# STUDENT USE OF ONLINE RESOURCES AS A FUNCTION OF INTEGRATION INTO COURSE ASSIGNMENTS: A COMPARATIVE STUDY

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#### Abstract

The great promise of blended learning lies in its potential to combine the best of both traditional and online practices through the provision of information and communication resources. While in theory the contribution of such resources to learning can be substantial, research tends to suggest that the provision of online resources does not necessarily lead to their actual use by students. Moreover, it appears that even when students do use such resources they do not always employ appropriate learning strategies. Thus, an important challenge for blended learning is to ensure the productive use of online resources provided. The present paper focuses on how the use of online learning resources by students varies as a function of how instrumental the resources are for the course assignments. 147 students who attended two blended learning resources provided were instrumental for the completion of assignments while the reverse was the case in the other condition. The use of online resources was determined through log file analysis. The comparative examination suggested that when the learning resources were essential for the course assignments students tended to use them more systematically. The paper is concluded with a discussion of the findings and the implications for the design of blended learning practices.

## Introduction

Ever since the early 1990s the growth of the World Wide Web (WWW) has been exponential. The emergence of Content and Learning Management Systems (CMS-LMS) and the corresponding spread of e-learning around 2000 have greatly changed the higher education landscape. E-learning has been used to deliver distance education courses as well as to supplement traditional face to face courses. The interest has been both academic and commercial. The academic approaches sought to enhance the potential of learning through ICT and have been coupled with the heavy investment in e-learning and the corresponding rapid development of the e-learning market. As a result, traditional courses have acquired a virtual dimension, turning into hybrid, i.e. blended learning courses. Blended learning involves two general types of resources, information and communication. The former refers to information services such as hypertext and hypermedia resources delivered through the WWW. The latter refers to either synchronous or asynchronous communication services achieved through forum, blog, and chat. The main idea behind blended learning is the improvement of traditional approaches to learning in higher education by combining the best of traditional and online practices (Thorne, 2003). The proposed benefits of blended learning include (a) administrative arguments (i.e., dissemination of materials, news, submission and grading of assignments), (b) spatiotemporal arguments (i.e., promote extensive course engagement by eliminating the space and time limits), and (c) cognitive arguments (i.e., facilitate communication and collaboration, enable flexibility and individual study pace, establish online communities of practice, enhance contextual learning) (Bonk, Wisher & Lee, 2004; Clark & Mayer, 2008; Khan, 2005; Naidu, 2003).

Despite the great promise of blended learning, it is not without serious challenges which are both multifaceted and complex (e.g., Bonk et al., 2004; Clark & Mayer, 2008; Delfino & Persico, 2007; Selwyn, 2007). The complexity of any e-learning implementation is high due to the large number of factors involved and the synergy which is required. Therefore, the problems are multiple and on many different levels.

First, the main source of problems stems from the fact that e-learning is commonly perceived to be traditional learning in electronic form. Typical approaches to e-learning tend to replicate traditional transmissionist practices which are usually didactic in nature and are mainly based on behaviorist conceptions of learning (Concannon et al., 2005; Conole et al., 2007; Littlejohn et al., 2007; Naidu, 2003; Philips, 2006). Moreover, the tools used to implement e-learning (e.g., e-learning platforms) are typically perceived of as delivery tools and mechanisms (Tu, 2005).

Second, the student perspective is also very important when it comes to e-learning since student perceptions of the e-learning environment and resources as well as student preferences might eventually undermine the resulting efficiency of any implementation (Siritongthaworn, 2006). For example, research suggests that students tend to adopt a poor approach to learning with online resources (Ellis et al., 2005) and that students continue to approach learning as they did prior to the introduction of technology (Concannon et al., 2005). This seems to suggest that a different learning approach might be required in e-learning compared to traditional settings (Massielo et al., 2005; Kirkwood, 2006).

Third, despite the provision of online resources their uptake appears to be low (Caverley & Shephard, 2003; Selwyn, 2007). Moreover, the mere provision does not appear to ensure their use (Caverley & Shephard, 2003; Grabe, 2005; Kirkwood, 2006; Selwyn, 2007). In fact some researchers even argue that students should be trained in the use of materials and the underlying logic behind their use (Concannon et al., 2005).

The success of e-learning depends on whether and how the information and communication resources provided are used by the students. More specifically, the uptake of learning resources is one of the most critical success factors for e-learning as it is indicative of student engagement with the online resources provided. Gilbert et al. (2007) have identified student engagement with the course materials as one of the most important topics of study for e-learning. This paper focuses on student use of learning resources in the context of blended learning and seeks ways to maximize student engagement with the resources and, consequently, student learning from the resources.

# **Background of the Study**

The present paper draws on data from a larger research project which adopts a design experiment methodology to improve the uptake of learning resources by undergraduate students. The project initiated in 2005 and the first cycle of implementation revealed minimal use of online resources which was mostly related to course materials and assignments. The second cycle of implementation (2006–07) involved a more systematic approach as we experimented with various types of learning resources as well as various levels of resource integration into the course structure. The present study draws on data from two undergraduate courses from the second cycle of implementation.

The study aimed to address the following research question: *Does the level of integration of online resources influence the extent of their use by students?* 

It was hypothesized that the more instrumental the resources for the course materials and activities the more they will be used by the students. Both our own findings (Karasavvidis, in press) as well as the research literature (Calverley & Shephard, 2003; Grabe, 2005; Kirkwood, 2006; Selwyn, 2007) suggest that if the resources are optional then it is less likely that students will use them.

The study followed a quasi-experimental design with two conditions. While both conditions included a large number of learning resources there were differences in terms of how the resources were integrated into the course. In condition A, the online resources were not integrated into the course structure, materials, and assignments; the assignments were not dependent upon the resources provided. In condition B, the reverse was the case: the online learning resources provided were essential for the course assignments. In this condition, there learning resources provided were a sine qua non for the completion of the assignments. Thus, while online participation was an essential requirement for both courses, the integration of the resources in the assignments was different for each course. Two groups of students participated in the study, one in each condition. Each group attended a different course as can be seen in table 1 where the design of the study is depicted.

Condition	Α	В
Level of integration of online resources	Low	High
Course	Introduction to ICT	Educational Applications of the Internet

### Table 1: Conditions and courses

# Method

# Subjects

Data were collected over two semesters for two undergraduate courses: (a) Introduction to ICT and (b) Educational Applications of the Internet. A total of 148 students initially enrolled in the two courses, 104 in the former and 44 in the latter. Due to withdrawers over the course of the semesters, the final sample was reduced to 70 students for the former and 37 students for the latter. The courses were taught by the author in the department of preschool education at the University of Thessaly in the winter 2006 and 2007 spring semesters respectively.

## Courses

*Introduction to ICT*. The course was an introductory ICT course, compulsory for first year students (1<sup>st</sup> semester). The course aimed to introduce core ICT concepts as well as to familiarize students with common software applications. On the conceptual level, the course comprised the following modules: Informatics, data representation, logical gates and circuits, hardware, software, free and open source software, and computer networks-internet. On the applied level, the aim was to render students skilled users of operating system software (GNU/Linux) and applications software (OpenOffice, Mozilla Firefox & Thunderbird).

For the purposes of the course, the students had to complete five assignments which were related to: (a) file management, (b) searching information on the World Wide Web, (c) sending and receiving e-mail, and (d) document formatting using a word-processor. With the exception of the first, all other assignments had to be submitted through the system. The assignments were self-contained in the sense that none involved the use of any of the learning resources provided for the course. The learning resources provided were meant to supplement the course materials and their study was highly recommended. More specifically, the resources provided aimed to support student learning, stimulate interest, assist with the visualization of abstract concepts, and furnish historical examples of technology evolution, hardware illustrations, animations as well as articles. An overview of the different types of the resources used as well as the number of resources per type is provided in Table 2.

*Educational Applications of the Internet*. The course was an elective one for second year students (4<sup>th</sup> semester). It aimed to introduce (a) common internet technologies and services and (b) the pedagogical principles which underlie the internet's educational use. The course comprised two main components: technical and pedagogical. The main objective of the technical component was to introduce students to information, communication, file, and application services. The main objective of the pedagogical component was to use the internet services to support a broad range of activities related to learning and instruction.

This course involved two main assignments. First, asynchronous online discussions which spanned over the semester and revolved around three main topics: (a) the impact of the Internet on everyday life, (b) the Wikipedia vs. Britannica debate and (c) file sharing practices and peer to peer networks.

Second, an extensive lesson plan which involved the use of internet information services for the preparation of the instruction. More specifically, the students had to use general-purpose search engines (such as Google or Yahoo) as well as specific search engines, portals, and repositories (such as the Gateway to Educational Materials) to locate the following with respect to the topic of the instruction: (a) scientific information, (b) research studies with pertinent instructional interventions, (c) lesson plans and activities, (d) information resources and learning objects involving text, graphics, sounds, videos, animations, (e) worksheets, and (f) other relevant online resources. To complete this assignment, the students could make extensive use of a set of compiled links to specialized web sites as well as use general-purpose search engines.

Both assignments required the use of the learning resources provided. In the first assignment, to participate in the online discussions the students had to study at least some of the resources so as to develop an elementary understanding of the concepts involved. The instructor posed some initial questions which essentially presupposed both the study and understanding of the issues addressed by the learning resources. In the second assignment, the compilation of links provided was an invaluable resource for locating certain types of resources as the use of specialized services (e.g., learning object repositories) could greatly reduce the time required to locate an information resource using general purpose web search engines. In addition to the specific compilation of links the other learning resources provided were highly relevant and could also be used as starting points for further searches.

#### Platform

Moodle, an open source learning management system (LMS) was used as the web application which hosted both courses.

#### Instruments & Operationalization

All student activity online was automatically recorded by the LMS and was used for further analysis. Additional sources of data included online surveys regarding the portal and its use as well as selected group interviews which were conducted by the author at the end of each course. For the purposes of the present paper we draw mainly on the log files. The use of online resources was operationalized through resource views.

# Analysis

A preliminary step in the analysis included the processing of the raw log file data. Firstly, all log file entries by the course instructor and the teaching assistant were removed. Secondly, all redundant information was also removed from the log files. By redundant information we mean student behavior which does not include any actual resource view (i.e., load a specific resource) but is recorded by the system, such as general course views. Third, we parsed the raw data files and created a student by array matrix which was used to import the individual student actions into a database. Using the database, the frequencies of use for all resources per student were calculated. Fourth, as the comparison of separate learning resources did not have any specific meaning (given the differences between the courses), the frequencies of the resources were aggregated into broader categories. Finally, the aggregated frequencies for the resources were compared to determine whether the observed differences were random. Given that the assumptions for the parametric t-test were seriously violated, we turned to the non-parametric Mann-Whitney U test for two independent samples. We compared the frequencies of resource use in condition A with the frequencies of resource use in condition B (required for the first assignment) as well as with the frequencies of use of the compilation of links (required for the second assignment). The results are presented in the next section.

## Results

As far as condition A is concerned, the resource types, the number of resources per type as well as the total number of visits per resource type are provided in Table 2.

Introduction to ICT				
<b>Resource</b> Type	Number of resources	Number of Visits		
Introductory	5	401		
Forum	2	257		
Lab Notes	4	260		
Assignments	21	5619		
Software	5	137		
General Interest	3	70		
Lecture-1: Digital Revolution	20	76		
Lecture-2: Introduction to ICT	4	42		
Lecture-3: Data Representation	10	67		
Lecture-4: Logical Gates & Circuits	3	27		
Lecture-5: Hardware	4	28		
Lecture-6: Software	22	60		
Lecture-7: FOSS	20	37		
Lecture-8: Computer Networks	14	34		
Totals	137	7115		

# Table 2: Resource type, number of resources per type, and number of visits per resource type

As can be seen from Table 2, the overwhelming majority of online resource views as related to assignments. For this condition where the use of learning resources were not an integral part of the course assignments the students accessed the learning resources provided 441 times, or 6.2% of the total resource views. We consider this number of learning resource views to be very low. On the other hand, the bulk of resource views (5619 or 78%) was related to the course assignments.

Regarding condition B, the resource types, the number of resources per resource type as well as the total number of visits per resource type are provided in Table 3.

<b>Educational Applications of the Internet</b>				
<b>Resource</b> Type	Number of Resources	Number of visits		
General Information	6	261		
Forum	2	2176		
Assignments	7	1148		
Links	1	1075		
Software	3	62		
General Interest	3	126		
Lecture-1: Introductory Concepts	31	247		
Lecture-2: Computer Networks I	18	80		
Lecture-3: Computer Networks II	15	117		
Lecture-4: Information Services	24	134		
Lecture-5: Communication Services	21	64		
Lecture-6: File & Application Services	31	104		
Totals	162	5594		

Table 3: Resource types, num	ber of resources, and
number of visits per re	esource type

As can be seen from Table 3, the distribution of resources for this condition is different compared to condition A. In this condition the learning resources provided were integrated with the two course assignments. The links (1075) constituted about 20% of the total resource views while the other learning resources amounted to about 15% of the total resource views. Interestingly enough, the assignments per se received comparatively less attention compared to condition A (1148 views or about 20%). Thus, in both conditions assignments seemed to have attracted student attention. Nevertheless, in the condition where the use of learning resources was recommended but optional the ratio of assignments to the total number of resource views is very high as about 8 out of the 10 resource views were assignment-related. On the other hand, only 1 in 5 resource views were related to assignments in the condition where the learning resources were integral to the course assignments. Moreover, the ratio of learning resources to the total resource views was much higher (15–20%) in condition B (compulsory use of learning resources) compared to condition A (6%) (optional use of learning resources). Since this difference represents our research question for this paper, we focus on it the remainder of this section.

After the initial processing of the log files and the removal of redundant information, 7115 resource views remained for condition A and 5594 views for condition B. Taking into consideration that the condition A involved about twice

as many students compared to condition B, it appears that the overall use of resources was comparably high (a difference of 1521 views for condition A). Nevertheless, given our specific focus on how the use of learning resources is differentiated as a function of the level of integration of learning resources into the course assignments, the absolute and relative frequencies of resource views in the two conditions are presented in Table 4.

Condition	Variable	Number of learning resource views	% of total resource views
Low	resources	441	6,2
Uich	links	1075	19,22
Figh	resources	872	15,59

# Table 4: Number of learning resource views and relative frequency in terms of the total resource views

Regarding the first condition, given the number of participating students (77) the number of learning resource views (441) is very small compared to the total number of resource views. Thus, despite the large number of resources provided, only a small fraction of resource views was related to learning resources. What is more, the small number of students who viewed at least one learning resource shows that about 1 out of 3 students did not view any of the learning resources provided (Karasavvidis, in press). Regarding condition B, the percentage of both links and resource views appears to be higher, ranging from 15–20% of the total resource views. These percentages appear to be much higher compared to the percentages for the low integration condition. To determine whether these differences were systematic, the mean ranks for the two conditions were compared. The main statistics for this comparison are presented in Table 5.

Variable	Condition	Mean Rank	U	Z	p (2-tailed)
Learning Resources	Low Integration	30,39	264	-4,91	.000
	High Integration	56,48			
Links	Low Integration	31,48	317	-5,16	.000
	High Integration	59,42			

Table 5: Inferential statistics for the two conditions

Results of the Mann-Whitney U nonparametric test indicated that there were significant differences between the two conditions on both measures compared. Regarding learning resource use in the two conditions, table 5 shows that the mean rank was higher (56, 48) for condition B (high level of integration) (U = 264, p < 0.000). With respect to links, the comparison also showed that the mean rank for condition B (high level of integration) was higher (59, 42) at a statistically significant level (U = 317, p < 0.000).

## Discussion

Despite the universally acknowledged potential of e-learning, its success is contingent upon a number of factors one of which is the uptake of the learning resources. The use of learning resources is a necessary condition for learning from e-learning settings. If students fail to use the resources provided or approach them as if they were conventional printed materials, then effective learning might be seriously undermined. The present study investigated how the degree of integration of learning resources in course assignments affects the frequency of resource use in the courses. Based on our own findings from the first cycle of the design experiment (Karasavvidis, in press) as well as on the research literature we hypothesized that if the resources are integral to the assignments then they would be more likely to be used by the students. The results obtained from the analysis corroborate our hypothesis. More specifically, we expected that the use of online learning resources would be higher in the condition where they would constitute an integral part of the course structure and, most importantly, assignments. We compared the use of resources in the two conditions and the use of learning resources turned out to be significantly higher in condition B, as predicted. This finding suggests that an important determinant of the use of online resources is the level of integration of these resources into the course structure, materials and activities. It appears that the more intertwined the learning resources are with the other components of the course the more likely it is that the students will use them. To conclude, the present study replicates previous research (e.g., Calverley & Shephard, 2003; Grabe, 2005; Kirkwood, 2006; Selwyn, 2007) in that the uptake of resources is probably going to be low unless other important instructional decisions are made to ensure that they will be used. While the uptake of learning resources is a necessary condition for learning from e-learning settings, it should be emphasized that it is not a sufficient one. As research shows, students might not use the resources. Thus, even though the findings of the present study suggest that assignments are a promising starting point for promoting the use of online resources in e-learning environments, more research is required in this direction and especially on the topic of how the online resources provided can be best used to advance productive learning.

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