Skill acquisition in blended learning courses: influence on student performance

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Abstract

E-learning platforms are a powerful tool that provides substantial improvements in the academic performance of students in distance learning courses and constitute an important support for the acquisition of skills. This paper explores whether these advantages also apply in blended learning courses (Moodle platform), where face-to-face interactions might attenuate them. Specifically, we asked whether the usage of online resources by students in blended learning courses also influences their performance. Particularly, we focus on evaluating the acquisition of theoretical and practical knowledge. The data for our study comes from 256 students in a Business Administration course. We use regression analyses to explain how Moodle platform usage influences academic performance in terms of both types of skills. We have found that the intensity of resources usage and their variety influence learning outcomes. This beneficial effect can be moderated by learning outcomes measurement and by students' previous abilities.

Keywords: Skills assesment, blended learning course, knowledge acqustion, knowledge application

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1. Introduction

One of the primary objectives of education and training systems is to meet the qualification needs of the labor market (Barr & Tagg, 1995; Rovai & Jordan, 2009). Hence, teaching models are increasingly incorporating the skills that students must acquire. They must be capable of tackling real situations, just as one would expect of an expert in a given area, and this is achieved via the application of active learning methods (Novak, Razzouk & Johnson, 2012; Wason & Vold, 2012).

In Higher Education this involves adapting the curriculum of the graduate programs and redefining and transforming the teaching concepts, methods, strategies and tools used by teachers and students (Barr & Tagg, 1995; Gardiner, 1998). This leads to a growing interest in a constructivist approach based on the accumulation of knowledge by performing different activities that encourage self-study (Charuni & Sumalee, 2012; Savery & Duffy, 2001). These approaches are having a great influence on current educational trends not only by conditioning the way in which educators design their courses, but also by redefining the role of the teacher and of the student and modifying the efforts ratios of teachers and students (Ćukušić, Alfirević, Granić & Garača, 2010; Laru, Näykki & Jarvela, 2012).

In this context, nowadays the adoption of e-learning platforms increasingly complements traditional teaching methods (Vovides, Sánchez-Alonso, Mitropoulou & Nickmans, 2007; Ćukušić et al., 2010; Gutiérrez, Trenas, Ramos, Corbera & Romero, 2010; Hung, Chou, Chen & Own, 2010; Dziuban & Moskal, 2011; Sansone, Smithe, Thoman & MacNamara, 2012). This facilitates adopting a constructivist approach. These tools encourage using active methods that enhance learning, follow-up and assessment processes both for the student and for the teacher.

The implementation of e-learning platforms in Higher Education courses takes two forms: as a substitute of pure face-to-face courses (distance learning courses) or as complement of them (blended learning courses). The effects of e-learning platforms on students' performance has been widely studied in distance learning courses, but not in blended learning courses (Halverson, Graham, Spring & Drysdale, 2012). For instance, we know that in distance courses the amount and variety of resources available to students increase their performance, especially when this variety corresponds to diversity in educational assessment strategies (Gvaramadze, 2012; Jethro, Grace & Thomas, 2012). Unfortunately, we lack evidences about what drives student performance in blended learning courses (Halverson et al., 2012).This research aims to explore whether the usage of online resources by students in blended courses influences their performance. Our results show that the amount and variety of resources used by students also boost their learning in blended courses. Nonetheless, our results indicate that the way of assessing learning outcomes and previous skills already acquired by students, moderated this effect.

The structure of this paper is as follows. Firstly, we present the theoretical background for our research. Subsequently, we provide details about research design and results. Finally, we present the main conclusions of this study, its limitations and suggestions for further research.

2. Literature review

The growing incorporation of the skills that students must acquire in the curriculum of graduate programs heavily relies on evaluating the progress made by the students and establishing feedback mechanisms. Evaluating the student progress implies establishing different types of tests to enable students and teachers to know at what stage the former are in their learning process, where they have to go and the best way to get there (Del Canto, Gallego, Santamaria, López, Medina, Mochón et al., 2011; Whitelock & Bill, 2011; Marchand & Gutierrez, 2012). Thus, the evaluation is not just a control activity, but a tool that improves learning acquisition (Whitelock & Bill, 2011) via providing feedback to students (Del Canto et al., 2011; Whitelock & Bill, 2011; Sansone et al., 2012).

To help teachers and students to take full advantage of evaluation activities, many institutions adopt e-learning platforms as a support in the design and implementation of learning systems based on skills acquisition (Ruiz, Mintzer & Leipzig, 2006; Rovai & Jordan, 2009). Within this teaching-learning model students' self-study takes on a special relevance. The traditional teaching models (fundamentally lecture-based) result in the students adopting a passive role. They receive knowledge from the teacher and little incentive to work independently. To change that model and its results teachers must act as the catalysts of the students' learning process. This enables students learning to assume full responsibility about the organization of their work.

In this context, using a teaching-learning model concentrated on achieving greater student independence requires that the teacher defines and specifies the conditions of the course, assessment system, output produced by students, types of exams, etc. Teachers must provide very clear indications and precise recommendations in the course syllabus (Hung et al. 2010). This structures learning activities and enhances students' interest in the learning process (Ames, 1992; Ames & Ames, 1984). If done properly, the student's self-study capabilities grow. They also become the central agents of a learning process where the teacher provides them with the tools that help them to take the initiative in their own learning process, thereby making them more active and independent.

The use of e-learning platforms has grown during the last few years, not only in universities, but at all levels of teaching. This is due to the benefits they provide, namely convenience, flexibility, the opportunity to work in a collaborative manner and interact with teachers and other students. However, the more we rely on this tool, the more experience we require, both as users (teachers and students) and as course designers (teachers) (Chou, Peng & Chang, 2010; Hung et al., 2010). The usage of e-learning platforms depends on the weight of face-to-face classes as opposed to work done by students outside the classroom; on the degree of teacher-student interaction; and on who is the central agent (student or teacher) of the learning process (Vovides et al., 2007; see Table 1). Nevertheless, the trend in Higher Education has been to adopt blended learning courses, which combine classroom attendance with following the course via an e-learning platform. In this type of course the platform enables a greater degree of teacher-student interaction (Malikowski, 2008), provides a greater number of resources that guarantee the student's learning process and makes the monitoring thereof more effective. Furthermore, students usually accept well e-learning platforms. Skilled enough to use basic software functions, students show a greater motivation to learn within this environment and a greater predisposition to use online communication systems.

Table 1. Levels of use of e-learning platforms.

	Physical presence	Interaction between teachers and students	…-based learning	Use of e-learning platforms
Traditional learning courses	high	low	teacher	low
Blended learning courses	medium	high	student	medium-high
Distance learning courses	none	high	student	high

Among the principal characteristics of e-learning platforms, we highlight the wide variety of technical capabilities available to their users. They also encourage the interactions between teachers and students compared with the traditional learning systems. Specifically learning outcomes are better for online students relative to classroom learners (Shea, Hayes, Smith, Vickers, Bidjerano, Pickett et al., 2012). The latter is one of the success factors of on-line learning experiences.

To date, previous research on the effects of resources available in e-learning platforms on students' performance has focused on distance courses, analyzing their types, dimensions and functions. In this type of courses, there is no physical presence of course participants. In order to compensate this, it is important to make the most of all the technical possibilities offered by the online platforms. The quality of their contents and the degree of interactions between teachers and students and among the students themselves are essential for an effective learning (Soo & Bonk 1998).

Additionally, Wang, Wang, Wang & Huang (2006) find that the learning style and the educational assessment strategy have a significant effect on learning results in distance courses. Hence, the more diverse the resources available for students and the educational assessment strategies are (with respect to the type of resources and types of learning considered), the greater the learning performance achieved by the student. Likewise, those teachers capable of using various strategies are usually more effective. Providing feedback to students also improves their results throughout the course (Rodríguez, Zamorano, Rosales, Dopico & Pedraza, 2004; Malmi, Korhonen & Saikkonen, 2002; Del Canto et al., 2011).

Despite these findings, how contents' utilization within e-learning platform affects students' performance in blended-learning courses is little know (Halverson et al., 2012). In these courses, the existence of face-to-face interactions might neutralize the benefits of online resources (Rovai & Jordan, 2004). Thus, the goal of our research is to determine whether the usage of these resources by students in blended courses influences their performance. Course design is challenging and time-consuming task when implementing blended-learning courses and therefore it is important to evaluate to what extent it is worthy to devote strong efforts to develop and implement online contents in this type of courses (Graham, 2006; Ruiz et al., 2006).

2. Material and methods

2.1. Background

The data for our study comes from a Business Administration course ("Principles of Marketing) imparted at the authors' university. The course took place between January and May 2011. It had 256 students, divided in 6 class groups. To pass the subject students had to enroll on a Moodle course. We designed this course to encourage a continuous learning process. It enables students to participate in different activities and use a bunch of complementary resources designed to facilitate self-study and skills acquisition.

We provided students with a detailed description of the course's structure in the syllabus of the subject. We also presented it at the beginning of the course. The stages followed in the design of the course where: definition of skills that students must acquire, the educational objectives associated with them, the activities and resources for achieving the objectives and the assessment system.

In this course, we implemented two performance assessment strategies. They aimed evaluating the acquisition of theoretical knowledge by students and their ability to apply it in business cases and projects:

- Knowledge acquisition. Fifty percent of the overall score in the course. Twenty-five percent corresponded to online tests (multiple choice and true-false) about the lessons in the course and the remaining twenty five percent to the resolution of mathematical exercises (implemented through cloze questions).

- Application of the knowledge acquired by the student (the student's ability to apply that knowledge). This made up the remaining fifty percent of the overall classification of the course. Twenty-five percent was obtained by taking an exam at the end of the course (business case method). The remaining twenty-five percent corresponded to the execution and presentation of a group project (rubric assessment system).

The platform provided a wide variety of learning tools designed to acquire skills (tests, group projects, problem solving, case studies, rubrics, etc.). In addition, the platform provided other resources designed to foster interactivity among them such as updated schedules of activities to perform, forums, news, etc. All of these allowed sending a fast feedback to students about their performance. This enabled teachers to adapt to the differences of the students, if any, with regard to their previous knowledge and skills level, as well as to better monitored their learning process.

Another important aspect to bear in mind in this design is that we evenly distributed the different activities throughout the course in order to balance out the student workload. To achieve this, we established the activities schedule at the beginning of the course, to which students could access via the Moodle platform. This meant that students could plan their work.

2.2. Empirical analyses

Moodle automatically gathers data regarding the use of the platform and the resources it contains by students. Together with the information provided by the qualifications gained by the students, this can help us to evaluate how the online contents within the e-learning platform influence students' performance.

We measured learning outcomes using two variables, corresponding to the two assessment strategies implemented in the course: the evaluation of the knowledge acquired (ACQUISITION) and that corresponding to how knowledge is applied in business cases and projects (APPLICATION). We measured the utilization of online materials by students using another two variables: the intensity of usage and the variety of resources used (CINTENSITY and CVARIETY respectively). In order to control to individual differences that might drive student performance we incorporated three additional variables. On the one hand, we included the proportion of specific resources aimed either at acquiring knowledge (THEORY) or at implementing knowledge (PRACTICE) that students used. This allows taking into account student natural inclinations to knowledge acquisition or implementation. On the other hand, we incorporated student performance in other previous courses as an indicator of its personal abilities (ABILITIES). Table 2 provides measurement details for our variables.

Table 2. Variable measurement.

Variables		Measurement
Dependent variables	ACQUISITION: Performance of each student in knowledge acquisition assessments.	Average of assessments in knowledge acquisition evaluations.
	APPLICATION: Performance of each student in knowledge application assessments.	Average of assessments in knowledge application evaluations.
Independent Variables	CINTENSITY: Course participation intensity	Number of days that students have accessed to Moodle course
	CVARIETY: Course participation variety	Average number of different resources and activities per day
	THEORY: Usage of theoretical resources and activities	Proportion of records in resources and activities oriented to knowledge acquisition
	PRACTICE: Usage of practical resources and activities	Proportion of records in resources and activities oriented to knowledge application
	ABILITIES: Student abilities	Number of credits obtained by student before course enrolment.

We used regression analysis (estimated by Ordinary Least Squares) to analyze the impact of platform usage on academic performance. Particularly, we estimated two regressions, one for each performance measure. Given the lack of normality of both our dependent and explanatory variables, we transformed them by applying logarithms. This transformation alleviates the consequences of non-normality in regression analyses while allows assessing the influence of explanatory variables in the dependent variables.

3. Results and discussion

We show the descriptive statistics of the variables included in our analysis in Table 3. Table 4 presents the results of the regression corresponding to the acquisition of knowledge. As in distance courses, a key factor in students' performance is their usage of resources in the e-learning platform. Not only the amount of resources but also its variety influences this type of performance. Furthermore, the more extensive the employment of theoretical resources the higher student performance in terms of knowledge acquisition is.

The importance of previous abilities (ABILITIES) with respect to a student's performance in knowledge acquisition must also be highlighted. This result is coherent with the type of traditional education previously received by the students of this course, typically based on methods that foster the acquisition of knowledge. Thus, a better performance of students in the past is positively related with a higher performance in knowledge acquisition.

With respect to the application of knowledge, we also observe a significant relationship between resources' usage and variety and students' performance in terms of knowledge application. Likewise, we have also found that using resources designed specifically for the development of practical skills (PRACTICE) impacts on their scores for knowledge application (Table 5). By contrast, previous abilities do not have a significant effect upon the application of knowledge. This might be due to the fact that

in the moment that we collected the data students had seldom been trained yet to put theoretical knowledge into practice.

Therefore, for our two performance measures, the intensity of resources usage and their variety influence learning outcomes in blended learning courses. Resources that aim to develop specific skills are also important. Comparing between our regressions results, the intensity of resources usage and their variety have a higher impact in the development of knowledge application skills than in knowledge acquisition. This could be because in previous courses the students under analysis had already developed knowledge acquisition capabilities.

Table 3. Descriptive estimates.

	Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard deviation
ACQUISITION	4.00	7.38	8.25	9.00	9.88	8.03	1.21
APPLICATION	1.25	5.78	6.75	7.62	9.65	6.52	1.52
CVARIETY	0.95	1.67	2.04	2.45	4.50	2.12	0.60
CINTENSITY	14.00	34.00	44.00	57.00	102.00	46.15	17.25
THEORY	0.68	0.82	0.86	0.89	0.97	0.85	0.06
PRACTICE	0.03	0.11	0.14	0.18	0.32	0.15	0.06
ABILITIES	12.00	51.00	60.00	60.00	84.00	54.69	8.94

Table 4. Knowledge acquisition.

	Estimate	Std. Error	t-statistic	
Intercept	0.37	0.26	1.44	
CINTENSITY	0.22	0.04	4.94	***
CVARIETY	0.30	0.06	4.72	***
THEORY	0.54	0.16	3.49	***
ABILITIES	0.19	0.05	4.13	***

Adjusted R- squared: 0.1522 ; $F_{5,248}$: 14.65 *** ; *** significant at a 99% level

Table 5. Knowledge application.

	Estimate	Std. Error	t-statistic	
Intercept	-1.72	0.41	-4.24	***
CINTENSITY	0.80	0.07	11.97	***
CVARIETY	0.91	0.10	9.37	***
PRACTICE	0.10	0.04	2.71	***
ABILITIES	0.03	0.07	0.45	

Adjusted R- squared: 0.3938; $F_{5,248}$: 42.09 ***; *** significant at a 99% level

4. Conclusions

The use of e-learning platforms for the development of new teaching-learning systems represents a valuable opportunity to obtain information for the improvement of the teaching methodologies implemented at universities. The adoption of these learning systems in Higher Education generates an

academic context that allows us analyzing the effects of educational resources in e-learning platforms on student performance within blended-learning courses. Our research contributes to understand the impact of these teaching tools on student performance, by clarifying how technologies support learning in this type of courses.

This study shows the importance of the teacher in not only defining and specifying the learning objectives, course conditions and assessment systems in advance, but also in providing students with a number and a variety of resources specific to the type of skills they must acquire. The usage of e-learning platforms makes possible for teachers to provide access to students to a large number of resources, activities and tasks that facilitate learning and make easier to monitor their progress. An active utilization of these resources by students increases their performance, especially when they take advantage of different resource types during the course. However, the importance of resource usage and variety is not necessarily the same for different assessment strategies, as shown in our case study. Depending on learners' experience with regard to the assessment strategy, resources might be more or less important. Consequently, the design of e-learning platforms for blended learning courses must carefully take into account what skills have been already acquired by students and avoid wasting efforts in creating resources for those skills.

Our study is not exempt of limitations. We just highlight two of them. Firstly, we do not consider cross effects between knowledge acquisition and application during the course, due to data limitations. Both performance measures are indeed related (Pearson correlation is 0.33, significant at a 99%). This could happen because advancing in skill construction for knowledge acquisition might also produce an improvement in knowledge application capabilities. Unfortunately, our data do not allow accounting for such effects. Secondly, we have not incorporated the potential existence of optimal levels of resource usage and variety. In effect, there might be levels of saturation in these variables from which using more (similar or different) resources do not improve student performance. Unfortunately, we lack information to identify such usage levels. Solving these, limitations constitute interesting research venues. Similarly, further research could analyze more deeply the impact of the interaction of assessment strategies and previous skills on students' performance in blended learning courses.

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