Research article

E-Learning Solution on Good Agricultural Practices (GAP) for Students of Higher Learning in Cambodia (Focus Vegetables)

ARUNA RAJENDRAM*
Malaysian Institute of Information Technology, University Kuala Lumpur, Malaysia
Email: arunarajendram@miit.unikl.edu.my

SHANMUGA VIVEKANADA NADARAJAN
Malaysian Institute of Information Technology, University Kuala Lumpur, Malaysia

DAHLAN ABDUL GHANI
Malaysian Institute of Information Technology, University Kuala Lumpur, Malaysia

LOR LYTOUR
Graduate School, Royal University of Agriculture, Phnom Penh, Cambodia

Received 21 December 2012 Accepted 27 March 2013 (*Corresponding Author)

Abstract Food security is one of the critical development issues faced by several developing countries. One avenue of yielding quality crops is by ensuring that good agricultural practices are followed throughout the entire farming cycle. This research focuses on educating students of higher learning on good agricultural practices associated with growing vegetables. Research target are students who are currently pursuing tertiary education in the field of agronomy and agroindustry, as it is expected that upon graduation, they will represent the frontlines of various agricultural concerns. As such, students form the basis for sustainable education as they can replicate knowledge gained and impact farmers on good agricultural practices through proper education, as well as enforcement. For the purpose of this research, students from Royal University of Agriculture, Cambodia are identified as participants. The electronic learning method (e-Learning) is deployed to expose students to new mechanisms of teaching and learning, as well as to encourage students to be more active in independent studying. As teaching material, interactive multimedia videos canvassing the general farming guidelines, production and post harvest practices pertaining to the cultivation of vegetables are produced and distributed to students through workshops. A web portal is also developed to form an online community of students and promote interaction through forums, live chats, news updates and social networking platforms.

Keywords good agricultural practices, e-learning, sustainable education, safe vegetables

INTRODUCTION

Food security remains as one of the critical development areas faced by many developing countries all over the world. Food security is said to be a country's capacity to provide and ensure people have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Reduced and inadequate food supply versus increasing demand from a growing population is the simple imbalanced equation to today's global issue of food shortage, with developing countries worst hit in spite of agriculture contributing a rather significant percentage to their respective GDPs.

While there are many undergoing efforts and research to improve agricultural produce, effective educational efforts at grass root levels is necessary to ensure the success of these improvement efforts. One of the measures to improve food security is by adhering to good

agricultural practices or commonly known as GAP. GAP involves taking all possible procedures recommended before, during and after the growing period to ensure that optimum quality and quantity of yield can be produced. The procedures cover a wide spectrum of farming activities, ranging from soil management, irrigation and fertilization to harvesting as well as packaging and storage.

There are several benefits of implementing GAP as highlighted by the Caribbean Agricultural Research and Development Institute (CARDI) and Food and Agriculture Organization (FAO):

- The appropriate adoption and monitoring of GAP helps improve the safety and quality of food and other agricultural products
- By improving the quality and quantity of yield, farmers are able to increase their income and living conditions. In the long run, poverty levels can be reduced
- It may help reduce the risk of non-compliance with national and international regulations, standards and guidelines, regarding permitted pesticides, maximum levels of contaminants in food and non-food agricultural products
- Adoption of GAP helps promote sustainable agriculture by preserving the environment (no contamination of water and soil)

Good agricultural practices is a very wide field and its application differs depending on the type of crop. For the purpose of this project, vegetables are selected as the focus area because they are easily susceptible to diseases which either damage the crop or render it unsafe for consumption. As such, complying with GAP for this type of crop is crucial.

Case Study: Cambodia

The Kingdom of Cambodia, is a developing country located at the southern section of Indochina in Southeast Asia. From its population of 11.5 million people, 84% are working in the agriculture sector. Cambodia's main produce include rice, cereal grains, vegetables, fresh fruits and sea products.

For the purpose of this project, Cambodia has been chosen as the country of study due to its deep involvement in agriculture activities. Additionally, University Kuala Lumpur (UniKL) and Royal University of Agriculture, Phnom Penh (RUA) have been collaboration partners on various projects pertaining to Information Technology and student exchange programmes. For these reasons and familiarity, both universities are collaborating on this project to develop e-Learning materials for students of RUA to educate them on GAP.

PROJECT BACKGROUND

Education on GAP has been implemented in developing countries for many years. The traditional approach (for developing countries) has been top-down, where agencies involved in formulating the practices train extension staff, and the latter is deployed to agricultural farms to educate farmers. Methods of teaching could be verbal, written literature and demonstrations. Literature suggests that with this traditional approach of educating farmers from some developing countries such as Cambodia have some limitations and the results of growing by adhering to GAP procedures takes a long time. This may be due to several challenges, such as the ones mentioned as follows.

Poor lteracy levels

In Cambodia, 77% of adults either have no education or only have primary school level education. In fact, 47% did not even have the opportunity to complete primary education (*www. cambcomm.org.uk*). As GAP generally involves specific procedures, measurements and instructions, one would require written manuals for reference. However, with low literacy levels, farmers in developing countries such as Cambodia may have difficulty reading and following all practices outlined.

Lack of expertise to monitor farmers

Implementing and complying with GAP procedures on a day-to-day basis is not an easy feat as there are many different guidelines to follow at different stages of a crop's growth cycle. GAP is the result of much scientific research and development activities performed by agricultural experts to continuously improve the quality and quantity of yield. Nevertheless, actual execution is at farm level and in the hands of the farmers. Sufficient specialists from agricultural ministries and agencies trained in GAP must be deployed to provinces and farms to not only educate farmers, but be available to provide hands-on assistance and monitor the cultivation activities of the farmers.

Difficulty in reaching farmers

Most farms and farmers are wide spread all across Cambodia and physically reaching out and communicating with them can be a challenge. In 2010, based on the ASEANGAP, the Ministry of Agriculture, Forestry and Fisheries of Cambodia issued Proclamation No. 099 MAFF on GAP in the Production of Fresh Fruit and Vegetables. However, until today, it's unclear how many farmers have heard of this initiative and implemented it. More manpower and effort is required to not only reach the farmers, but constant follow up is required to ascertain that they follow the GAP guidelines.

Farmers' reluctance to change

Very often, farming is a livelihood inherited from one generation to another and over the generations, farmers are accustomed to their legacy farming habits which may not be the best approach in today's conditions due to changes in agricultural inputs, climate and land conditions. GAP will help farmers deal with these changes and perform farming in a more contemporary way. However, because these farmers are acclimatized to ancient farming habits, they may not be willing to learn the latest farming methodologies.

Educating students of higher learning on good agricultural practices

Instead of directly coaching farmers at ground level, this project focuses on educating students of higher learning on good agricultural practices associated with growing vegetables. The project targets students who are currently pursuing tertiary education in the field of agronomy and agroindustry for two reasons. Firstly, upon graduation, these students will be attached to various agricultural agencies and they can be sent out to the ground level to train and monitor farmers closely on the implementation of GAP. Secondly, these graduates can be empowered as enforcement officers. After a period of learning, the Ministry of Agriculture can impose regulations to compel farmers to adhere to GAP procedures. Subsequently the enforcement officers (who have been educated on GAP since tertiary studies) can supervise farms and farmers under their jurisdiction to ensure GAP-based regulations are followed.

SOLUTION: e-LEARNING FOR AGRICULTURAL STUDENTS

Aside from contriving an alternative approach to strengthen GAP implementation efforts in Cambodia that is to expose university students to good agricultural practices, the purpose of this project is to expose these students to new mechanisms of teaching and learning via e-Learning and assess their acceptance of such teaching and learning systems.

E-learning is referred to as instructional content or learning experience which is delivered through electronic technologies. Delivery methods can be as advanced as satellite broadcast or interactive TV or even more practical such as through the Internet or CD-ROMs. E-learning models for higher learning were initially introduced to facilitate distance learning to allow

individuals in remote areas to gain access to higher education. However, in present times, e-Learning has been manipulated to inject variety in teaching as well as to expose students to independent studying.

According to Abdon, Ninomiya and Raab, e-Learning is increasingly being adopted in developed countries, however, it is still relatively unknown and unused as an educational approach in developing countries. e-Learning is emerging as the next explosion in teaching and learning for some of these reasons:

- Portability – students are not confined to the classroom to learn, instead by just owning a PC or a laptop, they can learn anytime, anywhere or even while on-the-go.
- Improves comprehension – e-Learning content can be developed with rich videos, graphics and audio elements and this improves a student's ability to understand.
- Consistent – An unavoidable weakness of humans is inconsistency. With e-Learning, content is standardized and regardless the number of students, everyone receives the same information in the same manner.
- Flexibility – Students are able to learn at their own pace and not at the pace of the fastest or slowest learner in class. They can spend more time on topics they are weak in or even skip topics which are known or not required.

Components and methodology

The e-Learning solution developed will comprise of two components – web portal and multimedia interactive CD. Figure 1 gives the framework summary of this solution. As this project focuses on GAP pertaining to the cultivation of vegetables, the entire e-Learning solution will cover the following categories and modules.

Web portal

The web portal is being developed using Joomla Content Management System (CMS), a free and open source CMS for publishing various content. Joomla is written in PHP and supports MySQL database. Joomla is selected as it has a variety of web templates available for selection. Various content, from text, photos, music, video and documents can be conveniently placed within the template and managed. Another advantage of using Joomla is that it requires almost no technical skill or knowledge to manage. Once the project is complete, it can be handed over to web administrators of RUA and they will easily be able to administer and update the website regularly.

The web portal will be developed based on the rapid application development (R.A.D) methodology, which uses minimum planning in favor of quick prototyping. With RAD, the portal's planning stage is interleaved with the coding process, thus making development faster and easier to change requirements. The process can also be turned back if changes are required prior to testing and implementation. Feedback from users and testers can be incorporated without changing too much of the template design. Figure 2 shows the home page of the web portal.

Table 1 Categories and modules

General Guidelines	Production	Harvest	Post Harvest
Planning Practices	Planning the Garden	Harvest Handling	Curing
Soil Management	Sowing	Containers	Pre-packaging (cleaning,
Irrigation Practices	Watering	Tools	disinfection, artificial waxing)
Fertilization Practices	Fertilizing	Packing	Packaging
	Pest Control		Cooling methods &
	Disease Control		temperature
	Weeding		Storage
			Pest Control & Decay

E-LEARNING SOLUTION ON GOOD AGRICULTURAL PRACTICES		
Deliverables	Web Portal	Multimedia Interactive CD
Content	General Guidelines, Production, Harvest & Post-Harvest	
Features	Home Page Latest News Online Tutorials FAQs Forum Live Chat Box Social Media Plug-ins	Modular videos developed using video footage, still images, 2D animation and 3D animation Background voice-over to explain topics
Language	English	
Development Platform	Joomla (PHP & MySQL)	Adobe Flash using Action Script 3.0 Adobe Photoshop Adobe Premiere Final Cut Pro Adobe After FX

Fig. 1 Framework for e-Learning Solution on Good Agricultural Practices

Fig. 2 Screen shots of the Web Portal Homepage (left) and one of the videos from the interactive CB (right)

Multimedia interactive CD

The multimedia interactive CD will hold individual videos/animations for each module covered under GAP. From the home screen, students will be able to select which module's video/animation they wish to view (for example 'Fertilizing' under 'Production'). At the end of the video/animation, they can attempt available questions to test their understanding.

The development of the CD content involves three phases, as outlined below:

1. Pre-production - This phase involves idea generation and brainstorming activities on how to turn information gathered on GAP into suitable graphical content. This is done through sketches formulating layout with flowcharts and storyboards.
2. Production - Production involves execution from the pre-production phase with the design ID of the user interface (UI) using creative designing software and programming.
3. Post-implementation - This stage involves system testing on CD Rapid Prototyping to test the application/system functions and rectify errors.

CONCLUSION

This project is currently in development phase and is expected to be implemented in RUA in March 2013. This is the first time an e-Learning solution for GAP is developed for students of higher learning in Cambodia. As such, upon successful implementation, students' acceptance levels will be gauged and their feedback will be gathered for further improvement.

One of the drawbacks of this solution is that it is fully developed in English and language can be a barrier to the students fully understanding the content. At the point of writing this paper, due to lack of funding, we are not able to translate and develop this solution in Khmer, which is the Cambodian national language.

REFERENCES

IFPRI (International Food Policy Research Institute). 2002. Reaching sustainable food security for all by 2020. Getting the priorities and responsibilities right. IFPRI, Washington, D.C., USA.

CARDI (Caribbean Agricultural Research and Development Institute). 2010. Good agricultural practices (GAP) / Farm management manual.

Izquierdo, J., Fazzone, M.R. and Duran M. 2007. Guidelines "Good agricultural practices for family agriculture". Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Food and Agriculture Organization (FAO). 2003. Development of a good agricultural practice approach. Concept paper for the FAO Expert Consultation on Good Agricultural Practices, 10-12 November 2003. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Trienekens, J. and Zuurbier, P. 2008. Quality and safety standards in the food industry, developments and challenges. Wageningen University, Netherlands.

Abdon, B.R., Ninomiya, S. and Raab, R.T. 2007. E-learning in higher education makes its debut in Cambodia: The provincial business education project. University of Tsukuba, Japan and Sustainable Development e-Learning Network, USA.