A Google Classroom-Based Learning Management System: Empirical Evidence from SEEU

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Abstract

The use of e-learning in a higher education institution is identified by the implementation of Learning Management Systems (LMS). South East European University's LMS experience is longer than a decade. From last year SEE – University is adopting Google Classroom (GC). However, despite adoption of these systems, there are considerable challenges facing the usage of the systems. Hence, a tool has been developed to track the activity of the teachers in the system and to analyze the factors that maximize its usage. Moreover, a module for course and users' management was also implemented. The purpose of this paper is to introduce a new approach of investigating the usage of GC, i.e. identifying the determinants of undertaking GC activities, by conducting empirical analysis for the case of SEEU. Using SEEU Usage Google Classroom Report & Analysis Data for 2016–2017 (SUGCR dataset 2017), we argue that (i) GC activities are affected by demographic characteristics and (ii) level, number of courses, and department affect the usage of GC. We apply appropriate estimation technique such as *mlogit* methodology. Identifying factors which encourage GC activities, with special emphasis on SEEU, might be of crucial importance for Higher Education academic leaders as well as software developers who design tools related to fostering GC.

Keywords: e-learning, LMS, learning content, Google classroom, LMS usage
JEL classification: O30, D83, I21

Introduction

E-learning is world widely accepted as a powerful and significant addition to traditional educational programs and Learning Management Systems (LMS) are the key tools that sustain these new educational approaches. Therefore a considerable amount of study and development on both technological and educational issues in e-learning has been going on with promising results. In many situations the traditional LMSs are short of flexibility needed for implementing innovative educational models or simply for implementing e-learning strategies of a certain institution.

South East European University's LMS experience

South East European University's LMS experience can be divided in three phases. First phase dates from the period 2006-2008 when SEEU initially started the usage of a commercial LMS (ANGEL) with various learning and managing tools. The system was used for more than three years at SEEU and this period was very important since it enhanced the e-learning culture among staff and students and helped us gather lot of data regarding the users' preferences on LMS (Abazi-Bexheti et al., 2009b). Although very popular and widely used among staff and students, it was very difficult if not impossible to extend, maintain or modify this LMS mainly due to its business model. Also because of its price tag, it was more feasible for the university to start developing its own system.

One of the requirements before building this system was to easily be bundled/integrated with other SEEU systems. A full integration with other electronic services on campus (enrolment services, grading schedule etc.), would be the main advantage of this LMS, something that was impossible or very hard to be achieved with other third party systems. Therefore, in the second phase a new in-house LMS-Libri, was developed and integrated with other e-systems at SEEU (Abazi-Bexheti et al., 2008). This phase lasted from 2008-2016. The initial version of Libri consisted of the tools that staff and students found as most important for their teaching and learning experience in the first phase (Abazi-Bexheti et al., 2009b).

This is in fact one of the main reasons for the in-house approach: to design a LMS that would be in line with the current trends and technologies and further on to explore, analyze and enhance it, based on users' experiences (Shehu et al., 2009).

The third phase of the LMS experience at SEEU started by the end of 2016, when on one side the LMS storage expenses started to increase and on the other side the in-house advancement and development of the system could not reach the pace of tools and developments that are coming from manufacturers and huge companies offered for free. The first advancement was done by integrating Libri with Google Drive. The purpose for this change was the issue that SEEU was dealing with the lack of storage for the learning contents. When it comes to storing data, cloud storage, more precisely Google Drive file repository system, was quickly seen as one of the best possible solution.

However, the appearance of Google Apps for Education has shifted teaching and learning into a completely new era of opportunities. Even though the initial belief was that Google Classroom (GC) will be used only by individual teacher and will not affect the LMS market, still it's APIs and possibilities for further extension towards meeting the criteria of an LMS were identified (Abazi-Bexheti et al., 2016).

GC-LMS solution is in use at SEEU from sept 2016 to present, as a successful solution of the financial barriers and user' requirements in the past decade. In addition to this, the developed tool tracks the activity of the teachers in the system and on the system usage. Moreover, it generates reports which are further on analyzed in order to identify the factors that maximize its usage.

Assessment of a LMS usage

Another perspective which raises considerable attention in institutions using a LMS is how to be able to assess the actual extent of LMS usage by the staff. Although the trends are towards more student centric learning tools, the research done has shown that yet the teaching staff is the key driver of a LMS usage "(Alshamari, 2015)". The need for a reliable guide of the extent of LMS usage becomes apparent when one considers the complexity of assessing to what extent a LMS is actually used within an institution. In this direction, range of aspects of LMS adoption, implementation,

support, and usage have been the subject of numerous studies "(McQuiggan, 2007)". The assessment method that we used is built upon the metric model for LMS evaluation proposed by Janossy "(Janossy, 2008)". This model is simplified in four basic levels of usage based on the history of LMS usage data that we had. The metric level model uses a different value for each certain group of activities on a LMS.

Level 0, defined in the proposed model is the null situation of LMS use, that is, non-use. It is identified as Level 0 and results when the instructor does not create a course in LMS or does not activate student access to the LMS for the students in the course if a course is automatically created in the LMS.

Level 1, refers to the very basic usage of the system only for uploading lesson content by the teaching staff and downloading lesson content or submitting assignments by the students.

Level 2, refers to the usage of communication and assessment tools in an LMS. It includes the usage of modules such as email, test, quizzes, or survey.

Level 3, refers to more advanced usage which includes recording lessons and applying more innovative methodologies in course delivery such as flipping classroom.

Research objectives

SEEU Usage Google Classroom Report & Analysis Data has been developed as a tool for two purposes: (i) to track the activity of the teachers in the system and (ii) to analyze the factors that maximize its usage. The data generated from this tool, SEEU Usage Google Classroom Report & Analysis Data for 2016–2017 (SUGCR dataset 2017), will be employed to empirically investigate issue of the level of LMS usage, in order to identify the factors that enhance the GC usage.

Thus, factors such as academic staff title, faculty/department, age, ethnicity and gender, are employed as determinants affecting level of LMS engagement.

Methodology

The methodology section consists of two parts: (i) system design and implementation – presents the developed tool and the its possibilities; and (ii) identifying factors that enhance the GC usage, using the generated data.

System Design and Implementation

The conceptual design of the proposed approach includes three main modules:

- Google Classroom, which manages instructors' and students' course works
- reporting and analysis module, which is used to generate real-time and accurate reports about the activities within courses, and
- management module, which allows one to create, edit or delete courses and manage course users' delegation.

The solution was implemented as ASP.NET MVC application using Entity Framework (version 6) for dynamic management of database design and Google Classroom API for .NET for Classroom courses management. To have a single point of interaction between our server and Google servers, the Google OAuth 2.0 service account scenario was approached. Namely, a G Suite domain administrator account was used to access user data on behalf of users in the SEEU Classroom domain.

In UI perspective, the application was designated to include a page for the user's Dashboard (Figure 1), Reporting & Analysis (Figure 2) and Course Management

(Figure 3). The system is used by three kinds of users: administrators, university academic leaders and faculty deans or directors of specific departments. Based on user role, the:

Dashboard page is divided into three columns, where the first one lists the instructor names, the second one the course list and the third one the course works (feeds) list. After loading the initial lists, whenever a user clicks on an instructor name the course lists becomes populated with his/her courses and the course works lists includes the instructor's works across all course engagements. Moreover, if one wants to see the instructor's work on a specific course, he/she may click on the course name and the feeds list will become updated with only the records published within that particular course.

Reporting & Analysis page consists of a set of reporting diagrams that enables deeper insight of course works for high management, deans and directors. Moreover, these users can observe course activities in real-time. A button to generate real-time statistics for all current term courses is also available to the users.

Course Management page provides the LMS administrator with the available tools to create, edit or delete courses, while also can make course delegations to course instructors or students. The GC API supports batch requests for making multiple transactions at once. This feature has been utilized for creating multiple courses from a CSV file or from the web service delivering the course details from the SEEU's admission office.

Figure 1

The application's UI pages for an administrator account: Dashboard

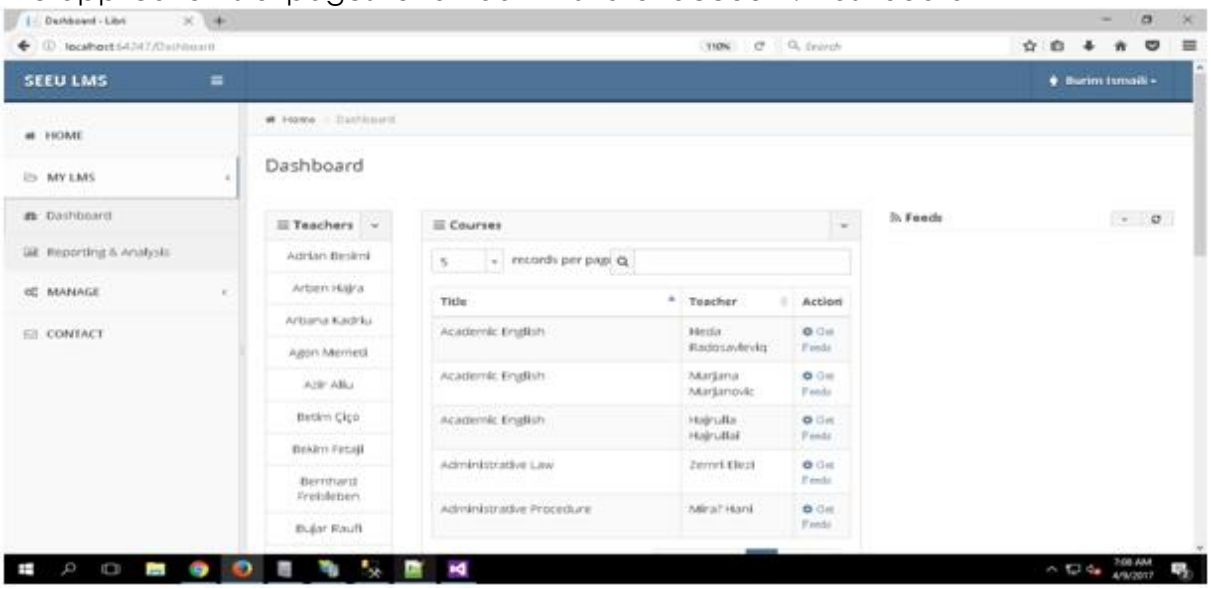


Figure 2
The application's UI pages for an administrator account: Reporting & Analysis

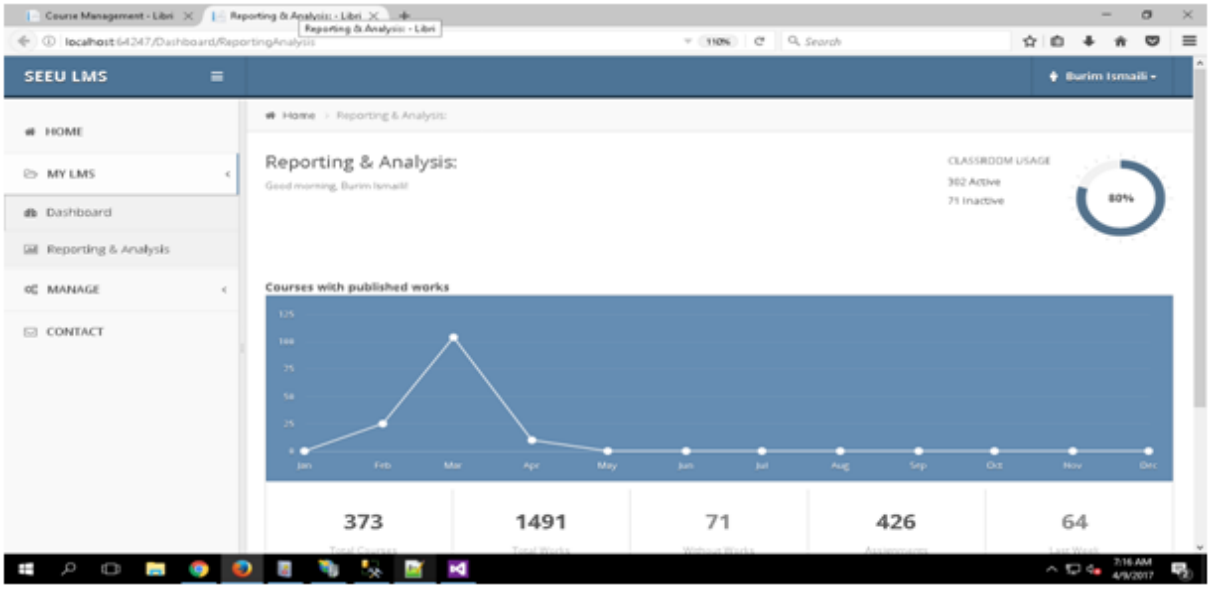
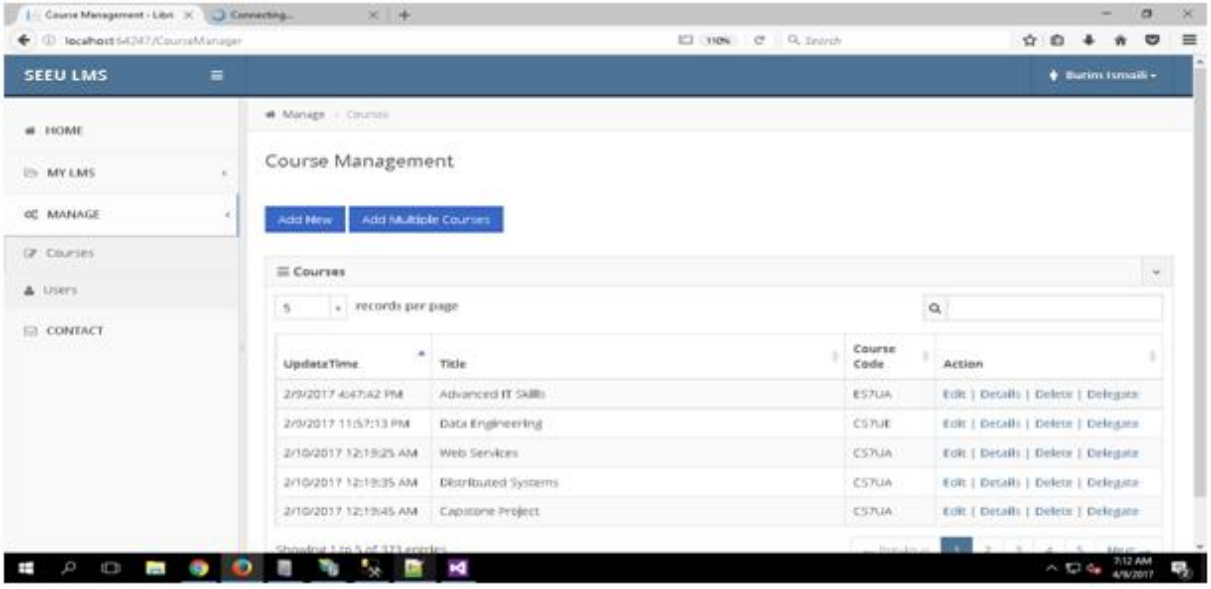


Figure 3
The application's UI pages for an administrator account: Course Management



Identifying factors that enhance the GC usage

The effects of the potential determinants identified in the previous research (Abazi-Bexheti et al., 2009a), of LMS level of usage will be estimated using data generated from the tool, i.e. SUGCR dataset 2017. The data consists of 364 observations, which at the same time presents the number of courses created on the GC. The empirical methodology involves a *Multinominal Logistic Regression* model, which is based on the assumption that there is an unobserved variable Y_i, the value of which is determined by the explanatory variables X_i (Menard, 2009):

$$Y_i = \beta_0 + \beta_i X_i + u$$

In the context of this research $Y_i$is the *level of LMS usage* indicator and X_i are the explanatory variables that were identified above. The program used for the

estimation is STATA 11 and the respective command for the estimation of this modelis*mlogit*.

The dependent variable in the model used is the *level of LMS usage,* which is equal to one if the course is assessed as Level 1; equal to two if the course is assessed as Level 2; so far there are no courses assessed as Level 3;and zero otherwise (which is Level 0 – base outcome). Whereas the independent variables are students enrolled, resources, assignments, academic staff title, faculty/department, age, ethnicity and gender. The correlation coefficients of the independent variables do not indicate multicollinearity problems.

Results

The results of the multinominal logistic regression estimations are presented in Table 1. The table includes estimations of the marginal effect coefficients for each of the independent variables.

Table 1
The results of the multinominal logistic regression

Independent Variables	Multinominal Logistic Regression		Marginal effects	
	Coef.	Std. Err	dF/dx	Std. Err
Level 1 equation				
Students	.0581***	.016	-.0079**	.0024
Resources	.3390***	0428	-.0488***	.0090
Assignments	-.9971***	.2204	.1329***	.0217
Age	-.0191	.0204	.0036	.0029
Gender	-.6530*	.4073	.1015*	.0642
Ethnicity	-.0772	.0715	.0991***	.0256
Faculty	.4666	.0917	-.0055	.0128
Title	-.0857**	.0766	-.0640**	.0281
Level 2 equation				
Students	-.0050	.0406		
Resources	.3731***	.0678		
Assignments	.7596***	.1694		
Age	-.1798***	.0599		
Gender	-.8161	.7526		
Ethnicity	.0473	.2881		
Faculty	-.1589	.2244		
Title	-.1562	.1529		
cons	2.4528	2.5398		
Observations	364			
LR chi2(16)	288.11			
Prob> chi2	0.000			
Pseudo R-squared	0.4841			

Source: Author's calculations

After generating the multinominal logit regression model for *level of LMS usage* we calculate the coefficients' exponentials of the statistically significant variables, such as students, resources, assignments, age and gender.

- Considering the coefficient of the variable *students* in *level 1 of LMS usage* equation is 0.058 (positive and statistically significant). Exponentiating the coefficient we obtain the value of 1.059, which means that the relative probability of Level 1 LMS usage rather than Level 0 LMS usage is 6% higher for larger groups of students. The coefficient of the variable *students* in the *Level 2 LMS usage* equation is -0.005. Exponentiating the coefficient we obtain the value of .99, which means that the relative probability of Level 2 LMS usage rather than Level 0 LMS usage is 0% for larger groups of students.
- Considering the coefficient of the variable *assignments* in *level 1 of LMS usage* equation is -0.997 (negative and statistically significant). Exponentiating the coefficient we obtain the value of .368, which means that the relative probability of Level 1 LMS usage rather than Level 0 LMS usage is 63% lower for assignments. The coefficient of the variable *resources* in the *Level 2 LMS usage* equation is 0.759. Exponentiating the coefficient we obtain the value of 2.137, which means that the relative probability of Level 2 LMS usage rather than Level 0 LMS usage is more than double for staff that posts assignments.
- Let us focus on the coefficient of age in the Level 1 equation, which is -0.019. Exponentiating we obtain 0.981, which means that the relative probability of level 1 rather than level 0 is for 2% lower for older staff than for young staff. The coefficient of age in the level 2 equation is 0.813. Exponentiating, we obtain 0.835, which means that the relative probability of level 2 LMS usage rather than level 0 usage is for (29%) lower for older staff than for young staff.
- Considering the coefficient of the variable *gender* in *level 1 of LMS usage* equation is -0.653 (negative and statistically significant). Exponentiating the coefficient we obtain the value of 0.520, which means that the relative probability of Level 1 LMS usage rather than Level 0 LMS usage is 53% lower for male than female. The coefficient of the variable *resources* in the *Level 2 LMS usage* equation is insignificant.
- Considering the variables ethnicity, faculty and title of staff, they are statistically insignificant, which means that the level of LMS usage is not affected by them.

Conclusion

E-learning is equally treated as reason and outcome of important changes in the nature of the education concept, as well as changes in the understanding of how it should be successfully established. With the e-learning arrival and progress, SEEU started to deal with diverse activities to address emerging challenges that go beyond educational issues. The new advanced LMS solution included all the elements in respect to learning, teaching, communication, creation and management. It was a planned process that required digital skills, competences and techniques of designing the course and course instruction, communication methods through electronic and other technologies, along with crucial organizational and administrative procedures.

In this paper was introduced a new approach of investigating the usage of GC (LMS), i.e. identifying the determinants of undertaking GC activities, by conducting empirical analysis for the case of SEEU.

Using Multinominal Logistic Regression model we found that: (i) the number of students registered in the course has impact in announcing the minimum required

lesson content by academic staff needed for level 1 of usage, but not for further advancement on level 2 of LMS usage; (ii) the assignments posted by the academic staff also confirm the appropriateness of the Level model used, where without significant number of assignments the advancement from level 0 to level 1 is not achieved whereas it is doubled from level 0 to level 2 with considerable number of assignments posted; (iii) there is negative relationship between the age and the usage of LMS, which is in accordance with our expectations due to the IT literacy needed for the use of technologies that is not very high for older members of the academic staff; (iv) females are more prone to level 1 of LMS usage which is not the case for level 2.

This study limitation is the time span of the data. These data reflect one semester observation and usage which is limited time period. Once the data for the next semesters will be generated, one can consider trend and suggestions for further developments.

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