A Case Study of Establishing
a Smart Campus for Distance Higher Education[*]

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━━━━━ ◼ ABSTRACT ◼ ━━━━━

Along with the development of information and communication technolgies, Korea National Open University (KNOU) configured its own task force team, named "Smart Campus TF/T", for technological innovation. The TF/T has developed a master plan to adapt to the fast-changing environment, identifying several objectives to establish a smart campus. This article elaborates the ways in which KNOU has responded to various external needs by creating the master plan in designing a smart campus. Using a qualitative-case-study approach, this study outlines the procedures through which the TF/T developed the master plan and its specific outcomes: one vision, three objectives and four major areas to transform the university into a smart campus. This study illuminates the ways in which an institution of open and distance higher education applies new information and communication technologies to development of a smart campus.

[Key words] mobile learning, ubiquitous learning, smart learning, smart campus, open university, distance higher education

Ⅰ. Introduction

As information and communication technology (ICT) has been increasingly utilized in the field of education, distance education as a practical area has been extensively discussed among educational researchers (Lee et al., 2004). Moreover, distance education technology has trasformed pedagogical systems in a number of distance education institutions.

The focus of this article is on exploring the case of Korea National Open University (KNOU), a public open and distance higher education institution in the Republic of Korea, that established a task force team (TF/T) to cope with challenges that resulted from social and technological changes. KNOU was found in 1972 as the unique instititioin for open and distance higher education in the Republic of Korea. Since its foundation, KNOU has played a major role in extending higher education to broader populations. Equipped with up-to-date distance education technologies, KNOU has positioned itself as a leading open and distance education institution not only domestically but also internationally.

However, the circumstances surrounding KNOU has recently changed in an unprecedented pace, especially in terms of the technological environment. Along with the development of ICTs and distribution of mobile devices, the needs for active learning to individual KNOU students has become salient. Furthermore, given the high level of the Korean network infrastructure, the demand to attain prompt, real-time information for learning has increased. These circumstantial changes have resulted in escalation of learners' expectation to get connected to the KNOU campus system such as using multimedia for lectures or communicating with instructors and/or peers.

On the other hand, the social context of KNOU has also constantly transformed. Given the relatively high rate of higher education in Korea, KNOU is now expected to function as not just a degree-providing institution but a lifelong education institution. More and more KNOU students want to gain practical knowledge and skills that are relevant to their lives. Besides, students' learning styles have become diversified. The increasing number of students prefer ubiquitous learning to studying in a conventional way.

In order to deal with both internal and external changes, KNOU has formed the KNOU task force team, named "Smart Campus TF/T", that aimed at developing a master plan to transform the KNOU's pedagogical system into the higher level of technological use, identifying several tasks to establish a smart campus. The vision of the TF/T was to establish the KNOU smart campus where all members of KNOU (i.e., staff, faculty and students) are able to teach, learn and work anytime and anywhere. The TF/T set up three key objectives of openness, autonomy and usability on the basis of which twelve concrete tasks were defined in developing the master plan of the smart campus.

KNOU's master plan to develop the smart campus illuminates the ways in which an institution of open and distance higher education reacted to the fast-changing circumstances, which ultimately helps us to discuss conceptual models for future study as well as strategies to promote open and distance learning via technological innovation. The TF/T needed to understand key dimensions and organizational issues of diverse factors influenced by the internal and external changes. An in-depth qualitative case study exploring the context and the process of what the TF/T created can demonstrate such conceptual and pragmatic understandings. Using qualitative case research, this study elaborates the processes and the outcomes of the TF/T.

The exploratory research questions for this case study are as follows.

- What are the processes through which the Smart Campus TF/T went in order to develop a master plan?
- What are the main contents of the master plan?
- What are major conceptual and theoretical constructs that enable an institution of open and distance higher education to transform itself into a smart campus?

II. Review of the Literature

1. KNOU as a Distance Higher Education Institution

Distance education refers to education of learners who are not physically present at a school (Andreas & Haenlein, 2016). The conventional notion of distance education primarily indicates correspondence courses wherein learners corresponded with instructors and school administration through post mails. Alongside the technological development at every level of computing and programming for education, distance education encompasses online education and e–learning. A distance education institution can provide its programs through both completely distance education methods and a combination of distance learning and on–site classroom instruction (Vaughan & Norman, 2010).

The notion of distance higher education is any learning and education programs provided in a distance education mode at the higher education level. Today, online education delivered on the internet is the prominent form of distance higher education. Web–based or online distance courses in universities or colleges employ a variety of educational technologies such as e–mail, computer conferences and learning management systems.

According to Kaye and Rumble (1981), the evolution of distance higher education institutions can be categorized into five stages. The first stage refers to correspondence education in the form of extended programs at traditional colleges. This type originates from the University of London in the nineteenth century. The University of London granted degrees to distance learners without on–site instructional courses. The second stage involves correspondence education implemented by conventional universities or colleges for external learners. For example, the University of Queensland in Austria offered correspondence education programs to external learners through its independent organization for distance education. The third stage means educational programs operated by a combination of several colleges and broadcasting corporations. The fourth stage is distance education managed by national authority. The fifth stage indicates distance education delivered by autonomous distance higher education institutions such as KNOU.

Though the history of distance education goes back as far as to the nineteenth century in some western countries, practices of distance higher education appeared lately in Korea. With the escalating need for national higher education, the Korean government launched

KNOU in 1972. In the beginning, most of KNOU's programs relied on correspondence methods via post and textbook. As radio and TV were popularized, KNOU started employing those methods for its distance education in 1980s. As electronic medias was gradually adopted in 1990s, KNOU's distance education system has been replaced by online technologies. Today, KNOU learners in every program use diverse platforms of distance education.

2. Three Conceptions of Learning Relevant to Smart Campus

The TF/T examined three conceptions of mobile learning (m-learning), ubiquitous learning (U-learning), and smart learning (s-learning) which yield the theoretical background to develop a smart campus. Before s-learning became a significant agenda for distance education, mobile learning (m-learning) and ubiquitous learning (u-learning) were two conceptual constructs more broadly discussed in higher education. Generally, these two concepts were considered to cope with the fast-changing technology by administrators and policy makers in universities and colleges.

As early as in 2002, Keegan (2002) anticipated that "mobile learning is a harbinger of the future of learning" (p. 9). The use of m-learning technology have been adopted at every level of education since the beginning of the 21st century. Prototypical examples of m-learning devices include, if not exclusively, cellular phones, smartphones, palmtop, and portable computers such as tablet PCs, laptops, and personal media players (Kukulsk-Hulme & Traxler, 2005). Walker (2006) argued that M-learning is not just about the use of mobile devices but about learning across various contexts. In other words, m-learning is considered a useful component of flexible learning (Peters, 2007), which can be identified as an extension as well as a subset of e-learning (Brown, 2005).

Among educational researchers, the concept of m-learning facilitated conceptualization of u-learning. U-learning involves learning in an environment where every individual has access to a variety of digital devices and services using ICTs whenever and wherever an

individual needs them (van't Hooft, Swan, Cook, & Lin, 2007). Park (2011) delineates comparisons and flow of e–learning, m–learning and u–learning as [Figure 1] below.
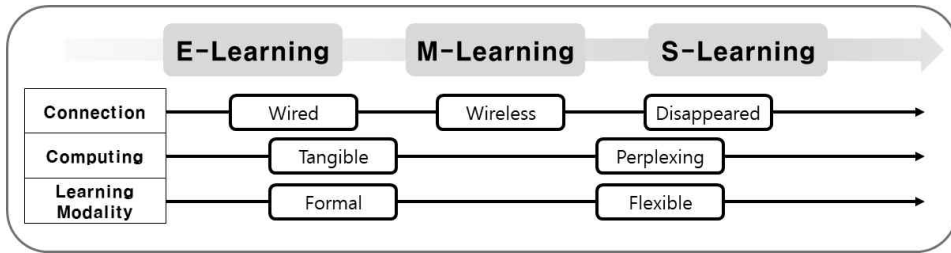
[Figure 1] Approaches of e–learning, m–learning and u–learning
(Adapted from Park, 2011, p. 81)

In the governmental sector of Korea, U–learning particularly draws significant attention. The Korean Ministry of Education (MOE) demonstrates that the extension of u–learning can improve citizens' right of lifelong learning and consequently help to develop the learning society. MOE defines u–learning as a learning system that promotes individual learning by attending any type of education regardless of circumstances such as time, place and social backgrounds. Lim (2008) articulates the characteristics of u–learning as follows:

- Management of Sustainable Learning Resources: Every learning resource exists and persists unless learners intentionally remove them.
- Accessibility: Learners have the access to learning materials regardless of time and location.
- Promptness: Learners can instantly gain information and knowledge that they seek.
- Interaction: Learners can interact with professionals, teachers or peers anywhere and anytime.
- Contextuality: Learning takes place in one's life, and thus every learning issue should be related to their lives.

In this sense, u–learning does not merely mean a technical form of learning; rather it is an

integrated learning system grounded in newly developed ICTs. Higher education institutions began to apply various dimensions and features of u–learning to their education systems. This innovated system, so–called U–campus, relies on both wired and wireless connectivity of the education portal. In U–campus, mobile devices utilizing wireless application protocol (WAP) play a key role in promoting the use of information and communication between individuals attending education. Likewise, digital computing technology and wired or wireless networks enable students and faculty/staff members to get connected anytime and anywhere. The focus of u–learning is on information of the campus.

Building upon the aspects of m–learning and u–learning, s–learning is a more integrated, learner–centered conception of learning. In s–learning environments, learners who are provided with appropriate support (e.g., guidance, feedback, hints or tools) interact with environments in a more convenient manner.

Hwang (2014) identifies potential criteria of a smart learning environment as follows:

- Context–awareness: The learner's situation or the contexts of the real–world environment in which the learner is located are sensed, implying that the system is able to provide learning support based on the learner's online and real–world status.
- Instant and adaptive support: Learners are supported by immediate analysis of their needs from different perspectives such as learning performance, learning behaviors, profiles and personal factors.
- Adaptive learning: Learners are offered the adaptive interface and the subject contents to meet the personal factors and learning status. Learners can interact with the learning environment via mobile devices, wearable devices, or ubiquitous computing systems embedded in everyday objects.

Particularly, adaptive learning is the key to successful s–learning (Spector, 2014). The term "adaptive" is associated with diverse system characteristics and competencies in educational institutions. Educational institutions need to make their environment adaptive in order to be capable of monitoring the activities of learners, of examining their activities in

the ground of domain-specific dimensions, and of catching learner requirements and preferences from the results of the examination.

Despite its brief history, s-learning has been explored by many educational researchers (Dodds & Fletcher, 2004; Hwang, 2014; Noh, Jung, & Ju, 2011; Spector, 2014). The essential factors of s-learning encompass learner-centeredness, technology-basis, flexibility, creativity, openness, collaboration, problem-solving, reality, informal or non-formal learning, and individuation. Drawing from these characteristics and principles of s-learning, more and more universities and colleges, both research-centered conventional and distance education institutions, have launched the smart campus project. All-in-all, it is pivotal to integrate smart technologies such as new application contents, mobile network infrastructure and artificial intelligence into the current education system in order to establish a smart campus.

Ⅲ. The Case Study

Employing the qualitative case study approach, this study reports an intensive analysis of facets and constituents documented though various activities of the KNOU's Smart Campus TF/T. Case study research contains intensive analysis of an individual unit to offer an opportunity to acquire an in-depth, integrative perspective of the research problem (Yin, 2003). Furthermore, a qualitative case study helps researchers to describe, understand, and explain a research problem or situation. Yin (2003) argues that conducting case study research is complex because its repetitive process comprises multiple stages of planning, designing, preparing, collecting, analyzing, and sharing.

The TF/T carried out a series of systematic activities to design and develop a master plan to develop the smart campus. The TF/T consists of one team leader who is the director of information and computing center and seven team members who are staff and faculty members (see <Table 1> below). The TF/T continued for about three months from January

to April in 2018.

<Table 1> KNOU's Smart Campus TF/T members

Role	Organization	Position
TF/T Leader	ICC	Director
Members	Department of Youth Education	Faculty
	ICC	Leader of Informatization Team
		3 Staff Members
	Academic Affairs	Leader of Course Planning Team
	Student Affairs	Leader

Identifying campus administrators, students, staff and faculty members as multiple sources of data for initial interviews, the TF/T explored and collected various ideas that can help to establish the smart campus and discussed significant agendas to develop a master plan. In addition to the TF/T meeting minutes in an electronic form, audio-recorded interviews and informal conversations were word processed. These electronic texts imported to Nvivo qualitative data management software. A content analysis was carried out to sub-categorize themes of the master plan to establish the smart campus. The TF/T members jointly coded and analyzed the data. If any differences were discovered, the TF/T resolved them though discussion. As a result, nine initial themes emerged from the series of discussion. Subsequently, by prioritizing the themes, the TF/T developed one vision, three objectives and four major tasks of the master plan to establish the smart campus.

Ⅳ. Results

The vision was "Creating KNOU campus where every university member is able to teach and learn using any ICT devices." To accomplish this vision, three concrete themes were identified as objectives of the master plan as below.

- Openness: Providing the efficient network that support teaching and learning
- Autonomy: Promoting ICT support adaptive to learner characteristics
- Usability: Enhancing convenience of faculty members as well as students in using any pedagogical technologies

Subsequently, the objectives can be achieved by four key tasks: 'promotion of user-orientation', 'reinforcement of the academic/service system', 'innovation of the learner support method' and 'establishment of the s-learning environment.'

1. Promotion of User-Orientation

As it is crucial to create the user-friendly environment for distance higher education, the TF/T posed promotion of user-orientation as the first task to transform KNOU into a smart campus. Several specific sub-tasks were identified to accomplish the promotion of user-orientation.

Firstly, KNOU needs to improve both online and in-person advertisement to advance University Identity Program (UIP). The TF/T proposed that designs of the university logo, fonts and standardized layouts on the webpage need to be redesigned to improve the brand image of the university. Additionally, by means of renovating the university webpage, massive students' data should be more effectively managed and used.

Secondly, enhancing the user interface and experience (UI/UX) is another important task to promote user-orientation. The master plan highlights the urgent need to set up the university's standard for the UI/UX of both PCs and mobile devices. Particularly, coinciding the mobile webpage with the UI standards was conceived to be more important through data analysis. The master plan also accentuates the significance of the consistent UX between PCs and mobile devices. To do so, new technologies such as the responsive web need to be introduced to the university system. As the responsive web allows users to input a single URL for the same purpose in any devices, accessibility can be significantly increased if it is incorporated to the current system.

According to the research of Korea Educational Computerization Center in 2014, over 70% of Korean universities and colleges use certain types of ICTs embedded in mobile devices. Even though KNOU developed its own learning platform of U–KNOU campus, an application used for mobile devices, the functions are limited in terms of the UI/UX. Moreover, the master plan emphasizes further consideration of various new pedagogical methods such as flipped learning and automated grading which need to be applied to the current system of KNOU.

2. Reinforcement of the Academic and Service Systems

Although technological innovation is important, reinforcing the academic and service systems is also pivotal to make KNOU a smart Campus. The master plan includes several tasks to reinforce academic and service systems of KNOU.

First, it is necessary to advance administration of academic affairs so that they can function more efficiently in smart campus. For example, KNOU's current evaluation system needs to be reconsidered as new ICTs are introduced to the evaluation system. If technology to check students' learning progress is incorporated to the education system, the grading rubric should reflect the completion rate of watching e=learning materials. In addition, students can be provided with customized information through the updated KNOU portal site where they can easily check their own progresses and learning schedules. The TF/T also suggested some new technologies that increase student authentication in assessment and class attendance.

Second, the master plan includes the need to develop the system based on learning analytics for policy planning and implementation in the future. Through learning analytics, KNOU's management can capture critical issues and problems of the existing system. Furthermore, strategies to offer more effective information to individual learners can be created by a scientific analysis of data about learners' online activities.

Third, given the massive number of KNOU students and alumni, students use their own e–mail domains to sign in the KNOU portal. However, using the third vendor domains limits

online collaboration. The TF/T suggested a cloud‒based e‒mail system that costs a minimal budget. Among various options, the master plan compares strengths and weaknesses of Google Apps for Education, MS 365, and Naver Solutions to find a optimal resolution. The TF/T suggests Google Apps for Education because it provides each student an e‒mail address with the KNOU's main domain (──@knou.ac.kr) for free of charge. Students can also use unlimited cloud space for their e‒mail, collaboration, and virtual drive spaces. Google Apps is the most compatible resolution with most of the electronic devices whether they are PCs or mobile devices.

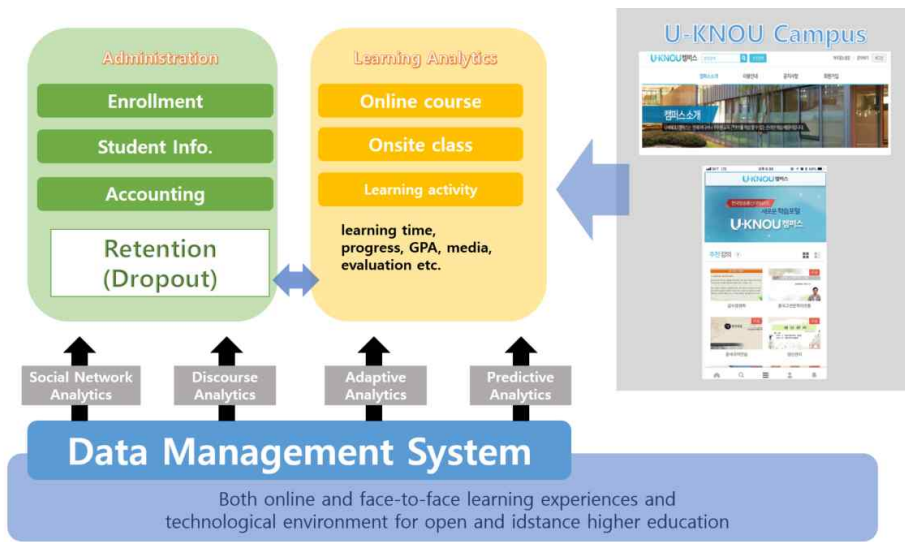## 3. Innovation of the Learner Support Method

In order to establish the smart campus, KNOU needs to improve its learner support system in terms of its organization and function. The major learner support system of KNOU includes systems for tutoring and mentoring managed by the student service center and each department. However, the disintegration of the current learner support system results in low satisfaction and inconvenience among students.

The master plan indicates the ways in which KNOU's learner support system can develop. For example, categorizing students by age groups can improve the quality of learner support. The categorization of students as suggested by the TF/T is fourfold: group one (Early 20s with no HE experience), group two (20s and 30s having careers), group three (30s~50s; housewives) and group four (over 60s; older learners). To students in group one, it is more helpful to provide foundational knowledge to study in higher education. Students in group two are more likely to require a balance among work, life and study. Thus they tend to prefer using s‒learning in an efficient manner. It is likely for students in group three to rely on the family support for their learning. At the same time, given the long time away from formal education, it is important to alleviate their fear against participation in educational activities among student in group three. Students in group four relatively require more training for their ICT literacy in order to succeed their learning in distance higher

education.

Additionally, the TF/T suggested a more systematic monitoring of learner support To make each students' learning experience more effective, it is necessary to offer adequate information about every step of adaptation to distance higher education. In doing so, professional competencies of student counselors play an important role. Thus The master plan involves appropriate and regular training programs for student counselors.

In addition, the information about each student needs to be securely collected and managed in a systematic framework. The learner data encompasses educational and social experiences in KNOU (see Figure 2).

[Figure 2] KNOU data management system

ICTs are pivotal in innovating learner support of KNOU. The master plan indicates the use of cloud technologies to facilitate students' collaboration with instructors and peers. The TF/T also proposed Information Strategy Planning (ISP) in order for ICTs to be fully integrated into the learner support system. ISP refers to an overall planning of organizational information by means of recognizing the entire situation of technological use and posing

relevant objectives to promote collaboration in KNOU. ISP is a core factor for an organization to achieve sustainable development.

The TF/T also envisioned to extend smart classrooms for face-to-face class sessions. KNOU's regional campuses need to be equipped with up-to-date electronic teaching desks and smart blackboards. To check the attendance of students, NFC (Near Field Communication) technology is proposed to be installed in each classroom of the regional campuses. Once the NFC system is installed, students can use their smart phones for attendance checking, which should save a great deal of time and effort exerted by instructors and staff members.

4. Establishment of S-Learning Environment

The last theme is establishment of the s-learning environment for smart campus. In the master plan, the s-learning environment includes, if not exclusively, the learner-centered s-learning platform, adaptive learning materials and the use of smart ICT devices.

The learner-centered s-learning platform features openness and flexibility of learning. In this platform, students are easier to use any devices to access a customized service. In addition, it is more affordable for students to approach external resources through which they can advance their knowledge by active learning. The master plan indicates the necessity of incorporating the N-screen technology into the KNOU's learning platform. N-screen refers to 'Network Screen' or 'Numbers Screen' by which users can consume a single content in multiple devices. It enables students to seamlessly continue their learning regardless of whatever devices they use. The master plan points out several technical conditions in which N-screen should be realized.

- Cloud service: N-screen requires mass storage and unlimited connectivity on any devices.
- High-speed network: N-screen requires the high-speed network by which streaming is possible without any connection issues.

- Security and standardization: N–screen requires an appropriate security system that controls authority of users. It also requires a standardized online environment so that users can have consistent experience regardless of devices used.

Alongside those ICT elements, a smart campus provides students with customized education contents that facilitate adaptive learning. This can be supported by developing a learning road map that involves specific learning models and strategy scenarios. The master plan clarifies that a timely monitoring and attendant interventions for learner support can maximize the effect in a systematic learning road map.

V. Conclusion and Limitations

Alongside the development of ICTs, the learning activities has evolved in higher education (Liu et al., 2014). This study investigates the process and the outcomes of KNOU's Smart Campus TF/T. The KNOU case illuminates how an open and distance higher education institution adopts and adapts s–learning to establish a smart campus by effectively applying new ICTs to their current systems. The case underscores technological innovation which enables students to have adaptive learning experiences.

Besides this case shows how the smart campus technology opens the doors for researchers to investigate and promote the university's services using innovative solutions. The adoption of such technology leads to convergence of educational programs in distance higher education into digital form. In sum, a smart campus not only improves the quality of learning experienced by students in distance higher education but also enhances the efficiency of educational systems in distance higher education.

A university campus is essentially a social environment where lots of social interactions occur. To facilitate convenience and effectiveness to distance education and improve social interactions, this study suggests that it is necessary to manage learners' data in an effective way on smart campus. The smart campus environment can boost management and

customization of broad information about learners in a systematic manner. Furthermore, an integrated environment of smart campus can make all kinds of application service system more handy for faculty, staff, and distance learners. The smart campus is an open, innovative, and collaborative platform wherein every university members can participate in their missions in a more active and competent way through efficient transmission of information (Yang, Li, Ren, Liu, Han, & Liu, 2018).

All in all, the KNOU case represents the major role of smart campus which is to provide dynamic services that meet the needs of learners using ICTs. This case implicates what to consider in transforming into a smart campus. Since each institution has its unique social and technological circumstances, the results of this study should not be generalized as the panacea for other higher education institutions pursuing smart campus. Nonetheless, the ideas elaborated with the case can help use understand the keys to realizing smart campus.

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요약

원격고등교육을 위한 스마트캠퍼스 구축 사례연구

주경필 (한국방송통신대학교)

   정보통신기술의 발달과 함께 국립 한국방송통신대학교는 기술 혁신을 위한 자체 "스마트캠퍼스 구축 TF팀"을 구성하였다. 이 TF팀은 스마트캠퍼스 구축을 위한 몇 가지 상세한 부분에 대한 계획을 세우고 원격고등교육기관으로서 한국방송통신대학교가 급속히 변화하는 환경에 부합하기 위한 마스터플랜을 개발하였다. 이 논문은 한국방송통신대학교가 외부 수요에 대응하여 스마트캠퍼스 설계를 위해 어떻게 마스터플랜을 세웠는지에 관한 구체적인 내용을 담고 있다. 질적 사례연구방법을 활용하여 이 연구에서는 TF팀이 수행한 절차와 결과를 기술하였다. 결과적으로 TF팀은 한 개의 비전, 세 개의 목표, 네 개의 주요 과제를 대학이 스마트캠퍼스로 변화하기 위한 방향으로 마스터플랜에 포함시켜야 할 내용으로서 도출하였다. 한국방송통신대학교의 사례는 원격고등교육 기관이 효과적으로 새로운 정보통신기술을 적용하여 스마트학습의 개념을 고려해야 하는 방식에 대해서 조명한 것으로, 다른 원격고등교육 기관의 기술혁신을 위한 기초자료가 될 수 있을 것이다.

[주제어] 모바일학습, 유비쿼터스학습, 스마트학습, 스마트캠퍼스, 개방대학, 원격고등교육