Hybrid Courses and Associated Distributed Learning Paradigms

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Abstract— **Current learning management system (LMS) are distributed learning environments that allow administration, documentation, tracking and delivery of educational programs worldwide. LMSs are targeted mainly towards online learning delivery but they also support hybrid forms. In this paper we present a brief review of current trends in LMS development and a case study targeted at student-student interaction improvement. We show how the hybrid version of a course can overcome some of the challenges associated with student retention, as well as present specific web-based tools and methods that can positively impact student learning and interaction. The experimental results prove that student retention can be improved by adopting specific early warning systems while student learning is positively affected through the employment of specific tools available in the LMS.**

Keywords-hybrid; e-learning; distributed learning

I. INTRODUCTION

By 2020, mobile applications are forecasted to generate around 189 billion US dollars in revenue via app stores and in app advertising [1]. Learning through videos will continue to hold its appeal as video-based learning will account for 75% of total mobile data traffic by 2020 [2]. Estimates show that by 2018, social media users will be 2.67 billion worldwide, up from 1.91 billion in 2014 [1]. Between 2017 and 2018, the LMS market will grow by about 23.17% [3]. A recent survey [4] shows that 82% of high school students use smartphones regularly, 90% of the students agree that tablets will change the way students learn in the very near future and 82% of the students agree that using tablets in the classroom lets them learn in a way that's best for them.

In an effort to cope with these fast technological advances we must continue to improve course materials and adapt teaching methods to make use of mobile devices as well as monitor the student learning efficiency using these novel teaching methods. Whether we like it or not, whether we agree with it or not, technology is permeating in all areas of teaching from content delivery to student performance assessment. Existing learning management systems are becoming more and more complex, and can improve both content and content delivery efficiency to help students succeed in their learning quest. Moreover, a significant amount of data can be extracted and can be used to enhance student learning.

LMSs have been deployed in the US for several decades and currently more than one in four students take an online course according to a 2015 survey of online learning [5]. While in Eastern-Europe, online programs are in their infancy, with the advent of high-speed Internet and mobile technology even in remote areas, the potential for rapid growth is tremendous.

An important factor for the implementation of distributed learning programs worldwide is the reduced cost associated with attending these programs, as well as the time flexibility provided to students and instructors. One can attend courses from home and interact with the instructor without additional costs associated with travel, on a flexible schedule around a full-time job.

This paper provides a brief review of the most popular LMSs and suggests ways to employ them in order to improve the learning experience. The paper is structured as follows. In Section 2 we present a review of existing LMSs and some of their main features. In Section 3 we present a case study in conjunction with a proprietary LMS that we have employed over the last decade, we conclude in Section 4 highlighting the main features that we believe can positively impact student learning and retention.

II. MAJOR LMS SYSTEMS

At present estimates show that LMSs generate about 7 billion dollars a year, where the most considerable contribution is from North America [6]. About 40% of this revenue is generated through Fortune 500 companies that use this technology for employee training. Furthermore, by 2019, it is estimated that half of the college level classes will have and online component [6].

There are many popular LMSs on the market today. The best LMSs are based on the novel cloud technology for data storage and retrieval. A simple search online retrieves over 130 systems [7]. Some are open source e.g. Moodle, Eliademy, Forma.LMS, ILIAS, Opigno - SCORM 2004 and Tin Can (xAPI). Some are proprietary, e.g. Coursera, Desire2Learn, Adobe Captivate Prime, Docebo, Talent LMS, Growth Engineering, ExpertusONE, Administrate, Dokeos, PROPEL Enterprise + Distribuire, LearnUpon, Fuse UniversalFuse Siguration, WiZDOM Enterprise,

GnosisConnect, Agylia, Cypher Learning, Absorba LMS, just to name a few.

Due to the large number of systems that have sprung in recent years it is difficult to name a winner however Blackboard, Canvas, and Moodle top the higher education space, whereas systems like Edmodo (one-part LMS, two-parts social media network) accommodates better K-12 students.

In terms of pricing, LMS vendors usually charge a monthly fee that can be reduced if a yearly plan is purchased. Such plans range widely in costs as well as features. At one end is Moodle, open source, and un-hosted; at the other are the all-inclusive, hosted offerings like Absorb and Schoology[8].

III. CASE STUDY – STUDENT-STUDENT INTERACTION

The focus of this paper is on the LMS currently adopted by the University System of Georgia (USG) in US. USG is composed of 28 higher education institutions including four research universities, four comprehensive universities, 10 state universities and 10 state colleges. The LMS used, Desire2Learn™ (D2L), is developed by an educational technology company with corporate headquarters in Kitchener, Ontario. It is also known as Brightspace learning management system. D2L is not new to online learning. Founded in 1999, D2L created one of the very first learning management systems. Today, Brightspace remains one of the most popular platforms in the educational space, behind only Blackboard, Canvas, and Moodle, according to a recent Edutechnica report [9]. It stands apart from other platforms in its longstanding commitment to competency-based education and blended learning.

We focus on student interaction through the D2L discussion forums. Two types of student interactions are enabled by D2L: synchronous and asynchronous. Whereas synchronous interactions requires participants to log in at a predetermined time and simultaneously join a chat channel, asynchronous activities allows users to organize, read, reply and post messages at their own pace, as dictated by their preferred schedule.

Several strategies for student-student interaction improvement have been presented in the past [10] however we are focusing mainly on improving asynchronous student-student interaction by means of contributions in the discussion forums.

A. *Monitoring and Increasing Student-Student Interaction*

We employed D2L to teach the computer science course CSCI 1150 "Fundamentals of the Internet and the World Wide Web". For this course we implemented a discussion forum with 10 threads. Each thread is associated with one of the main topics discussed in the course. Interaction in the discussion forums was monitored throughout each semester spring and fall each year for 5 consecutive years. The total number of posts has been summed up each year as well as the number of reads for each post. We also monitor the number of posts that are replies to existing posts to gauge the interest of students in helping each other by replying to their colleagues. The total number of students in each semester fall and spring was about 75, usually divided into 2-3 sections. Approximatively 150 students attend this course every year.

It is important to mention that an important motivation factor for the students is that interaction through the discussion forums is evaluated for each student at the end of the semester both qualitatively and quantitatively. This interaction counts as 10% of the student final grade. To increase student interaction in 2015, we added weekly reminders in the D2L announcement system to prompt students to participate online. Moreover we added an additional 3% extra credit if students replied to at least 3 questions of their colleagues in each thread. Figure 1 illustrates the impact of these policies. As one can see for 2015 and 2016 the number of thread reads surpasses the number of posts showing that students pay more attention to their colleagues' posts.

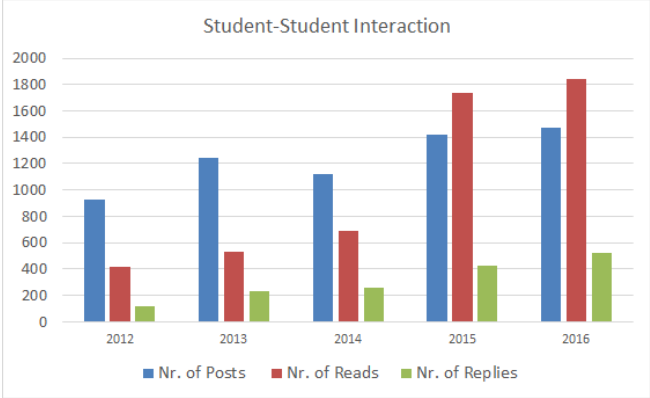

Figure 1. Student-Student interaction in the forums

Moreover the number of replies for existing posts has more than doubled in 2017 compared with 2015 showing that students attempt to answer each other questions and provide their opinions.

B. *Early Warning Systems*

Dropout, withdrawal and failure rates are closely monitored by universities and are associated with students' success. Distributed learning systems like D2L provides important statistical data that can help address these rates at a different level. For example student online interaction as well as assessment performance can be monitored and can provide early warnings in case the student fails to accomplish some of the course goals.

Figure 2 illustrates anonymized student data showing the percentage of course content visited online and the number of logins for each student. A significant drop in the logins, as well as online content reading, can trigger a warning signal for a specific student. An e-mail can be used to warn the student of his/her performance degradation followed by a set of suggestions of actions for improvement.

Figure 2. Student online participation sample

In the CSCI 1150 hybrid course, the students are assessed through a system composed of 10 quizzes, 4 assignments and 2 comprehensive exams. D2L statistical data can be employed to monitor the students' progress vis-à-vis their assessment grades. Figure 3 illustrates anonymized student data showing assessment grades.

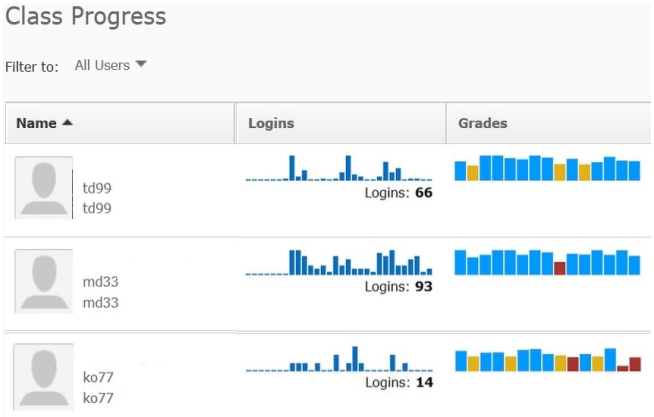

Figure 3. Student assessment grades

Student assessment grades are an excellent indication of student performance and early warnings can be implemented when student grades are consistently lower. In Figure 3 grades that fall below a certain threshold are highlighted with red, providing an immediate visual queue that the student is not performing well at that point in time. By analyzing this data, one can observe that some specific trends appear. For example a large number of logins and extensive online interaction tends to generate better grades while poor online presence is more indicative of a failing student.

IV. Conclusions

In this paper we have provided a brief overview of the current trends in distributed learning management systems. With the widespread of handheld devices among younger generations, more and more investments are made in developing online distributed learning and course management systems. While sometimes difficult to adopt, both by the teacher and the student, LMSs are capable of colleting a lot of data that can be employed in improving student-student interaction. Moreover statistical data collected throughout the semester can be used to implement early warning systems, in order to reduce student drop-out and failure rates.

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