

# Facebook versus Blackboard for Supporting the Learning of Programming in a Fully Online Course: The Changing Face of Computing Education

Mercy Maleko, Dip Nandi, Margaret Hamilton, Daryl D'Souza and James Harland

School of Computer Science & IT  
RMIT University, PO Box 2476V  
Melbourne Australia, 3001

**Abstract**— As students become more mobile they increasingly require access to their educational resources anytime and anywhere. University courses are typically managed through learning management systems, which were established to enable access to their educational resources online at any time, but are these enough? We are interested in researching the impact that Facebook can have for online students in an introductory programming course. In particular we want to know whether any learning can occur in Facebook. A programming group was set up on Facebook for our cohort of fully online students who already have access to Blackboard, our University's learning management system, for them to discuss, chat and brainstorm about programming. We compare the student participation to the two environments: the Blackboard Discussion Forum and the Facebook programming group, over the semester of the course. In this paper we analyse the student postings and identify the similarities and differences of the two environments and we discuss the benefits and drawbacks of each environment. Our primary finding was that Facebook attracted more students (over Blackboard) due to its social and community learning benefits, encouraging students to support one another. Blackboard was viewed as the authoritative and valid medium for official course material. Finally, there is a need for further work to determine how the two media may be better integrated for course delivery.

**Keywords**— *Social networking sites, Facebook, Blackboard, Learning Management System.*

## I. INTRODUCTION

Novice programmers can experience difficulties in learning programming, some of which may be due to the abstract nature of programming concepts. Many interventions have been put in place to assist and guide them while learning to program. Some of the initiatives taken include peer mentoring, one-on-one instructor-student consultations and programming clubs. Some of these interventions aim to increase student-to-student interactions, an important component of student success. Social networking sites are currently utilized to support communication, interaction, knowledge creation and sharing. As the current university students are heavily immersed in Web 2.0 technologies, educators are becoming increasingly

interested in using social networking sites for supporting student teaching and learning.

Learning Management Systems (LMSs) such as Blackboard were introduced to support and improve learning through provisions of tools and delivery of teaching content. The discussion forums and chat rooms in LMSs provide environments where students can interact with their instructors, tutors and with each other. However, these interactions are structured, monitored and have time limits, in most cases, a single study period, such as a twelve week semester, after which they are removed or archived.

To increase interaction while providing unstructured and time-limitless discussion environments, a Facebook programming group was set up which students can access anywhere, anytime for discussions, chats and brainstorming. The Facebook programming group is not intended to replace Blackboard learning management system (Blackboard), but rather, to complement it. Using a social networking site such as Facebook can allow students to personalize their learning within a framework where learning progress can be monitored by the teachers [7]. The popularity of Facebook has spurred substantial academic interest recently [2].

As the Facebook programming group provides an informal discussion environment compared to Blackboard [9], where students freely discuss, chat and brainstorm, we are interested to explore student behaviours in the Facebook programming group in relation to the learning of programming. We qualitatively analyse the messages posted on the Facebook programming group in order to identify the themes, that emerge and their relation to the learning of programming. We also analyse the messages posted by the same cohort on Blackboard, in order to identify themes and compare these results with the results obtained from the Facebook programming group.

The research questions that we seek to answer in this paper are:

1. What themes emerged from messages posted in the Facebook programming group?
2. What themes emerged from messages posted in the Blackboard discussion forum?

3. What learning implications does the Facebook programming group have in supporting learning of programming?

The rest of this paper is organized as follows. Section II presents a general overview of the creation of the Facebook programming group and use of the Blackboard discussion forums in education. Section III presents the methodology employed to answer the foregoing research questions, Section IV presents the themes emerging from the analysis of the student messages posted to the two separate places, Section V presents the discussion of the key themes and implications of the Facebook programming group drawn from these discussions, and finally, we present our conclusions in Section VI.

## II. BACKGROUND

Learning management systems (LMSs) have long been used to support and improve learning in many universities. LMSs are used to manage groups, providing tools and delivering content, be it for online or campus based education [15]. In the LMS, students are expected to download or read course materials, participate in discussion forums, receive grades, and interact and communicate with instructors and other students. However, there is a growing awareness in higher education about student engagement levels in Web 2.0 environment in contrast to their engagement in the LMS hosted in their institutions [15]. Web 2.0 environment offers students opportunities to communicate, create and share content [4]. Social networking sites in particular offer special kinds of personal interaction and connectedness beyond learning management systems [16, 7]. Interactions through social networking sites are not structured and do not restrict students to content designed for a particular course [15].

The development of mobile technologies and Web 2.0 brings a myriad of alternative ways which students can use for communication and interactions. One of the main educational uses of social networking is seen to lie in their support for interaction between learners facing the common dilemma of negotiating their studies [17]. Maloney [11] argues that social networking sites have shown, among other things that students will invest time and energy in building relationships around shared interests and knowledge communities.

Despite the popular positioning of social networking such as Facebook [22] as exciting educational tools [21, 23], some critics think they may distract learners from their studies [3] and hence continues to be a controversial element of the digital education landscape.

Madge et al. [8] state that there is a need for research regarding the impact of 2.0 technologies in the arena of teaching and learning; where empirical studies of how developments in social software are impacting on pedagogy and educational social relations remain a sparse, if growing, field of research. Hence it is worthwhile to investigate student postings in such environments in order to assert whether or not what is being discussed is meaningful for learning. This paper reports the results of the study to explore and compare student behaviors in terms of the themes that emerge from the

Facebook programming group and in Blackboard and their relation to the learning of programming.

## III. METHODOLOGY

In order to explore themes that exist in Blackboard and in the Facebook programming group, we have selected an online course because students enrolled in this course had access to both Blackboard and the Facebook programming group.

### A. The Blackboard

Blackboard is one of the leading commercial LMSs used in many universities [1]. Blackboard is used to provide students with access to the learning materials, course announcements, chats and discussion forum. Blackboard discussion forums are highly structured. For this course, the course instructor created the discussion forums for General discussions, Assignment 1, Assignment 2, Assignment 3, Exam preparation, Tutorial and practical discussions, and General feedback. Students accessed course materials from Blackboard, and they used the Blackboard discussion forum for interactions with each other and with the teaching team. Students also had one weekly live chat session with online tutors via a synchronous communication tool, available within Blackboard. These chat sessions aim to provide instant communication between students and the teaching team so that the teaching team can answer student questions and provide clarifications instantly. These sessions are also meant to bring students closer to the teaching team, as they include audiovisual chats.

### B. The Facebook Programming Group

The programming course-related group was set up in Facebook for fully online students enrolled in a Java programming course at the Open University of Australia. This group, set by researchers, exploits the traits of contemporary university students to increase interactions among them, to connect with one another anytime, anywhere, and to create an online learning community. In this dedicated group, enrolled students were connected via a social networking site for discussions, chats, and brainstorming, and for accessing course related materials uploaded by researchers from time to time. Facebook was used for these activities because it is popular among university students [5, 6], and a large percentage of our students already had accounts on Facebook [9]. Students accessed the site using mobile devices including mobile phones, smart phones, PDAs, tablets and laptops that have access to the Internet at all times. Students in this group also accessed Blackboard as their learning management system.

### C. Data and Analysis

For this study we collected the data from discussion messages that students posted in the Facebook programming group and the Blackboard learning management system in order to identify and compare themes that emerge in the two environments and discuss the benefits and drawbacks of both in supporting the learning of programming.

We collected data from one study period conducted between September 2011 and November 2011 for fully online

students enrolled in a Java programming course at the Open University of Australia. Data were de-identified following ethical requirements before being analysed. Data includes posts from the Facebook programming group and from Blackboard.

One researcher extracted student messages from the Facebook programming group and load them in NVivo for analysis. NVivo is a qualitative data analysis software package produced by QSR International [14]. NVivo was chosen because of its potential benefits such as the ability to make coding visible in the margins of documents so that the researcher can see, at a glance, which codes have been used where, which in turn makes it possible to write memos about particular aspects of documents and link these to relevant pieces of text indifferent documents [19].

The grounded theoretic approach [18] was used, that is, open, axial, and selective coding [12] to identify the themes that emerge from the messages. All the data from the Facebook programming group were loaded into NVivo 8 software for investigation through open, axial, and selective coding. A similar three-stage data analysis technique was used by Vlachopoulos and Cowan [20] to explore the different styles and practice of e-moderation. They reported that this method is useful for gaining deep understanding of a phenomenon or theme from raw data.

Another researcher extracted student messages from different threads in Blackboard and loaded them in NVivo for analysis. Again the grounded theoretic approach was used, to identify the themes that emerge from the messages. All the data from Blackboard was loaded into a separate NVivo file for investigation through open, axial, and selective coding.

Once we identified all the themes and sub-themes from the Facebook programming group and Blackboard, a comparison between the themes was carried out. We intended to identify the different patterns of postings in the Facebook programming group and Blackboard through this comparison. This set of themes is presented next.

#### IV. RESULTS

Out of 230 students enrolled in Programming 1(CPT 121), 156 students joined the Facebook programming group and 102 students completed the course.

Our purpose in employing open coding was to identify the themes emerging from the data. The unit of analysis in this case is the entire message. A message can be an initiating question or a reply to the question. We identify that the question in most cases appeared in the beginning of a thread. After analysis of the data at the end of the open coding phase, we identify 59 themes from the Facebook programming group and 21 from Blackboard. Each separate concept in the data is labelled and similar ideas are grouped and labelled. Following open coding, the next step is axial coding, where the aim is to assemble coding categories into larger conceptual groupings [6]. Ten major themes emerge from the Facebook programming group and seven from Blackboard after the axial coding phase, with each theme consisting of a number of subthemes. This process is repeated until no additional categories are identified and all the data have been analysed.

The third and final coding step is selective coding. Again, the data are re-examined and the prior coding and grouping are revisited and verified or changed as required.

We identified 10 major themes and 49 sub themes from the 1,372 posts (topics and replies) in the Facebook programming group. Seven major themes and 14 sub themes were identified from the 247 posts in the Blackboard. These themes tended to focus around assignments, examination, tests and quizzes, social cues, learning materials and course administration. Other themes expressed feelings and yet others provided encouragement and general advice. Table I lists the themes that were identified in the Facebook programming group.

The *Assignment* theme had a larger percentage of all references in the Facebook programming page (35.8%) and had all references that directly related to assignment. Student questions and answers were either on particular assignment questions or on assignment difficulties (21.5%) or assignment results (4.8%). Some posts were more about giving advice and alternative ways to tackle assignments (1.2%). In this theme, we noted a lot of discussion extensions where students freely jumped in to provide further solutions to the questions posted, regardless of the answers that already had been provided by others. Some students posted messages that further clarified previously posted answers to the questions. Also, we noted students extending discussions within threads by asking questions related to the one being discussed. Where there were disappointing issues with assignments, students did not hesitate to express them here.

The *Social cue* (17.7%) was the second theme mostly referenced in the Facebook programming group. Here students mainly posted messages that introduce one another names and background and messages that expressed personal feelings. Expression of personal feelings (10.4%) were on how they feel about programming, learning materials, assignment, test, quizzes, exams or results of an assignment, and, some were expressions that encouraged and supported others who were giving up or discouraged about the course (7.3%).

TABLE I. THEMES IDENTIFIED FROM THE FACEBOOK PROGRAMMING GROUP

Themes	Number of References	Percentage of References
Assignment	491	35.8
Social cue	243	17.7
Discussions about learning material and additional resources	217	15.8
Examination	123	9.0
Discussions outside programming	91	6.7
Test and quizzes	70	5.0
Expression of Dissatisfaction	49	3.6
Course admin	41	3.0
Provide Encouragement	33	2.4
General advice	14	1.0
<b>Total</b>	<b>1,372</b>	<b>100</b>

The *Discussions about learning material and additional resources* was referenced by 15.8% of all references. Here students discussed mainly about course learning materials available to them (3.9%), where they can find extra learning materials, links to external materials and discussions on programming concepts learned in those materials (2.9%), and

how to use programming environments such as Eclipse and NetBeans (3.7%). Problems in debugging computer codes were also discussed in this theme (4.2%).

The *Examination* theme had 9.0% of all references where students discussed about exam coverage, exam duration, examination-difficulties, how to practice exams questions in terms of time management, the time to release exam results. Some students expressed their personal worries about the forthcoming exams. We noticed here that some previous semester students were encouraging others and advised them on how to prepare for their final examinations.

The fifth theme in the Facebook programming page was the *Discussions outside programming*, which received a total of 6.7% references. This theme contained messages that discuss issues that did not relate to programming at all.

The *Test and quizzes* was the sixth theme that had 5% of all references on the Facebook programming group page. It contained general discussion messages about tests and quizzes, how important they are and how they contribute to overall course assessment. Following the *Test and quizzes* theme was the *Expression of Dissatisfaction* theme with 3.6% of all references. This theme had all messages that students expressed their disappointments about exams, assignments, assessment policies and learning materials. This theme was among the unique themes appearing on the Facebook programming page.

The last three themes were *Course admin*, *Provide Encouragement* and *General advice* with 3%, 2.4% and 1% of all references on the Facebook programming group, respectively. The *Course admin* theme had questions related to administration of the course. The *Provide Encouragement* theme contained mainly messages that encourage students who are disappointed with exams or assignments or tests, and messages that encourage students struggling with learning of programming. The *General advice* theme had discussions on how to handle file sharing, how to store data, how to download IDEs, how to choose subjects depending on one's background experience and courses taken.

TABLE II. THEMES IDENTIFIED FROM BLACKBOARD

Themes	Number of references	Percentage of References
Assignment	148	59.9
Discussions about Learning materials and additional resources	44	17.8
Social cues	20	8.1
Question to the lecturer	16	6.5
Examinations	11	4.5
Test and quizzes	4	1.6
Collaboration/community building	4	1.6
<b>Total</b>	<b>247</b>	<b>100</b>

Table II lists the themes that were identified in the Blackboard learning management system. The *Assignment* theme had a larger percentage (59.9%) of all the references. There were only two sub themes. Students discussed directly assignment questions (52.6%) and the results of their assignments (7.3%). Students did not express any disappointment with assignments in Blackboard, did not

not give advice on how to tackle assignments, and did not extend discussions once the solution to the question was given.

*Discussions about Learning materials and additional resources* (17.8%) was the second most referenced theme in Blackboard where most of the messages focused on learning materials. However, we noticed here that students did not advise others on where they found extra learning materials. The third theme was *Social cues*, having 8.1% of all references, where students introduced themselves (1.2%) and expressions of personal feelings (6.9%) were mainly started via emoticons. Students asked direct questions to their lecturer and we grouped these questions to one theme, the *Questions to the lecturer* theme, which was the fourth theme having 6.5% of all references. These questions were for clarifications of questions in the assignment (5.3%) and in sample exam papers (1.6%). The *Examinations* theme had 4.5% of all references where students posted questions regarding sample exam papers uploaded for review. The last two themes from Blackboard were *Test and quizzes* (1.6%) and *Collaboration/community building* (1.6%). Students post messages regarding their tests and quizzes under the *Tests and quizzes theme*, and messages calling for formation of group study or study partners under the *Collaboration/community building* theme.

## V. DISCUSSION

In the result section we report the themes that emerged after analysis of messages posted by students in the Facebook programming group and in Blackboard discussion forum. The Facebook programming group had 1,372 total references while Blackboard had 247 references. These results are supported by other studies on the use of social networking sites for learning, that is, social networking sites facilitate more natural student interactions [13, 10], provide easy access to discussions as opposed to different website layers in which students have to navigate through to Blackboard forum, and instant feedback from many students logging in to a social site [9]. Some of the themes were unique to the Facebook programming group while others were unique to Blackboard, and some were common to both.

### A. Themes Unique to the Facebook Programming Group

The themes that were unique to the Facebook programming group were *Expression of Dissatisfaction*, *Course admin*, *Provide Encouragement*, *Discussions outside programming* and *General advice* that has some general discussions on future subjects to choose.

Looking at these themes we see that students used the Facebook programming group to express out their concerns, and receive moral support from others. Students used the Facebook programming group for expressing their feelings of dissatisfaction with assignments, exams and learning materials. It was considered as a place to vent frustrations, to get instant support, be it moral or academic. Students sought academic advice from others in this programming group. Although Facebook as a social networking site is a place for social interactions, students used this programming group for supporting their learning by utilizing the opportunities Facebook offered for communication, interactions and knowledge sharing. This is evidenced by the percentages of

references within the Facebook programming group that had no relations with the learning of programming. Only 6.7% of all references were not related to learning of programming.

#### B. Themes Unique to Blackboard

The themes that were unique to Blackboard were *Collaboration/community building* and *Question to the lecturer*. The *Collaboration/community building* theme had messages that proposed formation of study group for students residing in the same area. These kinds of messages showed the need for collaboration by some students who were using Blackboard. These messages, most likely have been posted by students who either did not join the Facebook programming group or just needed a physical study group for learning. The *Question to the lecturer* theme contained messages with questions directed to the course lecturer. These messages were more formal, and were expected, as the Blackboard discussion forum was the official means through which students can discuss course matters with the course lecturer.

#### C. Themes Appearing in Both the Facebook Programming Group and Blackboard

The themes that appeared in both environments were *Examinations, Assignments, Tests and quizzes, Discussions about learning materials and additional resources*, and *Social cues* (Table III).

Students discussed examination related issues more in the Facebook programming group than in Blackboard. Discussions about quizzes and tests appeared more frequently in the Facebook programming group than in Blackboard, and so were social cues. Learning materials were less discussed in the Facebook programming group, however, additional resources were provided more in this environment. In percentage terms, discussions about assignments appeared more in Blackboard than in the Facebook programming group. This could be explained by the fact that messages posted in Blackboard, though not instantly seen or answered, have a chance to be seen or answered by tutors or the course lecturer, or that those assignment questions were more specific that they needed a tutor or lecturer attention. However, we did not differentiate the assignment questions posted in Blackboard from those posted in the Facebook programming group.

TABLE III. PERCENTAGES OF THEMES THAT APPEAR ON BOTH THE FACEBOOK PROGRAMMING GROUP AND BLACKBOARD (% OF REFERENCES)

Themes	Facebook	Blackboard
Examination	9.0	4.5
Assignment	35.8	59.9
Test and quizzes	5.0	1.6
Learning materials and additional resources	15.8	17.8
Social cues	18	8.1

From Table III, we see that the Facebook programming group was used almost equally to Blackboard for discussing programming related issues. However, we also see that social cues were posted more in the Facebook programming group than in Blackboard. Students openly expressed their feelings and even frustrations more on the Facebook programming group than in Blackboard. The Facebook programming group was the place to express dissatisfactions, a place to encourage others, and advice others on matters related to learning of

programming. Interactions and discussions in the Facebook programming group were less structured, less monitored and time-limitless. Students were academically and socially interacting while supporting each other in their learning programming.

#### D. Implication of the Facebook Programming Group

Several learning implications, theoretical and educational can be drawn from the Facebook programming group.

Students show willingness and capabilities to use the Facebook programming group to support learning of programming. More than 60% of all references in this group were related to examinations, assignments, tests and learning materials. All major themes that were in Blackboard were also in the Facebook programming group. Regardless of the absence of instructor/tutors, student discussions were around course related content. Non-programming related content was less discussed in this group than programming related content.

Unlike normal Facebook pages where users post messages and expect no replies, in the Facebook programming group majority of the posts were questions or doubts, for which the majority received replies, which encouraged further interactions.

As more themes emerged in this group than in Blackboard, this shows that the Facebook programming group provided an alternative environment for students to interact and engage with learning by facilitating education-related interactions and communication between students, anywhere, anytime.

Facebook programming group provided a social space where students could express themselves socially, through the use social cues. Students could freely encourage one another and express feelings of affection or dissatisfactions, and, as a result, secure a sense of connectedness and belonging, thereby enhance their learning experiences.

The Facebook programming group has supported the learning of programming through provision of content creation and sharing space. Unlike Blackboard, students in this group uploaded programming related content from other sources to help others to learn and understand difficult concepts. Also, as is seen in Figure 1, there is an increase in activities and posts during the time assignments were released, during exam preparations and after the exam, where students discuss how they feel about the exam.

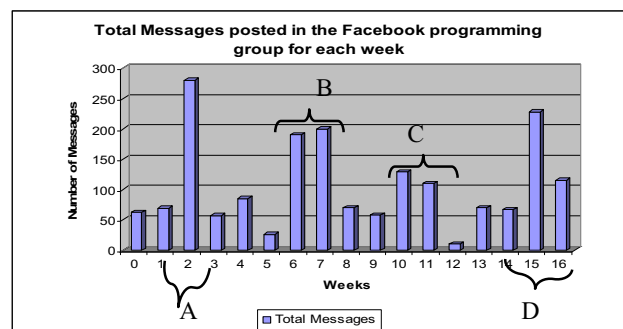


Figure 1. Total messages posted in the Facebook programming group. Discussions A-during Assignment 1, B- during Assignment 2, C- during Assignment 3 and D-during Exam preparations and after the Exam.

### E. Drawbacks of the Facebook Programming Group

Even though Facebook is popular among university students, the Facebook programming group had some drawbacks. Out of 230 students who were enrolled, 156 joined the group. The remaining students did not like the idea of using social networking site (Facebook) for academic purposes. Some did not have accounts on Facebook, and, for some reasons, did not want to establish Facebook accounts for this study. Hence participation in the Facebook programming group had to be optional. It was not possible to assess participation because even for those who joined the group, some were not active in terms of posting messages. Only interested students participated fully in either asking questions or answering other student questions. However, the percentage of active students in the Facebook programming group was much higher than in Blackboard. For the same reason, it was not possible to upload assessed activities to the group as one would have done in Blackboard.

## VI. CONCLUSION AND FUTURE WORK

This paper has reported the qualitative analysis of messages posted by students in the two environments, the Facebook programming group and the Blackboard. We identified several themes that emerged from both environments and compare them.

In investigating our first research question, we found out that themes that were unique to the Facebook programming group were *Expression of Dissatisfaction*, *Course admin*, *Provide Encouragement*, *Discussions outside programming* and *General advice*. These themes expressed social concerns of students, including expressions of personal feelings on particular issue, students encouraging one another, and provision of advice to others in a learning community. These themes were unique to the Facebook programming group because of the advantages that Facebook offered to students such as it being easily accessed, dynamic and tension-free. The Facebook programming group was more populated as students access it more frequently than Blackboard and, as a result, a message posted in the Facebook programming group is more likely to be seen and answered quickly. Furthermore, students upload content related to programming from other sources that they think are more simplified or easy to understand compared to the content provided in the Blackboard. The uploaded contents were helpful for students who were struggling with certain programming concepts to read.

For the second research question we found that the themes that were unique to Blackboard were *Collaboration/community building* and *Question to the lecturer*. The *Collaboration/community building* theme had 1.6% of all references, which shows that some students realized the need for learning together, supporting one another apart from having Blackboard as their learning management system. This shows that there is a need for a more dynamic, collaborative tool, where students can communicate, interact and share programming knowledge instantly.

We investigated the third research question based on the themes that appear in the Facebook programming group. Having a large percentage of themes being related to the

supporting of learning, it seems clear that the students generally preferred to use Facebook, particularly for discussions about the best way to approach examinations, tests and assignments, that is, students have used Facebook more than Blackboard to support their learning.

What is less clear cut is the extent to which it is necessary or appropriate to have an authoritative voice (i.e. the lecturer) separate to these discussions, or integrated in with them. There is a risk that by having an identified lecturer presence in Facebook discussions will change the nature of these interactions for the worse, in that students are less likely to discuss problems they are having with assignments if they know the lecturer is likely to see and perhaps participate in these discussions. On the other hand, it seems necessary to have some kind of authority present, in order to definitively answer questions about due dates, submission procedures and clarification of the tasks required.

One way to investigate this further would be to carry out some further experiments, with a 'normal' Facebook group, as above, and also with another parallel one with the lecturer present. In other words, we would duplicate the process used in this paper, but with the Blackboard component replaced with Facebook. This would allow us to gain some insight into whether it is a technological difference (i.e. Facebook vs. Blackboard) that is responsible for the disparity in use noted above, or whether it is a difference between informal discussions between peers and the necessarily more formal discussions between students and lecturers. Yet another research direction is needed to investigate the impact of implementing or integrating Facebook inside the learning management systems such as Blackboard and in order to further understand whether Facebook has the potential to replace learning managements systems to support interaction.

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