E-learning: Design Strategies for Promoting Sustainable Practices in Paddy Farming

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ABSTRACT

Malaysia aims to transform its current agricultural practices to modern, innovative and sustainable levels. There are many issues highlighted to improve the sustainability of agricultural practices. However, this is not an easy task because there are several problems that the society and farmers will face, especially in enhancing their lifestyles as well as their ecosystems. Introducing Information and Communication Technology (ICT) application like electronic learning (e-learning) is a novel way to educate and promote the young generation to appreciate sustainable agriculture. Therefore, the main objective of this paper is to discuss a design of a prototype of persuasive learning in virtual paddy as a tool to promote sustainable practices in paddy farming. Before designing a prototype, the current practices of sustainable agriculture should be collected. After that, a pilot test will be conducted with the help of an expert user.

Keywords
Sustainability, virtual reality, paddy, education

1.0 INTRODUCTION

Knowledge Management (KM) refers to a multi-disciplined approach to achieve organizational objectives by making the best use of knowledge. According to Alrawi and Jaber (2007), e-learning is closely linked to and is overlapping with, but is not equal to knowledge management. E-learning can be an effective medium for disseminating knowledge management and this paper discusses a preliminary study in design strategies for promoting sustainability in paddy farming.

1.1 Creating Awareness in Sustainable Agriculture

In Malaysia, public awareness of sustainable agriculture is quite low, especially in organic paddy practices. Organized public awareness campaigns, both by public and government institutions, are not actively promoted (Suew, 2008; Mustapha & Mohd. Jani, 1995). However, effective promotion and public awareness are two of the main factors that would affect the success of sustainable development through the Green Technology agenda. This is particularly significant as such adoption requires a change of mindset of the public through various approaches including continuous promotion, effective education and information dissemination through comprehensive roll-out programmes to increase public awareness of sustainable agriculture and on ways to conserve the environment (Ministry of Energy, Green Technology and Water, 2009). As a solution, introducing the use of information technology innovation through learning as a tool to promote sustainable awareness in paddy farming practices in order to increase public awareness is one of the best alternatives available.

2.0 LEARNING THROUGH VIRTUAL REALITY

Virtual Reality (VR) is a way for humans to visualize, manipulate and interact with computers and extremely complex data (Isdale, 1993). VR means using computer technology to create a simulated, three-dimensional world that a user can manipulate and explore while feeling as if he were in that world.

The use of virtual reality as playing games in a learning programme in sustainable agriculture has grown exponentially in recent years. Numerous researchers such as O'Connor (2004); Kuo et al. (2004); Ha and Woo, (2006); and Oka and Yamauchi, (2006) found that virtual reality offers many benefits that are able to support learning. Some of the benefits include the meaningful learning, easy and better understanding of the learning contents.

Virtual Reality and multimedia have the advantages of being used as persuasive technology. Fogg (2003) has coined a word ‘captology’ that is about understanding how what is known about motivation and persuasion can be applied to computers and consumer devices. The objective is to change behaviour and attitudes in predictable ways.

2.1 ICT in Sustainable Agriculture

Sustainability is now becoming both an important concept and a practice for society, economics, and the environment (Goodland 1995; Ismail, 2006; Kajikawa, et al. 2007). Sustainability in agriculture refers to the farmer's ability to maintain production and give benefits based on maintaining nature and the environment, accelerating the social growth, stabilizing the economy and being a commercially good competitor in the fast changing environment (Ismail, 2006). Furthermore, sustainable agriculture covers both the aspects of production and preserving the environment. It means sustainable agriculture integrates three main goals, environmental health, economic profitability, and social and economic equity. These goals have been defined by a variety of philosophies, policies and practices, from the vision or perceptions of the farmers and the consumers.

In the Information and Communication Technology (ICT) experts' discussion, sustainability is defined as: "Investment which continues to produce a return". 'Return' was defined in its broadest sense (i.e. beyond financial and including other aspects such as education, social, etc.). By using emerging ICT capacities, user-friendly interfaces and virtual reality technology has allowed structured learning about personal and aggregate societal impacts on environmental resources (Batchelor & April, 2002). There are several successful implementations of e-learning in the agriculture sector such as those discussed in the next sections.

2.1.1 SimFarm, Harvest Moon and Plant Tycoon.

SimFarm is SimCity's country cousin programme. While the SimFarm provides the same kind of building and planning atmosphere of SimCity, much of the player's time is spent in micromanaging crops. SimFarm consists of descriptions of all the animals, buildings, vehicles and chemicals in the games. It has also the descriptions of all the crops and methods on how to grow them. There are all together 24 different crops, each documented with a picture. In addition to SimFarm, the agricultural games can also be found in Harvest Moon from Nintendo and Plant Tycoon.

2.1.2 VIRTU@LIS

VIRTU@LIS, funded under the Information Society Technologies (IST**)** Programme, explored the potential of new digital and multimedia technologies to increase awareness of environmental management and risks in four domains - agricultural pollution, climate change, freshwater resources and fisheries. The 11-member consortium, consisting of specialists in information technology, sustainable development, environmental modelling, public policy and governance, learning psychology and open learning, used emerging ICT capacities to work interactively with users during the prototype development phases. The prototype enables visitors to learn about how their lifestyle and behavior affects the environment (O'Connor, 2004).

2.1.3 Ecological Farmland Navigating System

Council of Agriculture, Taiwan (COA), promoted the importance of farmland conservation to help the elementary education authority on basic agricultural and ecological education. In this study, a 3-D virtual environment is developed to demonstrate the virtual farmland theme and associated temporal and spatial data and information (Kuo et al., 2004; 2007).

2.1.4 Garden Alive

The Garden Alive aims to provide both entertainment and education. The proposed system is composed of three components. In the first module, tangible user interfaces bridge to the garden in a virtual world. In the second module, an artificial intelligent module consists of two sub-modules: an evolution module and an emotion module. The third module is the virtual garden, which displays growth and the reactions of virtual plants. Virtual Garden has adapted the L-system, so the virtual plants grow in a similar manner to real plants. In this proposed "Garden Alive" system, there are several kinds of plants and each has different genes that are individually unique (Ha & Woo, 2006).

Based on these literature, learning using virtual reality, games and multimedia applications have been widely used to improve the agricultural sector.

3.0 RESEARCH METHODOLOGY

The research involves several stages (refer to Figure 1 and Figure 2). The first stage is understanding the problem domain.

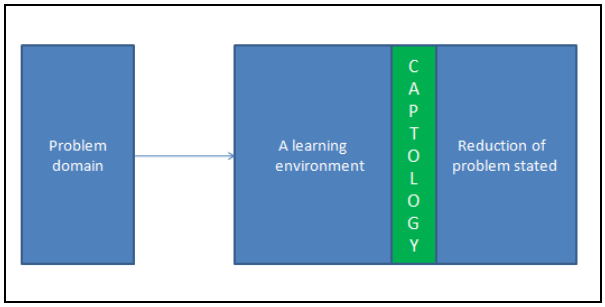

Figure 1: Generic model of the study

In the first stage, the method involved participatory observation and interviews at four selected locations in West Malaysia, which are Mada, Sabak Bernam, Tunjung and Kahang. The respondents are farmers,

researchers and agriculture officers. The results show that paddy farming in the four locations has employed a sustainable agriculture system in certain phases of the management of paddy farming. The real practice in sustainable paddy farming practices will adapt in design of education prototype using multimedia and virtual reality software. The prototype aims to provide both entertainment and education.

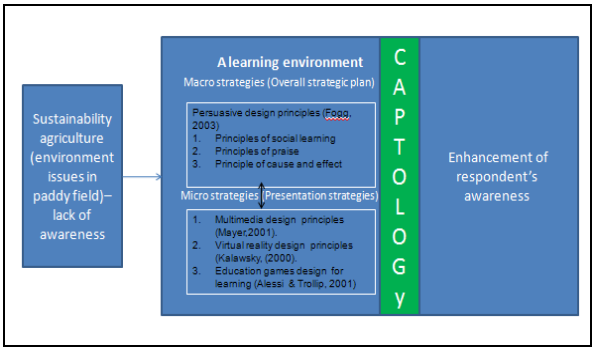

Figure 2: Specific model of the study

The second stage is the design and development of a persuasive learning environment. Several design and development models were used in the making of this prototype. Evaluation by experts and consumers was also carried out.

4.0 MODEL FOR DESIGN AND DEVELOPMENT

A methodology used for prototype design and development in this study is adapted from the model for design and development created by Alessi and Trollip (2001). There are three main components in this model which are planning, design, and development. Figure 3 illustrates how each component is linked to the others. The Model of Instructional Design by Alessi and Trollip (2001) was chosen as the methodology in this study because this model proposes a set of standards that should guide the design and development work, suggest ways of being creative and introduce techniques for designing, developing and integrating the various components of multimedia application (Alessi & Trollip, 2001).

4.1 Planning

There are four steps identified in this phase for planning a design of a persuasive learning environment. The steps are determining the scope of the project, identifying the characteristics of the learner, establishing the constraints, and determining and collecting the resources.

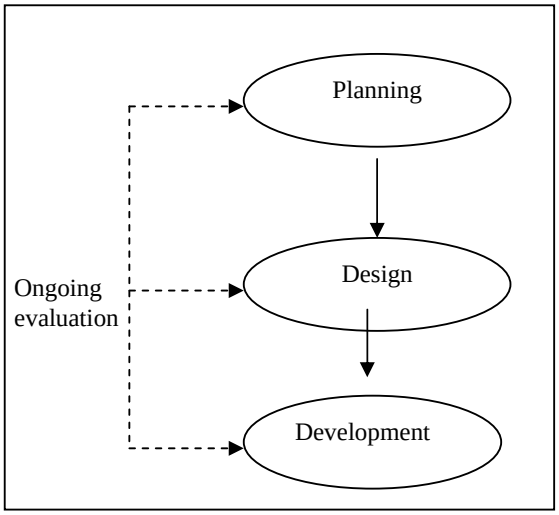

Figure 3: The Alessi & Trollip (2001) model of instructional design

4.2 Design

In this research, the learning outcome of a persuasive environment is to persuade society to enhance its sustainable awareness in paddy farming practices. In the design phase, the intended outcomes will link to the requirements and constraints of the prototype. Furthermore, a conceptual model including theories, principles and guidelines are used to engage people in such a way that learning takes place in an effective and efficient manner.

There are four steps identified in this phase for planning a design of a persuasive learning environment. The steps are developing the content ideas, preparing storyboards, preparing scripts and preparing a prototype. In addition, there are four design principles involved in this prototype. They are persuasive design principles, multimedia design principles, design guidelines for games and Virtual Reality Design Principles.

4.2.1 Persuasive Design Principles

There are three persuasive principles that have been applied in this study. They are the principle of praise, the principle of social learning and the principles of cause and effect.

4.2.2 Virtual Reality Design Principles

The Principles of VR Situation Awareness Rating Technique (VRSART) by Kalawsky (1998) have been applied to this study.

4.2.3. Design Guideline for Games

There are seven factors of what people consider games to be, and these comprise goals, rules, competition, challenge, fantasy, safety, and entertainment. This research also involves three categories of design guidelines for games by Alessi and Trollip (2001). There are the introduction, the body and the conclusion.

4.3 Development

This phase is the implementation of a prototype's design which includes the development process of a non-immersive VR desktop (Kalawskhy, 1998) and Alessi and Trollip's (2002) model. There are eight steps involved in the development phase which are the production of the text, graphics, audio and video, assembling all the pieces, preparing the support materials, doing an alpha test, doing revision and doing the beta test (Alessi & Trollip, 2002). After that, the prototype was evaluated by an expert.

5.0 DISCUSSION

In the pilot test, expert reviews are needed to go through the programme to evaluate the content, the flow of the material, the user interface and the usability of the prototype. There are two experts identified for this study which are the subject matter expert and the user interface expert. The subject matter expert's responsibility is to review the accuracy, significance and comprehensiveness of the content. The content is about sustainable paddy practices. An expert reviewer from Universiti Kebangsaan Malaysia was chosen to evaluate the content. Three sessions of interviews and discussions were conducted.

The responsibility of the user interface expert is to examine the interface of the prototype and judge its compliance with recognized usability principles (the heuristics). Two user interface experts from Universiti Utara Malaysia were selected for this phase (ongoing evaluation design process).

In addition, a pilot survey was conducted in the Computer Laboratory of the Engineering Department, Universiti Putra Malaysia on the 2th April 2010. 20 respondents from the Biology, Engineering and Agriculture Department, Faculty of Engineering were selected randomly to answer the usability and awareness questionnaire.

In summary, the usability result shows that the learning prototype has the potential to be a communication tool, particularly to be used in promoting sustainable issues and enhancing the level of awareness in sustainability. In addition, it is easier to use, understand and remember; provides greater flexibility and clearer information; and is more attractive compared to the conventional techniques. However, this paper does not aim to discuss the detailed results, but it is just to highlight the design strategies of the model.

6.0 CONCLUSION

In brief, knowledge and information have become the medium to generate and disseminate sustainable agricultural knowledge and technology for environmental, social, and economic sustainability. Sustainable agriculture has an important role to play in improving the quality of human lives and the environment. In doing so, technology should be used to facilitate sustainable practices in farming activities. From the study, it has been shown that using Information and Communication Technology (ICT) tools in the learning environment, can be used to educate and promote sustainable practices to the public.

7.0 ACKNOWLEDGEMENT

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