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Building a Platform that makes Online Learning "Anti-Ubiquitous"

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ABSTRACT

In this study, we propose a method of building a platform that makes learning contents on the Web "Anti-Ubiquitous"; resolving the problem of halting study that ubiquity causes in web-based learning (WBL) and making WBL more effective and beneficial. The Anti-Ubiquitous concept which is opposite to the ubiquitous learning concept, adds constraints to a location and time. Anti-Ubiquitous learning increases the awareness and concentration level of students and promotes effective and substantive learning. However, it is inefficient for each teacher to create Anti-Ubiquitous learning content from scratch. Therefore, our platform aims to make existing online learning content Anti-Ubiquitous. Currently, because so much high-quality learning content such as Open Course Ware and Massive Open Online Course already exists on the Web, the significance of our approach is immense.

KEYWORDS

Web-based learning, Anti-Ubiquitous learning, Platform, Learning content

1 INTRODUCTION

Although ubiquitous web-based learning (WBL) [1] makes it highly convenient to study whenever, wherever, and by whomever, the ubiquity may lead to eroding the quality of education. This is because it is easy for the priority of learning to drop when there are no limitations. In fact, it is easy for "anytime, anywhere" to become "sometime, somewhere;" as a result, WBL may lead to procrastination about learning activities.

This study aims to establish a method to make learning content on the Web "Anti-Ubiquitous" to resolve the problem of halting study created by the ubiquity of WBL and thus to make WBL more effective and beneficial. Anti-Ubiquitous is a concept we propose that is the opposite of ubiquitous learning; it adds location and time constraints to ubiquitous study. Learning based on the Anti-Ubiquitous concept [2] increases the awareness and concentration level of learners and promotes effective and substantive learning.

However, it is inefficient for each teacher to create Anti-Ubiquitous learning content from scratch. Because there is a lot of high-quality learning content on the Web, it is desirable to realize Anti-Ubiquitous learning using such existing content.

From this viewpoint, we propose a method to make learning content on the Web Anti-Ubiquitous. Concretely speaking, we aim to build a platform for Anti-Ubiquitous learning on the Web and to adopt a way of adding constraints to the learning time and location when students access content through the platform. Because high-quality learning content exists already as Open Course Ware (OCW) [3] and Massive Open Online Course (MOOC) [4], the significance of our approach is immense.

The remainder of this paper is as follows: Section 2 mentions our research background and clarifies the problem that we try to solve. The proposed Anti-Ubiquitous learning concept is also mentioned in this section. Section 3 comprehensively describes our method for making learning content on the Web Anti-Ubiquitous. Section 4 discusses related study. Section 5 concludes this study.

2 RESEARCH BACKGROUND

2.1 Inherent Problem in WBL

Nowadays, there are a lot of high-quality learning sources such as OCW and MOOC on the Web. WBL has spread rapidly all over the world. In fact, hundreds of thousands of students have rushed to free online courses provided by famous MOOC platforms such as Coursera [5] and edX [6].

Such online courses are high quality, and their platforms employ state-of-the-art technologies. For example, they provide a place that functions as a social networking service where students mutually learn from each other. In final exams for the online courses, they try to combat substitute exam takers and identity thieves by analyzing students typing, etc.

However, even if such MOOC platforms have some state-of-the-art technologies, they cannot handle the inherent problem in WBL. i.e., halting study due to the ubiquity. Although WBL is highly convenient (whenever, wherever, and whoever), the ubiquity may lead to halting study. This is because it is easy for the priority of learning to drop when there are no limitations. Since it is easy for "anytime, anywhere" to become "sometime, somewhere," ubiquity may lead to procrastination about learning activities [7].

In fact, from usage data of the learning management system at Okayama University, we had to acknowledge the reality that many students only accessed the learning content in the week before final exams.

2.2 Anti-Ubiquitous Learning

We have proposed Anti-Ubiquitous learning, defined as learning "at a specified time and place" by using information and communication technology to create a virtual space for learners. It is directly opposite from the ubiquitous concept, but the shared foundation is "e-learning." Anti-Ubiquitous learning is not "non-ubiquitous," which does not use e-learning at all, but Anti-Ubiquitous, which is realized by adding restrictions and limitations to ubiquity in e-learning.

Anti-Ubiquitous learning makes it possible for learners to learn only at the time and place they have specified. Therefore, because the learners feel that "we can only study here and now," Anti-Ubiquitous learning increases the awareness and concentration level of students and promotes effective and substantive learning. As a result, the learners develop a self-motivated learning attitude and regular learning habits, because they specify the "learning time and place" themselves and must stick to those strictures.

In Anti-Ubiquitous learning, the most important point is the constraint and/or restriction on a learning time and place. This is because time and location are assumed to occupy an extremely important position in learning. In fact, the times when people are best able to concentrate vary greatly between individuals, depending on lifestyle habits and natural biorhythms. Based on these factors, more effective learning can be anticipated by choosing the time and place of learning carefully.

However, it is difficult to realize Anti-Ubiquitous learning completely because of technical issues such as accuracy of location information. Nevertheless, assuming that there is some degree of correlation to the time and place of learning, it is possible to simulate Anti-Ubiquitous learning by using existing learning management systems (LMSs) in a pseudo way. In practice, we implemented pseudo Anti-Ubiquitous learning in real lectures using WebClass [8] and verified its effectiveness [9]. In particular, we practiced two methods in two classes on the same subject. One class employed pseudo Anti-Ubiquitous learning, and the other used ubiquitous learning. We compared the average test score and duration of study for both classes. On both the score and the duration of study, the class in pseudo Anti-Ubiquitous learning achieved better results than did the class using ubiquitous learning.

Furthermore, we designed and implemented a prototype system for Anti-Ubiquitous learning. The prototype based on the LMS e-learning platform, enables or disables access to learning content depending on the time and location of each learner. Although it was built on the Web, we had to implement learning content from scratch to meet the specification for Anti-Ubiquitous learning. Moreover, there was a fatal problem, i.e., we could not leverage a lot of existing learning content on the Web when using the prototype.

3 ANTI-UBIQUITOUS METHOD

3.1 Basic Policies

Here we consider the research background in Section 2 and aim to establish a method that makes existing online learning content Anti-Ubiquitous. Specifically, for learning content on the Web, we design a mechanism for adding constraints regarding the learning location and time and then implement a prototype system. The basic policies for the prototype are as follows:

1. It does not alter the implementation (HTML, CSS, etc.) of learning contents websites.
2. It does not require any special knowledge and skills to use.
3. It does not require special programs except for web browsers.
4. It does not depend on particular web browsers.

Policies 1 and 2 are prerequisites rather than policies per se. Number 1 also precludes changing the configuration files of websites that have learning content. While number 3 rules out requiring a standalone special program besides a web browser, some cases will require plugins for web browsers. Although we aim to realize number 4 as fully as possible, it is difficult at present. Because not all web browsers implement mechanisms for HTML5 [10], CSS3 [11], and other techniques, it is hard to achieve number 4 completely.

3.2 Difficult Problems

The most difficult problems in implementing Anti-Ubiquitous learning content on the Web are as follows:

- Hiding the URLs of learning content
- Real-time control of learning location and time

In this study, to make learning content on the Web "Anti-Ubiquitous" means to add access restrictions to learning content according to the time and the student's location. However, if we cannot hide the URLs of learning content, the Anti-Ubiquitous effect is cut in half. Needless to say, if URLs are known, students can directly access learning content at any time, from anywhere. To simply hide the address bar of web browsers is inadequate. Currently, for security purposes, many web browsers do not allow the address bar to be hidden.

Using HTTP redirects, it is possible to realize Anti-Ubiquitous learning content without hiding URLs [12]. However, to implement redirects, we need to modify configuration files for websites that contain learning content. Not only is that a violation of basic policy number 1 in Section 3.1, but it is impossible in the real world.

Control over access to learning content is required not only at the start of learning but even during learning. Time keeps progressing, of course, and students may move during their learning. In other words, from the beginning to the end of learning, we have to continue to monitor the time and location of learners, and if constraints on access time and location are no longer met, we must block access to the content.

However, exact tracking of students' location is difficult with current technology. In this study, we must leave it to future technological innovation. The accuracy of location

Figure 1. Embedding learning content in an inline frame hides the URL, but only superficially.

information measurement depends on the range of current technology.

3.3 Handling the Problems

It is difficult to solve the problems in the previous section completely. For the implementation of a prototype system, we examined the following solutions.

- Use of inline frames in HTML5
- Prohibition of right-click on web pages
- Use of AJAX techniques for asynchronous communication

If we embed learning content into an inline frame in HTML5, URLs of the learning contents are hidden outwardly (Figure 1). However, if the right-click context menu is available, the URLs can be revealed from the source code within the web browser. Therefore, right-clicking on web pages must be blocked. This can be easily implemented in JavaScript.

Unfortunately, that method is incomplete. This is because it is also possible to view source code from the menu of web browsers. Even if we can hide the address bar and menu option, it would still be insufficient. We must also prohibit screen capture and printing. Although we can do such things, what can we do against

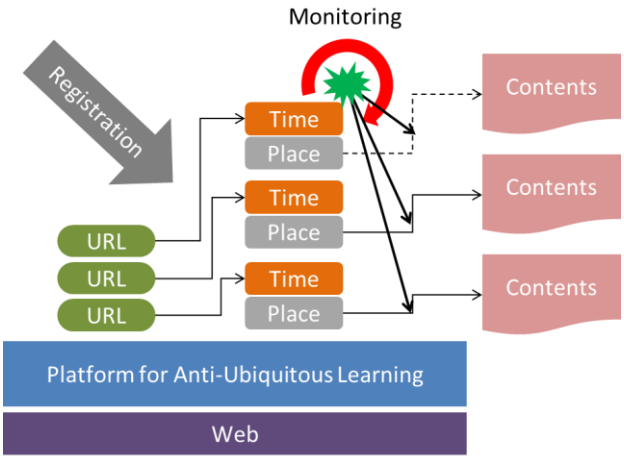

Figure 2. System architecture of the prototype uses a web platform to allow access and monitoring control.

screen photography with digital cameras? To answer these points, consult the research into technologies to prevent spying [13]. To not exceed the scope of this study, we do not adopt such technologies.

For now, we use AJAX scripting techniques to control access based on a location and time. With AJAX, changes of students' location and time progression can be acquired asynchronously from web browsers. This allows us to control access to learning content.

3.4 System Architecture of Prototype

We are currently working on the implementation of a prototype system for Anti-Ubiquitous learning. Figure 2 shows the system architecture.

The prototype system is a platform on the Web. When users access learning content through the platform, access is controlled depending on the location and time. The use procedure is as follows:

1. The user registers an account (initial time only).
2. Names and URLs of learning content are registered.
3. The learner selects the desired content and registers his or her location and time.

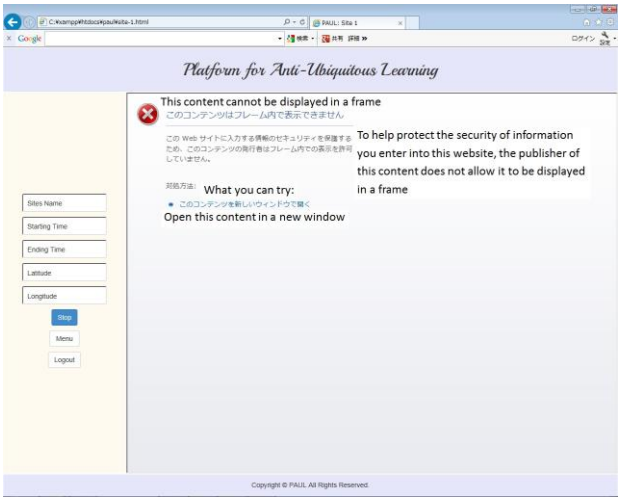

Figure 3. Many online learning sites block inline frame use because of its security risks.

4. The learner logs on the platform from the registered location at the registered time and then studies the learning content.
5. When the learner leaves the specified location or the block of learning time expires, the platform will detect it and block access to the learning content.
6. The learner can change the time and location of learning after a certain period (around one week). Through trial and error, the learner can determine the most suitable time and location for studying.

As the above shows, the mechanism of the platform is simple and obvious. Currently, we do not handle access control of learning content in real time for users who frequently move around during learning. That is, once learners leave the learning location and get their access blocked, if they return to their location during the learning time period, they must log on again.

In addition, we built the platform with the function of storing learning histories of registered learners. As we described in Section 3.2, the complete hiding of URLs is very difficult. By accessing the bare URLs, learners can access learning content directly and bypass the platform. In such a case, there is no meaning to have a platform like this.

However, the purpose of Anti-Ubiquitous is not to prohibit off-sides learning. It is to boost the awareness of students who cannot learn proactively. Paradoxically speaking, it is not necessary for students who are accustomed to learning proactively to use this platform, but if they do not use the platform, their learning histories are not tracked by the platform. This means there is no evidence that they have learned, at least from teachers' viewpoint. Instructors can see the learning histories of students in the platform and use those histories for academic assessment. By devising how to leverage the platform in that manner, we can sidestep the impact of problems such as the incomplete hiding of URLs.

3.5 Security Issues

Like any system, the platform is open to security problems. In particular, malicious users may intentionally register phishing sites instead of valid learning content. Although the platform can check such problems systematically to some degree, that approach has limitations. Currently, we are considering imposing a validation step that requires some identification before users are allowed to register content in the platform.

Moreover, another serious problem is that, to protect users against hacking, many education sites prohibit their content from being loaded into an inline frame, including prominent MOOC providers such as Coursera and edX (Figure 3). As Figure 3 shows, if we try to click the link "Open this content in a new window" in the broken inline frame, the original URL will be revealed completely.

This is how many WBL sites handle the type of security attack known as "clickjacking." To sidestep this situation, we would need to change the configuration of the learning content websites. Unfortunately, that is contrary to the number 1 policy mentioned in Section 3.1, and also it is not realistic. Because it is expected that such security policies for websites will only increase, it is a fatal problem for our

approach. Even if we can avoid this problem by using JavaScript or other code, it remains as a security issue. This problem is also considered in our future study.

3.6 Stateful Web Content

We must also consider the management of learning content that has states. Concretely speaking, states are the learning histories of users. Learning content on MOOCs has such states. Currently, we are considering whether the platform for Anti-Ubiquitous should manage such states for learning content hosted on other websites. The simplest solution is for the platform to focus solely on Anti-Ubiquitous histories and leave each learning content provider to manage its own states. In that case, however, the usability of the platform becomes diminished, leading to a loss of user motivation to use the platform. On the other hand, if the platform could also manage the states of other learning content providers, the functions and structure of the platform become more complex.

3.7 Role and Authority of Users

Teachers and students are assumed to be users of this platform. Now, we examine whether we should distinguish the roles of teachers and students. The issue is the following:

Should we permit students to register learning content in the platform?

In terms of proactive learning support, it would be desirable that students also be able to register learning content in the platform. In such a case, hiding the URLs of learning content becomes almost meaningless. As described above, it is not essential to hide URLs of learning content. However, it is unlikely that students who lack solid study habits and a proactive attitude – the target demographic for our project platform – would register learning content in this platform and autonomously practice Anti-Ubiquitous learning.

In addition, the platform needs a mechanism to bind teachers and students. To allow teachers to see and evaluate learning histories compensates for the incomplete hiding of learning content URLs by giving students a good reason to use the platform.

4 RELATED STUDY

In e-learning methods such as WBL, because the ubiquity that gets rid of the learning constraints of time and location is the main selling point, there is no motivation to add such constraints. However, methods similar to Anti-Ubiquitous exist, namely self-regulated learning (SRL) and cohort-based learning (CBL).

SRL [14] is a method in which learners specify learning schedules, study according to the schedules, and evaluate their own learning outcomes. As a method to enhance the effectiveness of e-learning, SRL has come to the forefront recently. Although SRL is similar to Anti-Ubiquitous learning in that students set their own learning schedule, it is hard to bring a compelling sense of tension for learning by specifying a schedule only. SRL does not have the concept of learning location.

CBL [15] is a group learning method that designates start and end points of a course and requires learning targets and problems set at fixed intervals to be cleared. The University of Illinois adopted CBL in order to increase the effectiveness of e-learning and reported good results. CBL shares several things with our study in terms of setting temporal constraints on e-learning. However, in Anti-Ubiquitous learning, time settings are based on the learning habits of the students, not an external obstacle course. Moreover, CBL does not have the concept of learning location either.

Kajita et al. [16] have been constantly researching about a context-aware LMS based on ubiquitous computing. It provides educational services for students and faculty

depending on their context. Therefore, it can be regarded as a type of research in ubiquitous learning [17]. Li et al. [18] and other groups have been doing similar study. Ubiquitous and Anti-Ubiquitous learning are not competitive but complementary.

For the problem of halting study in e-learning, there are also methods that are not systematic, such as mentors in e-learning [19] and blended learning [20] that combines face-to-face lectures and e-learning. However, there are hundreds of thousands of students in MOOC, and the number of students in WBL overall is uncountable. Because of sheer numbers, neither the introduction of mentors nor the realization of blended learning is appropriate or realistic.

5 CONCLUSION

In this study, we proposed a method that makes learning content on the Web "Anti-Ubiquitous." Because a lot of high-quality learning content already exist on the Web within OCWs and MOOCs, the significance of our method that realizes Anti-Ubiquitous learning by using such learning content is immense.

We are in the stage of implementing a prototype system using PHP and HTML5. In the prototype system, we use the geolocation API [21] to acquire location information. Because the accuracy of the location information depends on each web browser, we are considering focusing on specific web browsers at the moment.

Furthermore, we have a plan to use the platform in our classes. After successfully conducting the experiment and evaluating the platform in a real setting, we will open it up to the public.

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