

# u-Learning System based on Memory Theories in Ubiquitous

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*Abstract:* - In this paper, we suggest a design of learning system to learn effectively in the ubiquitous environment. Today, U-learning system merely strengthens a part of mobile at e-learning system and it is in the first stage. Although using learner's learning information, it can't provide learners with the service that is suit for their situation and learning ability based on learner's modeling. Thus, in this study, we intend to suggest the learning system that provides service pushing proper contents according to learner's situation based on learner's modeling. Especially, we want to suggest the push service learning system that is being treated importantly in the current learning based on memory Theories, not providing contents simply. This design of system will be a basic study to construct a learning system in the ubiquitous environment. And particularly, the system related to memory Theories will contribute to effective learning.

*Key-Words:* - **u-learning, u-system, u-learning system, memory theory**

## 1 Introduction

The current on-line learning environment has a form mixed e-learning with m-learning. Partly, it is tending to approach u-learning early environment. According to the ubiquitous service stage presented by Nomura laboratory in 2003, the current stage can be seen as u-communication service, which is a first stage of ubiquitous [11]. Many countries including U.S.A. are attempting 1 to 1 Pc learning or U-learning through the mobile learning. For example, Singapore is progressing Backpack.net project. Also, in England, the construction of future classroom is being operated and in U.S.A., studies on the future learning group of MIT and the future school of Microsoft are being done[12][13]. And Korea appoints nationally from elementary to middle and high schools to the research school and it is progressing a variety of researches [14]. Even if the learning environment is developing like that, the system used in the learning environment hasn't been built to perfect form so far. Various learners' information is stored in the server, but the service that only utilizes a part of a lot of data can be provided. For example, the current u-learning system merely checks up learner's rate of progress, provides contents according to it, saves and provides the

learning result according to test. In addition, the e-learning system that learning theories or methods for effective memory are applied wasn't built. In this situation, the u-learning system doesn't have proper form and can't provide the system suited for the u-learning environment. In fact, these problems are appearing during the process of u-learning research school in Korea. As the preparatory research, we interviewed teachers of the U-learning research school and they caught up problems as follows.

- The contents of LMS system are poorly.
- The management of learning suited for learners isn't being operating.
- There isn't a function that utilizes learner's learning information.

Therefore, in this paper, we analyze the problem of current e-learning system and early u-learning system. According to that result, we suggest the effective u-learning system, which is based on memory theories to help a learner with learning practically, otherwise the existing system. In chapter 2, we analyze a study on the U-learning and memory theories and in chapter 3, develop the structure of

system based on that and seek the applying method of memory theories. In chapter 4, we show how the service progress, and in chapter 5, the present learning scenario of system suggested. In final chapter, we offer the conclusion and proposal.

## 2 Backgrounds

### 2.1 u-Learning

The u-learning refers to learning that is operated in the Ubiquitous environment, and the environment that can learn with some device whenever and wherever. *School 2.0* is a brainstorming tool designed to help schools, districts and communities develop a common education vision for the future and to explore how that vision can be supported by technology. *School 2.0* provides a "big picture" perspective that allows for a common point of entry so that all community stakeholders can participate in this important conversation. While *School 2.0* depicts a variety of educational and management scenarios that utilize technology, the examples, information and ideas included are designed to serve as prompts for discussion and should not be construed as a recommendation of any particular technology or scenario[13].

U.S.A. conducted the study on "digital school 2006". when operating 1:1 computing or Ubiquitous skill, we offered the idea to understand given situation definitely, so that officials participating administration understand the point factors and limited factors in the process of drawing up of a policy or operating and check up them [7]. In this study, though a variety of views were suggested, the part of U-learning system wasn't referred to in detail.

In 2006, the education district of Philadelphia operated the future school project linked with Microsoft as cooperation project. In this project, the part about the construction of classroom, the teaching of I&C skill and the applying to learning were presented. But the contents of detail system weren't.

In the Harvard University of U.S.A., researchers offered various consequences during HDUL project, researched the learning styles, the future trends, learning and teaching with handheld device based on plenty of data that appears by using wireless device especially [2][3].

In Singapore's vision 2015, we will still have learners, teachers, schools, libraries and books. But they will learn and teach in different ways, interact in more diverse and interactive ways, forge partnerships

and collaborations across borders, and create new models of pedagogy. Such as, One-to-One Computing, Wireless Campus, Learners on the Move, Learning at home[5].

England operated the 30 pilot projects in the 12 local institutes related to education as the future school project

These projects focus on making the learning environment that reforms and aims at the future to collect the idea on the design factors of future school.[15].

Like this, although many parts of the u-learning are being attempted, the study on learning system that is practical and strong in the aspect hardware or interaction is insufficient.

### 2.2 Memory Theories

The psychological study on memory is widely divided into Ebbinghaus's and Bartlett's tradition. Ebbinghaus wanted to research pure combination process regardless of the existing Knowledge [4].

And Bartlett regarded the memory as indivisibility with knowledge and wanted to research the effect that the existing knowledge influences on the memory.

Ebbinghaus measured how long it takes to learn at the level that can memorize the meaningless spelling list in the correct order.

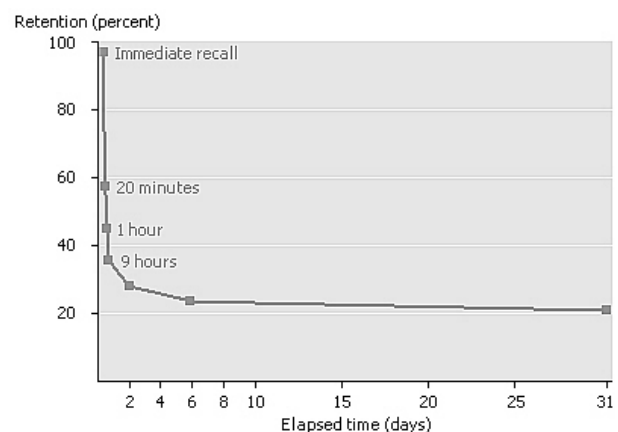


Fig 1. The Forgetting Curve

In this situation, the focus lies on how faster re-learning is operated than the existing learning. In fact, what re-learning shortens that of the existing is referred to the amount of saving. It is a famous forgetting curve, which presents to percentage. We suggest the system that transmits the learning key-word to a learner's device after 20 minutes, 1 hour, 9 hours, according to this forgetting curve.

As another method, we also suggest the system that transmits learning key-word according to the multiple memory theories, which see a basic structure of memory system as a lot of storehouses of memory. First of all, according to the result of study by Miller, chunking makes key-word limited from 5 to 9 [9]. Also according to Goldden and Baddeley’s study [6], because learners have a good memory when going to the environment that is same to the learning environment, we suggest the design of learning system that can provide push service in the environment suited for key-word not only in the environment of classroom but also in that of real world by relating the learning subject.

Finally, applying the interval effect - it is effective to repeat through the time interval, when the information is offered again and again – studied by Melton, Shulman(1970) and Bahrick(1993), we suggest the design of system that pushes learning key-word at 8 weeks intervals [1][8].

### 2.3 Case of u-Learning in Korea

The current u-learning focuses on a part of hardware and the study on a learning system is insufficient.

When seeing the situation of U-learning research school in Korea, the LMS system used commonly in the school is equipped. However, because it provides merely the management of menu, the process of education, attending a lecture and users, and aid about the management of learning and the function of system monitoring, the system that supports memory of learning contents isn’t equipped.



Fig 2. LMS system for u-Learning in Korea

Previously this study, we interviewed teachers in charge of 20 research schools. They said that they want the service that can provide good contents and manage conveniently learning information in many ways. Also, they wanted the system to speed up, and especially, needed to the structure all-around the system. That is, they emphasized necessity of system that provides effective and practical learning as the system suggested in this paper.

## 3 Design of u-Learning Systems

### 3.1 Overview of u-Learning System

The structure of U-learning system is like Fig 3.

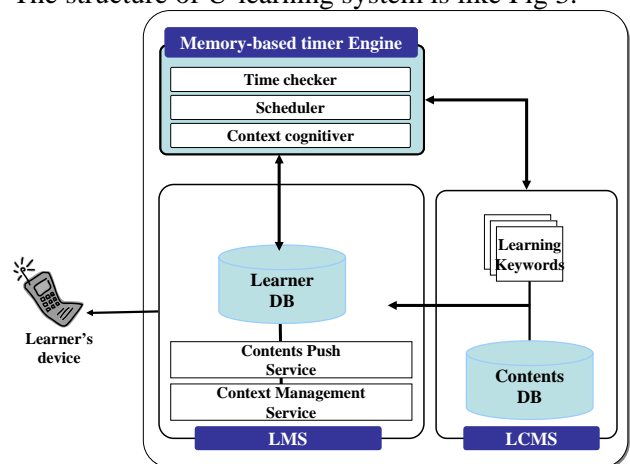


Fig 3. The Design of u-Learning System

The system is divided into 3 parts broadly.

First, memory-based timer Engine, as seen already, checks the time and pushes learning key-word into the learner’s mobile device in the proper time to push learning key-word based on his or her learning information. Second, LMS stores his or her learning information and charges the management throughout learning, if it provides the service that stores learning contents and time when learning, brings learning key-word contents suited for learning contents from LCMS according to the requirement of memory-based timer engine and pushes them into the learner’s learning mobile device.

Also, when the device that notices the position and situation of learner requires the learner’s contents in the LMS, the system estimates the accord with learning contents and pushes them into the learner by selecting learning key-word. Finally, LCMS is the space that is stored learning contents. In this, there are not only contents that contain learning contents but also contents that are made into learning key-word by summarizing learning contents.

When LMS requires the contents suited for the situation or time of learner, it researches and sends them into LMS and LMS pushes them into the learner.

### 3.2 Memory Engine

The detail of memory engine is like Fig 4.

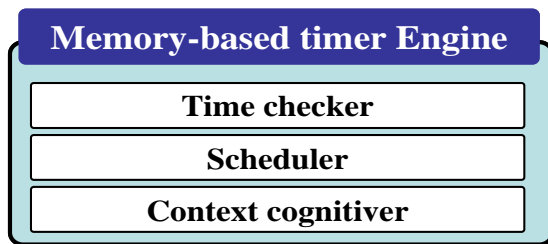


Fig 4. Memory-based Timer Engine

Memory engine is divided in 3part broadly. First, Time Checker records the finish time of learning in addition to contents of that. After 20 minutes, 1 hour, 9 hours from the finish time of learning, , it informs LMS to push key-word by summarizing the contents of learning. Also, after 9 hours, it informs LMS to push the same learning key-word again and again at 8 weeks intervals. It is based on Ebbinghaus and Bahrick’s study.

Because the learning contents aren’t only one, Scheduler helps offering learning key-word by scheduling not to mix various contents of learning.

In general, though LMS system also schedules, scheduler of memory engines only charges a call of learning key-word from the finish time of learning.

Context cognitive module is related to context management service of LMS and sends the learner’s information to LMS system by the device noticing the learner in the place. LMS researches the learner’s learning information and calls out context cognitive module and it selects contents suited for the situation of learner and contents of learning and requires them to LCMS. And then, it finds out the key-word of contents and pushes them into the learner through LMS.

As Goldden and Baddeley’s study, this flow applies the theory that the contents of learning suited for the situation of learner can be better remembered.

## 4 Memory Flow

### 4.1 Memory Flow

If the flow of memory is presented as a diagram, it is like following Figure 5. When a teacher or researchers

makes contents, they will put metadata in it and register from 5 to 9 main key-words about the contents. And then, students will connect with learning system and attend a lecture or will learn by listening teacher’s lecture, In this point, the contents of learning will be stored in the short-term memory or the long-term one.

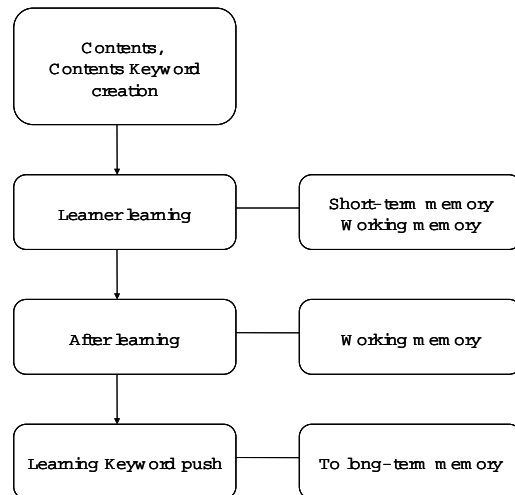


Fig 5. Memory flow

When a learner finishes learning, after 20 minutes, 1 hour, 9 hours, key-word about the contents of learning will be transmitted into the learner’s mobile device and he or she can see or listen it. At this time, the method providing learning key-word is divided into 3 types.

- As the method that decreases load of the learner’s mobile device, learning key-word is only as text.
- According to theory that if the sights and sounds of stimulation are offered at once, learners will have better memory, sound file reading key-word in addition to text is provided.
- Although it can be a burden to learner’s mobile device, because the current no-wire network can transmit the movie and improve in the future, it will offer the key-word made by multimedia.

A learner can remember the learning key-word by constant stimulation and the contents of learning can be changed from short-term memory to long-term one through this flow.

### 4.2 Applying to u-Learning Environment

Though this system is fit for the current e-learning environment, it is fit for the u-learning environment the better. The system provides learning key-word according to the flow of time. But it was also designed

to utilize in the Ubiquitous environment by effective method. When Ubiquitous environment arrives, learners will use around-embedded device that notices learners wherever to go. The communication is operated through learner's LMS system, which transmits the proper learning key-word by researching learning contents based on the situation of learner. In the far future, the contents of learning will be saved through the chip or sensor equipped in the human body without this part.

But, now, and until establishing the Ubiquitous environment, the structure of system suggested in this paper is needed. The system will lead learning effectively. Therefore, this system can seek the applying possibility in the Ubiquitous environment as follows.

- By providing the contents of learning suited for the situation of learner, increases the learning effect.
- Regardless of whenever to go, by transmitting the learning key-word according to time required the stimulation of learning key-word, learners can have the best memory of the contents of learning.
- It will change the existing learning method that has carried out the mainstream until now, and contribute to building new learning model suited for the Ubiquitous environment.
- It will overcome the limit point that a teacher can't give many students the feed back and will lead many students to learn by stimulating properly through the system.

## 5 u-Learning Scenario based Memory Theory

Schwartz claims that using scenarios is rehearsing the future. It is useful for overcome analytic method in these days [10]. Also, it is useful for estimate forthcoming future. In this paper, because there is no complete ubiquitous learning environment until today, it is impossible that this system applied. Therefore we groped the possibility of this system.

In this paper, we assume the situation about higher education and describe the scenario for the situation with this system.

An instructor makes the material of lecture. In the process registered the lecture material made by them into LMS system, the core key-word among the contents of lecture is input together.

It is limited to 5 to 9 key-words according to the chunking theory.

An instructor gives face-to-face lecture to learners with registered materials. In this part, a remote-education can be operated not face-to face, when the lecture finishes, immediately an instructor will transmit the number of participant and finishing situation. The learners' names will be noticed right away when they enter classroom and the instructor will check it up in the classroom system. And then, when he or she pushes the finishing button, the time will be transmitted to LMS and begin the management learners' information related to memory timer engine.

If that is operated with a remote-education from the point learner finish learning, LMS system will begin the management.

LMS system, by connecting memory timer engine, after 20minutes, 1hour, 9hours from the finish of learning, pushes key-words into each learner's mobile device. The learners watch or listen to them, so the contents of learning can be changed from short-term memory to long-term one.

The long-term memory will be transmitted to the learner's device once more at 8weeks intervals not to forget them by offering constant stimulation. If the learner has another lecture after 20minutes from finishing time, it will transmit key-word according to 20minutes and hold 1hour and 9hours.

That is, the part of operating actively according to the learner's schedule is undertaken by scheduler of memory timer engine. Also scheduler manages the finish time of each lecture, controls the transmitting time and assigns proper time. What's more, if the learner goes to the same environment with the contents of learning, the around - device noticing the learner will transmit his or her information into LMS system. Because LMS system transmits learning key-words suited for the situation of learner by connecting the context cognitive of memory timer engine, it stimulates the contents of learning naturally.

Until now, when learning, the learners himself or herself try to memorize the contents of learning.

But, by utilizing this system, learners can have the effect that memorizes naturally by the stimulation of system.

In other words, the effort of learners can be declined and the learning effect can be maximized.

## 6 Conclusions

In this study, we suggested the u-learning system based on the memory Theories and sought the applying possibility of it. First, we considered the international progressing situation of the u-learning

and sought the method to construct the system. Also, considering the method suited for the U-learning environment among the memory Theories, we applied the Ebbinghaus, Chunking method and the interval effect to this system. Before designing this system, we interviewed teachers participating in the u-learning research schools in Korea and designed it by studying a remedy. Finally, we sought the method that this system was applied to the U-learning and according to it, suggested the learning scenario. Because the system was constructed based on the memory Theories, it will be very effective and practical when a learner memorizes learning contents. Also, it will be an essential basic study to build the learning system in the u-learning environment. What's more, our team is planning to embody, apply the system into the real field and present the conclusion of applying the system soon.

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