Emerging Flow of New Communication Technology in Education Using u-Learning : focused on Case Study

Min-Cheol Kim†   · Jung-Hwa Kang† †

ABSTRACT

This paper provides the emerging flow of new communication technology using ubiquitous learning (u-Learning). In the intelligent Ubiquitous environment, humans and devices with computing abilities become interoperable. u-Learning will lead students to open their minds to the world and motivate self-learning, which may lead them to learn and communicate more efficiently, and save time, cost and energy. Through case research, regarding education, learning attitude, custom and, personal relations, one must solve the fundamental issues of misuse and outflow problems regarding personal information that will be widely collected in detail than the present condition, and in order for this not to happen, further support of the law and system, plus ethical perspectives must be considered in order to progress.

Key words : u-Learning, Education, New Technology, Ubiquitous, Characteristics of u-Learning

유러닝이용 교육에서 신기술의 발달 : 사례중심 연구

김민철† · 강정화† †

요   약

이 연구는 유러닝 이용 교육에서 신기술의 발전에 따라 나타나는 특징과 문제점 들을 사례를 분석하여 연구하였다. 이러한 유비쿼터스 환경에서 인간은 컴퓨터 능력을 갖고 있는 장치와 상호 교류가 가능하며, 유러닝을 통해 학생들은 열린 자세를 갖으며 스스로 공부하는 데 동기부여를 갖게 된다. 이는 학습과 의사소통을 효율적으로 할 수 있게 하며, 시간과 비용 에너지를 절약 할 수 있게 한다. 국내 • 외 사례에서 살펴보았듯이 유러닝의 발전을 도모하기 위해서는 여러 가지 측면에서 고려되어야 할 것이지만, 교육, 학습태도, 관습, 인간관계 등에 있어 현재 보다 훨씬 광범위하게 수집되어 오용되거나 유출되는 문제를 반드시 해결해야 할 분야이다. 이를 위해 법이나 제도 그리고 윤리적 관점에서 고려되어야 할 것으로 본다.

주제어 : 유러닝, 교육, 신기술, 유비쿼터스, 유러닝 특징, 사례 연구

---

1. Introduction

This paper provides the emerging flow of new communication technology using ubiquitous learning (u-Learning). Ubiquitous is the telecommunication environment where the user can freely access the network no matter where the user is located and without being conscious to the network or the computer. In other words, it is the environment where the user is not aware of the computer or the network and where the user can freely access the network regardless of location. The concept was first introduced by Mark Weiser in 1988 when he used the computing word in Xerox (the copier manufacturer)[9]. In the intelligent Ubiquitous environment, humans and devices with computing abilities become interoperable. In order to implement services in this environment, hardware technologies such as sensing and security technology are needed. However, more importantly, the development of technology that enables devices to be aware of context is also necessary[12]. The intelligent u-Learning sector is one of the fields that could be heavily affected by the advent of the ubiquitous computing era.

2. Ubiquitous Technology and U-Learning

2.1 Concept of the Ubiquitous Technology

Many people now have easy access to business-related information and communication technologies (ICTs) at home[7]. In addition to this tool, ubiquitous computing envisions a world of fully connected devices, with omnipresent wireless network. It postulates that you need not carry anything with you, since information will be accessible everywhere. Ubiquitous computing has as its goal to enhance computer use by making many computers available through the physical environment, but making them effectively invisible to the user. Ubiquitous computing is not virtual reality and ubiquitous computing endeavors to integrate information displays into the everyday physical world[9].

Weiser[9] strongly insisted that ubiquitous computing will lead to the third information revolution after mainframe and personal computing. However, it currently is not used alone but is used in a form of ubiquitous communication and network. In other words, it does not mean adding features to the computer, but to insert equipments or objects in the car, refrigerator, glasses, watch, stereo equipment, etc. to enable the information technology environment or the information technology paradigm communication. In other words, the computer is expected to become a ubiquitous resource, much similar to the light with a switch and water with a tap. Two functionalities, computing tasks and telecommunications, are required to realize the features of ubiquitous computing such as localized information, localized control, and resource management[9][11]. The evolving mobile technology has expanded the applicability of ubiquitous computing to areas including virtual reality, head mounted display (HMD), wearable computing, and smart office room[10].

Once the ubiquitous network is established, one can utilize the information technology at home, in the car or even at the top of a mountain. Moreover, because of the increased number of computer users connected to the network, the size and scope of the information technology industry will be enlarged even further. Nevertheless, to accomplish the ubiquitous network, the information technology's advancements must be realized such as the generalization of broadband communication, convergence technology, and decreased costs of information technology's equipment. Because of these limitations, currently it is not generalized, but the fierce competition is driving its progress in the world due to the advantages of connecting to the

network without regards to time and place, but also its mobility and composition.

2.2 Changes in the Educational Environment

Knowledge-based society's educational paradigm has been changed with rapid development of two-way communication technology in the educational environment. These changes translated the educational environment from computer usage to internet usage, ICT to e-learning, again to u-Learning. Educational environment changes were based on the paradigm change in the role of the computer[8].

Moreover, in order to graft together the ubiquitous network to work with existing computer technology in education, it usually formed on-line space concept as a core with the main purpose of translating the reality to the cyber space. However, the main purpose in the ubiquitous environment is to load the computer technology to the real environment, which can be said to be the major difference between these two. In other words, the computer is integrated with reality and enabled to exist in any time and place.

Since every computing and communication capabilities should be added to electronic devices, every electronic device must have their own addresses, and be able to be connected to the broadband network by wired or wireless technology. In order to facilitate this activity, IPv 6[1)] technology and home network technology was created.

2.3 Concept of the U-Learning

u-Learning is abbreviation of the ubiquitous learning which represents an integrated learning system that can be utilized by selecting learner's needs from the open learning resources.

Scholars of systems theory emphasize that all elements of an organization are interconnected[6][7]. For such an ubiquitous learning system, it is defined as the ideal learning system that one can learn whenever, wherever, whoever in whichever the most convenient way that may be. Regarding u-Learning, some define it as receiving education from PDA, tablet PC, or notebook by utilizing wireless and high-speed internet or searching for the information in real-time or downloading educational services. Nevertheless, this can be regarded as a small part of the whole concept because u-Learning is not restricted to the media or devices, but signifies integrated media.

The main characteristics of ubiquitous learning are shown as follows[1][2];

http://www-yano.is.tokushima-u.ac.jp/ogata/clue/)[19]:
1) Permanency
2) Accessibility
3) Immediacy
4) Interactivity.
5) Situating of instructional activities[5].
6) Adaptability.

2.4 Characteristics of U-Learning

The educational purpose of e-learning is to develop the educational environment so that the students can learn wherever and whenever with any kind of terminal/unit that can bring the creativeness and realization of the learner-centered educational course. In the u-Learning educational environment, rather than being uniform or compulsory, each student can learn based on individual will, so that the interaction between the parents and teachers can be achieved rather more smoothly and comfortably.

Ubiquitous learning is characterized by providing intuitive ways for identifying right collaborators, right contents and right services in the right place

---

1) IPv6 is short for "Internet Protocol Version 6".

at the right time based on learners surrounding context such as where and when the learners are (time and space), what the learning resources and services available for the learners, and who are the learning collaborators that match the learners' needs[13].

3. U-LEARNING CASES

Many characteristics of U-learning have been developed and implemented in several areas such as private organizations, government offices and especially Universities in the world. We searched for characteristics of them here and analysed 6 foreign sites and one Korean site.

3.1 UCLA's Smart Kindergarten Project
(http://nesl.ee.ucla.edu/projects/smartkg)

The Smart kindergarten project in UCLA (US) is a research project designed to examine how kindergarten pupils learn from the actual physical space of kindergarten through the ubiquitous computing and the sensor-based wireless network [16]. This research is jointly carried out by the graduate schools of computer engineering, electronic engineering, and education information science from UCLA. The Smart kindergarten project examines how ubiquitous computing technology applies to the educational field. To do so, it analyzes how pupils learn to speak, utilize toys to learn, observes interactions between pupils or with pupils and teachers, and how these affect the children. Also, by utilizing various ubiquitous computing and network technologies, it grasps children or toy's name and the location in real-time with the wireless recognition technology. Moreover, through the sensor and the situation recognition technologies, they trace language recognition that the children use, interaction characteristics, detection of behaviors and changes of movements.

Through the automated data-mining technologies, it analyzes and infers the conditions that translate from the sensors in real-time, the badge and the sensor network that children have placed on them are connected through the Jini based technology. Smart kindergarten project has a big significance in the level of the condition recognition in that the sensor based wireless network technology and the interaction of the sensor planted objects or between people were analyzed in real time.

3.2 UbiCampus in the EU
(http://www.ubicampus.mh-hannover.de/)

Hanover University in Germany and VTT University in Finland have done research to determine the necessary technology foundation for the ubiquitous computing environment, the vision regarding the ubiquitous computing application scenarios in the university environment and to grasp wrong expectations of the ubiquitous computing or the technology by acquiring the new technology integration in the ubiquitous computing area[17]. This UbiCampus project was envisioned by IRB and VTT to study and develop the post 3G ubiquitous networking environment for intelligent applications. The UbiCampus Project aims at building and using a local ubiquitous computing environment on a part of the campus of the University of Hannover. The project includes transmission technology, middleware and application aspects. This paper gives a short introduction into Ubiquitous Computing, introduces the basic idea of the UbiCampus project and discusses its objectives in terms of infrastructure, applications and Jini-based service architectures.

3.3 Ubiquitous Language Teaching System in Spain
(http://www.upgrade-cepis.org/issues/ 2001/5/upgrade-vII-5.html)

By utilizing ubiquitous computing and collaborative writing, it developed learner's English composition and communication skills[18]. When the teacher presents a composition subject, ideas can be shared and organized in group brainstorming through the mobile devices and projection. Again, by utilizing these devices, opinions can be shared and decided what contents will be placed with the voting function. After that, an agreed summary will be presented in the mobile device in a tree structure. In the digital devices, it is easy to copy and delete, so one can simply correct the writing and develop further whenever and wherever the idea appears. Furthermore, one can be connected to the joint writing work space, have a debate and work on the writing activities. Moreover, when the teacher saves them in the shared server after the feedback, learners can view one's writing at the web whenever one desires. An ubiquitous system is being developed with the aim of studying ways and means of bringing new technologies into the classroom. It will help concerned people develop their subjects of interest and study them by sharing them with others easily and quickly.

3.4 Mystery at the Museum Program in MIT
(http://education.mit.edu/ar/matm.html)

This is the first indoor Augmented Reality simulation by the MIT Teacher Education Program[14]. With the simulation program realized in the indoor augmented reality in the Science museum in Boston, the framework of the story is that there was a robbery in the science museum in Boston and 6 students will form a group with a role of biologist, technical expert, and a detective to find out what was stolen, and grasp what method will be utilized to catch the thief.

Students must form a strategy to solve the subject, and based on the collected information and integrated data from the information such as learner's interview, evidence collection, fingerprint inspection and various science tests to lead to solve the problem. This can be done with help of Ubiquitous characteristics.

3.5 The Handheld Devices for Ubiquitous Learning
(http://gseacademic.harvard.edu/~hdul/#Selected)

This webpage provides an overview of the Handheld Devices for Ubiquitous Learning Project (HDUL)[15], the promise of ubiquitous computing, a brief history of handheld computers, an overview of wireless handheld devices(WHD), and exemplar examples of educational software designed for handhelds, general information about peripherals, and exemplar uses of handhelds in education. Dieterle[3] discusses these methods and initial findings situated in current theories of learning and teaching. As the evaluation of HDUL continues, this paper is also a venue to share with community member's work. Dieterle & Dede[4] presents an analysis of HDUL and complementary research projects illustrating WHDs as communicators, construction kits, information banks, phenomena, symbol pads, and task managers in a wide variety of learning environments. Within categories, characteristics of both straightforward effects (i.e., streamliners – mechanisms that actively improve the efficiency of a process or action) and deep effects (i.e., enablers – mechanisms that make an action or process possible that before or otherwise would be impractical or impossible to carry out) emerged.

3.6 e-Class in Georgia Institute of Technology
(http://www.cc.gatech.edu/fce/eclass/)

The e-class project has automated the record that integrated the educational process and each individual's lesson contents[20]. First, it constructed a lecture room environment that is necessary for the software infrastructure and trial performance to process various interactions in a typical college lecture. Also, e-class room utilizes high definition display equipment for the presentation that interacts with the normal blackboard size, so one can write or draw on the electronic board; pretending students are taking lessons with the computer, and utilize electronic board or notebook pc as the class tool. What is more, to make the best use of the students' questions and discussions, personal monitor and group monitor can be shared. Table calculation tool is used for the personal calculations. Furthermore, by providing e-class software for the lesson and study, it supports records of the class, discussions, group activities, votes, etc. that are achieved in real-time during the class and avoids simple memorized class only targeting the test. In the mean time, electronic board, e-class software tools are provided to the lecturer, so that with the minimum efforts and changes, one can lecture in the ubiquitous computing educational environment. In other words, escaping from the traditional desktop computer usage paradigm, it is translating to the mutually connected computing based on the group user environment rather than the individual oriented environment. Classroom 2000 has been an ongoing research effort for over 3 years with over 100 classes taught by more than 24 instructors. As a part of the evaluation of the system the researchers distribute a questionnaire at the end of each course taught.

3.7 Incheon Yale High school's U-group Learning Room
(http://www.incheonnews.com/news/article View.html?idxno=14349)

In August 25th, 2006, Incheon Yale High school in South Korea opened the first ubiquitous learning concept u-group learning room[21]. U-group learning room went one step further from e-learning which one can connect to the internet and study educational process utilizing PDA, tablet PC, etc., where the wireless internet is possible without being constrained from time or space and receive customized learning service. This can be defined as the next generation's on-line learning system and a good case of ubiquitous learning. In the u-group learning room of Incheon Yale High school there are 1 reverse side electronic board, 11 tablet PCs, 11 computers, 6 printers, and 1 broadcast information technology office. The remarkable part is that it perfectly realized the future ubiquitous educational environment where the wireless internet is connected within school area and every school ground can be accessible for learning.

This u-group learning room which is based on the multi-purpose electronic board, tablet PC and wireless internet, can be used as the space for the group survey, information search, discussion, collaboration, project learning, providing a various learning methods in various learning space.

What differentiates the most from other schools where it selects one grade and gives them the experience of u-Learning, it establishes u-group learning room where all students can receive the service. This method not only can guide learning interest to all students, but also help to contribute to enhance one's accomplishment. In addition, they can experience the most new technology and develop their creative learning.

4. Conclusion and Direction for the Future Development

Currently we are closely nearing in the era of ubiquitous learning. Ubiquitous learning, as it is previously stated, enables one to learn whenever and wherever just by connecting to the network. Therefore, as the era of ubiquitous is coming nearer, our environmental life will change as well. For example, we will not use the teaching materials nor reference books made of thick paper. What is more, wireless network will definitely be the general trend than the wired network. Learning by PMP, mobile, etc. are changing, and to keep up with these trends, people and companies are adapting to the u-era at a rapid speed.

In the era of u-Learning, one will not find essential elements such as the blackboard, chalk, book, notebook, etc. that we find in the traditional lecture room. Also, lectures will not only be made within the classroom, but wherever one is connected to the wireless internet.

Evolution of u-Learning can contribute to reduce the cramming method of teaching and reduce the cost of private studies. Further, it is possible to learn based on one's ability and progress of the class, and smooth the interaction among learners, parents and teachers. It will lead students to open their minds to the world and motivate self-learning, which may lead them to learn and communicate more efficiently, and save time, cost and energy.

Of course there is a weak point that the effect of the education can vary depending on one's learning will since it is an individually oriented learning rather than between two parties. Nevertheless, the remote education, digital library, etc., will aid to reduce the information gap for those who are in an alienated location. However, without the support of the information development at the government level, the economic disparity will deepen the difference of the information, which is one of the most prescient concerns.

When one can quickly grasp the strengths and weaknesses of u-Learning, then by accepting the strengths and making-up the weaknesses, it will rapidly and conveniently be developed as can be seen case from the studies. Furthermore, when u-Learning is combined with home network, and RFID, the method of study and student's in-school/out-school life will dramatically change, but it may raise serious problems of individual information outflow. Especially, regarding education, grades, learning attitude, personal propensity, custom and personal relations, one must solve the fundamental issues of misuse and outflow problems regarding personal information that will be widely collected in detail than the present condition, and in order for this not to happen, greater support from the law and system, plus ethical perspectives must be considered.

REFERENCES

[1] Chen, Y.S., Kao, T.C., Sheu, J.P., and Chiang, C.Y. (2002). A Mobile Scaffolding-Aid-Based Bird -Watching Learning System, Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE'02), IEEE Computer Society Press, 15-22.

[2] Curtis, M., Luchini, K., Bobrowsky, W., Quintana, C., and Soloway, E. (2002). Handheld Use in K-12: A Descriptive Account, Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE'02), IEEE Computer Society Press, 23-30.

[3] Dieterle, E. (2005). Handheld devices for ubiquitous learning and analyzing, the 2005

National Educational Computing Conference, Philadelphia, PA.

[4] Dieterle, E., & Dede, C. (2006). Straightforward and deep effects of wireless handheld devices for teaching and learning in university settings, the 2006 American Educational Research Association Conference, San Francisco, CA.

[5] Kang, J.H.(2010), A Study of the Relations among English Thinking Structure, Pre-English Skill, Self-efficacy in English, Flow and Learning Effect, The Journal of Digital Policy & Management, Vol. 8(4), pp.165-176

[6] Kang, J.H.(2011), A Study on the curriculum of the Industry-University Cooperation, The Journal of Digital Policy & Management, Vol. 9(3), pp. 261-271

[7] May, S. (2006). Case Studies in Organizational Communication (Case Study 3, pp. 75 - 86). 2455 Teller Road, Thousand Oaks, Califorinia: Sage Publications

[8] Mock, J. Kang, J.H., Ha, T.H.(2008) A Comparison of Internet Access between Korean and Japanese University Students, The Journal of Digital Policy & Management, Vol. 6(4), pp. 147-156

[9] Weiser, M. (1993a). Hot topic: Ubiquitous Computing, IEEE Computer, 71-72.

[10] Weiser, M. (1993b). Some computer science issues in ubiquitous computing, Communication of the ACM, 36(7), 75-84.

[11] Rhodes, B. & Mase, K. (2006). Wearables in 2005. IEEE Pervasive Computing, 5(1), 92-95.

[12] Salber D. & A. K. Dey & G. D. Abowd (1999). The Context toolkit: Aiding the development of context-enabled applications, Proceedings of ACM SIGCHI Conference on Human Factors in Computing Systems, 434-441.

[13] Yang, S. J. H. (2006). Context Aware Ubiquitous Learning Environments for Peer-to-Peer Collaborative Learning, Educational Technology & Society, 9 (1), 188-201.

[14] http://education.mit.edu/ar/matm.html

[15] http://gseacademic.harvard.edu/~hdul/#Selected

[16] http://nesl.ee.ucla.edu/projects/smartkg

[17] http://www.ubicampus.mh-hannover.de

[18] http://www.upgrade-cepis.org/issues/2001/5/upgrade-vII-5.html

[19] http://www-yano.is.tokushima-u.ac.jp/ogata/clue

[20] http://www.cc.gatech.edu/fce/eclass

[21] http://www.incheonnews.com/news/articleView.html?idxno=14349

Min-Ccheol Kim

1991 Dept. of Business Administration, Chung-ang University (BA), Korea
1995 Graduate School of Business Administration, Korea University(MA), Korea
2000 Graduate School of Business Administration, Korea Univ. (Ph.D), Korea
2002 Graduate School of Public Health of Seoul National University (MPH), Korea
2004 Graduate School, Seoul National University (Ph.D Candidate), Korea
2005 Certificate of IT Project Management, Georgia Tech, USA
2010 Graduate School, University of Wisconsin - Platteville (MS), USA
1993~1998 Researcher of Marketing Research Team , SK Telecommunication Company, Korea
2007.1~2008.1. Visiting Scholar, Mississippi State University, USA
2001.3~Current. Associate Professor, Dept. of Management Information Systems / Tourism, Business and Economic Research Institute, Jeju National University, Korea
Research Area: u-health, Health Tourism, telecommunications and health management.
E-mail: mck1292@jejunu.ac.kr

Jung-Hwa Kang

1997 University of Wales, UK. Management Science (BSc)
2002 University of Wales, UK, Computer Science (MSc)
2007 Course Jeonbuk National University(PhD), Korea
2002~2003 Shelter Cymru
2005~2006 NZIS Director
2009~2010 Researcher CTL Woosuk University
2010.7~Present Adjunct Professor CTL Jeonju Uni.
Research Interests : e-Learning, Curriculum & Educational Method, Educational Technology, Teaching English with IT
E-mail : kangjh_uk@nate.com