PREDICTORS OF STUDENT PREFERENCES FOR BLENDED LEARNING: AN EMPIRICAL INVESTIGATION

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Abstract: This study investigates engineering student preferences for blended learning adoption in higher education. No major study to date, however, has taken into consideration the influence of interaction, digital technology, social presence, and internet self-efficacy on student preferences for blended learning approach. This study is based on a sample of 126 students who can use Moodle platform at University Politehnica of Bucharest in Romania. Hierarchical multiple regression was employed to test hypotheses. Results revealed a significant effect of most predictors on student preference for blended learning. The findings are expected to enhance the understanding of blended learning for teachers and students.
Keywords: Blended learning, higher education, online learning.

INTRODUCTION

Distance learning refers to the use of information and communication technology (ICT) in teaching and learning processes (Salmon, 2005). Online learning is less expensive, it provides access to education for students who aren't located near university, and it also offers more flexibility to students in terms of how and when they attend classes. Blended learning or hybrid learning combines traditional classroom or face-to-face with online education (Graham, 2013). This approach is a fundamental change in the way teachers and students interact and how they meet new learning experiences. Limited interaction may affect students' satisfaction without the utilization of appropriate technologies in fully online learning settings (Kuo et al, 2014). Blended learning incorporates technology to customize student learning. Student-centered learning process means that students know how to collaborate, communicate, and solve problems in group and individually. Online learning requires students to be willing and able to self-manage their learning process (Sun and Rueda, 2012).

New technologies based on internet provide teachers and students tools that can be used to improve the teaching and learning processes. E-learning platforms or virtual learning environments (VLE) support teaching and learning processes. They provides over internet different tools such as uploading of content, students assessment, communication, wikis, blogs, forums, tracking, manages the students' database, quizzes, and other activities in each top section. Quizzes are a useful tool for students to test their level of knowledge. An example of open-source platform is Moodle (Modular Object-Oriented Dynamic Learning Environment). This platform has been used as a modular and open source learning management system (LMS) for sharing information and knowledge management in teaching and learning processes. LMS is used to manage delivery of course material. Moodle offers a wide range of functionalities for students and teachers. Asynchronous communication technologies would be best suited for collaborative learning approaches. Every student has unlimited access to Moodle resources. One interesting tool of Moodle is the fact that students can ask questions to their teachers or their colleagues (Martín-Blas and Serrano-Fernández, 2009). This study examines a case of using Moodle platform at the University Politehnica of Bucharest, Romania, to develop online courses as a complement or an extension of the face-to-face courses. Reliable and robust infrastructure must be in place to support students demand for convenient online education delivery.

While a number of studies have explored the drivers and barriers to blended learning adoption in higher education (Porter et al, 2016). Further, little research has explored factors associated with student preferences for blended learning, especially in technical universities. Student preferences for hybrid teaching may influence their engagement, and consequently, the effectiveness of teaching and learning processes. Accordingly, we identified and explored factors that influence the engineering student preferences for adopting blended learning. Specifically, we sought information concerning how students perceive hybrid learning as a valuable alternative to traditional face-to-face teaching approach influenced their willingness to adopt blended learning. For this purpose, an empirical study has been conducted using a survey to ask the engineering students from sample to tell us their preference about different kind of teaching and learning approaches.

The present research aims to enhance our understanding of how engineering students may benefit from traditional face-to-face teaching combined with online course provided them using Moodle platform. In addition, we are interested in exploring the indirect effects of control variables on student preferences for blended learning. The results of the study have important implications for faculty members, students, researchers, and ICT developers.

Next follows a literature review and hypotheses development. Then a section is dedicated to test our model and hypotheses on data collected from respondents. Next section provides details about the empirical results. Finally, a concluding section presents implications, limitations, and directions for future research.

THEORY AND HYPOTHESIS DEVELOPMENT

The integration of face-to-face and online learning enhanced active learning possibilities of the online environment and gives teachers the flexibility to work with students one-on-one. Thus, with the learning management system, one teacher can work with students in small groups or individually by organization the content and facilitate communication. Asynchronous learning is a student-centered teaching method that uses online learning resources to facilitate learning in traditional brick-and-mortar university. This asynchronous learning network supports online interaction, resource sharing, content development, and so much collaboration allowing users to organize discussions, upload courses and access multimedia. Today, one of the most important ideas in education is that students do not acquire, but instead construct new knowledge (Bjork et al, 2013). In this section, we explore the influence of interactions, technology, social presence, and self-efficacy on student preferences for blended learning in higher education institutions. We next propose a conceptual model to investigate the relationships between these factors and student preferences for hybrid learning.

Watson advanced the idea that blended learning is the result of convergence of online and face-to-face education methods. Teachers have increased their use of internet-based content and other digital resources in their classrooms. Traditional higher education learning environments are characterized by desks, black boards, and lecture halls. The organization of student learning has tended to follow traditional approach through face-to-face taught sessions. The percentage of the student population seeking a fully distance-based education will remain relatively low.

Interaction refers to a two-way communication between students and teachers. It is important factors in all forms of education. Interaction allows students to link existing knowledge with new knowledge and make new meaning through analysis and integration (Juwah, 2006). Through interactions students cognitively elaborate, organize, and reflect on the new knowledge. Other studies indicated that interaction among students or between students and teachers is a predictive factor of student satisfaction (Rodriguez Robles, 2006). Students in a collaborative interaction have higher satisfaction and can support the engineering student preferences for blended meaning. We thus propose:

H1: *Interactions among students and teachers are positively related to the engineering student preferences for blended learning*

Universities must provide a computer network infrastructure, including software, servers, and other hardware needed to develop a powerful asynchronous learning environment. In addition, students must also have the digital skills required to participate in the asynchronous learning environment. The value of technology has great power to influence teaching process. The software is following a problem-solving approach engaging students in inquiry-based activities, including collaboration tools, wikis, polling tools, as well as various content-specific applications, this is essential for ensuring an effective learning environment for students. Digital technologies provide an interactive and dynamic environment within which students and teachers engage in collaborative learning. Digital technology plays the role of a mediator in blended learning. Students may organize their learning program in terms of their time requirements and job schedules. Student collaboration and teacher interactions are facilitated by connectivity, mobility, and online support. Due to the importance of technology tools in web-based learning, determining exactly which technology tools best enhance learning process is essential to continue integration computer interaction with traditional classroom activities. Therefore, it is hypothesized:

H2: *Digital technology is positively related to the engineering student preferences for blended learning*

Online communications is used to support learning but the lack of facial expressions, tone of voice, and non-verbal cues is one common difficulty in online learning environments. Interactivity is a potential quality of communication and it is necessary to increase effect of education in face-to-face and online courses. The possible delays in asynchronous online environments can affect levels of student participation and interaction. This situation can be explained by the lack of social presence (Kear, 2011). Thus, in order to increase the level of online interaction, the degree of social presence must be increased because social presence can influence the participation in the online learning process. Unless students feel comfortable when communicating online this may result in low levels of engagement and can affect their preferences for blended learning. Some exploratory and confirmatory factor analyses consistently revealed five factors what characterizes social presence in online environments: social respect, social sharing, open mind, social identity, and intimacy (Suny and Mayer, 2012). On the basis of the above discussion, the following hypothesis is proposed:

H3: *Social presence is positively related to the engineering student preferences for blended learning*

Students may differ substantially in their skills, especially in their interne experiences and capabilities. Internet self-efficacy refers to one's belief in his or her capability to accomplish online tasks or assignments, including understanding of internet software and hardware (Eastin and LaRose, 2000). Online learning environments are designed to promote personalization and adaptability to the students' needs. Still, many students do not use the available digital tools because the lack of appropriate digital skills. Liang and Wu (2010) indicated that higher internet self-efficacy led to higher motivations for web-based learning and show preference for blended learning. Therefore, it is hypothesized:

H4: *Internet self-efficacy is positively related to the engineering student preferences for blended learning*

To reduce the variance caused by other factors, we controlled for the age and gender of respondents. Relationships among the constructs were empirically tested as follows.

METHOD

Research context: To test the conceptual model and hypotheses, we conducted a survey using a paper-based questionnaire and some interviews with faculty members at University Politehnica of Bucharest, Romania. This study used cross-sectional survey data. In this regard, a survey instrument was created using a combination of existing and newly development measures. University Politehnica of Bucharest (UPB) is the largest and the oldest technical university in Romania. The use of technological information in education and professional training are elements that define the university profile. A few years ago, UPB offered its students the possibility to use in their education process a combination between face-to-face and online learning through using Moodle platform.

Sample: Data were collected from a sample of engineering students (N=126) were recruited from UPB, during March and May 2015. All of engineering students have returned the filled in questionnaire, and after rejecting eight partially filled in questionnaires 118 could be used for analysis. The response rate was 93.7 percent. The data were assessed for the extent of missing values. This assessment found missing values for 14 of the 126 possible responses (11%) and determined that these values were missing completely at random. Therefore, the means substitution method was used to replace missing values. All of the items were measured on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). About 62 percent of the respondents were males and 38 percent of the respondents were females. The age of the respondents ranged from 20 to 24 (SD=1.7 years). About 70 percent of the respondents were between 21 and 23 years old. The average age was 22.6 years.

Measures and instrument development: When possible, construct measures were created based on previously validated survey instrument. In addition, individual measures were averaged to obtain a simple value for each construct. *Engineering student preferences for blended learning* (dependent variable) were measured using 4 items adapted from Moss, O'Connor and White (2010) and Mishra and Panda (2007): "In comparison to the traditional classroom teaching (face-to-face), blended learning offers student greater flexibility to complete her or his tasks any place and any time", "Blended learning enhances the pedagogic value of a course", "Blended learning experiences cannot be equate with other forms of learning", "Blended learning improves communication between students and teachers", and "Blended learning can engage students more than other forms of learning". *Internet self-efficacy* (independent variable) was measured using 2 items developed by Eastin and LaRose (2000) and adapted for this study: "The extent to which students feel confident with the internet hardware and software", and "The extent to which students can gather data through internet". *Interactions* (independent variable) were measured using 3 items derived from scale developed by Kuo (2009): "Activities during class gave me chances to interact with my classmates", "I received enough feedback from my teachers when I needed it", and "Online course materials helped me to understand better the class content". *Digital technology* (independent variable) from student's perspective was measured using a scale consisting of 3 items: "Technology makes teaching and learning processes more flexible", "Technology improves the interactivity and collaboration between students and teachers by customized interface", and "Technology need to make the learning process more enjoyable and easy of navigation". *Social presence* (independent variable) was measured using 3 items developed by Suny and Mayer (2012): "I was able to form distinct social identity", "I enjoyed myself of social respect and intimacy", and "I felt comfortable interacting with other students and teachers". Three additional variables were included in the analysis – gender, digital skills and age (control variables). *Gender*, as dummy variable, was included to control for the specific impact on the engineering student preferences for blended learning. We coded male respondents as 0 and female as 1. The students' *digital skills* were measured using 3items derived from scale developed by Kennedy's et al (2008). The respondents was asked to rank their digital skills on a scale where 1 was "not very skilled", 2 was "moderately skilled", and 3 was "highly skilled". Student *age* was represented as the log of the number of years.

ANALYSES AND RESULTS

Data was analyzed with SPSS 20.0 software with maximum - likelihood estimation. Cronbach's alpha was used to determine the internal consistency of items in each scale. Statistical procedures were used to establish the reliability and validity of the measures with all items. Reliability of the factors was measured using Cronbach's alpha for each construct and was found to be greater than the recommended minimum of 0.7 indicating high reliability (Hair et al. 2007). The Cronbach's alphas ranged between 0.847(for internet self-efficacy) and 0.753 (for student preferences). Descriptive statistics and scale reliabilities are presented in Table 1.

Table 1 - Descriptive statistics and scale reliabilities.

Constructs	Mean	SD	Cronbach's alpha
Student preferences	5.87	1.46	0.753
Interactions	5.34	1.23	0.804
Digital technology	6.18	1.79	0.786
Social presence	4.38	1.22	0.823
Internet self-efficacy	5.26	1.17	0.847

The correlation coefficients of all constructs are within acceptable levels (no bivariate correlation is greater than 0.56). The highest correlation coefficient is between digital technology and the student preferences for blended learning. This correlation coefficient is equal to 0.563. The measures of interaction, digital technology, social presence, internet self-efficacy, gender, digital skills, and age were positively correlated with the measures of student preference for blended learning, with correlation coefficients ranging from 0.001 to 0.563. The correlation analysis show that most coefficients are low, which minimizes concern with multicollinearity issues in our analysis. Correlations greater than or equal to 0.186 are significant at $p<0.05$. Correlations greater than or equal to 0.231 are significant at $p<0.01$. Table 2 presents the correlation matrix of all the variables used in this study.

Table 2 - Correlation matrix among independent variable and student preferences for blended learning

Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Student preferences (1)	-						
Interaction (2)	0.343	-					
Digital technology (3)	0.216	0.563	-				
Social presence (4)	0.124	0.386	0.237	-			
Internet self-efficacy (5)	0.473	0,189	0.492	0.157	-		
Gender (6)	0.021	0.002	0.034	0.231	0.179	-	
Digital skills (7)	0.186	0.237	0.513	0.183	0.534	0.326	-
Age (8)	0.041	0.001	0.017	0.09	0.392	0.002	0.187

Note. $*p <0.05$, $**p<0.01$

Student preferences towards blended learning were investigated using a hierarchical multiple regression. Gender, students' digital skills and age were entered in first stage of the regression as control variables (Model 1). The independent variables (interaction, digital technology, social presence, and internet self-efficacy) were entered in the second stage of the regression (Model 2). In the third stage, the hypothesized interaction terms (Interaction x Digital technology, Interaction x Social presence, Interaction x Internet self-efficacy, Digital technology x Social presence, Digital technology x Internet self-efficacy, and Social presence x Internet self-efficacy) were entered

(Model 3). The interaction terms were calculated by multiplying and centered the corresponding construct values. The hierarchical linear regression results are summarized in Table 3.

The individual reliability of all constructs was estimated with R square because this coefficient indicates how well a model fits data. The adjusted R square is used to compare models with different numbers of predictors as our case. The results of the regression analysis show that Hypothesis 1 is accepted. To test Hypothesis 2, we examine whether digital technology has a positive and significant effect on the engineering student preferences for blended learning. The results of research show that Hypothesis 2 must be rejected.

Hypothesis 3 proposes that social presence into teaching and learning processes is a good driver for the engineering student preferences for blended learning. Social presence explains important social relationships among students and teachers and the social climate that contributes to success of learning. Thus, on the basis of our research we accept this hypothesis. Finally, on the basis of study results, Hypothesis 4 have been accepted, this states that internet self-efficacy significantly affect engineering student preferences for blended learning. Results showed that gender and digital skills are not significant factor in terms of influencing the student preferences for blended learning.

Table 3 - Regression results.

Constructs	*Model 1*		*Model 2*		*Model 3(full model)*	
	b	*SE*	*b*	*SE*	*b*	*SE*
Control variables						
Gender	-0.076	0.048	-0.051	0.039	-0.049	0.042
Digital skills	-0.049	0.031	-0.033	0.031	-0.026	0.037
Age	0.134*	0.059	0.048	0.056	0.052	0.048
Direct effects						
Interaction			0.197*	0.064	0.199	0.052
Digital technology			0.041	0.021	0.054	0.0038
Social presence			0.196*	0.084	0.203	0.065
Internet self-efficacy			0.213*	0.074	0.287	0.067
Interaction terms						
Interaction x Digital technology					0.108	0.045
Interaction x Social presence					0.037	0.028
Interaction x Internet self-efficacy					0.089	0.036
Digital technology x Social presence					0.167	0.052
Digital technology x Internet self-efficacy					0.263	0.053
Social presence x Internet self-efficacy					0.048	0.032
R^2	0.143		0.267		0.368	
R^2 (Adjusted)	0.12		0.22		0.289	
R^2 change	-		0.124		0.101	

Note. N=118 engineering students; b = unstandardized regression coefficient; SE = standard error of b; *p<.05; **p<.01 and ***p<.001 (two-tailed)

CONCLUSIONS

This research has investigated the impact of interactions, digital technology, social presence, and the internet self-efficacy on the engineering student preferences for blended learning. We found that students' preferences for blended learning are influenced of interactions between teachers and students, social presence and internet self-efficacy. The quality of learning depends on the level of student engagement in the learning process.

Several limitations should be noted. First, the respondents came from one university (UPB), so results may not generalize well to other higher education institutions, only with caution. Second, the sample size provides the minimum number of participants required, the result would be more reliable with additional respondents. As regards the sample, a larger sample would reduce the influence of random variation. Future research using larger samples should aim to examine the robustness of our findings, preferably by simultaneously testing them. Third, future research is indeed needed to more precisely understand the effects of dynamic nature of influence of various factors on innovation. The present research assumes that relationships between variables are in some kind of statistical equilibrium. Nonetheless, we encourage researchers to engage in longitudinal research on mediating effects of the relationship between predictors and student preferences for blended learning. Researchers using a longitudinal study can provide more specific information about the stability and change of the variables, and thus could complement the present empirical finding. Fourth, any theoretical model could be improvement. Nonetheless, more variables can be added to our research model. Also, other measurements such as blended learning adoption and service education quality need to be taken into account. Future studies look to refine this variable through further pilot testing with faculty members, students, and employers, or by selecting a different set of items to represent this construct.

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