Assist Your Study at Home: Design, Implementation and Evaluation of the ULS System

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Abstract

With the great progress of technologies, computers are embedded into everywhere to make our daily life convenient, efficient and comfortable. Further more, most of them are small, powerful, intelligent and invisible. In a ubiquitous computing environment, support methods for learning are more effective than some traditional ways, such as WBT (Web-Based Training) and e-learning. In this paper, we proposed a support method which aims to encourage a learner to acquire his/her learning habit based on Behavior Analysis. The supports to the learner are provided through a scheduler system, a Ubiquitous Learning Scheduler (ULS). In our design, the learner's situations are collected by sensors and analyzed by comparing them to his/her learning histories. Based on this information, supports are provided to the learner in order to help him/her forming a good learning style. Our Research results revealed that ULS not only benefited learners to acquire their learning habits but also improved their self-directed learning styles.

1. Introduction

The world ubiquitous [11] means an interface, an environment, and a technology that can provide all benefits anywhere and any time without you are aware of what it is, and the ubiquitous computing [12] is the term which is a concept to let computer exist everywhere in the real world. Ubiquitous devices such as RFID, sensor, camera, T-engine, and wearable computer have a rapid progress in recent years. Ubiquitous technologies have begun to play important roles at everywhere and at any time in our daily life [18], [19], [20]. Services required for a user can be provided without demanding intentionally. This trend is also making a big influence even on the e-learning field.

So far, many researches have been done on Web-based learning support systems. For example, some Web-based CAI System for educational using in some universities [1], [2], [16] a system for teacher-learners' interaction in learner oriented education [3] and so on had succeeded in the field. Some universities have already offered real e-learning programs for students [13], [14]. However, a learner's learning time is more abundant in the real world than in the cyber space, and learning support which based on individual situation is insufficient only with WBT and E-learning. At the same time, since the number of hours of classes at school has been reduced in Japan (Yutori Kyoiku [12]), self-learning has become more important than before for students. However, some researches show that it is difficult for almost all learners to adopt a self-directed learning style and few of learners can effectively follow a self-planned schedule [4]. Therefore, support in the real world is necessary for learners to manage a learning schedule to study naturally and actively with a self-learning style. Fortunately, with the rapid development of embedded technology, wireless networks, and individual detecting technology, these ubiquitous technologies have become widely used in education field. Unlike a traditional learning support style, the technologies make it possible to support a learner anytime and anywhere kindly, flexibly, and appropriately. Moreover, it comes to be able to provide the support more individually through analyzing the context information (e.g. location, time, actions, and so on) which can be acquired in the ubiquitous environment.

The purpose of this paper is to provide a method which can support managing of a learning schedule at home. We designed a Ubiquitous Learning Scheduler (ULS) to meet this goal. The Scheduler can analyze the learner's situation and give advice to the learner based on Behavior Analysis [8]. By using our scheduler, the learner can acquire a self-planning learning habit.

The remainder of this paper is structured as follows: In Section 2, we discuss some related works. A model of a ubiquitous learning environment is shown and problems are formally defined in Section 3. After giving the details design of ULS in Section 4, implementation of ULS is described and the result of the system is shown with an experiment in Section 5. Finally, we have conclusion in Section 6.

2. Related Work

There are many works which have been done in the ubiquitous learning area. [5] emphasized the management of a learning schedule. Srelaysoft Y-A10 + Learning Schedule is a software as a commercial product of learning support. However, grasping learning situations automatically as same as a present learning style is not enough in the system. Therefore, it is solely depending on a learner whether he/she can study according to a schedule. There is no enough support for motivating the learner. Enlight-Pen is a research on motivating a learner to carry on the self-paced learning in real time [6]. It can solve the problem we mentioned above in [5]. However, the following problems are still remained. The system is not enough to motivate a learner based on detail learning situations; learning time, subject, and so forth. A ubiquitous framework is proposed in [7]. The system has RFID embedded in objects and using it to gather the context information. The proposed idea is good, but it has a little bit luck about considering learners' behavior and learning habits. A real world based support desk [17] has been developed. The assumption in that system is a desk is connected between schools by the internet, and it can send pictures and sounds in real time. Also, it has cooperative spaces to share information with remote places. However, this approach required much expensive equipment and did not take a consideration about suitable personal support. A Mentoring System based on Learning Log Data is developed in [21]. It consider about learner's log data and feedback of learning process. However, the system is a web-based system and ubiquitous learning system has not been proposed. As our group's previous work, Ubiquitous Desk [22] is proposed. The aim of the U-Desk is to grasp the learner's situation accurately. The information of learner's study is gathered by using microware sensors and RF-IDs. U-Desk has two regions to detect the learner's condition. One is the active region and another is passive region. In the active region, objects (textbook, pen, notebook, etc.) are not influenced by the learner. On the other hand, objects have a relationship with learner's existence information. U-Desk is used in our research to catch the learner's situation.

3. The model and problems

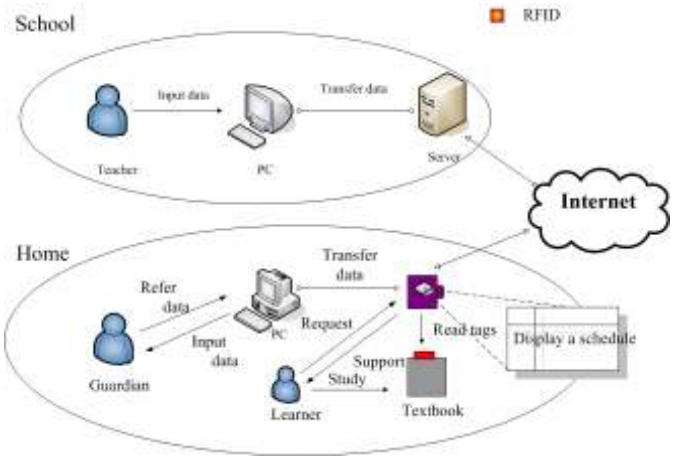

Figure 1. The whole model

Figure 1. shows a whole model of a ubiquitous learning environment. The system to manage a learning schedule is embedded in U-Desk [22]. In the future, it will be possible to embed the system in a portable device like a cellular phone. As a result, a learner will be able to study without choosing a place.

In Figure 1., there are two environments. One is a school area. In this area, a teacher inputs a learner's data, test record, course grade, and so forth. This information is transferred to the learner's desk in his/her home through the Internet. The other is a home area. In this area, a guardian inputs data based on his/her demands. This information is also transferred to the U-Desk. When the learner starts to study several textbooks, his/her learning situation is collected by reading RFID tags attached to textbooks with an RFID-reader on the desk. Based on combination of teacher's data, parent's demand, and learner's situation, a learning schedule is made by the system. A learning schedule chart is displayed on the desk. The learner follows the chart. The chart changes immediately and supports flexibly. The guardian also can see the chart to perceive the learner's state of achievement.

In this paper, we are focusing on the home area, especially learners' self-learning at home. We assume a learning environment is with the condition as same as Figure 1. To achieve the goal, we have the following problems to be solved:

1) How to display an attractive schedule chart to motivate the learner?
2) How to give a support based on Behavior Analysis?
3) When to give a support?
4) How to avoid failure during learning?

In order to solve the above problems, at first, a method which can manage a learning schedule is proposed. Its feature is to manage a learning schedule based on combination of the teacher's needs, the parent's needs, and learner's situation. Its advantage is that the learner can determine what to study at the present time immediately. Secondly, the ULS is implemented based on behavior analyzing method. Because behavioral psychology can offer students more modern and empirically defensible theories to explain the details of everyday life than can the other psychological theories [9].The function of the ULS is to use different colors to advise the learner subjects whether to study or not.

4. Ubiquitous Learning Scheduler (ULS)

4.1 Basic ideas

This paper proposes a system called Ubiquitous Learning Scheduler (ULS) to support learner managing their learning schedule. The ULS is implemented with a managing learning schedule method. It analyses learning situations of the learner and gives advices to the leaner. This method solves the problems we mentioned above. Its details are described in following sections.

4.2 How to display a learning schedule chart.

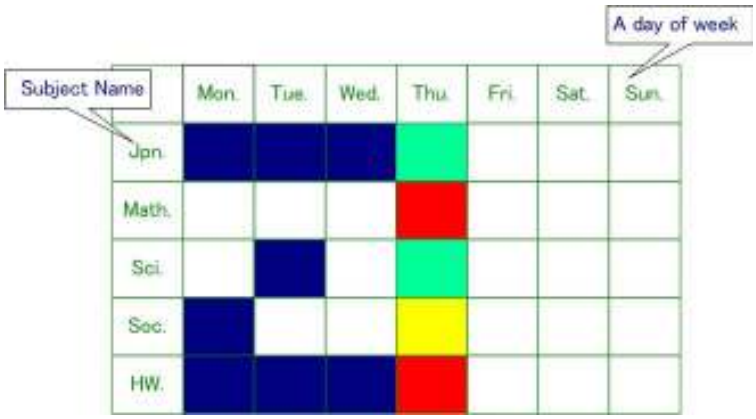

Figure 2. A scheduling chart

Figure 2. shows how to display a learning schedule chart in the ULS. Its rows indicate names of subjects and its columns indicate days of the week. For instance, a learner studies Japanese on Monday at a grid where Jpn. intersects with Mon. The ULS uses several colors to advise the learner. The learner can customize the colors as he/she like. Grids' colors shown in Figure 2. is an example of the scheduling chart. Each color of grids means as follows.

• Navy blue: The learning subject has been already finished.

• Red: The subject is in an insufficient learning state at the time or the learner has to study the subject as soon as possible at the time.

• Yellow: The subject is in a slightly insufficient learning state at the time.

• Green: The subject is in a sufficient learning state at the time.

As identified above, red grids have the highest learning priority. Therefore, a learner is recommended to study subjects in an ideal order: red→yellow→green.

The indications consider that accomplishments lead to motivations. There are two points. One is that a learner can find out which subjects are necessary to study timely whenever he/she looks at the chart. If a learning target is set specifically, it becomes easy to judge whether it has been achieved. The other is that the learner can grasp at a glance how much he/she has finished learning. It is important for motivating the learner to know attainment of goals accurately.

4.3 Basic support

Basically, the ULS gives a learner supports when he/she is not studying in an ideal order. For example, when the learner tries to study a subject at a green grid though his/her chart has some red grids, the ULS gives a message such as "Please start to study XXX before YYY", where XXX is a subject name at a red grid and YYY is the subject name at the green one.

4.4 Supports to avoid failure during learning.

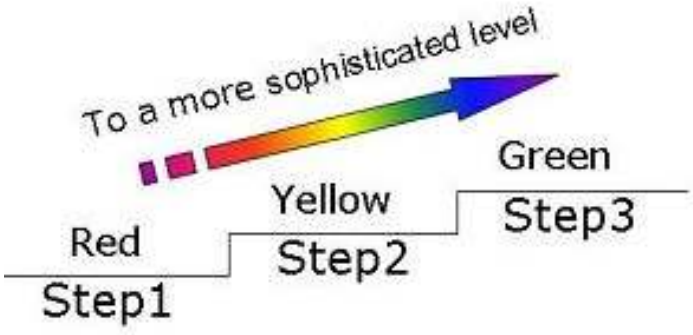

Figure 3. Model of Shaping

The ULS also aims to lead the learner to a more sophisticated learning style than his/her initial condition. To solve this problem, we used the Shaping principle in Behavior Analysis [9]. When differential reinforcement and response generalization are repeated over and over, behavior can be "shaped" far from its original form [9]. Shaping is a process by which learning incentive is changed in several steps from their initial level to a more sophisticated level [9]. Each step results from the application of a new and higher criterion for differential reinforcement [9]. Each step produces both response differentiation and response generalization [9]. This principle also makes sense in the learning behavior. By referring to Figure 3., this paper considers red grids as step 1, yellow ones as step 2, and green ones as step 3. Step 1 is the lowest level. The ULS gives the learner different compliments based on learning time according to each color. Learning time depends on a learner's situation. How to decide the learning time is elaborated in Section 4.5. Table 1 shows an example of that. Learning time of yellow and green are based on average of elementary students' learning time in home in Japan [4].

Table 1. Example of complements and learning time

	Red	Yellow	Green
Compliment Examples	Good! You've challenged this subject.	Quite good! You've done basic study for this subject.	Excellent! You've studied this subject quite enough.
Learning Time (Objective Time)	Regard-less of time	More than 10 min.	More than 20 min.

4.5 Design of the system

Figure 4. shows a flow chart of the system in this research. A teacher and a guardian register each demand for a learner into each database, a *Teacher's Demand DB* and a *Guardian's Demand DB*. The demands indicate which subject the learner should have

emphasis on. Each database consists of learning priorities and subject names. On the other hand, the learner begins to study with some educational materials. At the same time, the ULS collects his/her learning situations and puts them into a *Learning Record DB*. The database consists of date, learning time, and subject names. By comparing and analyzing the information of three databases, the ULS makes a scheduling chart such as Figure 2. and always displays it in learning. The learner pursues its learning schedule. The ULS gives him/her supports, depending on learning situations. The guardian can grasp the learner's progress situation of the schedule by the ULS supports.

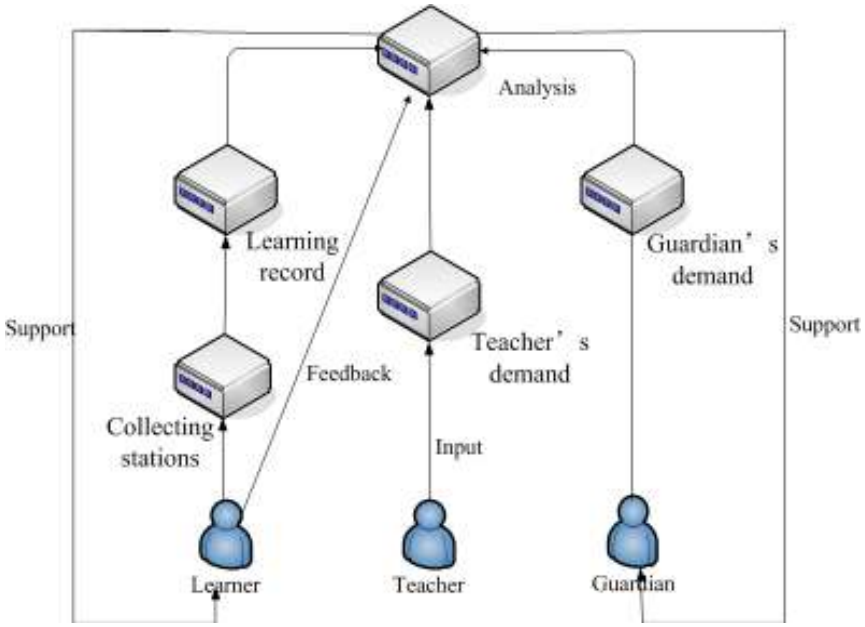

Figure 4. Flow chart of the ULS

4.6 How to decide a grid's color

Each grid's color is decided with calculating Color Value (CV). We configure the following formula for determining CV.

$$CV = CV0 * LAD + SAD$$

Each notation means as follows.

$$CV[-2 \leq CV \leq 4] : Color\ Value$$

CV decides a color of current grid and has some ranges for three colors such as red, yellow, and green. The green range is from -2 to 0, the yellow one is from 0 to 2, and the red one is from 2 to 4. Also, the value small than -2 will be considered as green and bigger than 4 will be considered as red respectively. For example, when CV equals to 0.5, the color is yellow. These ranges are not relative to RGB code and are assumed to be set by the teacher in this paper.

$$CV0[0 \leq CV0 \leq 1] : \textit{Initial Color Value}$$

CV0 is decided with combination of the teacher's demand and the guardian's one. At first, the teacher and the guardian respectively input priority of subjects which they want the learner to self-study. Priority is represented by a value from 1 to 5. 5 is the highest priority and 1 is the lowest one. ULS converts each priority into CV0. CV0 is calculated by the following equation.

$$CV0 = (TP + GP) * 0.1 \quad (1)$$

- TP: Teacher's Priority
- GP: Guardian's Priority

For an example, in Table 2, Math ranks the value as 2 by the teacher and the 4 by the guardian. Therefore the sum of their priority equals to 6 and CV0 is decided as 0.6.

Table 2. An example of relationship between ranks and CV0

	Jpn.	Math.	Sci.	Soc.	HW.
Teacher	5	2	3	4	1
Guardian	5	4	2	3	1
Sum.	10	6	5	7	2
CV0	1.0	0.6	0.5	0.7	0.2

The learner's situation also affects CV. We express it as Long-term Achievement Degree (LAD) and Short-term Achievement Degree (SAD). Both of their values are fixed at the end of a last studying day.

$$LAD[0 \leq LAD \leq 100] : \textit{Long-term Achievement Degree}$$

LAD indicates how much the learner has been able to accomplish a goal of a subject for a long term. In this paper, this goal is to acquire his/her learning habit. The default value is 100 percent. We assume that the learner has achieved his/her goal when all grids are green. Then, the LAD value equals to 100 percent. For example, if the number of green grids is 12 where the number of all grids of a subject is 15 at current time, the LAD value equals to 80 percent. The term period is assumed to be set by a teacher. For instance, the term is a week, a month, or anything. LAD values are initialized when the term is over.

$$SAD[-1 \leq SAD \leq 1] : \textit{Short-term Achievement Degree}$$

SAD indicates how much the learner has been able to accomplish a goal of a subject for a short term. In this paper, this goal is to study a subject for objective time of a day. The default value is 0. SAD has particular three values, -1, 0, and 1. These values means as follows.

- 1: The learner has studied for no time.
- 0: The learner has studied for less than objective time.
- -1: The learner has studied for more than objective time.

Objective time depends on a grid's color. This idea is based on Section 4.4. For example, objective time is 10 minutes for red grids, 20 minutes for yellow ones, and 30 minutes for green ones. At a subject on a red grid, we assume that a learner is not willing to study it. Therefore, to compliment studying is important, even if the learner studies for only a fraction of the time. That is why objective time of red grids is less than one of others. If the learner takes 10 minutes to study a subject on a yellow grid, the SAD value equals to 0. In this paper, objective time is initialized by the teacher based on the learner's ability. Since the learner starts to use the ULS, the ULS automatically has set objective time. The ULS analyzes average learning time of the learner, and decides it as objective time for yellow grids. The ULS also analyzes minimum learning time and maximum one, and decides each them as objective time for red grids and green ones. Therefore, the objective time is flexibly changed with the learner's current ability.

Sometimes there are some relationships between the subjects. If the learner studies the subjects in a meaningful order, it will result a better understanding. Otherwise, the learning efficiency is down. For example, classical literature (Ancient writings or Chinese writing) witch is told in traditional Japanese class might require some pre-knowledge about the history to help learner understanding the contents and meaning well. In this case, it is clear that the priority of study the subject History is higher than the subject Japanese. Also, it is a common sense that rudimentary mathematics might be a prerequisites course before science study. Considering this characteristics, we also proposed a formula to improve the system,

$$CV'_i = CV_i + (\sum_{j=1}^{n} CV_j) * P_i \tag{2}$$

$$\text{Where, } P_i = \frac{X_i}{\sum_{j=1}^{n} X_j}$$

We improve the CV' to apply the shaping principle. P means the priority of each subject. In this paper, we take the teacher's priority into this formula. Because teachers are more familiar with the relationships between each courses than guardian and it should has more weighted to influence the learner.

For example, in Table 3., the teacher set the priorities as (Jpn., Math., Sci., Soc., HW.), (5, 4, 1, 2, 3) respectively.

Table 3. An example of relationship between CV and CV'

	Jpn.	Math.	Sci.	Soc.	HW.
TP	5	4	1	2	3
CV	1.8	1.2	-0.5	0.4	0.8
CV'	3.03	2.18	-0.25	0.89	1.54

Using (2), we can earn the new priority, for example, Jpn. like:

$$CVJpn.' = 1.8 + (1.8 + 1.2 - 0.5 + 0.4 + 0.8) * \frac{5}{(5+4+1+2+3)} = 3.03,$$

$$CVMath.' = 1.2 + (1.8 + 1.2 - 0.5 + 0.4 + 0.8) * \frac{4}{(5+4+1+2+3)} = 2.18,$$

and the same to the other subjects.

5. Implementation and evaluation of the system

5.1 Implementation environment

We implemented ULS based on U-Desk using a laptop PC, which is connected a RFID-READER with RS-232C in this research. We use version 1.01 of DAS-101 of Daiichi Tsushin Kogyo Ltd for RFID-READER and RFID [10]. Programming langrage C# is used to develop the ULS system. We use Microsoft Access for a *Teacher's Demand DB*, a *Guardian's Demand DB*, and a *Learning Record DB*.

In this research, each class has its own textbook with an RFID-tag. The ULS recognizes that a learner is studying a subject of which an RFID is read by the RFID-READER. We assume that as learning time while the RFID-READER reads the RFID.

Figure 5. is a screen capture of ULS in this research. It shows a learning scheduling chart for a student and his/her guardian. Marks indicate that the learning of the subject has been already finished.

Figure 5. Screen shot of ULS

5.2 Evaluation of the system

The purpose of the evaluation is as follows:

1) Could the system provide efficient and effective learning style to the learner?

2) Could the system increase the learner's motivation?

3) Could the system improve self-directed learning habit of the learner?

Through verifying these points, we attempted to find several needs to be improved in this system.

The method of this evaluation is a questionnaire survey. 20 examinees studied five subjects with this system for a few hours. Based on their information such as liked or disliked subjects, Color Value of each subject is initialized. After an examining period, they answered some questionnaires for evaluating this system. Contents of the questionnaires are as follows:

Q1: Did you feel this system makes your motivation increase for self-directed learning?

Q2: Did the system provide suitable visible-supports to you?

Q3: Do you think this system helps you to improve your learning habit at home?

Q4: Did you feel this system was easy to use?

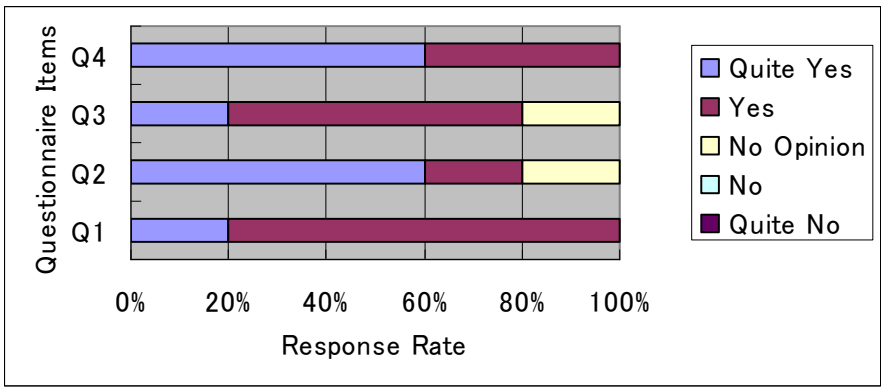

Figure 6. Result of Questionnaire Survey (1)

Figure 6. shows statistical results of questionnaire survey of only using fomula (1). Positive responses, more than 80 percent of "quite yes" and "yes", were obtained from every questionnaire item. However, some comments were provided in regard to supports of this system. For example, "It will be more suitable if the system can support for a particular period such as days near examination." One of this reasons was the system was designed focused on usual learning-style.

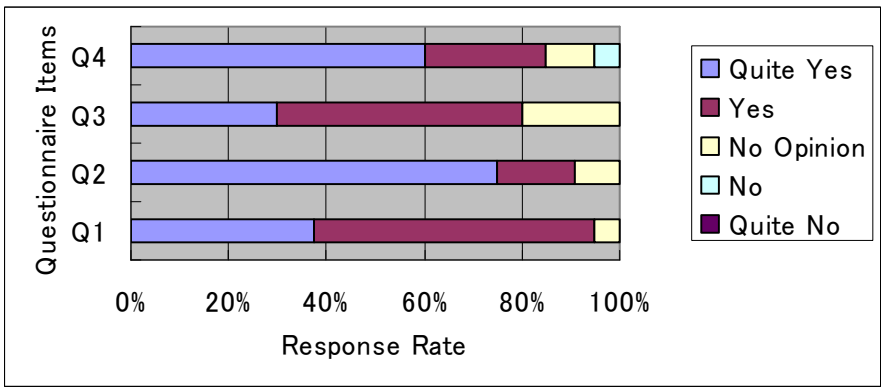

Figure 7. Result of Questionnaire Survey (2)

Figure 7. shows statistical results of questionnaire survey with the formula (2) implemented in the system. We can see there is a progress especially on the answer "Quite Yes" comparing with the result only using formula (1).

6. Conclusion

In this paper, we proposed a support method for self-managing learning scheduler using Behavior Analysis in a ubiquitous environment. Based on our method, the ULS is implemented. The ULS has been evaluated by some examinees. According to the results, the contribution of the ULS may be summarized as follows: the ULS is effective to motivate a learner at his/her home study, and the ULS helps to improve

his/her self-directed learning habit with considering his/her teacher's and his/her guardian's request.

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References

[1] R. Taniguchi, "Development of a Web-based CAI System for Introductory Visual Basic Programming Course", Japanese Society for Information and Systems in Education, 2002, Vol.19 No.2, pp. 106-111.
[2] Y. Fuwa, Y. Nakamura, H. Yamazaki, and S. Oshita, "Improving University Education using a CAI System on the World Wide Web and its Evaluation", Japanese Society for Information and Systems in Education, 2003, Vol.20 No.1, pp. 27-38.
[3] S. Nakamura, K. Sato, M. Fujimori, A. Koyama, and Z. Cheng, "A Support System for Teacher-Learner interaction in Learner-oriented Education", Information Processing Society of Japan, Feb. 2002, Vol.43 No.2, pp.671-682.
[4] Benesse Corporation, "Home Educational Information of Grade-school Pupils," *Benesse Corporation,*Japan*,* 2005.
[5] Srelaysoft, Inc., "Learning Scheduling Software," *Srelaysoft*, Japan, 2002.
[6] S. Yoshihara, K. Tsukada, and M. Yasumura, "The pen for helping learners to carry on the self-paced learning," *Interaction2003,* Japan, Feb 2003, pp. 193-194.
[7] H. Ogata, and Y.Yano, "How Ubiquitous Computing can support language Learning", Proceeding of KEST 2003, Korea, 2003, pp.1-6.
[8] S. Shimamune, *Performance Management: Behavior Analysis for Solving Problems,* 5th ed., Chiba: Yoneda Publisher, Inc., 2000.
[9] J.D. Baldwin and J.I. Baldwin, *Behavior Principles in Everyday Life*, 4th ed., L. Pearson, Ed. New Jersey: Prentice-Hall, Inc., 2001.
[10] Daiichi Tsushin Kogyo Ltd., "Automatic Recognition System," *Daiichi Tsushin Kogyo Ltd.*, 2003. http://zones.co.jp/mezam.html.
[11] M. Weiser, "The Computer for the 21st Century," Scientific Am., pp. 94-104, September, 1991.; reprinted in IEEE Pervasive Computing, pp. 19-25, January-March 2002.
[12] Wikipedia, the free encyclopedia, "http://ja.wikipedia.org/wiki/"
[13] School of Human Sciences, Waseda University.: E-School. "http://e-school.human.waseda.ac.jp/"
[14] Oklahoma State University: Online Courses. "http://oc.okstate.edu/"
[15] Z. Cheng, S. Sun, M. Kansen, T. Huang, A. He, "A Personalized Ubiquitous Education Support Environment by Comparing Learning Instructional Requirement with Learner's Behavior", Proceedings of IEEE 22nd International Conference on Advanced Information Networking and Applications, 2005, pp.567-573
[16] J. Barbosa, R. Hahn, D.N.F Barbosa, C.F.R Geyer, "Mobile and ubiquitous computing in an innovative undergraduate course", In Proc. of 38th SIGCSE technical symposium on Computer science education, pp. 379–383, 2007
[17] J.Yamashita N.Inoue H.Kuzuoka Paul Luff K.Yamazaki, "Development of the desk that supports real-world based remote collaborative learning "THE VIRTUAL REALITY SOCIETY OF JAPAN, Vol. 7, No. 1, CSVC 2002-05, pp. 27-32
[18] M. Satyanarayanan, "Pervasive Computing: Vision and Challenges", IEEE Personal Communication, pp. 10-17, August 2001.

[19] S. R. Ponnekanti, et.al, "Icrafter: A service framework for ubiquitous computing environments", In Proc. of Ubicomp 2001, pp. 56–75, Atlanta, Georgia, October 2001.
[20] V. Stanford, “Using Pervasive Computing to Deliver Elder Care”, IEEE Pervasive Computing, pp.10-13, January-March, 2002.
[21] Xiaofei Liao K.Seki T.Mathui, T.Okamoto, ”Development of the Mentoring System for WBT based on Learning Log Data”, TECHNICAL REPORT OF IEICE, ET2004-28
[22] Tomohiro Hosokawa, “Development of a Ubiquitous Desk for Guessing Learner’s Context with RF-ID and Sensors in a Ubiquitous Learning Environment”, Graduation Thesis, The University of Aizu, 2005

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