

# *Rural Economies and ICT Policies for Rural Development*

## Development of an Online Agricultural ICT Literacy Test System for Korean Farmers

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### ABSTRACT

This study proposes a framework for constructing an agricultural information and communication technology (ICT) literacy test system for personalized e-learning. Farmers can identify their ICT literacy level using an ICT literacy test system developed by the researchers and then use the results to choose suitable e-learning contents. Learners receive their test results based on item response theory (IRT) immediately after completing the test. An ICT literacy online test system was developed to assess the ICT literacy level of the farmers who participated in the e-learning programs. The web server environment was constructed using LINUX WEB SERVER as OS, Apache 2.0.61 as web server, PHP, HTML, JavaScript as language, and MySQL 3.23 as database. The web client environment consisted of Windows XP professional as OS, NamoWeb editor Editplus as the developing tool and editor, and IE60 as the simulator. The current online ICT literacy test system is available to any farmers who are interested in diagnosing their level by following a simple registering process.

Keywords: *Online ICT literacy test; Item response theory; Adaptive e-learning; Farmers' ICT literacy.*

### Introduction

The newly developed information and communication technology (ICT) is a vital tool to form a bridge between the information society and the knowledge society, and has supported a quiet revolution in education over the past decades. The use of distance learning is a primary example of ICT in education.[1] As a communication measure, internet technology has played a great role in facilitating interaction between teaching and learning.[2] Internet based e-learning has become more and more popular and has expanded rapidly in both education and industry. [3]

One of e-learning's merits is its flexibilities for learners. Adaptive e-learning or personalized e-learning may be used interchangeably. Personalization can be offered by tailoring the content according to the user's preference or academic level. According to Weibelzahl [4], the term of personalization is synonymous with the terms of adaptivity and adaptability. In the real world, however, much e-learning takes place without taking into account the learner's existing knowledge or

experiences.[5] Further, insufficient flexibility is offered for learners, despite the inherent attraction of flexible learning in the use of e-learning.[6]

Personalization needs to be attentive because the learners' characteristics are very diverse with the respect to their demographic variables such as knowledge, age, experience, professions, motivations and goals. Since elearning addresses the importance of self-directed learning, personalized e-learning must be developed along with this important issue. As aforementioned, a personalized elearning system may be constructed according to the learners' knowledge level. This study proposes a framework for constructing an ICT literacy test system for personalized e-learning. Learners can identify their ICT literacy level using the ICT literacy test system developed by the researchers and then use the results to choose suitable e-learning contents. Learners receive their test results based on item response theory (IRT) immediately after taking the test.

### ICT literacy

ICT literacy may be a function of knowledge about ICT, attitude toward ICT, and ability to use

ICT.[7] It can be explained in terms of cognitive, affective, and psychomotor domain in the context of learning. Similarly, the Educational Testing Service (ETS) concluded that the concept of ICT literacy should be broadened to include both critical cognitive skills and the application of technical skills and knowledge.[8] ETS later proposed an ICT literacy proficiency model composed of three large domains: cognitive, ethical, and technical.[9] The model included the following 7 proficiencies called "iskill" under the three large domains: define, access, manage, evaluate, integrate, create, and communicate.

Define is the ability to use ICT tools to identify and appropriately represent an information need, access is that to collect and retrieve information in digital environments, manage is that to apply an existing organizational or classification scheme for digital information, integrate is that to use ICT tools to synthesize, summarize, compare and contrast information from multiple digital sources, evaluate is that to judge the quality, relevance, authority, point of view/bias, currency, coverage or accuracy of digital information, create is that to generate information by adapting, applying, designing or inventing information in ICT environments, and communicate is that to communicate information properly for a target audience.

Based on the literacy proficiency model, the researchers developed the basic framework of the ICT literacy test items. Figure 1 depicts the model framework. Three versions of ICT literacy test items were developed: A (basic level), B (intermediate level) and C (advanced level) types composed of 34, 44 and 41 items, respectively.

This paper outlines the development of an online diagnostic test system for measuring ICT literacy among farmers in Korea who participated in e-learning programs run by the Agricultural Forestry Fishery Information Service (AFFIS).

### Item response theory (IRT)

IRT (Ed- this IRT acronym has already been defined above) was introduced to provide a formal approach to personalized testing.[10] IRT was developed to compensate for the weakness of classical test theory (CTT) which only uses the sum of correct scores of test items. For tasks that can be accomplished using CTT, IRT generally brings greater flexibility and provides more detailed information. Although computerized adaptive testing cannot be implemented with CTT, it is enabled by IRT. It also allows a researcher to improve the reliability of an assessment.[11]

In IRT, the probability of a correct answer to any given question is expressed as a function of the characteristic value to be measured. IRT is based on the idea that the probability of a correct/keyed response to an item is a mathematical function of personal and item parameters. The personal parameter is called a latent trait or ability; it may, for example, represent a person's intelligence or attitudinal strength. Item parameters include difficulty (location), discrimination (slope or correlation), and pseudo guessing (lower asymptote). It does not matter which type of version (A, B, C) is selected to assess each person's ICT literacy level because of IRT. The researchers adopted the BILOG-MG program for IRT.

### Development of ICT literacy online test system

An ICT literacy online test system was developed to assess the ICT literacy level of the farmers who participated in the e-learning programs. The web server environment was constructed using LINUX WEB SERVER as OS, Apache 2.0.61 as web server, PHP, HTML, JavaScript as language, and MySQL 3.23 as database. The web client environment consisted of Windows XP professional as OS, NamoWeb editor Editplus as the developing tool and editor, and IE60 as the simulator.

Figure 2 shows the first page of the ICT literacy online test system (<http://edutech.ivyro.net>). Farmers who wish to diagnose their ICT literacy select one from three different versions (A, B, C), implement the online test, and then verify their level with IRT after the test. The BILOG-MG program automatically runs to let the farmers know their ICT literacy level with true scores within the online test system. The system architecture is depicted in Figure 3.

The current online ICT literacy test system is available to anybody interested in diagnosing his or her level by following a simple registering process. The algorithm of the membership registration process to log in is depicted in Figure 4. A total of 412 Korean farmers participated in the online test system in 2009 to determine their literacy level. The results of the farmers' level testing are included in Table 1.

### Conclusion

The researchers developed ICT literacy domains and test items for Korean farmers. After developing the test items, the researchers constructed the ICT literacy online test system for personalized e-learning. Farmers may select e-learning programs according to their ICT literacy level. They also choose specific e-learning programs to compensate for their weakness in ICT literacy.

Within the system, farmers can identify their ICT literacy level after completing the test. BILOG-MG was embedded into the system as an IRT tool. The researchers can identify the difficulty, discrimination, and pseudo guessing parameters of each test version with BILOG-MG. Thus, the researchers can continue testing items and constructing a test item bank with the results from BILOG-MG to provide adaptive e-learning for farmers. The AFFIS (Ed- this acronym has already been defined above) is currently using this system and plans to update and upgrade the system in 2010 to provide a better online interface and environment.

- [1] UNESCO. (2003). Communication: from information society and knowledge societies. *The new Courier*, 3, Retrieved January 25, 2007, from [http://portal.unesco.org/en/ev.php-URL\\_ID=14339&URL\\_DO=DO\\_TOPIC&URL\\_SE TION=201.html](http://portal.unesco.org/en/ev.php-URL_ID=14339&URL_DO=DO_TOPIC&URL_SE TION=201.html)
- [2] Roberts, T. G., & Dyer, J. E. (2005). The influence of learning styles on students attitudes and achievement when an illustrated web lecture is used in an online learning environment. *Journal of Agricultural Education*, 46(2), 1-10.
- [3] GunaseKaran, A., McNeil, R. D., & Shaul, D. (2002). Elearning: research and applications. *Industrial and Commercial Training*, 34(2), 44-53.
- [4] Weibelzahl (2003) Stephan Weibelzahl. Evaluation of Adaptive Systems. PhD thesis, University of Trier, 2003. [http://www.easyhub.org:8000/stephan/\]wei belzahl03-diss.pdf](http://www.easyhub.org:8000/stephan/]wei belzahl03-diss.pdf) [Last access May 8th, 2005].
- [5] Huang, M. J., Huang, H. S., & Chen, M. Y. (2007). Constructing a personalized e-learning system based on genetic algorithm and case-based reasoning approach. *Expert Systems with Applications*, 33, 551-564
- [6] Xu, D., & Wang, H. (2006). Intelligent agent supported personalization for virtual learning environments. *Decision Support Systems*, 42, 825-843.
- [7] Park, S. Y. (2005). LISREL analyses of vocational high school teachers' computer literacy with their daily computer use time, computer experience years, age, and educational levels. *Journal of agricultural education and human resource development*, 37(2), pp.73-88.
- [8] ETS. (2002). Digital transformation a framework for ICT literacy: A report of the international ICT literacy panel. [www.ets.org/Media/Tests/Information\\_and\\_Communication\\_Technology\\_Literacy/ictr eport.pdf](http://www.ets.org/Media/Tests/Information_and_Communication_Technology_Literacy/ictr eport.pdf)
- [9] ETS(2008). ICT Literacy assessment. Retrieved July 15, 2008, from [http://www.ets.org/Media/Products/ICT\\_Lit eracy/demo2/index.html](http://www.ets.org/Media/Products/ICT_Lit eracy/demo2/index.html)
- [10] Fernandez, G. (2003). Cognitive scaffolding for a web-based adaptive learning environment. Lecture notes in computer science, 12-20.
- [11] Wikipedia (2010). Item response theory. Retrieved May 20, 2010 from [http://en.wikipedia.org/wiki/Item\\_response \\_theory](http://en.wikipedia.org/wiki/Item_response _theory)

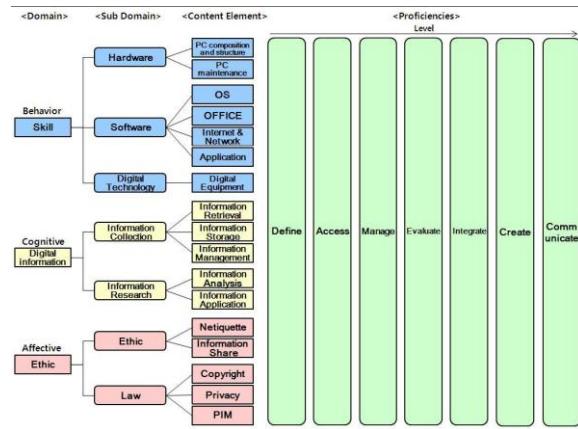


Figure 1. ICT literacy proficiency model



Figure 2. Online testing site's main screen (<http://edutech.ivyro.net>)

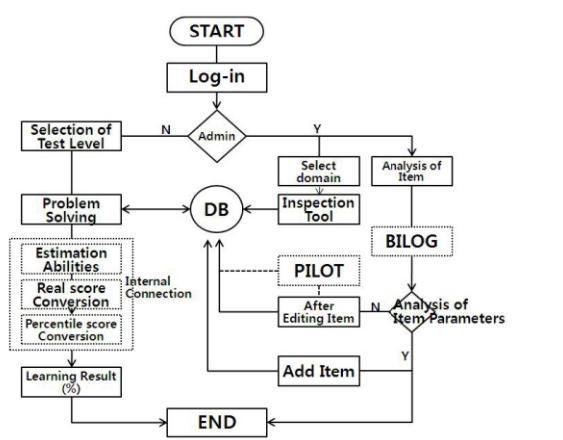


Figure 3. System structure of Question Bank in Online

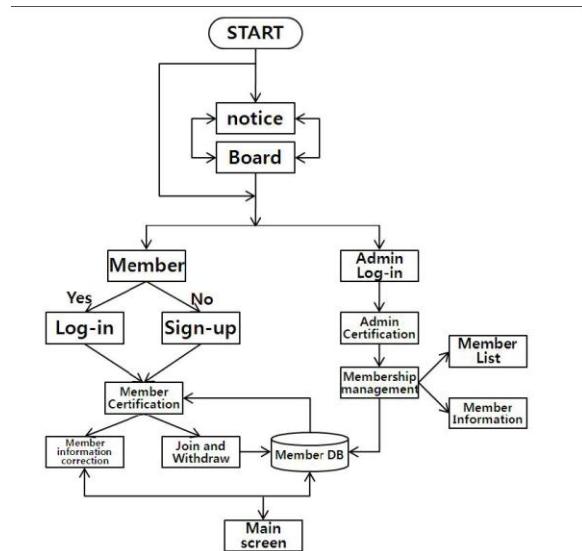


Figure 4. Online testing site's membership structure

Table1. Results of Farmers ICT literacy TEST

Section (Level)	Farmers (n)	percentage (%)	Level		
					Farmers
<b>Basic Level</b>	181	40.77	<b>Basic</b>		10.7603
			Low	70	39.5512
			High	48	87.8766
			Low	48	50.71542
			High	2	55.55555
			Total(Aya.)	181	40.6111
<b>Intermediate Level</b>	120	26.71	<b>Basic</b>		0
			Low	26	55.5508
			High	54	54.5455
			Low	0	0
			High	0	0
			Total(Aya.)	120	26.7854
<b>Advanced Level</b>	111	22.52	<b>Basic</b>		0
			Low	5	47.1274
			High	106	52.8085
			Low	0	0
			High	0	0
			Total(Aya.)	111	27.88174
<b>Total</b>	412	100		412	51.5054