

# EXTRANEIOUS COGNITIVE OVERLOAD IN THE BLENDED LEARNING PARADIGM. CASE STUDY: USE OF SOCIAL NETWORKS IN COMPUTER SCIENCE COURSES

F. Martinez-Ruiz, P. Godina Gonzalez, A. Lourdes Borrego, H. Gamboa Rosales,  
J. De la Rosa Vargas

*University of Zacatecas. Faculty of Computer Engineering (MEXICO)*

## Abstract

Social networks are becoming a standard way for sharing and collaborating between students and professors. Currently, our Class Website is not the primary source of information and materials. Professors are using a combination of these social networks. For instance, some classical LMS (Learning Management Systems) as Moodle with ludic or general purpose networks as Facebook. This strategy allows learners to access information in their favorite social network. However, gathering and processing this information implies a mental effort since there are multiple distractors (e.g., notifications and friends' messages). A survey study asked college students, enrolled in computer sciences courses, to describe their behavior and perceptions regarding classroom use of social networks for learning purposes. The study included students of the program of Computer Engineering at the University of Zacatecas (Mexico). Respondents confirmed partially the hypothesis: Class Websites immersed in social networks (no academic ones) implied a heavier cognitive load. Learning tasks completion is affected in consequence. Finally, there is no important difference between using social networks inside and outside the classroom.

Keywords: Blended learning, web 2.0, Social Networking, cognitive overload, usability.

## 1 INTRODUCTION

Social networks are becoming a standard way for sharing and collaborating between students and professors. Currently, our Class Website is not the primary source of information and materials. Professors are using a combination of these social networks. For instance, some classical LMS (Learning Management Systems) as Moodle with ludic or general purpose networks as Facebook. This strategy allows learners to access information in their favorite social network. However, gathering and processing this information implies a mental effort since there are multiple distractors (e.g., notifications and friends' messages).

The goal of this paper is analyzing the extraneous cognitive overload of Students while using social networks (academic and ludic ones) in a location inside and outside their classrooms (Blended paradigm). For this experiment, students of the program of Computer engineering were invited. In the context of this paper extraneous cognitive overload is conceptualized as, all the external elements of distraction inside a general social network. For instance, notifications, messages of friends, photos among other elements. Note: for this experiment Facebook and Moodle are used.

This paper is organized as follows: Related Work section introduces previous work in social network mixing with LMS, as well as some definitions about the concept of cognitive overload. Then, Research objective and Method section is explained the proposed survey and After that, Experiment and results are discussed. Finally, limitations, conclusions and future work are presented.

## 2 RELATED WORK

Blended learning paradigm combined classical face-to-face classes with online teaching. This combination has given great flexibility to students in different areas [3]. The online learning (eLearning, blended paradigm, among others) take advantage of the Internet in order to extend the opportunities of improvement [1][2]. Distance learning gave students the flexibility of reviewing information at any time and depending on their concerns [5]. This approach is especially useful in situations related to distance, difficulties, family or work [6].

Despite all their advantages, some studies showed that technology-assisted learning affected student's ability to process information related to concrete experiences, as well as, learning that

involved listening comprehension skills [7]. In the other hand, in [8] the experience showed that distance learning increased skills in a similar way as a small group face-to-face context.

## **2.1 Using Moodle in a typical educational context**

Moodle [9] is one of the most used LMS. This kind of LMS online systems are described as distance learning [10]. Nowadays, Moodle is combined with traditional lessons in order to create a Blended learning environment. In this case, Moodle, the selected LMS is presented as a web application with a very clean design, course-oriented. A plethora of resources are available: forums, questionnaires, assignments, among others.

## **2.2 Using Facebook in an educational context**

Using Facebook [11] in Education has been reviewed in multiple studies[12][13][14]. This Social Network is considered the most popular one. 1.65 billion monthly active users were reported in march of 2016 [15]. Facebook is used as an educational environment since there are interaction tools, peer feedback, among others facilities [12].

## **2.3 Cognitive overload and distractors**

The cognitive overload is used here as in Albers' paper [17]: Exceeding the supply of mental resources available to assign in order to resolve a problem.

According to [16] 80% of students (in their study) had indicated that using a digital device for texting, emailing and Social networking led to paying less attention in their courses. Then usage as an academic resource of a Social network could be counterproductive. Students are accessing Facebook course groups where course activities are surrounded by distracting elements (notifications, photos, tags). Specific studies about Facebook effects are discussed in [18]. There, Facebook users scored lower in the experiment. Also [20], [21] reported lower GPAS in users of this social network.

# **3 RESEARCH OBJECTIVE**

In this paper, we try to understand behavior and perceptions regarding use of social networks for learning purposes of students in computer science courses.

## **3.1 Research questions**

1. Class Websites immersed in social networks (no academic ones) impose a heavier cognitive load (since there are a lot of external distractors)?
2. There is a difference between using social networks inside and outside the classroom?

## **3.2 Hypothesis**

Our hypothesis is that a class website or group immersed in a social network produces a cognitive overload to students. Also, this overload increases outside the classroom.

# **4 METHODOLOGY**

## **4.1 Participants**

Eighteen participants (three females) at the faculty of Computer Engineering in the University of Zacatecas (Age <18 5.6%, 18-21 88.9%, 22-25 5.6%) completed the exercises and the survey.

## **4.2 Materials**

Two simple tasks were selected. First, T1: The design of a pseudocode for a number guessing game. Second, T2: A pseudocode to find whether a given number is even or odd. Both problems were selected because their similar complexity.

### 4.3 Procedures

All participants accessed our Facebook group after university (Blended paradigm). In order to search and follow instructions of the last activity posted. The activity asked participants completing T1 in fifteen minutes. Then, they had to go to LMS (Moodle) location and completed T2 (also in fifteen minutes as a suggestion). Finally, they were invited to complete the online survey. They could finish the experience in a window time of three days. The survey included three sections: (a) General information: Age and Gender. (b) A section that asked them about their Facebook habits. (c) A final section that asked them the distraction factors during task completion. The last two sections included a 5-point Likert-type scale (1 – Never, 2 - occasionally, 3 - sometimes, 4 – often, 5 - always) measuring how participants described their interaction and cognitive load. And also, two open-ended questions in order to gather opinions about other distractors.

### 4.4 Results

Students were asked to provide answers about their Facebook habits in the initial section. Participants of the experiment spent between 20 to 40 minutes in a typical session (see Fig. 1). (a) How often do you check for updates (Photos, status, etc.) without interacting? 33.3% sometimes 33.3% occasionally. (b) How often do you post in your social network? 72.2% occasionally. (c) how often do you check for updates (Photos, status, etc.) interacting? 44.4% - sometimes. (d) How often do you start a personal interaction (inbox message, tagging, posting) 44.4% - sometimes.

This is a group with more experience in the use of technology than other students. Most of the users were consumers of the produced social content instead of producers.

The following section included questions about the distractors during task 1: (a) notifications 33.3% - sometimes. (b)Timeline 33.3%- sometimes and 33.3% - never. (c) Chat 27.8% - rarely. Finally, in the open questions videos were included as an alternative distractor.

Next section. Distractors during task 2. (a) Navigation 44.4% - rarely. (b) Other courses 44.4% - never.

### 4.5 Findings about educative and ludic environments

The questions related to educative and ludic environments produced the following findings: (a) Which environment is more suitable for your learning process? 94.4% - LMS (Moodle) (see Fig. 2). (b) Which environment is more distracting for your learning process? 94.4% - Social Network (Facebook) (See Fig. 3). (c) There is also the question: Your social network was open while doing task 2? 61.1% - Yes (see Fig. 4). (d) Task 1 was depicted with a medium difficulty level in 61.1% of responses. (e) Task 2 was considered with a low difficulty level in 55.6% of responses. Finally, (f) if you are in the classroom, your behavior in Facebook is modified? 61.1% indicated that almost nothing changes.

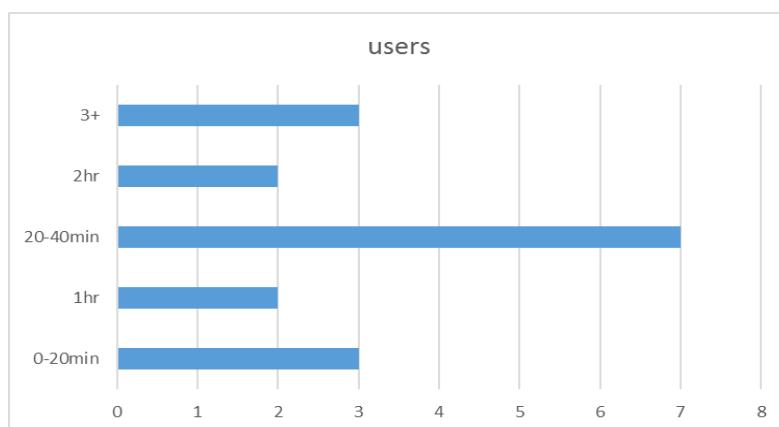


Figure 1. How many minutes/hours do you spend on Facebook per session?

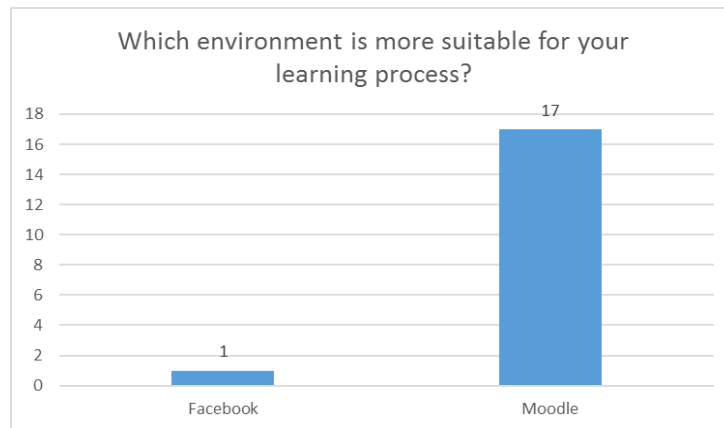


Figure 2. Which environment is more suitable for your learning process?

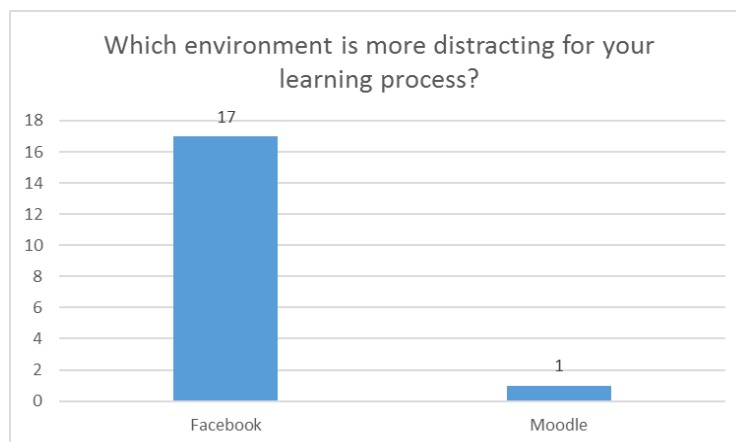


Figure 3. Which environment is more distracting for your learning process?

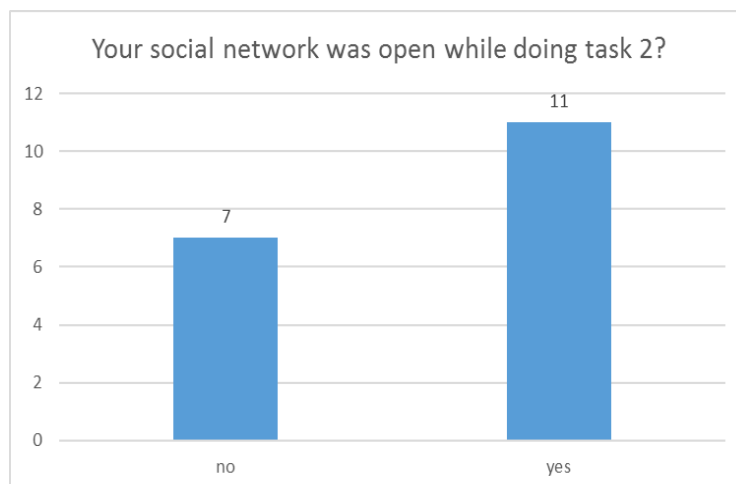


Figure 4. Your social network was open while doing task 2?

## 5 LIMITATIONS AND FUTURE RESEARCH

The main goal of the study was to identify preferences of undergraduates in Computer Science discipline and also it was limited to the dominant Social Network (Facebook), as well as, the dominant LMS (Moodle). Instead of including a wide range of Web 2.0 technologies. A more extensive study should be done. Including students from multiple orientations, undergraduates and postgraduates. This research was a first step. Since survey questions should be retested and redefined in order to

recover more information. Specially, questions about Facebook habits could be restructured to produce a more clear and open response from users.

## 6 CONCLUSION

This research indicated that undergraduate computer science students intuitively preferred the more constrained environment of the LMS for learning purposes. Students in [4] also pointed out the same comment. On the other hand, the students signaled that for ludic activities the social network had been a distracting element. Participants were well aware of new technologies despite taking for granted all web 2.0 technologies, especially social networks.

Cognitive overload could not be fully established with the current results. In this study, elements and activities within the Social Network such as notifications, photos, tagging, messages, among others, were used to infer the cognitive overload of students and their level of attention in order to fulfill the tasks. Beside participants in the sample were using Facebook less than expected. Nevertheless, some of the findings of the study included that 60% of users were working while an instance of Facebook were open. Also proposed tasks were ranked as medium difficulty. These two conditions suggested that the cognitive load was affected by distractors during the completion of proposed activities. Finally, the behavior of students, according to results has little changed in both contexts (in and outside classroom).

## ACKNOWLEDGEMENTS

This research is supported by the University of Zacatecas. We thank The Faculty of Computer Engineering for all the facilities for this work.

## REFERENCES

- [1] Aydin, C.C., & Tirkes, G. (2010). Open source learning management systems in distance learning. *The Turkish Online Journal of Educational Technology*, 9(2), 175–184.
- [2] Demirci, N. (2010). The effect of web-based homework on university students' physics achievements. *The Turkish Online Journal of Educational Technology*, 9(4), 156-161.
- [3] Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, 7(2), 95-105.
- [4] Sweeney, J. & Ingram, D. (2011). A comparison of traditional and web-based tutorials in marketing education: An exploratory study. *Journal of Marketing Education*, 23(1), 55–62.
- [5] Kamsin, A. (2005). Distance learning the solution and substitute for conventional learning? *International Journal of the Computer, the Internet and Management*, 13(3), 79–89.
- [6] Hobl, M., & Welzer, T. (2010). Students' feedback and communication habits using Moodle. *Elektronika Elektrotehnika*, 6, 63–66.
- [7] Hui, W., Hu, P. H., Clark, T. H. K., Tam, K. Y., & Milton, J. (2008). Technology---assisted learning: a longitudinal field study of knowledge category, learning effectiveness and satisfaction in language learning. *Journal of Computer Assisted Learning*, 24(3), 245-259.
- [8] Solimeno, A., Mebane, M., Tomai, M. & Francescato, D. (2008). The influence of students and teachers characteristics on the efficacy of face-to-face and computer supported collaborative learning. *Computers & Education*, 51(4), 109–128.
- [9] Dougiamas, M., & Taylor, P. (2003). Moodle: Using learning communities to create an open source course management system.
- [10] Desnica, E., Letic, D., & Navalusic, S. (2010). Concept of distance learning model in graphic communication teaching at university level education. *Journal TTEM – Technics, technologies, education, management*, 5(2), 378-388.
- [11] Facebook. Retrieved September 15th,2016 from <http://www.facebook.com>

- [12] Cassidy, J. (2006). Me media: How hanging out on the Internet became big business. *The New Yorker*, 82(13), 50, Retrieved September 15th,2016 from [http://www.newyorker.com/archive/2006/05/15/060515fa\\_fact\\_cassidy](http://www.newyorker.com/archive/2006/05/15/060515fa_fact_cassidy).
- [13] Abramson, L. (2011, 9 February). Can social networking keep students in school? NPR: Morning Edition, Retrieved September 15th,2016, from <http://www.npr.org/2011/02/09/133598049/can-social-networking-keepstudents-in-school>.
- [14] Kamenetz, A. (2011). Gates Foundation bets on Facebook app to help kids graduate. *Fast Company*, Retrieved September 15th,2016, from <http://www.fastcompany.com/1725665/gates-foundation-bets-onfacebook-app-to-help-kids-graduate>.
- [15] David Cohen. Everything You Need to Know About Facebook's Q1 2016 Earnings Call. <http://www.adweek.com/socialtimes/q1-2016-earnings-call/638692>. Retrieved September 15th,2016.
- [16] Bernard R. McCoy, "Digital Distractions in the Classroom: Student Classroom Use of Digital Devices for Non-Class Related Purposes," *Journal of Media Education* 4, no. 4 (2013).
- [17] M. J. Albers. Cognitive strain as a factor in effective document design. In *Proceedings of the 15th Annual International Conference on Computer Documentation, SIGDOC '97*, pages 1–6, New York, NY, USA, 1997. ACM.
- [18] Frein, S. T., Jones, S. L., & Gerow, J. E. (2013). When it comes to Facebook there may be more to bad memory than just multitasking. *Computers in Human Behavior*, 29(6), 2179-2182.
- [19] Petrovic, N., Jeremic, V., Cirovic, M., Radojicic, Z., & Milenkovic, N. (2013). Facebook vs. Moodle: What do students really think. In *International Conference on Information Communication Technologies in Education* (pp. 413-421).
- [20] Kirschner, P. A., & Karpinski, A. C. (2010). Facebook and academic performance. *Computers in Human Behavior*, 26(6), 1237–1245. <http://dx.doi.org/10.1016/j.chb.2010.03.024>.
- [21] Junco, R. (2012). Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Computers in Human Behavior*, 28(1), 187–198. <http://dx.doi.org/10.1016/j.chb.2011.08.026>.