

Effectiveness of Online Learning Tools in College Education: Experiments in Physical Geography

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자연지리 강좌를 대상으로 한 온라인 러닝의 효과 분석

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Abstract : The purpose of this study was to quantitatively evaluate the effectiveness of learning management systems (LMS) in the physical geography class. The study adopted the experimental design and three classes participated in this study. The first class was controlled using only classroom lectures, the second class used PPT slides along with the classroom lectures, and the third class used online video clips along with the lectures. The experiments were conducted from the Spring Semester 2007 to the Spring Semester 2008 for the introductory physical geography course. The study results showed that online learning tools help students improve academic performance and their attitudes towards the class and the instructor. Compared to simple PowerPoint slides, voice recording attached to the visual lecture slide materials enhanced students' motivation. Class lectures with lecture slides did not improve students' scores. However, when the visual materials were combined with voice recording, the number of internet access to online class materials increased, and class attendance and students' final grades were improved. Based on the results, the instructional design model that combines classroom and online learning was suggested.

Key Words : online learning, physical geography, RSS, podcasting, Profcast, course evaluation

요약 : 현재 대부분의 국내외 대학과 교육 기관에서는 온라인 학습방법을 채택하고 있다. 이에 본 연구는 전통적인 교수법에 대한 상대적 이점으로 많은 온라인 학습도구를 통한 학습효과를 자연지리학 강좌를 중심으로 정량적으로 평가하고자 하였다. 자연지리학 수강자들을 대상으로 실험을 실시하였으며, 인터넷 상에서 정보의 전파 도구로 널리 사용되고 있는 RSS(Really Simple Syndication) 기반의 Podcasting과 Profcast 소프트웨어 프로그램을 이용하여 생성한 동영상 강의가 온라인 도구로 활용되었고, 전통적인 강의실 수업도 함께 병행하였다. 학습효과를 살펴보기 위해, 수강자들이 작성한 강의평가 자료를 분석하였다. 실험은 2007년 봄학기부터 2008년 봄학기까지 동일한 자연지리학 개론 강좌를 대상으로 실시되었다. 본 연구에서 다루어진 실험의 결과에 의하면 온라인 학습 도구는 학습자들의 학습 효과뿐 아니라 수업과 강사에 대한 태도를 긍정적으로 변화시키는 것으로 나타났다. 또한 단순한 PowerPoint 슬라이드만 제공될 때에 비해 교수자의 음성 녹음이 결합된 강의자료가 학습 동기를 높이는데 더욱 효과적인 것으로 조사되었다. 즉, PowerPoint 슬라이드와 같은 시각적인 강의 자료만 제공되는 경우에는 기존의 강의방식과 학습 효과 면에서 큰 차이를 보이지 않았으나, 시각자료에 강의음성이 결합되었을 때, 인터넷 학습자료에 접근하는 빈도가 증가하고 학업성적 및 수업 출석률이 향상되었다. 연구 결과를 바탕으로 온라인과 교실 학습을 병행한 블렌디드형 교수설계 모델이 제안되었다.

주요어 : 온라인 러닝, 자연지리학, RSS, podcasting, Profcast, 강의평가

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1. Introduction

With the development of information and communication technology, online education has been proposed as one of the excellent educational solution for students who have not been able to physically attend the school (Lim and Lee, 2007). According to Park and Kang (2010), market share of internet-based education is constantly growing and the number of online learning users reaches 45% of internet users in Korea. As demands of online learners and their active responses to the demands increase, online learning and teaching methods have been rapidly adopted by various educational organizations (Allen and Seaman, 2004; Ruth, 2006; Zhang *et al.*, 2004).

In Korea, online learning in higher education is still at the beginning stage (Lee and Choi, 2000). Internet-based education takes 13.6% of entire university courses in the nation, but the proportion of courses that use online learning tools more than 30% of course materials is only 10.4%. Online learning service is operated 56.7% of universities, and 90% of online learning contents are instructor-centered video lectures (Lim and Lee, 2007). Considering the advanced level of infrastructure in information and communication technology, highly-adapted internet users, and widespread usage of portable communication devices, there are promising opportunities of high-quality on-demand learning in Korea (Khan *et al.*, 2009).

Contemporary research emphasizes the terms, 'learner-centered', 'interactive', and 'self-regulated' as important characteristics of online learning. Self-regulated learning is guided by strategic action and motivation to learn (Butler and Winne, 1995; Winne and Perry, 2000; Choi *et al.* 2003; Perry *et al.*, 2006; Zimmerman, 1990; Zimmerman, 2008). They are aware of their academic strengths

and weaknesses and have their own strategies of academic tasks (Dweck and Leggett, 1988; Dweck, 2002). In addition, the students believe that challenges to difficult tasks, practice, and efforts to develop a deep understanding of subject matter will lead them to academic success (Perry *et al.*, 2006). Online learning is meaningful when students are actively engaged in the learning process. The students can acquire high level of achievement, obtaining learning goals and objectives as a result. Kwon(2010)'s recent study on online learning reported that online learning is effective when the students are self-regulated, self-motivated, and actively engaged in their learning process.

In general, online learning systems provide flexible environments with various types of learning materials such as text resources, movie clips, animations, audio materials. Depending on how instructors present the information, the learning resources can be effectively integrated into students' learning processes (Piskurich and Sanders, 1998). However, innovative and advanced features of the online instruction are not free from limitations, including low levels of interaction, lack of varied instructional strategies, and poor instructional design when discussing the effectiveness of online instruction (Kang and Lee, 2009; Machay and Stockport, 2006). Studies showed that online learning is an independent job in nature because it prevents both learners and instructors from experiencing sharing opportunities in dynamic communication environments. In addition, online learning is impersonal, superficial, misdirected, and potentially dehumanizing and depressing, inhibiting the pedagogical values of education as well.

Online learning and classroom learning are two different instructional modes and thus, instructional strategies should be different from each other. However, many online learning

educators have a tendency to take the same teaching strategies and instructional resources for both instructional modes. In many cases, they merely present instructional materials online without considering students' characteristics. Knowing that it is important to share feelings, experiences, knowledge, and a sense of belonging in the learning process, online learning environments should be designed systematically, providing students with meaningful learning experiences (Park and Kang, 2010; Piskurich and Sanders, 1998).

For quality instruction and successful online learning, universities should regularly evaluate the online learning contents and suggest ideal instructional models, designs, and systematic course developing process to faculty members (Morrison and Khan, 2003; Khan, 2005). As the number of institutions adopting online instruction is rapidly increasing, quality issues such as usefulness and effectiveness of online learning should be fully examined and evaluated for a competitive, alternative instructional mode in the future (Dalsgaard, 2006; Hrastinski, 2008). The purpose of this study is to evaluate the effectiveness of online learning in the physical geography field. This study examines experimental outcomes on how online learning tools influenced college students' performance based on their course evaluations and grades. For obtaining the study goals, three research questions are presented as below;

Research questions

- (1) Is the students' academic performance influenced by the access to online learning materials?
- (2) Is the students' attendance influenced by the availability of online learning materials?
- (3) Are there differences in the course evaluation results between the traditional classroom and the classroom using extra

online learning materials?

2. Literature Review

1) Distance learning

Distance learning is broadly defined as any formal instructional approach in which the majority of the instruction occurs at a distance (Grimes, 1993). Due to the nature of the instructional delivery mode, distance education has been proposed as an excellent educational solution for students who have not been able to physically attend the school. Over the years, it has been expanded substantially in its quality and quantity responding to the needs of the academic society. Particularly, today's society increasingly requires educational systems to accommodate students' diverse needs by providing quality instruction at a distance with similar learning environments to classroom instruction.

In the earliest form of distance learning, instruction took place using printed materials delivered by mail. As the population of distance education has increased and information technology has advanced, the definitions of distance learning have also been modified depending on the delivery tools and types of services that students would receive from instruction. The early definitions were correspondence or off-campus or off-site learning, and then open education became a term when broadcasting systems became a common means of instruction reaching the public in fairly large areas. Recently, with the advent of computer technology, including network systems and communication tools, distance education has been known as online or computer-mediated learning that provides people with synchronous instruction online at a real time or asynchronous

pre-designed instruction (Reiser and Dempsey, 2003).

Various definitions have been suggested in defining distance learning, depending on the emphasis of characteristics in delivery and instructional methods. Moore and Kearsley (1996) describe distance learning as a planned learning by using special techniques and methods for designing and delivering instruction. The California Distance Learning Group defines it as a process of learning at a distance by connecting learners and educational resources. The United States Distance Learning Association (USDLA) explains distance education as a way to acquire knowledge and skills through mediated information and instruction that is transferred by any types of technologies or learning medium at a distance. Keegan (1986) describes distance education as “noncontiguous communication between learner and teacher mediated by print or some form of technology.” Definitions of distance learning continue to change and new definitions keep evolving based on the delivery medium. Considering current trends in using information technology, the term “distance education” is interchangeable or replaced by “online learning” or “distributed learning” or “blended learning”. Among many different formats, online learning is currently the most prevailing format of distance learning in higher institutions.

2) Online learning

(1) Theoretical framework of online learning

Behaviorism: Behavioral learning theories were proposed by Skinner (1954, 1961). In the theories, learning was regarded as observable events, and it had a great influence in the development of computer-based education. The basic learning principles, such as individualized instruction, controlled/uncontrolled operant conditions, immediate feedback, linear sequence

of learning, and instructional prompts match with logistics of computer-based instruction. The emphasis on the behavioral changes in learning has contributed to concepts such as behavioral objectives, formative evaluation, and instructional feedback as reinforcement.

In the aspect of pedagogical framework and practical effectiveness, proponents of online instruction take views of behavioral learning theories. Behavioral learning theory focuses on modifying the learner’s behavior and produces instruction that involves a presentation of information, a question to elicit a response from the learner, feedback to the learner’s response, and either positive reinforcement for a correct answer or a response of the cycle to learn correctly (Dewald, 1999).

Constructivism: In constructivist approaches, learning occurs when learners are actively engaged in the process of constructing knowledge by making connections between their previous knowledge with new information. According to the theory, knowledge is constructed, and social interactions are crucial in the knowledge construction process (Vygotsky, 1962). An underlying assumption of the constructional design practice is that learners are active and changing entities. Therefore, there is a need for “layers of negotiation” among teachers and learners (Cennamo *et al.* 1996). In this theory, the learner is also a designer, not merely a receiver of designed materials and activities. In order to make distance learning more effective, the nature of instructional process has to be changed (Filipczak, 1995). Many people agree that the constructivist’s approach is appropriate for distance learning; thus, course developers and distance education instructors have to take constructivist views in their approaches.

Cognitive science: According to Piaget, learning takes place by assimilating new information into their existing cognitive structure and

accommodating their cognitive structures. Online interactive communication tools (i.e. automatic feedback, interactive activities, asynchronous communications, synchronous communications) allows learners to modify their behaviors by assimilating instructors' or peers' knowledge structures through interactions with each other or reactions from instructors. Since learning through technology is new to students, they may repeat the process of assimilation and accommodate their learning throughout the course constantly (Dewald, 1999).

Multiple intelligence: In recent years, learning theories have more focused on individual characteristics including learning styles, preferences, strategies, and motivations. Gardner (1983) proposed multiple intelligence theories. In his theories, he suggested that individuals have eight different intelligences that account for their potential abilities in development. Those are linguistic, logical-mathematical, spatial, kinesthetic, musical, interpersonal, intra-personal, and naturalist intelligence. Those are closely related to individual characteristics; thus, learning characteristics are considered the most important factor to maximize learning when designing instruction. In that sense, online environments can be one of the learning options for students with diverse needs and preferences.

Problem-based learning: In the problems-based learning theory, finding the unknown is the process of problem solving. In the problem-based learning, students are given ill-structured and authentic problems and asked to find solutions for the problems by obtaining necessary knowledge and applying the learned knowledge to possible real situational problems. The problems are socially, culturally, and intellectually valuable. The entire process encourages students to develop higher critical thinking, analytical, and reasoning skills. Online learning environments provide students with authentic problems and

research tools to solve the problems. In that sense, online learning promotes problem higher-order thinking skills through problem solving activities. Usually, the success of this learning depends on instructors' skills to guide students though the process step-by-step with necessary help. Studies suggest that the combination of online communication tools and problems solving learning methods premises pedagogically sound learning practices.

(2) Advantages and disadvantages of online learning

Previous studies (Cooper, 2001; Dunn, 2001; Balram and Dragiccevic, 2008) pointed out several advantages from taking online classes. Those include specific learning properties and individual preferences that can be provided only in online environments. The following advantages are commonly found in the online instruction literature;

- It bridges the instructional gap of physical distance by benefiting people who are remote from the classroom geographically.
- It provides student-directed and self-directed instruction-learners have control over information flow, pace of instruction, selection of learning activities, and time management.
- It offers tools capable of facilitating learners' diverse needs.
- It creates online learning community with shared interest.
- It brings about globalization in education and many other fields, enabling students and school to collaborate each other synchronously and asynchronously.

The advantages of online classes appeal to students, especially to students with jobs. Studies focusing on effectiveness, students' perceptions,

and satisfaction often find that the levels of satisfactions and achievement from online learning environments are equal or higher than those of classroom instruction. Despite the advantages and satisfactions from online learning, there have been many controversial issues related to individual characteristics in the success of online learning. There are arguments that online learning environments are not appropriate for individuals with certain characteristics—individuals with certain learning styles are not likely to be successful in learning. Yet, Merrill's (1994) proposed that students tended to develop their own learning strategies when taking online classes, adjusting themselves to online learning environments. Learning is optimal in any circumstances when the goal of the instruction is consistent. The important factor that affects students' learning is not a physical means but instructional strategies and persistent goals.

Many studies (Truell, 2001; Wang *et al.*, 2001) revealed that there is no difference in achieving academic skills and knowledge in both learning environments, regardless of students learning styles. Based on studies on learner characteristics in online environments including Oh *et al.* (2004) and Oh and Albright (2004), learning styles may not influence students' learning in online environments. However, it is true that individuals develop different learning strategies depending on the individual characteristics and learning preferences. Furthermore, students familiarize themselves to listening, reading, and discussing for their learning practice; they prefer utilizing five modalities in nature. In the use of sensory modality, the participants in the study reported learning best while they listen to a lecture, read a text, and take notes simultaneously and most students prefer reading a paper copy to reading a screen. These data may imply that online classes with static text only constrain students to use a variety of sensory functions that students would

use to enhance their achievement. Therefore, when developing online courses, it is important to consider possible situations through multifaceted reviewing process by peers, students, and professional course developers.

Jones *et al.* (2002)'s study is one example that shows no differences in students' achievement, especially their critical thinking skills, in both learning environments. The study measured the acquisition of critical thinking skills using California Critical Thinking Skills Test over one semester with distant and campus social work students enrolled in graduate-level policy courses. A sample consisted of thirty-eight distant students and twenty-four students on campus. Before the instruction started, a pretest and a posttest were given to both groups to account for possible differences in their knowledge levels. For the activities to increase critical thinking skills, the instructor required students to exchange e-mails, keep journals of activities, participate in online discussions, and group presentations for both groups. The study results revealed that both groups showed statistically significant improvement in their scores of critical thinking.

Along with the effectiveness of instruction, students' perceptions and satisfactions are very important factors used to validate educational soundness of online instruction. Teh (1999)'s study assessed students' perceptions of online learning environment. The research was conducted in three geography classes in a tertiary institution in Singapore. Web-based instruction included asynchronous discussion forums and online course materials. Students' perceptions of their web-based learning environment were measured by the Geography Classroom Environment Inventory (GCEI) after twelve-week sessions. The results revealed that students have very positive attitudes towards online education environments. In addition, many other studies (Cooper, 2001; Leonard and Guda, 2001; Truell,

Table 1. Participants and classroom treatments

Groups	Participating semester	Number of participants	Classroom treatment
Level 1	Spring 2007	37	Only Classroom lectures were provided only.
Level 2	Fall 2007	38	Microsoft PowerPoint slides were added to WebCT
Level 3	Spring 2008	27	Presentation recording was additionally provided online

2001) have proved that students have positive attitude toward online instruction because of its flexibility and convenience.

3. Materials and Methods

1) Experimental setting

An introductory physical geography course was used for an experimental research design. Geography 101, namely 'physical geography and the environment' was taught at the University of Hawaii for three consecutive semesters from Spring 2007 to Spring 2008. Students who took the course were divided into three experimental subject groups with different instructional levels. For the first experimental semester (Spring 2007), only classroom lectures were offered to the students. For the second semester (Fall 2007), Microsoft PowerPoint presentation files were provided to the students during the semester using the WebCT. In the final experimental semester (Spring 2008), presentations were recorded and made as video clips. The videos clips were also provided to the student online along with the regular lectures. The research group was composed of three levels and Table 1 below presents information regarding the participants and classroom treatments for the study.

2) Online learning tools

WebCT: WebCT is a Learning Management System that is most frequently used in higher education institutions. It was developed at the University of British Columbia (UBC) as a web-based education system to improve students' performance. In his research, Dr. Goldberg, a faculty member at UBC, noticed that student satisfaction and academic outcomes could be improved by the use of a web-based course tools from which WebCT was originated. The first version of WebCT came out in 1996 at the 5th international World Wide Web conference in Paris. Dr. Goldberg's continuing effort led to establishment of WebCT Educational Technologies Corporation, a spinoff company of UBC. In 2006, WebCT was sold to Blackboard Inc., and it takes on the world's first successful course management system for higher education. WebCT consists of numerous helpful functions. Among those are e-mail, announcement, discussion, chat, quiz, assignment, teaching materials, grade management, survey, and log-in check. Students can log-in anytime, anywhere as long as they have the Internet access.

Podcast: Podcast is one easy way of broadcasting digital media. Compact digital files can be produced, transmitted and stored through podcasts. Podcast is a new dictionary word in the Internet environment, and it was developed for digital recording of radio broadcasting available on the Internet for downloading to personal

multimedia programs. It can be understood as a specially formatted web page that allows Internet users to easily get updated audio and video files. RSS, or Really Simple Syndication is one standardized format used to publish frequently updated works, such as blogs, news headlines, audios, and videos on the web. Noticeable strength of podcast is its subscription function with which users subscribe to podcasts and download and store various types of media files automatically. An RSS document is called a “feed” or “web feed,” and it can be handled by RSS-reading software, which can be desktop-based, web-based, or mobile-device-based. On a web page, a user can subscribe to an RSS feed by typing in its URI or clicking an RSS icon.

Profcast: Profcast is a quick-and-easy, low-cost application that records lectures on either Mac or Windows environment. Users can record their presentation as they give it using Apple’s Keynote or Microsoft PowerPoint. For example, using PowerPoint slides, it creates enhanced podcast media files through an integrated workflow of recording and publishing compact podcast media files, including .m4a (enhanced audio files), m4b (audio book format), .m4v (mpeg4 video files), or .mov (Quicktime movie format). Each lecture was split into 15-20 minute video clips so that each presentation file was small enough to download and easy to handle for students. Another

advantage of creating a short video is that it can be produced with the minimum number of recording and editing.

iTunes: iTunes is an Apple’s free computer application that organizes and plays digital music, video clips, movies, and even TV shows. In terms of podcast materials explained above, iTunes program searches for updates and downloads them if any online. Portable devices, such as iPod and iPhone can be connected to computer for download of media. iTunes instantly synchronizes files on the mobile devices and saves them on the computer. Instructions on how to download, install, and use iTunes program were provided at the beginning of each semester.

3) Data analysis tools

Students’ midterm and final exam scores, WebCT logs, class attendance record, and course evaluation were used for data analyses. Students’ test scores were used to compare academic performance and WebCT logs were counted to the number of times to use online materials. Class attendance record was used to compare the relationships between the availability of online class materials and students’ attendance tendency. Course evaluation was used to examine students’ satisfaction with the course in general and it was conducted at the end of each semester. The

Table 2. Course evaluation questionnaire

Items	Evaluation questions
Students’ attitudes (3 questions)	The amount of time I spent weekly on this course outside of class The number of times that I miss the class The grade I expect to receive in the course
Instructors (3 questions)	The instructor was able to explain concepts clearly. The instructor facilitated my learning of the subject. Overall how would you evaluate this instructor
Course (2 questions)	The level of the course Overall evaluation of the course

course evaluation questionnaires were composed of three sections regarding questions about students, instructors, and the course itself. The students' attitude section and instructor's section have three questions each, and the course section has two questions. Questionnaire is scaled with five different levels and weighted with scores from 0 to 4. Results of the course evaluation were reported with descriptive statistics. The composition of course evaluation is as follows:

4. Results and Discussion

1) Access to online learning materials and academic performance

When examining the students' scores, students' exam scores progressively increased from 74.7 to 77.2 when online learning materials were added to WebCT (Level 1, Level 2, and Level 3). Standard deviations of exams ranged from 10.9 to 17.7 on the Level 1. But, on the Levels 2 and 3, they decreased to 11.6 and 9.7 for midterm and 12.2 and 10.8 for the finals. Another parameter that showed the distribution of students' exam scores was the score range. Its range decreased slightly when online lecture slides were provided to students, but significantly decreased as both lecture slides and presentation movies were added to WebCT. Individual students' exam score difference between midterm and finals substantially decreased as the online lecture materials were provided on WebCT. The difference was 11% when only lectures were given, but it decreased to 7.9% and 4.0% as lecture slides and lecture movies became available to the students (Figure 1).

The number of hits or access to the online learning materials did not have any (or weak) relationships with students' grades ($r=0.082$) and

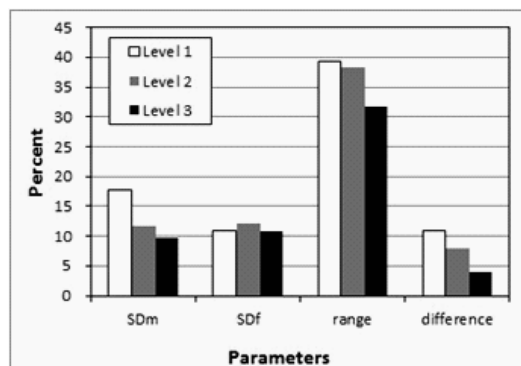


Figure 1. Basic statistics of students' test scores

(SDm and SDf represent the standard deviations of midterms and the finals. The range of the two test scores and the difference between them are also shown in the graph.)

attendance ($r=0.116$) on the Level 2 experiment. However, a moderate correlation ($r=0.516$) was found between the number of hits and students' attendance when presentation movie clips for students were provided online (Level 3). With this improved correlation, students' grades had a significantly stronger relationship with the frequency of online access ($r=0.715$, $p<0.05$) on Level 3. These two variables (the number of access and grade) showed a hyperbolic relationship ($r^2=0.511$, Figure 2). This result indicates that students' grades improve rapidly as

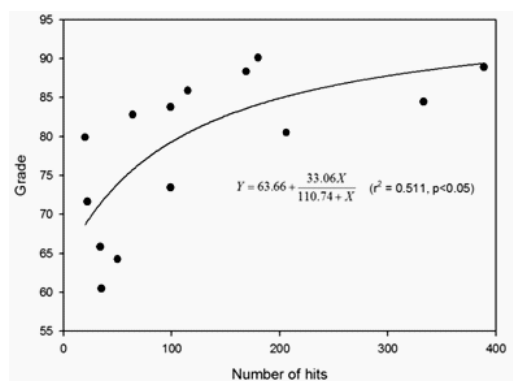


Figure 2. Relationship between the number of hits to online learning materials and students' grades

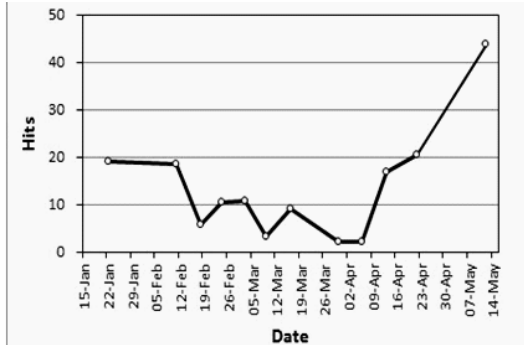


Figure 3. Weekly records of the number of hits to online learning tools (Spring 2008)

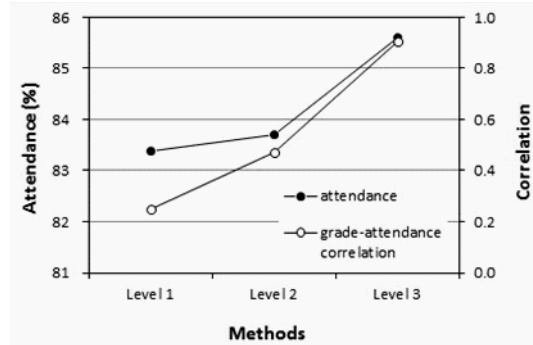


Figure 4. Relationship between grades and class attendance

they use online learning materials, but their improvement rate levels off as the number of hits reaches a certain range.

It was also shown that students tended to use the online learning tools most frequently during the final few weeks followed by the first few weeks. In the Spring semester 2008, the usage of the online tools was particularly low from mid-February to early-April (Figure 3). Therefore, it is clear that students use the online tools primarily for exam preparation.

2) Availability of online learning resources and attendance

Students' class attendance increased from 83.4% to 85.6% as online learning tools were added to the Internet (Figure 4). It is hard to say that online tools improved students' class attendance because a correlation between the two variables was not constantly increasing from Level 1 to Level 3 ($r=0.249$ on Level 1, 0.116 on Level 2, and 0.516 on Level 3). However, a relationship between students' class attendance and their grades was substantially influenced by the introduction of online teaching materials to the course. The correlation coefficient increased from 0.249 for Level 1 to 0.474 for Level 2 and 0.904

for Level 3. This result indicates that the availability of online course materials encourage the students to pay better attention to class.

3) Course evaluations

Course evaluation results were analyzed under three categories, including students' attitudes, instructor, and the course. Five questions on the questionnaire belonged to students' status. For the instructor category, three questions were considered important. The course itself was evaluated with two questions. Choices for each question were assigned values ranging from 0 to 4, and these values rated by students were averaged for each question.

During the three-semester long experiments, 74% of the students took the course as a requirement. 24.7% of the students took the course as an elective. Since the course was an introductory geography course, majority of students registered was freshmen, and 92.8% of them took the course for the first time.

(1) Students' attitudes

Three questions were asked to evaluate students' attitudes in the class. First, the students were asked how much time they spent for the

course on the weekly basis. The amount of time students spent on the course varied before and after online materials became available to the students. 45% of the students spent more than 2 hours per week on Level 1, whereas 65.3% and 60% of them spent more than 2 hours on Levels 2 and 3. Second, students were asked how often they had missed class. Majority of the students missed less than 10% of class meetings. Class means increased from 3.45 (Level 1) to 3.80 (Level 3)(Figure 3). Statistics showed that 50% of the students missed more than 10% of the time on Level 1, and it decreased to 30.8% and 10% on Levels 2 and 3. This result is important because class attendance was an influential factor for their final grades. Last question measured students' confidence level on the course. It was about their final grades they expected. Mean scores for this category were 2.63, 2.57, and 3.4 for Levels 1, 2, and 3, respectively. Only 50% of the students chose an A or a B for their expected grade on Levels 1 (15% for an A and 35% for a B) and 2 (26.9% for an A and 23.1% for a B). On the Level 3, however, 90% expected their final grade to be an A (50%) or a B (40%). It seems that students' confidence level improved as more online course materials became available.

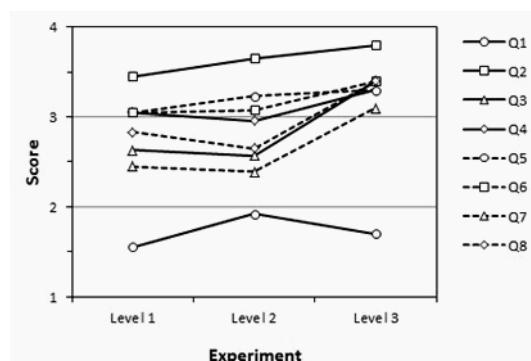


Figure 5. Course evaluation scores for each question from the experiment level 1 to level 3.

Labels from Q1 to Q8 represent the question numbers of the course evaluation.

(2) Instructor assessment

Instructor assessment was focused on his ability to explain course concepts and its effectiveness. Students were asked if the instructor had explained course concepts well. Scores decreased from the Level 1 (3.05) to the Level 2 (2.96), but improved at the Level 3 (3.3). Another question asked on the instructor was about his teaching effectiveness. Regarding the question about whether the instructor facilitated their learning of the subject, students responded to this question more positively as the experiment progressed from the Level 1 to 3 ranging from 3.05 to 3.3. Overall evaluation on the instructor gradually increased from the Level 1 to the Level 3. Lastly, about the asking the overall evaluation about the instructor, 70% of the students graded the instructor with an A or a B at the experiment Level 1 whereas the proportion increased to 80% at the Level 3. Overall evaluation about the course improved gradually from 3.05 (Level 1) to 3.4 (Level 3) as online tools were added to the course.

(3) Course assessment

Course assessment was evaluated with two questions. First, regarding the course score, the traditional lecture-styled format of the course seemed to be less effective for the students compared to the online learning tools. 45% of the students thought the course was difficult (or very difficult) on the Level 1 whereas only 20% of the students thought it was difficult on the Level 3. As a matter of fact, no student thought that the course was "easy" at the Level 1, but 30% of the students evaluated it as an easy course at the Level 3. As a result, mean scores of course difficulty were 2.55, 2.42, and 1.90 on the three different levels, respectively. Second, students' overall evaluation of the course was much improved from the Level 1 to the Level 3. While 65% and 57.7% of the students considered the

course as a good one (A or B grade) on the Levels 1 and 2, majority (90%) of the students thought that it was good on the Level 3. Mean scores increased from 2.83 (Level 1) to 3.4 (Level 3).

5. Conclusions and Implications

This study examined how much online learning tools influenced students' learning in physical geography. The study found that when online learning tools were used along with the traditional lectures, students' exam scores increased and their attendance rates were also improved. In addition, availability of online course materials influenced students' attendance but the number of hit to the online materials is not related to students' academic performance or attitudes. Regarding the course evaluation, the students in the traditional class (Level 1) felt that the course was more difficult than the class using online learning tools. The groups that were offered online learning tools were more confident with their learning and they had more positive attitudes towards the class and the instructor. The study showed that online learning tools were effective in the college geography class, improving the overall academic performance of

students and attitudes towards the class. In particular, video clips combining PPT slides and instructor's voice seemed to draw students' attention and motivation. Overall study results presents in Table 3 below.

However, this study has some imitations to generalize the study results. This study did not consider personal factors such as age, gender, race, academic level, and cultural background. These factors are a part of learning processes and it may influence the effectiveness of the students' achievements. In addition, students' behavior on and off campus in relation to network and wireless environments has not been thoroughly examined, and online learning technology, course structure, instructional design, usability, and readability of web page and PowerPoint slides should be evaluated before the study is conducted (Kordel, 2008). Therefore, the study results are only limited to the physical geography courses of the participating university.

Formal or informal online learning environments expand its capacity worldwide, overcoming social and temporal issues. Issues of specific subject studies can be solved with online learning tools, and class resources can be enriched by online learning environments. According to Favier and Schee (2012), students in geography classes often do not clearly understand geospatial data. They are

Table 3. Study results

Groups	Averages of Academic performance	Classroom attendance rate	Course evaluation results		
			Class attitudes	Course assessment	Instructor assessment
Level 1 (classroom only)	74.7%	83.4%	3.45	2.83	3.05
Level 2 (PPT added)	75.5%	83.7%	3.65	2.65	3.08
Level 3 (Online video clips added)	77.2%	85.6%	3.80	3.40	3.10

Table 4. Online activities and classroom activities in blended instructional mode

Online Activities	Classroom Activities
Lectures Using Course Management Systems	Lectures
Uploading course syllabus, schedule, and instructional materials online	Student presentations, Discussions, Groups works
Posting assignments and announcement online	Invite guest speaker
Synchronous /Asynchronous Discussions	Simulations
Individual/group work	Review sessions, Practice sessions
Lecture slides, video , audio clips	Test/assessment
Simulations, Online practice sessions (items)	Consultation sessions/office hours
Online Test/assessment	Field trips
Self-paced learning modules	
Consultation sessions/virtual office hours	

unstructured, incorrect, and limited to explain geo-data using formal geographic terms and concepts. For example, instead of saying “The population density is higher there,” the students tend to say “There are more people living there”, and students’ explanations about areas or environments are not specific enough. They tend to use the word “just like” instead of using specific parameters. In addition, students often have difficulties in analyzing maps in GIS while they can easily read maps. Since GIS consists of layers and symbols with extended windows, students find it difficult to identify the maps and the relationships among the maps at a glance.

Therefore, courses have to provide students with learning experiences that are realistic, meaningful, and relevant to their subject matters using simulations in virtual environments. Studies on geography education stressed that students should practice geographical skills in a real environment and the problems, tasks, and settings of geography education should be explicit and domain specific to reduce the challenges of information overloading (Balram and Dragicevic, 2008; Demirkays and Atayeter, 2011; Liu *et al.*, 2004). Balram and Dragicevic (2008) suggested that providing learning

resources such as simulations, videos, and geographic information systems can be the best practices to solve the problems in geography classrooms. Particularly, online learning resources offer vivid geography experiences without taking field trips, overcoming the traditional place-based learning systems (Balram and Dragicevic, 2008). In that way they can develop their knowledge, skills, and motivation to engage in geographic inquiry.

Based on the results of this study and many other previous studies, blended instruction that combines both online and classroom instructional components can be suggested as an effective instructional method to solve such classroom issues. The instructional activities for the learning method can be suggested in Table 4 and the blended learning model can be proposed as shown in Figure 6.

The instructional models can be made based on the institutional situations and classroom needs. Followings are the possible combinations of online and classroom learning for developing blended learning models with different proportions of learning modes and the use of technology;

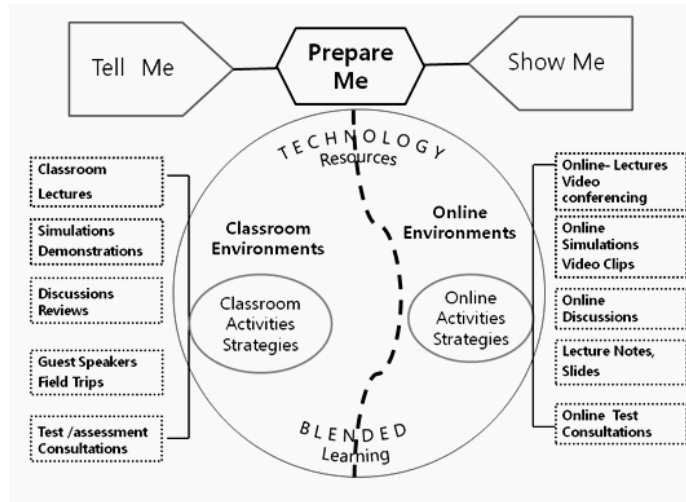


Figure 6. Blended Learning Model

1. Replace one or more face-to-face classes per week with online work, such as providing students with an opportunity to get more involved in research (e.g. working with data, conducting research online, working on simulations and online demonstration).
2. Provide lectures online (e.g. via WebCast or PowerPoint slides with voice recording) with the expectation that students review materials before class. Face-to-face meetings are used for active learning (e.g., discussion problems, research, application problems). The number of face-to-face meetings remains the same but the learning objectives for those face-to-face meetings have changed.
3. Meet in the classroom for several sessions at the beginning of the term, have students complete work online for several weeks, and meet in the classroom every few weeks during the term.
4. Replace one or more face-to-face classes per week with graduate students or peer mentors leading technologically enhanced laboratory/discussion sections.
5. Replace some portions of lectures with

expert-quest lectures via videoconference (online or in the class).

6. Replace some portions of lecture with small group video conferencing.

This study focused on the geography classrooms, but practices in blended instruction are obviously not limited to the specific subject areas and the proportion of instructional formats or classroom size. There have been numerous approaches in many other universities that have been practiced in different subject areas to meet their educational needs. With the number of students who choose to take classes online, universities need to make great efforts to develop practical models to serve optimal learning for diverse students. Seamless teamwork of faculty, students, course developers, and technical support are required for excellent achievement in the processes of designing, developing, delivering, and evaluating distance education courses. Course developments and updates from continuous course reviews will help them ensure the success of teaching and learning online.

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