ENHANCING IN CLASS LEARNING THROUGH A TWITTER-BASED MICROBLOGGING AND SOCIALLY INFLUENCING SYSTEM

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Abstract

Education and learning experiences are fundamental for our evolution and prosperity. Novel information systems can bring new ways to enhance teaching and learning in classrooms, by addressing important aspects of learning experience as fun, novelty, student engagement, learning effectiveness, learning satisfaction, and social learning. We investigate the potential of microblogging in improving learning experience through more harmonious and dynamic class atmosphere, and how to keep attractive the continuous use of microblogging in class using socially influencing features. Results reveal that the microblogging system had the capacity to significantly increase fun, novelty, student engagement, learning effectiveness, and learning satisfaction in classrooms. The socially influencing features, applied in the microblogging system, contributed to increase fun and learning effectiveness.

Keywords: Collaborative work, Educational activities, Educational technology, Information and communication technology, Instant messaging, Learning systems, Social computing.

1 INTRODUCTION

The importance to provide an enriched education in college is not a new agenda. Reference [1] already highlighted principles that a good education should promote, including: student-faculty interaction, cooperation among students, active learning, prompt feedback, time on task, high expectations, and respect for diverse talents and ways of learning. The emergence of information systems (IS) for learning purposes has stimulated research, mainly based on the fact that IS itself do not guarantee learning success, since success depends on how IS are utilized by educators [2]. Educational context has then been taken advantage of IS and Internet to improve course quality, student engagement and consequently learning outcomes.

Applications based on microblogging (with Twitter being one of the best-known) have been used by educators in a way to engage students in classroom by promoting interactivity and reflective learning. For instance, [4] showed that the use of a microblogging tool improved the quantity and quality of students' participation. According to [5], Twitter itself can be used to generate discussion and interest in the course topics, being beneficial to engage students in experiential learning. Reference [6] used a microblogging tool to allow students to post questions and answers during the class. They found that the tool is effective to promote class discussion, and consequently to improve active learning. Reference [7] used microblogging in lectures to capture students' questions and also propose a classification approach to help professor to identify relevant questions to address in class. Reference [3] has explored how a Twitter-based IS can be enriched with social influence features to increase user engagement in various contexts, including classrooms.

Among possible types of IS for classroom learning, we chose microblogging, due to its characteristics of novelty, facility to use, and interaction capability. We designed a microblogging system to be tested with students using it in their classes. Based on the reflections of [8], we chose a subject in an engineering course where exercises have to be solved collaboratively. The aforementioned scholars explain that active experimentation is essential for students, as it enables them to obtain or reinforce knowledge by putting abstract theories into practice. Regarding engineering education, [9] adds that engineering straddles the boundary between abstract and experiential worlds, so learning experiences have to enable students to shuttle such boundary.

Our goal is to explore the potential of microblogging in improving learning experience through more harmonious and dynamic class atmosphere. Such context enables us to investigate various interesting learning perspectives and relevant factors. The introduction of a new system in class can be perceived as novelty by students and bring fun to routine. Student engagement, learning effectiveness, and

learning satisfaction are fundamental factors that often determine the success of educational IS. A classroom with students instantly creates a social context. That naturally opens an interplay of various social influence aspects. As microblogging by default enables active communication and interaction possibilities, one interesting factor to explore would be social learning, i.e. how students learn from each other. Depending on how microblogging is implemented, students often may also compare their performance with others, compete with others, or feel recognized for their participation. Further in this paper, we provide a conceptual background and state our research question. We describe our experimental design. We outline our data analysis and results. We conclude and indicate the potential for future research and application.

2 METHODOLOGY

Participation is directly related to student engagement, which can be defined as the student's willingness, need, desire and compulsion to participate in the learning process [10]. Learning engagement means then the students' voluntary participation in activities designed as part of the learning program. Engagement can be seen as a perception of student involvement with the studied topic resulted from in class interactions [11], [12]. As students learn better when they are engage in the learning process, student engagement is a pervasive and persistent goal for educators [6]. One way to seize students' attention in classroom is by offering activities based on novelty and fun [13].

Learning engagement, in general, affects positively learning effectiveness and learning satisfaction [11]. Learning effectiveness refers to the extent to which students acquire knowledge and skills [14]. Learning effectiveness is then the main learning outcome, since educators are interested on students' comprehension and retention of the course content. Learning satisfaction depicts students' assessment of their overall learning experience [15], so it represents a manifestation of students' learning experience. Satisfaction is also a relevant measure to assess the quality of the teaching in an institution [13]. Students that exhibit higher satisfaction, in general, are those who perceive effective knowledge transfer [11], [16], so learning effectiveness can also bring learning satisfaction.

Interactivity is a key source of success in education. Two types of interactivity can be distinguished: interactivity with instructor and interactivity with peers [12]. Microblogging usually empowers students to share their views, doubts and opinions. Although an obvious benefit instructors can access students' feedback, but the major gain is for students that can learn with peers' responses characterizing the social learning [17]. When students use information about classmates to evaluate themselves, they engage in social comparison [18]. More precisely, social comparison is defined as the process of thinking about others in relation to the self [19]. This process influences motivation as students look for self-enhancement when comparing with others worse off or self-improvement when seeking a positive example for comparison [20]. So, it affects their attitudes [21] and behaviors, e.g. contribution to online communities [22], [23].

Interpersonal factors of competition and recognition provide important intrinsic motivations that would not be present in the absence of classmates [24]. Competition is directed toward the same social end by at least two individuals [25]. Students compete when trying to achieve more than others in the class [26]. With independent tasks, providing some salient metric for students to compare their performances could promote competition [24]. Recognition could be experienced after competing with other students [27] or simply enjoyed when gaining acceptance and approval [28]. Both motivating factors influence various behaviors, including learning [24] and use of blogs and pod-casts for generating sense of community [29].

Our investigation explores how microblogging in class can enhance different learning factors. Moreover, we are interested in the effectiveness of continuous use of microblogging. Thus, we focus our study on the two research questions: (R1) "How microblogging in class contributes to fun, novelty, student engagement, learning effectiveness, learning satisfaction?" and (R2) "How to keep attractive the continuous use of microblogging in class?". In this section, we explain how we conducted the experiment to investigate the proposed research questions.

We used a sample of 50 undergraduate students enrolled in a course about Numerical Methods at a major engineering institute. Participants belonged to two different sessions and they were in their second year of study. Only one professor was in charge of the course in both sessions. The professor used the same course material and provided the same lectures to both sessions, in order to ensure that students covered the material in an identical way. Students attended classes 2 days a week for 3 hours during a semester. Their ages ranged from 18 to 24, with a mean of 20. The sample consisted

of 45 males and 5 females. Regarding their experience with microblogging (in particular, Twitter), they reported for how long they are Twitter users: never (60%), less than one month (2%), 6 months to 1 year (4%), 1 to 2 years (22%), and 2 years and more (12%).

2.1 Microblogging system and socially influencing system.

We designed a microblogging system (further, the system) to show tests and receive student responses (using predefined hash-tags) submitted via Twitter, a popular microblogging social media platform [30]. Moreover, Twitter is found to be effective for student engagement [31], persuasion [32], and influence on actions outside the virtual world [3]. The system was designed for projection on large screen with an aim to engage students in answering the given tests during the class. The system displayed tests at the top of the screen, while students provided answers by sending Twitter messages, i.e. tweets.

As students began using the system, it automatically showed all updates on the screen, so that everyone in the class could follow their own actions and also what other classmates are tweeting. Answers given by students were displayed on the left side of the screen. This feature provided means for social learning as it allows students to observe how others provide answers and learn from that. The professor was also able to read the responses of all students for any test, which helped to identify students' doubts or misunderstandings.

We also designed a socially influencing version of the system [33], which included three additional social influence features. The features were related to recognition, competition, and social comparison. The recognition feature showed a name and picture of each participant with their achieved level during each session. We used the following levels: bronze (1-2 tweets), silver (3-4 tweets), gold (5-6 tweets), platinum (7-8 tweets), and diamond (9 and more tweets). The feature regarding competition presented a rank of participants ordered decreasingly by the number of tweets, so participants could observe how they were in the rank and be stimulated to improve their position. The feature about social comparison showed the name of each participant in different sizes and colors depending on the participation in the session. We used the following pattern: 1 tweet (grey color and font size as 1), 2 tweets (brown color and font size as 2), 3 tweets (black color and font size as 3), 4 tweets (orange color and font size as 4), 5-6 tweets (red color and font size as 5), and 7 or more tweets (blue color and font size as 6). The features were rotated on the right side of the screen.

2.2 Procedures and data collection measures.

The system was used by two groups of students. Group A had 23 students, and Group B had 27 students. Students of Group A used the basic system twice. Students of Group B used the basic system once, but later its socially influencing version. A set of 7 tests were specified for students to respond to using the systems. The tests covered the subjects of "Floating Point System" and "Solution of Linear Equation Systems". The students also had the tests in printed version, just in case they desire to read more carefully the given test. Each student could send zero or more responses to each test. All responses had to be sent to the system. Before using the system, the professor explained it and gave some time for students to practice with the system. A large screen in front of the class was used to project the system, so any student could fully observe it. The professor could also explain each test by commenting the responses on the screen and explaining possible errors.

We designed a questionnaire to measure the following factors of interest: fun (" The class is exciting"), novelty ("There is the usage of new learning resources in class"), student engagement ("I stay interested during class time"), learning effectiveness ("I perceive a knowledge growth in class"), learning satisfaction ("I am satisfied with the class"), social learning ("I am able to learn from other students in the class"), social comparison ("I am able to compare my performance with the performance of other students in the class"), competition ("I am able to compete with other students in the class"), and recognition ("I can receive public recognition for my activities in the class"). We used seven-point Likert scale items in all cases: 1 (strongly disagree), 2 (disagree), 3 (somewhat disagree), 4 (neither agree nor disagree), 5 (somewhat agree), 6 (agree), and 7 (strongly agree).

2.3 Experiment structure.

Participants responded to the questionnaire in three distinct times, according to Fig. 1. Time 1 was before using the system, considering only the previous experience of students in regular classes. Time 2 was the moment after using the basic system. In Time 3, Group A considered its experience with the second usage of the same basic system. In Time 3, Group B evaluated its experience with the socially influencing system. The experiment structure flowed directives of pre-test and post-test experiments,

which is an assessment model designed to examine the change in overall situations or dispositions in a group of test takers. In Fig. 1, with dashed lines we mark the designed analysis as well as the related research question (R1 or R2). We also allowed the participants to write thoughts about their experiences, so we collected complimentary qualitative data for further analysis.

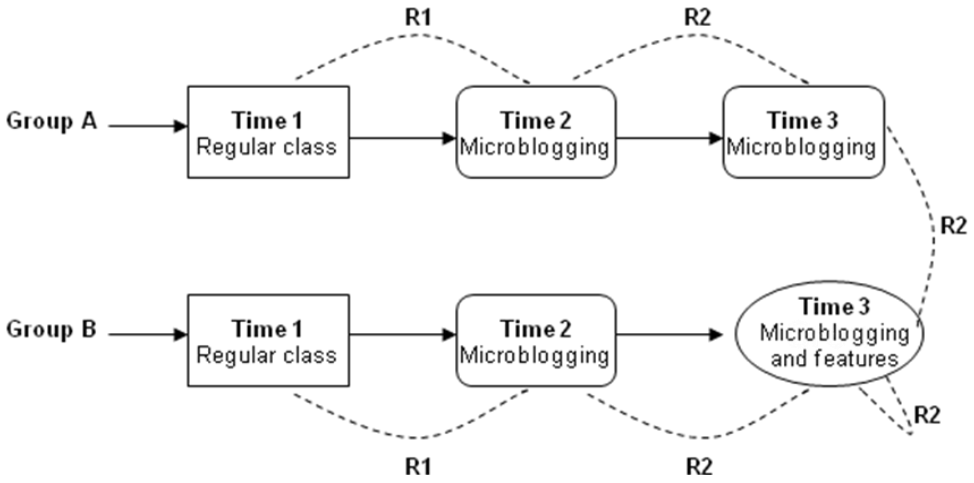

Figure 1. Experiment structure.

To reason about research question R1, we conducted the following analysis: (a) In Group A, we compared, for each factor, distributions in Time 1 and Time 2 using paired test; and (b) In Group B, we compared, for each factor, distributions in Time 1 and Time 2 using paired test. To reason about research question R2, we conducted the following analysis: (a) In Group A, we compared, for each factor, distributions in Time 2 and Time 3 using paired test; (b) In Group B, we compared, for each factor, distributions in Time 2 and Time 3 using paired test; (c) We compared, for each factor, distributions in Time 3 of Group A and Group B using independent sample test; (d) In Group B, we investigated dependence among factors in Time 3 using correlation analysis.

3 DATA ANALYSIS AND RESULTS

Table 1 and Table 2 show the median of each assessed factor in Group A and Group B, respectively. For distribution of Group A and B in Time 1, 2 and 3, we executed Anderson-Darling test for all factors, which showed that data were not normally distributed. We then used non-parametric tests to compare scores in distinct times. We used Wilcoxon signed-rank test as the paired test. We used Wilcoxon-Mann-Whitney test as the independent sample test. Table 1 and Table 2 show W (meaning Wilcoxon test statistic) and p (meaning p-value) for the paired test used in each group to compare Time 1 with Time 2. We performed the same test comparing Time 2 with Time 3. We also applied independent sample test to compare Time 3 in Group A and Group B. Using Wilcoxon signed-rank test or Wilcoxon-Mann-Whitney test, we want to test a null hypothesis, which says that the distribution X is the same as the distribution Y. For typical analysis, using the standard $\alpha=0.05$ cutoff, the null hypothesis is rejected when $p < 0.05$ and not rejected when $p > 0.05$. A result is said to be statistically relevant if it allows rejecting the null hypothesis, meaning that there is a difference between distributions X and Y. We indicated with an asterisk when the null hypothesis is rejected.

3.1 Responding to research question R1.

Aiming to respond research question R1 (“How microblogging in class contributes to fun, novelty, student engagement, learning effectiveness, learning satisfaction?”), we compare in Group A distributions in Time 1 and Time 2 using paired test. According to results of Wilcoxon test shown in Table 1, null hypothesis was invalidated for all factors, except social learning. So, our data analysis indicates that all factors, except social learning, increased significantly when using microblogging. Social learning did not increase, however it already had good evaluation in regular class (Time 1). Moreover, we can evidence that the p-value for social learning ($p=0.056$) is really near the cutoff point ($p=0.05$).

Table 1. Factors assessed by Group A.

Factor	Time 1 Median	Time 2 Median	Time 3 Median	Time1-Time2 W	Time1-Time2 p
Fun	2	6	5.5	0	3.83E-05*
Novelty	2.5	7	6	2.5	5.64E-05*
Student Engagement	3	6	6	0	8.60E-05*
Learning Effectiveness	4.5	6	6	39.5	0.004*
Learning Satisfaction	3	6	6	0	2.57E-05*
Social Learning	5	5	5	60.5	0.056
Social Comparison	4	5	5	9	5.32E-04*
Competition	2	4	4	16	0.001*
Recognition	3.5	5	5	36.5	0.003*

* Null hypothesis is rejected at 0.05 level.

Table 2. Factors assessed by Group B.

Factor	Time 1 Median	Time 2 Median	Time 3 Median	Time1-Time2 W	Time1-Time2 p
Fun	3	6	7	9	2.23E-05*
Novelty	3	6	7	27	1.55E-04*
Student Engagement	3.5	6	6	17.5	9.21E-05*
Learning Effectiveness	5	7	7	5.5	4.69E-05*
Learning Satisfaction	2.5	7	7	10.5	1.7E-05*
Social Learning	5.5	6	6	49.5	0.349
Social Comparison	4	5	5	58	0.044*
Competition	2	4	4	50.5	0.013*
Recognition	4	4	6	101	0.155

* Null hypothesis is rejected at 0.05 level.

To expand our analysis, we made the same comparison above in Group B using paired test, considering participants' experience in regular classes (Time 1) and in the proposed microblogging class (Time 2). According to results of Wilcoxon test shown in Table 2, null hypothesis was invalidated for all factors, except social learning and recognition. So, data analysis indicates that all factors, except social learning and recognition, increased when using microblogging. Social learning did not increase again. However, it had already good evaluation in the regular class (Time 1), which indicates that it was well addressed even before, in the regular classes for both Group A and Group B. We found that microblogging did not contribute to improvement in recognition in Group B. In group A, we had results showing increase in recognition.

3.2 Responding to research question R2.

Aiming to respond R2 (“How to keep attractive the continuous use of microblogging in class?”), we compare in Group A distributions in Time 2 and Time 3 using paired test. According to results of Wilcoxon test, null hypothesis was not invalidated for any factor. So, no relevant change was found in factors in case of repeating the use of microblogging. It was already expected, since no new elements were submitted to the group. Comparing only the medians shown in Table 1, we noted that fun and novelty decreased, since the microblogging was already used by the group. The other factors remained at the same level.

In Group B, we used paired test to compare distributions originating from the basic system (Time 2) and the socially influencing system (Time 3). According to results of Wilcoxon test, null hypothesis was not invalidated for any factor. So, no relevant change was found in factors in case of using microblogging with the social influence features. Comparing only the medians shown in Table 2, we found that fun, novelty and recognition increased, mainly because of the social influence features used with microblogging.

We compare distributions in Time 3 of Group A and Group B using independent sample test. According to results of Wilcoxon test shown, null hypothesis was invalidated only for fun ($W=117$ and $p=0.020$) and learning effectiveness ($W=103$ and $p=6.25E-03$). So, data analysis indicates that these factors significantly increased when using the socially influencing system. No relevant changes were found in other factors. According to the professor’s feedback, Group A was a little disappointed to use the same basic system again in Time 3. However, Group B was very enthusiastic to see new social influence features in Time 3, and they began to explore the socially influencing system more and to participate more actively in the class.

To expand our analysis, we investigated in Group B the dependence among factors after using the socially influencing system (Time 3) using correlation analysis. The result contributed to interesting findings. Fun, student engagement, and learning satisfaction are three top factors that strongly correlate to all other factors, except recognition. Novelty and learning effectiveness strongly correlate to all other factors, except each other and recognition. From the social influence factors, social comparison really stands out, as it significantly correlates to absolutely all other factors. Social learning significantly correlates to all factors but competition and recognition. Competition is related to all factors but learning effectiveness and social learning. Recognition is related only to social comparison and competition.

3.3 Discussion.

We introduced the system in an engineering class in order to evaluate its capacity to improve learning. Our study confirms that microblogging can enhance learning experiences, as it contributed the uncovered increase of fun, novelty, student engagement, learning effectiveness, learning satisfaction, social comparison, competition, and recognition. Especially, we can see that the factors of fun, novelty, student engagement, and learning satisfaction made the most significant increase after the system was introduced for the first time (Time 1 – Time 2). However, we cannot evidence any significant changes in each of the groups after the participants used the system for the second time. Moreover, the median values for the factors of fun and novelty went down slightly for the group that used the exactly same system twice (Group A at Time 3). In contrary, the median values of fun and novelty increased for the group that used the socially influencing system instead (Group B at Time 3).

The basic system, interestingly, even without specially designed social influence features, revealed its capacity to foster an increase in the factors of social comparison, competition, and recognition (Time 1 – Time 2). Further, comparing the reactions of the students form both groups in Time 3, the analysis uncovers that the group using the socially influencing system (Group B) experienced significant increase in the factors of fun and learning effectiveness. Although, they might seem quite obvious, these are great findings. The fun factor was measured as the perception of whether “the class is exciting”, so this finding confirms that socially supported education increases excitement while learning new content in classrooms. More importantly, the results of our study show that the socially influencing system increased learning effectiveness, which we measured as “I perceive a knowledge growth in the class”. To our understanding, this factor is one of the most fundamental for learning, because it tells that students experience actual knowledge improvement. While the factors of student engagement and learning satisfaction are also good and helpful by their nature, they do not necessarily imply a direct acquiring of knowledge.

Social learning scored high already in the assessment of regular student classes (Time 1) during the experiment, so we believe that there was very little room left for experiencing significant increase comparing to the classes with the systems (Time 2 – Time 3). Nevertheless, social learning is well correlated to all other factors that increased in our study, so we believe that social learning can also have significant increase in groups that did not have it well established in the first place. For example, the factor of social learning should increase more in other places, where students are more silent in their regular classes and do not dare to ask questions or raise their concerns about the class material. Social learning was measured as "I am able to learn from other students in the class", so naturally it is more difficult to experience that if students are hesitant to speak out. Therefore, it would be interesting and also important to test the system in such contexts.

The continuous use of microblogging systems in class might be ineffective and lose its effectiveness, as students get used to changes and the factors of novelty and fun decrease over time. One way, to keep the use of such microblogging systems interesting, is to have a strategic plan for repeated use of the system so that student participation continues throughout the whole course, instead of having a blank system every class. Our experiment showed that the socially influencing system increased fun and learning effectiveness. Thus, learning experiences can benefit from the social influence features of social comparison, competition and recognition.

4 CONCLUSIONS

We studied ways to improve learning experience in classrooms by adding novel systems based on microblogging and socially influencing features. We designed a Twitter-based microblogging system and also a socially influencing version of the system, featuring social comparison, competition, and recognition. We explored the use of the systems by fifty undergraduate students in one of their engineering courses to investigate the extent to which it contributes to factors of learning experience in the class, including fun, novelty, student engagement, learning effectiveness, learning satisfaction, social learning. The results of the study reveal that the basic version of the system has the capacity to significantly increase fun, novelty, student engagement, learning effectiveness, and learning satisfaction in classrooms. It also enables students compare their performance, compete, and experience recognition to some extent. The socially influencing version of the system uncovered its capacity to increase fun and learning effectiveness.

We learned that properly designed information systems can contribute to the betterment of all the aforementioned learning factors to various degrees. Therefore, we need to continue designing educational systems and seek for ways of introducing socially influencing systems into classroom education practices and beyond. Our proposed system might produce divergent or unexpectedly positive effects at different levels and forms of education. Results might also differ depending on what subjects are taught. Researchers can replicate our study to explore its validity. Scholars can also expand our study design by adding more social influence features, e.g., normative influence, social facilitation, and cooperation, to explore what effects on learning factors would bring such extended socially influencing systems. We encourage scholars and instructors to increasingly focus on expanding ways for complementing their daily work with the association between information systems and learning methodologies. It is very important, as our evolution and prosperity fundamentally depend on how well we will enhance our educational approaches and learning environments.

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