LEARNING WITH FACEBOOK: PREPARING FOR THE MATHEMATICS BAGRUT - A CASE STUDY

Yaniv Biton, Sara Hershkovitz, Maureen Hoch

Center for Educational Technology, Tel Aviv, Israel

To help students prepare for the resit exam of the mathematics Bagrut (Israeli matriculation) of 2013, the Center for Educational Technology established a virtual review session using Facebook, for four days before the exam. 614 students and 16 teachers participated. We examined three central questions, each about using Facebook to prepare for the mathematics Bagrut: What opportunities for learning were created? What are the students' opinions? What are the teachers' opinions? Analysis of the posts on Facebook revealed five types of situations with potential for learning. Answers to on-line questionnaires show that both students and teachers hold positive opinions towards the solution for learning provided by Facebook. We recommend researching the opportunities for learning afforded by the social networks.

INTRODUCTION

Online social networking sites like Facebook have developed in recent years and have become the most popular meeting places for youth and adults (Boyd, 2010). Many studies have investigated the potential of using these networks to promote learning (e.g. Forkosh-Baruch & Hershkovitz, 2013; Neman, Lev, & Amit, 2013). In some of these study teacher-student interactions the student has the status of the teacher's friend (Madge et al., 2009) and hierarchies are formed as a result of this friendship status (Steinfield, Elison & Lampe, 2008). Asterhan et al. (2013) discuss whether and how teachers may use Facebook for innovative, collaborative forms of online learning that extend beyond the traditional classroom, and whether this is at all recommendable or feasible.

Recently many researchers have studied the Facebook option of creating a group where teacher and students belong but do not need to be "friends". Students perceived learning in this environment as very intensive and collaborative in nature (Meshar-Tal, Kurtz, & Pitwerse, 2012). In the learning of mathematics social network sites have been found to invite student collaboration and encourage learning (Baya'a & Daher, 2013).

In this present research the learners were members of a group on Facebook opened specially for preparation for the mathematics Bagrut (Israeli matriculation) exam. We investigated what opportunities for learning were created as a result of the interactions that formed within the group and examined the viewpoints of students and teachers who took part in the study group. We present the results of a pilot study, in preparation for a wider research on this subject.

OUTLINE OF THE RESEARCH

Eight groups – four in Hebrew and four in Arabic – were opened on Facebook for four days, twelve hours a day, before the resit of the mathematics Bagrut exam. Teachers were on call to respond to students (three shifts of four hours). The Hebrew speakers' group comprised 513 students, and the Arabic group 101 students. The groups were divided according to the questionnaires in the Bagrut exams at intermediate and advanced levels. The teachers were trained in online teaching, in the principles of a forum, and in the Facebook tools, and were given technical instructions on how to provide responses in the forum.

During the activity the students raised questions in whatever subject they wish. The questions were uploaded to the forum as photographs or as details of book, page, and exercise number (the teachers were provided with all the relevant textbooks). On receipt of a question the teacher sent a reply, "I will upload an answer soon" and after several minutes (on average 10 minutes) he uploaded a response to the forum in a similar manner: as a photo of the page on which he wrote the solution, or hints on how to reach it. At the end of the study session online questionnaires were sent to the students and teachers who took part in the forums. 105 students and 15 teachers completed the questionnaires.

RESEARCH METHODS AND TOOLS

We used a mixed methods research model (Johnston & Onwuegbuzie, 2004) which combines qualitative and quantitative data analysis. The research tools were two online questionnaires, one for students and one for teachers, comprising open and closed questions. The open questions for the student included those on his background, which exam paper he was taking, how he heard about the study group, and his suggestions for what he would like to preserve in the study group and what he would like to improve. The open questions for the teacher included those on his seniority, his online teaching experience and the classes he usually teaches. Teachers were also asked to write down their feelings about teaching through Facebook, to describe interactions they remember favourably, etc. The closed questions in both questionnaires comprised statements on a Likert scale from 1 (disagree) to 4 (strongly agree). These statements included issues such as the use of technology, peer learning, motivation to continue learning/teaching in a similar manner in the future, interactions with students, etc.

The participants answered the questionnaire at the end of the Facebook review session. The answers to the open questions were analysed by three mathematics education experts to improve validity reliability by triangulation (Denzin & Lincoln, 2000). The analysis was carried out in four stages: first the answers were collected; in the second stage all the answers were divided into short sentences; subsequently each sentence was classified according to general subject matter; and finally the sentences in the same subject matter group were collected together and arranged according to categories. After much discussion 100% agreement was achieved between the judges about the categorisation of the data.

In order to learn what opportunities for learning were created as a result of revising for the Bagrut exam in mathematics through the medium of Facebook an analysis was made of the content appearing in Facebook throughout the review session. First we mapped the participators in the interactions: teacher-student as opposed to student-student. In the second stage we analysed all the interactions and learning opportunities that arose.

FINDINGS

Figures 1 shows the number of students in each group according to the levels of the exam papers (804 and 805 - intermediate, 806 and 807 - advanced) and the number of questions or discussions raised (the posts). Figure 2 presents a map of the opportunities for learning observed throughout the review session.
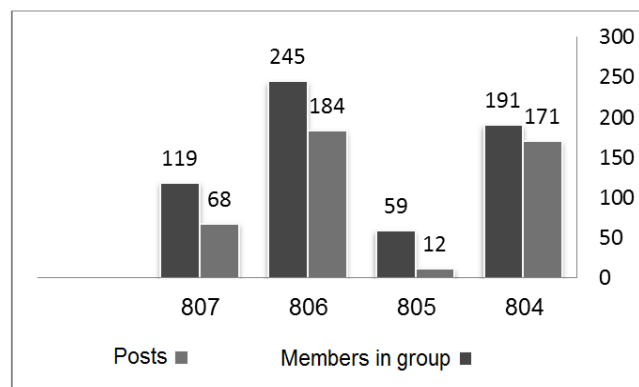

Figure 1: Number of participants and number of posts in each study group.
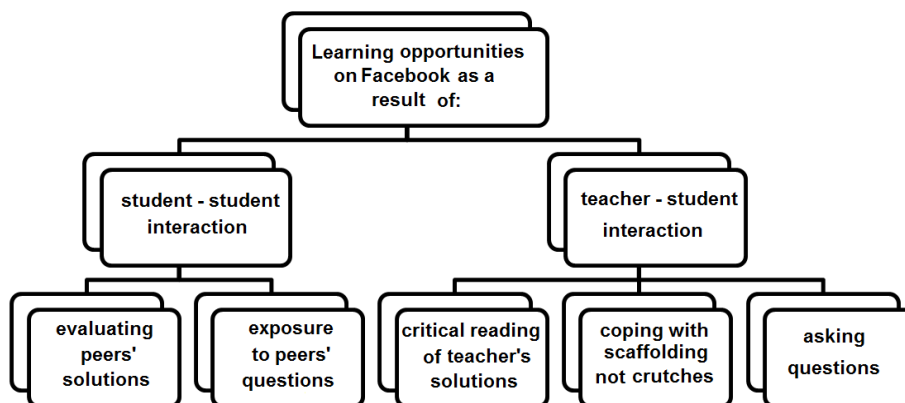

Figure 2: Learning opportunities on Facebook resulting from teacher-student interactions and student-student interactions.

We now provide a short description of each opportunity and some episodes from the forum.

Evaluating peers' solutions

During the review session students asked for help in pinpointing the mistakes they had apparently made in their solution, intending that the teacher would evaluate their work and find the mistake. We observed that during the time that passed between a student

uploading his solution and receiving a reply from the teacher (perceived as the source of authority in the forum) other students responded and tried by themselves to pinpoint the source of their peer's error. The students' attempts created a cognitive appeal to the correctness or incorrectness of the evaluation and thus started a chain of responses until a final response was given by the teacher. Similarly we noticed that throughout the review session students had considerable success in taking the teacher's role by attempting to provide explanations through the forum. This finding is strengthened by the students' answers to the questionnaire at the end of the review session. 72% (N=104) stated that they learned from responses given by other students. Figure 3 presents a solution uploaded by a student (Shiran) and is followed by an excerpt from the forum where another student (Achinoam) evaluates the solution before a reply is received from the teacher.
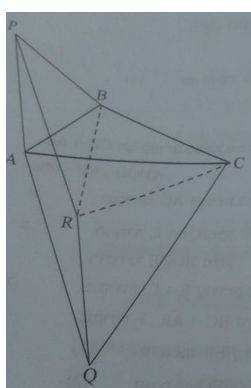
Triangles APB, ACQ, BCR are similar isosceles triangles whose bases are the sides of triangle ABC.

Prove: ∡ACB = ∡QCR

Figure 3: Geometric problem and student's solution uploaded on the forum.

Achinoam: I think you made a mistake with the angle QAC. Shouldn't it be 90 minus half alpha?

Shiran: Yes you're right. And that changes them all to 90 minus half alpha… So it's the same proof, I simply need to change the alpha to half alpha… right?

Achinoam: Yes, got it, great, thanks ☺ But I think that generally you can't say that AC=AB is given. Right? Shouldn't it be 90 minus half alpha?

Shiran: I meant br=rc

Shiran: I've got too many mistakes ☹

Achinoam: Aaah. Now it all makes sense! It's really not so bad. It's a mini mistake! ☺

Exposure to peers' questions

Throughout the review session students were exposed to questions raised by other students and tried to answer these questions themselves. This finding is based on the

number of observers of each post in the forum, on the students' reports in the questionnaire, and on the responses of the students in the forum itself. Exposure to peers' questions expanded the available pool of exercises and presented the additional challenge of dealing with questions that were difficult for their peers to solve. This finding is supported by the students' questionnaires where 78% reported that they learned from questions raised by other students.

Critical reading of teachers' solutions

The most significant learning opportunities that occurred during the review session were the chance to read, to analyse, and to understand the teachers' solutions on the forum. On some of the posts, after reading the teachers' solution the student returned to his own solution to compare the two methods. In this excerpt we can see the comparison one student made after receiving the teacher's answer to his question. At the end of this post an error was found in the book, thanks to the student's "stubbornness".

> Thanks. But somehow in the answers they put 3/4 instead of 3 root 3 divided by 2. And according to the volume of the prism that you found I got the correct t but the maximum volume is different. Maybe they made a mistake? I'd like you to solve the rest because I didn't get the same answer …

Coping with scaffolding not crutches

In not a few cases the teacher's response was advice for continuing the solution and the student had to deal with the problem on his own. 87% of the students claimed that the teachers' tips helped them learn. In this excerpt we see a hint given by the teacher and the student's satisfied response that it helped him to solve the problem.

> Teacher: I recommend you to try to finish this by yourself. If not, let me know and I'll post the solution. Tip: the lateral area is the sum of the areas of the rectangular faces without the bases.

> Student: Thank you very much for the help. I got it right! ☺

Asking questions

Throughout the review session, in addition to the problems the students posted as photos or text, they asked concrete questions on particular parts of a solution, and expressed doubts that arose during a solution. In contrast to questions asked face to face, here asking questions requires another skill – the ability to formulate the question in writing, with suitable emphasis for the teacher who is supposed to answer.

The following excerpt show a student's questions after a solution has been posted by the teacher. It includes a search for explanation/proof, indicating critical reading of the solution.

> It's not clear to me why you can deduce from the sketch of the graph alone that there are no maximum or minimum points? Who says there isn't one before the asymptote? And how can you tell without a table if the function is increasing or decreasing from the asymptote? Thanks!!

Instructional interactions on the social network

The answers to the questionnaires were analyzed as described in the section on research methods. In Table 1 we show examples of students' and teachers' remarks in each of the categories: motivation for continued learning, peer learning, technology utilisation, and supportive learning climate.

Categories	Student questionnaire	Teacher questionnaire
Motivation for continued learning	I'm glad I got the chance of the Facebook forum. It gave me the option with exercises that I couldn't solve, not to give up like I usually do, but to get the solutions from a teacher – that really helped me.	I really liked the fact that the students asked relevant questions, related to the answers, and didn't give up until they understood.
Peer learning	The forum was a very good idea. We could learn from other students' questions and answers.	A student posted a question after a lesson, and I noticed that students started to help each other in the forum, and succeeded in solving some parts of it.
Technology utilisation	I would recommend improving the method of posting pictures on Facebook.	The idea of photographing the problem or the solution and posting is brilliant and effective in making best use of the time and for presenting the solution.
Supportive learning climate	I would be very happy to get this kind of help throughout the year. It is all over and above what a student can expect for success. Thank you so much for all the help.	The students' appreciation was heart-warming.

Table 1: Students' and teachers' remarks about the integration of Facebook in preparing for the Bagrut exam in mathematics.

As can be seen in the table, students' and teachers' responses were mainly positive, and in general the participants' responses indicate great satisfaction with the use of Facebook in preparing for the exam. 75% of the students (N=105) stated that it was easy for them to ask questions and receive replies through Facebook, 79% stated that they would like to use Facebook in this way also for learning other subjects, and 87% stated that they would like to continue learning in a similar manner throughout the year. 93% of the teachers (N = 15) stated that the environment encourages meaningful learning and that the project justifies the investment of resources. There was 100%

agreement among the teachers on willingness to continue in a similar manner next year. 93% stated that they would be interested in opening similar learning environments for their own students during the year.

A little criticism on the use of technology was heard from both students and teachers, relating to the uploading of pictures that were sometimes not clear, thus making it difficult to understand and respond to the problem. In addition, teachers in charge of forums where there was a lot of activity indicated the need for extra staff to help manage the responses where necessary.

DISCUSSION AND CONCLUSION

The findings in this research indicate students' great satisfaction with the opportunity given them to study for the mathematics Bagrut exam through the medium of Facebook. The Facebook forum encouraged different interactions between teachers and students and among the students themselves. These interactions provided the learners with learning opportunities which included: asking questions, peer learning, different methods of problem solving, and critical reading of solutions. They were motivated to deal with questions their peers found difficult, and were exposed questions from different textbooks and to solution methods of different teachers. These learning opportunities carry extra value and are important in the learning process leading up to the Bagrut exam and in general. Individual study without interactions with peers or with a teacher is unlikely to afford any of these opportunities.

The findings relating to the students' positive opinions of learning in a Facebook environment strengthen findings of earlier studies about learning on social networks (Meshar-Tal, Kurtz, & Pitwerse, 2012). The teachers also expressed great satisfaction with the Facebook environment for learning and declared their intention to adopt a similar environment preparing for Bagrut exams in the following years and for teaching during the school year.

This research was an initial testing of teacher-student and student-student interactions on Facebook in a four-day review session in preparation for the Bagrut mathematics exam. The results encourage continuation and further research into these and other related aspects, on wider groups of teachers and students, and for longer time periods. A wide based research in the subject would be likely to lead to peer learning also among the teachers themselves – on how to characterize students' questions leading up to the exam, and in general. In addition, we recommend that continued research on these issues could provide educational policy makers with an understanding of the value of investing in similar projects in the future.

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