Using Emerging Mobile Technologies to Enhance Collaborative Learning. A Study Case in a University Environment

R. Berjón, M. E. Beato, M. Mateos and A. Fermoso

Abstract—Since emerging mobile technologies are completely introduced in our society, the Mobile Computer-Supported Collaborative Learning (MCSCL) is a fact that we must keep in mind. However it is necessary to have available adequate technological tools. In this work, we present a communication tool (called SCHOM) it was entirely developed by us. SCHOM uses different kind of channels for communication (instant messaging, push notifications and integration with social networks), it ensures the digital anonymity, and for instance, a user could send a message to other one knowing only his identity. Other characteristic of the tool is that can be used without restrictions, from anywhere, anytime and any device and it is fully customizable so it can be adapted to other environments.

We also analyses the tool with a study case in a university environment, a small group of students and teachers of first and fourth course of Computer Science Degree participated. In our study, the main advantage of the tool showed by students and teachers was relative to enhancing communication and the possibilities to share information and knowledge in agile way. Moreover both students and teachers expressed the useful of the tool in every kind of messages.

Keywords—Collaborative learning, mobile communication tool, mobile instant messaging, mobile technologies, social media.

I. INTRODUCTION

RECENTLY, possibilities of mobile learning (m-learning) and collaborative learning have been increased due to evolution of mobile technologies and its market penetration through smartphones and tablets, but also due to high acceptance of these technologies among young people.

Some characteristics such as social relationships or the mobile technologies and information and communication technologies have an important influence over human learning. Some researchers state this [1], [2] and they show a big

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interest in studying and researching how these new technologies can affect the teaching and learning process. The main reasons of this interest come from the own properties of these new technologies, for instance, its portability, customization and ubiquity [1], [3].

Collaborative learning in virtual environments (Computer-Supported Collaborative Learning CSCL) is a new style of learning [4]–[7] to improve the learning process through the use of computers connected to Internet.

The appearance of mobile devices connected to Internet and their differences with personal computers have led to a new learning paradigm, the Mobile Computer-Supported Collaborative Learning (MCSCL) [8]. The new paradigm aims to take advantage of possibilities offered by new mobile devices connected to Internet to interact, connect and communicate everywhere and every time [9], [10].

Collaborative learning in virtual environments uses tools such as chats, instant messages or blogs. Some authors as Ting [11] explain the advantages of these types of learning. This author believes that with these tools through mobile devices or PC, students can express their opinions and make questions without the pressure of an environment like the traditional classroom. Nevertheless some authors believe that when these tools are used from a personal computer, these do not answer the needs of mobility and ubiquity that the students demand when they use their mobiles [12]. On the other hand, other authors [3] have studied how mobile learning has affected to collaborative learning and their results. These authors suggest that students use different types of tools in different situations. In this context the instant messaging could be a good communication media to make easier group work and collaborative learning.

From the beginning of mobile learning, different tools have been proposed to promote the interaction in the secondary school [13]. Most of them are based on the use of SMS and MMS, or even email. For instance, SHERPA [14], which is a mobile tool designed and used by teachers and students in order to make easier the communication between both and also to help in the administration activities in the classroom. This tool uses the email as communication media. Or the Flying2U platform [15] allows the students to create their own mobile community and communicate via SMS or MMS. In our university we also have experience with a tool named

MoviUPSA [16], which was pioneer in Spain. MoviUPSA is a communication service based on sending SMS and email. This service allows communication between different university profiles, such as students, teachers or university services. Nevertheless, nowadays the use of SMS has decreased for different reasons: user has to pay for the service, it has restrictions about types of information it can send, for example it is impossible to attach files instead you have to use MMs, more expensive even.

But recently have emerged new mobile instant messaging services, for example Whatsapp. This new instant messaging allows exchanging free messages, moreover with this service is also possible to send images, videos and audio. Therefore, all these features solve the SMS shortcomings. These new services are free and without limits in message contents. Zhuhadar et al. [17] assert that social multimedia systems can help teachers to disseminate knowledge and attract students in a more effective way than traditional online teaching. They recognized the added value for the students because they can watch multimedia contents in their smart phones and this affect to the student learning.

Moreover, the boom of social networks and microblogging has made that they have become the new broadcast channels. Social networks are the way where converge individuals with similar interests, and mobile social networks are social networks where communication is through mobiles or tablets. All these services are closely related to learning process, besides they are able to provide an efficient framework where users can share and distribute information in order they can acquire knowledge in a collaborative way, as Adriana Gewerc et al. ([18]) explain.

A report of Deloitte [19] predicts that in 2014 instant mobile messaging services on mobile phone will carry more than twice the volume of SMS messaging. Others reports assert that only the instant messaging has grown (8.9%) in communication services. This type of instant messages is the most used and it is employed by more than 56% of young people [20] and [21]. Moreover, the growth of use, the use frequency (83% of users daily use them) and the importance of instant messaging, shows the role of this service as communication media.

Users use the communication channels that they prefer depending on not only the nature of the communication, but also depending on receiver of the message. For instance, personal communication uses the phone to speak, while small group communication prefers instant messaging (for instance, Whatssapp, MSN, Messenger, Yahoo messenger…). On the other hand, if the group is larger, they prefer the social networks, for example Facebook. Finally to spread the message as much as possible, the channel used is microblogging, mainly twitter. These services are also organized attending to the number of communicating users. In Figure 2 we can see that both landline and mobile phone are used to communicate with few persons (5,84 and 8,43 respectively), while microblogging and social networks are used to communicate with a large number of people (28,6 and 18,6 respectively), more than direct communication between people (16,15 people).

The great use of these technologies by young people makes necessary their use in education. There are many studies that show the students satisfaction with the use of them [22]–[32]. Students say that the main advantages of mobile devices would be ubiquity, interactivity and instant and personal communication.

In this paper we present a collaborative learning experience in a university context, using our tool named SCHOM. This tool offer new possibilities of collaborative learning user centered. SCHOM has been designed by our research group and it allows sending messages through different channels. Moreover messages can also be received by different devices. These devices could be mobiles, tablets or personal computers and with different platforms or operating systems (android or iOS). Different channels from where we can send the messages will be: instant messaging, social networks, microblogging and email. This tool, as we will see later, allow digital anonymity and it is multichannel and multidirectional. In the following sections we are going to present our tool as well as the advantages and disadvantages of the use of this tool like support tool in the collaborative learning process, such as teachers have explained.

The aim of this work is to analyze how the new emerging communication channels, such as instant messaging, social networks and microblogging, that are commonly used, can facilitate, support and enhance the collaborative learning. Nevertheless, in order to apply the collaborative learning in mobile environments, it is necessary a technologic tool. In this paper we are going to describe one of these tools named SCHOM. SCHOM joins in the same tool all communication channels. Besides, SCHOM is also abled for mobile devices, therefore it guarantee access to information from everywhere, any mobile or any device. This paper also aims to evaluate SCHOM and how it can be used in university.

The survey has been carried out in a university context, specifically with the participation of teachers and students of the first and last course of the Computer Sciences Faculty of our university. The students of the last course, in the previous three courses had already used the university tool named MoviUPSA [16], [33], [34], while the students of the first course did not have yet any experience with this tool.

MoviUPSA is a tool with a good acceptation in the university community. It is integrated in the Virtual Campus and fully configurable for message communication through different communication channels such as email, SMS and MMS.

In the survey it has been employed a qualitative study based on interviews to teachers and students to evaluate their satisfaction and opinion after using the new SCHOM tool, different to the already existing MoviUPSA tool.

In the following sections we are going to explain the SCHOM tool, and then we will describe the survey we have

performed, showing which items have been considered and analysed.
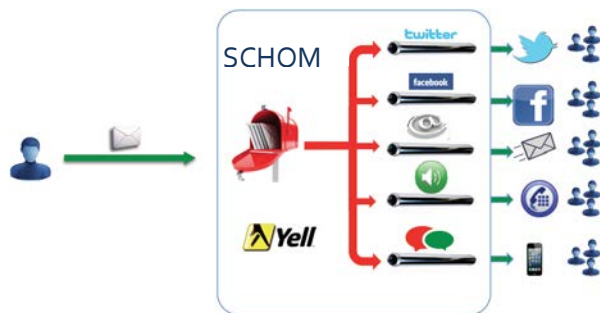
II. COMMUNICATION TOOL. SCHOM

Fig.1. SCHOM Schema

In Fig.1, a SCHOM schema is showed. SCHOM incorporates a directory or yellow pages (Yell) which manages all user accounts. Each user has the possibility to set up his channels that is to say, his email addresses, phone numbers, social network accounts, microblogging accounts. Yell uses open APIs for managing those accounts and also for searching. At all times the security and confidentiality are granted as well as anonymity digital (it is possible to send a message to John Smith but it is not possible to know what his email is, or what his phone number is, etc.). The user is who decide which channel is used for receiving messages.

SCHOM is a tool which integrates different communication channels, from user's point of view it can be seen like tree applications or subsystems with different functionalities:

- Notices subsystem. This subsystem is completely customizable, in other words the notices are categorized and it is possible dynamically to change categories. Users choose what categories are subscribed for them or what categories are interesting for them and also they set up for what channel or channels they want to receive the notices. For example, a user subscribed to library category that has set up Twitter channel and instant messaging to receive notices, he will receive all notices from the library in both channels.

  With the tool is also possible to send personalized notices, very useful for example for sending student report.

- Private instant messaging subsystem. It is a service similar to WhatsApp. A user can send private messages to other user or to a group of users selected for him. And also there are group of users presented in the system, and there are users with licence to send messages to those groups.

  The message is sent from the tool and also it can be received in the tool but it is possible to receive the message throw any of the configured channels. However if a receiver wants to respond to a message, the tool must be used. All senders know which are the users or groups to who can send messages (he has licence to do that); they are in his directory, accessible form the tool.

- Forum subsystem. This system is used to support discussion group forums. Users of a group can participate in the forum and also the can create new topics. Although it is completely configurable, it exists default forums. The tool is used for exchanging messages in all forums.

SCHOM classifies messages according to nature of messages or to usefulness of these.

So, according to nature of message, messages are classified in:

- Non-persistent. When the message is delivered to the receiver, the system loses its reference. Only sender and receiver have a copy of it. This kind of message is used in private communication between users, using instant messaging.

- Persistent. This kind of messages is used in discussion board, important notices and topic subscription. They may be reviewed at any time.

According to usefulness of message, messages are classified in:

- Notice: It is a message used to post a notice. This kind of message can be send by users with permissions of sending; also the own SCHOM system can send this kind of message to report an error or a warning, in other words, the senders of this type of messages can be users with permissions or the own system. It is a unidirectional message; the sender is not waiting for a response from receiver.

- Private: It is used in n:m communications between users, using instant messaging.

- Discussion: It is used in discussion forums.

Fig.2. User Configuration

The user decides what kind of message he wants to receive for each of his channels and then he can configure his account in the system according to his preferences (see Fig. 2). Furthermore he can block private messages from a particular sender. On the other hand, when a user sends a message, he

has available the option to choose all users that he needs to send a message. We will use the term "contact" to refer to the receivers of a message.

A contact can be: individual or group.

- Individual. It is a contact representing a user. We will use contact or user indistinctly.

  Every user belongs to an organization or domain. Every individual contact (or every user) must have a profile. A user profile represents the role of the user in the domain that he belongs to.

  It is possible to have individual contacts without domain associated but in this case, we are talking about special users who are responsible to make configuration and administration tasks. They are called system users.

- Group. Individual contacts must be organized in groups, so a group represents a list of contacts. To describe the group contacts, we will focus on four aspects: composition, security, structure and types.

The tool also has an administrator part where users, groups, profiles, privileges and permissions are configured.

A. SCHOM performance

Users are automatically registered using their users and passwords of Virtual Campus University. SCHOM is initially configured with some contacts groups, one contact group for Faculty, other for Degree, and other for Course and finally other for Subject. All users are member of the groups that represent their subjects (like student or teacher). In the default configuration, a user can send private messages to any user of his groups. In Fig.3 examples of private message are showed.

All users have at least one of the next profiles: Teacher, Student or Secretary. There are two profiles more: Dean and StudentRepresentative. All student users (users with Student profile) can send private messages to any other user in their groups. So, a student can send messages to his classmates and to his teachers (teachers of his subjects). On the other hand, teachers (users with Teacher profile) can send private messages and notices to any user in their groups and to any other teacher and secretary (users with Secretary profile). And Secretary users can send notices to teachers, students and other secretary users and they can send private messages to dean (user with Dean profile) and teachers.

A teacher, who is in the Deanery, will have Dean profile too. Dean profile users can send private messages and notices to any other user in their faculty (Faculty group). In Fig4 there is a notice example received in the app or received using a PUSH notification.
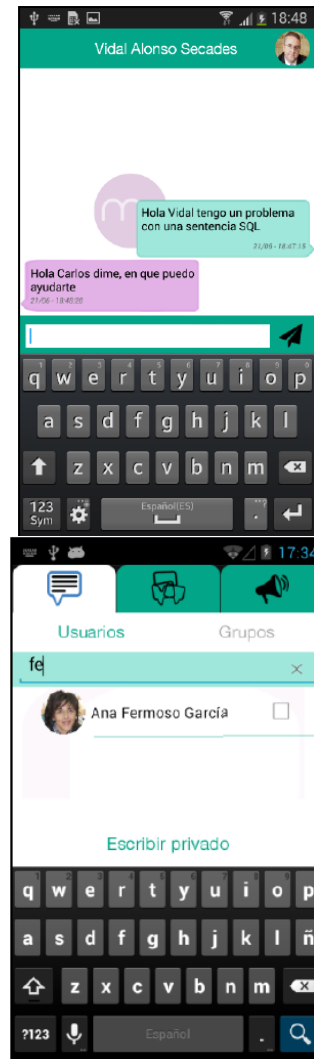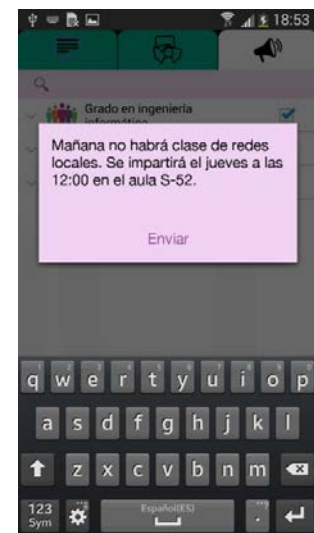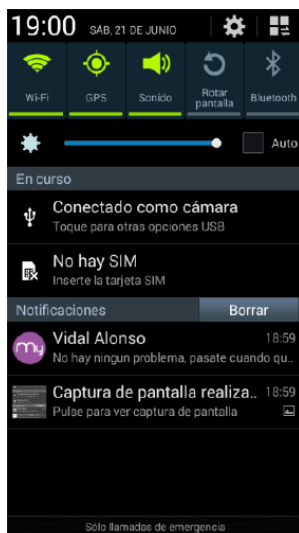

Fig.3. Private messages

Fig.4. Notice received in the app and notice received using PUSH notification

On the other hand, users with studentRepresentative profile can send private messages and notices to any other user in the groups of his course (i. e. to all users in all subjects of his course), and private messages to Dean. Moreover, all subjects are discussion forums, teachers and students can create discussion threads and they can publish in them.

One of the advantages of SCHOM is that it assures digital anonymity. For example, a student can send a message to a teacher via instant messaging although he does not know the teacher mobile number. The student only has to know the teacher name because SCHOM is who send the message and SCHOM is the only who knows the links between user names and their digital ids (email, mobile number, twitter account).

Another advantage is that the user is who decides the channel for receiving the information (PUSH notification, instant messaging, email or twitter) and he can modify his channel configuration in any moment.

SCHOM was used for 63 students and 7 teachers in first and last courses of Computer Science Degree during four months. At the end of the course, a satisfaction questionnaire was filled. The objective was check if SCHOM enhances the communication and collaborative learning. The questionnaire was answered for 26 student of first course, 32 of fourth course and 7 teachers.

The next items were replied for students:

- Item1. Enhances the interaction/communication with other classmates
- Item2. Enhances the interaction/communication with teachers
- Item3. Increases your motivation
- Item4. Enhances learning
- Item5. Promotes personal satisfaction

On the other hand, items replied for teachers were the next:

- Item1. Enhances competences acquisition
- Item2. Stimulates students' participation
- Item3. Improves the sense of responsibility

- Item4. Promotes the construction of knowledge

All these items could be answered using the following Likert scale:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

The questionnaire also had questions YES/NO/No Answer (NA). Also they have available an essay answer and a space for comments or suggestions where they could express their opinion about the use of SCHOM. The questions were:

- Item A. Do you think <TYPE> messages are useful?
- Item B. Would you remove <TYPE> messages of SCHOM?
- Item C. Why?

Where TYPE is: notice, private and forum.

III. ANALYSIS OF RESULTS

The questionnaire results were collected automatically, Google forms was used for it. The questionnaire was anonymous, however only users of the University, which were working with SCHOM, could answer it. That is, users must be authenticated in the University domain.

After that, a statistical analysis was done; basically frequencies and percentages were obtained. The answers of first course students, fourth course students and teachers were separately analysed (see tables 1, 2 and 3).

Regarding the students, as you can see in the following tables, the tool was assessed positively, although some differences can be found between first and fourth course students in any item.

Table 1. Percentages of answers for first course students

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Item1	3,85	3,85	15,38	50	26,92
Item2	0	11,54	11,54	34,62	42,31
Item3	3,85	3,85	23,08	46,15	23,08
Item4	7,69	11,54	42,31	19,23	19,23
Item5	3,85	23,08	34,62	30,77	7,69

Table 2. Percentages of answers for fourth course students

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Item1	0	6,25	6,25	53,13	34,38
Item2	3,13	3,13	3,13	18,75	71,88
Item3	0	6,25	18,75	31,25	43,75
Item4	6,25	15,63	18,75	31,25	28,13
Item5	12,50	21,88	31,25	18,75	15,63

Table 3. Percentages of answers for teachers

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Item1	0	0	28,57	28,57	42,86
Item2	0	0	14,29	28,57	57,14
Item3	14,29	14,29	71,43	0	0
Item4	0	0	14,29	42,86	42,86

With respect to if the tool enhances the communication, both between students and between teacher and students, the answer was positive. For first course students, upper 75% in both items (adding "agree" and "strongly agree" answers). Whereas that for fourth course students the answer is better yet, closer to 90% in both items. It is important that more than 70% of last course students were strongly agree that tools enhances the communication with teachers. Perhaps the difference is due to fourth course students' experience in the University. They can compare with other courses in the University and first course students do not have any reference to compare. Furthermore, the communication between students and teacher in the first months in the University is very poor.

With respect to item 3 (improves the sense of responsibility), the results are very similar for first and fourth course students. In cases, upper 70% adding "agree" and "strongly agree" answers. And for item 4 (enhances learning), the answers are uneven, fourth course students express that tool enhances learning (42.31%) but an elevate percentage of first course students answer "neither agree nor disagree" so they do not know if tool enhances their learning.

Finally, both kinds of students did not express that tool promotes their personal satisfaction; an important percentage of answer was "neither agree nor disagree" or "disagree".

On the other hand, with respect to teacher's answers, in general it is possible to say that tool enhances learning, collaborative work and it makes communication agiler. Item 1 (enhances competences acquisition) and item4 (promotes the

construction of knowledge) adding "agree" and "strongly agree" answers, are upper 70% and 84% respectively. Moreover, item 2 (stimulates students' participation) is upper 85% too. However, in the item 3 (improves the sense of responsibility) there is not the same result, upper 70% of teachers chose "neither agree nor disagree".

Table 4. Percentages of answers for first course students

	First course students		
	YES	NO	NA
ItemA: notice	92,31	3,85	3,85
ItemB: notice	3,85	96,15	0,00
ItemA: private	88,46	0	11,54
ItemB: private	0	100	0
ItemA: forum	84,62	0	15,38
ItemB: forum	96,15	0	3,85

If we analyse the students' answers of all kind of messages: notice, private and forum (see Table 4. and Table 5). We can observe that for all students (first and fourth course) all kind of messages were useful (between 90%-100%). In the comment part of the questionnaire some students said that they utilized Whatsapp for private conversation with his classmates but they preferred use SCHOM for "academic messages" and a lot of students (30) admitted that one of the most important advantages of SCHOM was that with this tool the communication with the teacher was instant. On the other hand, some students told about forums in Moodle versus SCHOM forums and they declared that SCHOM forums were better because the interaction was quicker and more agile.

Table 5. Percentages of answers for fourth course students

	Fourth course students		
	YES	NO	NA
ItemA: notice	84,38	6,25	9,38
ItemB: notice	6,25	93,75	0
ItemA: private	100	0	0
ItemB: private	0	100	0
ItemA: forum	93,75	0	6,25
ItemB: forum	96,88	0	3,13

Some students of fourth course talk about MoviUPSA (an old tool for communication in the University [33], [16]) and obviously they preferred SCHOM. MoviUPSA is a tool only for notices; the user cannot interact with it.

Furthermore, SCHOM registers each type of sent message. The number of sent messages was: 3243 privates; 630 notices

and 245 forums (see Fig. 5). So we can confirm that private messages are significantly the most used.
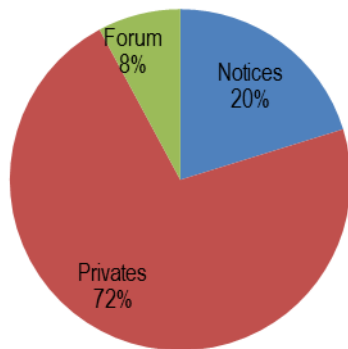

Fig.5. Percentage of use of different types of messages

IV. CONCLUSIONS

In this paper we present a powerful tool for communication. This tool uses emerging mobile technologies to enhance the communication process. Although students have embraced mobile technologies, nowadays there are not dedicated tools that use this so new technology in a learning environment. In this sense, our tool (SCHOM) is unique and original.

SCHOM takes advantage of the communication possibilities that smartphones provide nowadays, mainly if we consider instant messaging. But it does not force us to use it because the user is who chooses the channels to receive the information (push notification, emails, SCHOMobile app or Twitter). One of the main advantages is that ensures the digital anonymous, regardless of the channel chosen. So a user can send a message to other user, using for example instant messaging, knowing only his name. Also it is an entirely customizable tool so it could be used in any educational context or any organization where an effective informal communication is needed.

The analysis of the result let affirm that with the use of mobile technologies a new paradigm of collaborative learning has been born. This paradigm enhances the collaborative learning and both students and teachers can obtain benefits of it. The main advantage of the tool for students and teachers was relative to enhancing communication and the possibilities to share information and knowledge agilely; a consequence of this could be the enhancing competences acquisition and promoting personal satisfaction noticed by teachers.

Specifically, we can affirm that SCHOM, tool developed by us, is appropriate for a University environment and it could be added like a new resource in the virtual campus. The tool agglutinates different kinds of tools (instant private messaging, notices, notifications, and forums) that some authors like Kim et al. [3] think are necessary in a collaborative learning process. With our study, we can also affirm it.

Moreover we have probed, as some authors [1], [3], [27], [30] affirm, that these tools are appreciated by their characteristics of ubiquity and portability. Furthermore, these tools enhance interaction, personal communication and they facilitate knowledge acquisition, both formal and informal in a university environment.

In future researches we want to repeat the study but with more students of different Degrees, not only of Computer Science Degree. So, the study will be more complete but our hypothesis is that the result will be similar because university students are digital native and they are in the same age range and all of them are digital native.

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