8]:

1) *Analysis*
   The phase of analysis identifies the problems, the objectives, the learning environment and the knowledge or skills possessed by students.
2) *Design*
   This relates to the design phase of learning objectives, assessment instruments, training, content, lesson plans, and instructional media selection.
3) *Development*
   This is the development of the learning content.
4) *Implementation*
   This phase includes the execution of the curriculum, learning outcomes, delivery methods, and procedures of testing.
5) *Evaluation*
   This phase has two assessments, namely formative and summative assessments. Formative evaluation is carried out during the implementation phase with the help of students and instructors. At the end of the implementation of the learning program, there is a summative evaluation to improve learning.

3 Methodology

The framework that would be used in the research methodology was Design Science Research Methodology (DSRM), initiated by Peffers [9].

3.1 Design and Development

The framework design is based on a common form of instructional design, i.e. analysis, design, development, implementation and evaluation (ADDIE). By describing the ADDIE model into general forms, appropriate modifications are subsequently performed to the system development. Implementation outcomes are capable of providing an alternative of multimedia teaching materials in various forms according to the needs. Based on these results, a flow illustration from framework development can be shown as in **Figure 1**.

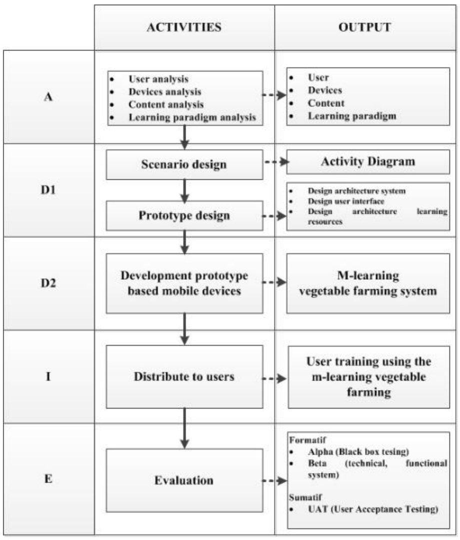

Fig. 2. The Flow of Framework for M-learning in vegetable farming.

3.2 Content Analysis

The interview yielded wished content lists, as seen in Table 2. Such lists would be created and/or procured in the proposed system.

Table 1. M-learning content needs in vegetable farming.

No	Content	%
1	Information availability of seeds	79.5
2	Information vegetable crops	79
3	Calculating fertilizer requirements per unit area	77.5
4	The introduction of pests and diseases	79
5	How to control pests and diseases	79.5
6	Looking for pesticides that are appropriate to the target pests and diseases	79
7	Information how to spraying pesticide	77.5
8	Information tools and agricultural machinery for cultivation needs	77.5
9	Post-harvest handling	75
10	Information commodity prices (vegetables) in some areas	99.5
11	Send questions to an expert (expert) via SMS about the problems of cultivating faced by farmers	69.5
12	Video about practical cultivation	82.0

No	Content	%
Average		79.5

Table 2 shows that the average of 40 farmers respondents expressed their agreement by 76% on the entire content required in the m-learning system of vegetable farming.

4 Study Result

1) *System Testing Results*

The beta testing was performed to the 40 farmers in two places: 20 farmers from the Lembang and 20 farmers from Enrekang (**Figure 2**). The technical system testing results for administrators show the results that the system administrator strongly agrees that the technical system is functioning properly. The test results by the farmers showed that 83.9% of 40 respondents agreed that the system is technically functioning well. When the functional testing was performed to 40 farmers, 20 extension workers, and 5 researchers, we found that 79.4% of the farmers agreed that the system has been functioning well in accordance with their needs. An average of 87.3% of extension agents agreed that the system had conformed to the functional needs. Further, an average of 87.0% of the researchers agreed that the system had conformed to the functional requirements. The beta testing results based on the responses from farmers, extension agents, and researchers suggest that the system is in conformity with the needs and objectives of the system, which have been determined in the limitations and needs analysis stage and reliability.

Fig. 2. The implementation of M-learning system to farmers.

2) *Validity testing results*

By using a factor analysis procedure, if the items have a loading factor greater than 0.4, it can be stated that the items are valid [13]. The results of validity testing can be seen in Table 3.

Table 3. Validity testing result.

Variables	Items	Factor Loading	Description	
			Test Factor	Validity
Usability	U1	0,86	> 0,4	Valid
	U2	0,69	> 0,4	Valid
	U3	0,69	> 0,4	Valid
	U4	0,72	> 0,4	Valid

	U5	0,64	> 0,4	Valid
	U6	0,60	> 0,4	Valid
Accessibility	A1	0,81	> 0,4	Valid
	A2	0,87	> 0,4	Valid
	A3	0,91	> 0,4	Valid
Easy of Use	E1	0,72	> 0,4	Valid
	E2	0,84	> 0,4	Valid
	E3	0,87	> 0,4	Valid
Content	C1	0,92	> 0,4	Valid
	C2	0,91	> 0,4	Valid
Convenience	CV1	0,93	> 0,4	Valid
	CV2	0,89	> 0,4	Valid
Screen Design	SD1	0,89	> 0,4	Valid
	SD2	0,86	> 0,4	Valid
	SD3	0,85	> 0,4	Valid

The validity testing using factor analysis has met the criteria and all items are declared valid.

3) *Reliability testing results*

The reliability testing was done by using Cronbach's Alpha coefficient with a significance level of 0.70 [14]. The analysis is carried out using SPSS software. Table 4 displays the testing results of each variable.

Table 4. Reliability testing result.

Variables	**Items**	**Mean**	**SD**	**Alpha**
Usability	U1	4,20	0,52	0,79
	U2	4,15	0,36	
	U3	4,15	0,36	
	U4	4,05	0,40	
	U5	4,05	0,40	
	U6	3,90	0,44	
Accessibility	A1	4,05	0,75	0,82
	A2	4,00	0,64	
	A3	4,00	0,84	
Easy of Use	E1	4,05	0,45	0,73
	E2	3,90	0,55	
	E3	4,07	0,66	
Content	C1	4,45	0,75	0,81
	C2	4,22	0,70	
Convenience	CV1	3,67	0,80	0,79
	CV2	3,45	0,68	
Screen Design	SD1	3,87	0,82	0,82
	SD2	4,20	0,65	
	SD3	4,17	0,59	

We can see that the Alpha value was greater than to the threshold value of 0.70, thus questionnaire items can be said to be reliable or trustworthy as a means of data collection in this research. The results show that the prototype is ready to be tested in actual cases.

4) Expert Judgment Testing Results

The final testing was the experts' test in order to assess the entire framework. The test results of the experts are shown in Table 5.

Table 5. Expert judgment testing result.

No	Question	%
1	Farmers can use the application and obtain the information needed continuously.	92
2	Farmers can obtain information such as learning data, instructional videos from any source based on the needs of farmers.	88
3	Farmers can get information quickly according to their needs.	88
4	Farmers can interact with experts and researchers in the m-learning applications.	88
5	Learning information can be embedded in everyday life. Problems encountered and the knowledge required all presented in the form of natural and authentic.	92
6	Farmers can get the right information at the right time.	80
Average		87.3

Based on the questionnaire outcomes (see Table 7) distributed to researchers having different areas of expertise, it is found that 87.3% of them strongly agreed that the framework for agricultural m-learning is in conformity with the functional needs of the system, i.e. to provide learning materials of vegetable farming to the farmers.

5 Conclusion

The implementation of the proposed mobile learning framework assessed by farmers, extension agents, and researchers has shown to meet the vegetable farmers learning needs. Based on these results, it is concluded that the framework could provide information in accordance with the needs of vegetable farming.

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