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Analysis of the Collaboration that Is Produced in Online Learning Using Python Technology

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ABSTRACT

Universities and institutions began to create their virtual campuses by using *eLearning* platforms whether commercial or not. Within these, it has highlighted among other tools instead of the didactic forums where students among themselves and students and teaching teams could discuss and in general build knowledge within a collaborative context. The data coming from these forums have been analyzed, with different techniques, and have allowed obtaining some very interesting conclusions. However, in recent academic years there is a clear trend of migration of collaborative work that previously occurred in the forums to social networks and mobiles. This poses a problem since these tools are not coordinated by the teaching teams. A preliminary work analyzes this trend and points out the consequences to which it may give rise. The present work exposes a methodology to automate the information obtained from Facebook working group, which have been designed by the students themselves.

Keywords: learning analytics, collaborative learning, collaborative interactions, analysis social networks

INTRODUCTION

This work is a continuation of another previous one carried out last year (Romero-Moreno, 2018). The former analysed and compared different tools that the students use in order to construct knowledge: the forums from the eLearning platform, social networks and mobiles. Students work in a virtual campus and follow a method in which they mix online and face-to-face learning *(bLearning)*, although online modality predominates. The work developed in the didactic forums of the eLearning platform coordinated by teaching teams is contrasted with the work that the students develop in parallel in their collaboration groups created in social networks and with the use of the applications of their mobile devices.

In the previous paper, the work developed in the didactic forums of the eLearning platform coordinated by teaching teams is contrasted with the work that students develop in parallel in their collaboration groups created in social networks and with the use of the applications of their mobile phones.

On the other hand, we have the discipline of Learning Analytics that are providing analysis techniques that can of processing a large volume of data from the educational field (usually from university contexts) and with the clear objective of obtaining conclusions of that analysis, that contribute to the improvement of the teaching-learning processes (Fesakis et al., 2004; Romero-Moreno, 2017; Romero-Moreno et al., 2008).

To carry out the experiment, data obtained from work with the platforms and from work groups with social networks was analysed, as well as the data from a survey passed to the students at the end of four-month courses in three subjects: two of mathematical profile and one of technological profile (Computing).

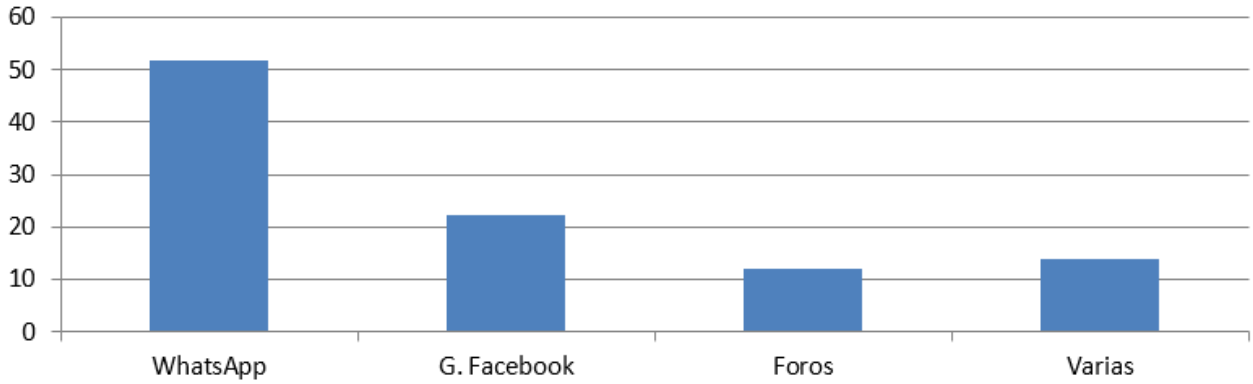

Figure 1. Preferences of the students for the different teaching tools

In that work a comparative study was presented between the messages and interactions held in the forums of the eLearning platforms and coordinated by the teaching teams and the collaboration that is produced by other means among the students and apart from the work developed by teachers and tutors.

In conclusion, we warned that if these analyses are disregarded, the risk of the institution is clear, losing the live, dynamic and adaptable connection to the student that the online modality requires. **Figure 1** shows the preferences of the students for the different teaching tools.

The present work exposes a methodology in order to automate the information obtained from Facebook working groups, which have been designed by the students themselves.

ANALYSIS OF DATA OBTAINED FROM THE SURVEY

Having seen the phenomenon described, we have chosen to pass a survey of 50 students enrolled in these subjects and we have contacted the students *face and face* through the classroom, because we are in a *bLearning* context. The methodology followed (Romero-Moreno, 2008, 2012; Sancho, 2015; Zapata-Ros, 2013), adding certain modifications.

The questions have followed the next two objectives:

To Learn and Go in Depth the Subjects

Considering the aspects:

- Speed formulating the questions or in obtaining an answer
- Security and intelectual rigor
- Simplicity
- Activation of previous knowledge
- Loneliness of online learning

Pass the Subjects

Consideranding the aspects:

- Speed formulating the questions or in obtaining an answer
- Final review for the exams
- Continuous assessment tests
- Simplicity
- Loneliness of online learning

Con las herramientas en ambos casos:

With the tools in both cases:

- App Groups
- Página de la asignatura (sobre todo foros didácticos)
- Website of the subjects and teaching team videoconferences
- Facebook Group that is administrated by the students

The survey and its results have pushed us to carry us a more exhaustive work that contemplates instructional materials and message categories.

Table 1. Other aspects to consider with the total group of students

Facebook Groups	Messages by subject		
	Fundamentos Matem	*Matemát. I*	*Matemát III*
Messages	73	190	42
Interactions	125	327	77

CONTEXT IN WHICH THE COURSES ARE FRAMED

We are framed in the context of a university that provides a mixed teaching between a part of face-to-face tutoring and a large part of online teaching who use an eLearning platform. The main tools that are used in the development of the courses are:

Use of the Platform's Didactic Forums

The forums are an important teaching material and there is also a Student Forum (not coordinated by teachers or tutors) and a set of coordinated forums in which students can interact and collaborate with each other and with their teachers and tutors. They can represent the libraries and classrooms where a group of student study and build knowledge collaborating among the group itself.

Webconferences and Videoconferences that are Taught by Teachers and Tutors

It is a set of lectures that are usually recorded and that try to explain most of the programs of the subjects. The additional advantages of these are that they consist of a real-time chat in which the students interact with the speakers and also that this material remains in the virtual course during the whole course, then they pass to a Repository where it is possible to go if you wish.

Weekly Face-to-face Tutorial

In this case, the students can receive face-to-face classes with their corresponding tutors and to set out their doubts and considerations.

Other Platform Tools

In the courses of the platform there are other tools to present notes and diverse material, besides the possibility of realizing self-assessment tests and functionalities to deliver work and exercises that can help the continuous evaluation. Also, of course, working groups can be formed within the platform.

DESCRIPTION OF THE COURSES

The subjects that will serve as an object of study in this case will be three, of degrees belonging to the area of social sciences. All of them have a mathematical profile, Matemáticas I and Fundamentos de Matemáticas (first year course) and Matemáticas III (third year), annual teaching period: 2018-19.

These subjects follow all the contexts mentioned and described in the previous section and have for their developments the same tools and study materials. In the table I we can see the activity of the didactic groups in Facebook.

DESCRIPTION OF METHODOLOGY

In order to design the methodology we have revised different academic papers (Romero-Moreno et al., 2007, 2008)

The methodology has the following steps:

A. *Obtaining data from the Facebook platform, classification and transformation of them and then be analyzed using analysis social network software*
   - From the Facebook platform we obtain csv file
   - Identifiers are assigned according to categories
   - Csv files are classified and concatenated
   - Weight are assigned to messages and interaction and categories
   - The associated graphs are displayed

B. *The files obtained are subjected to database treatment*

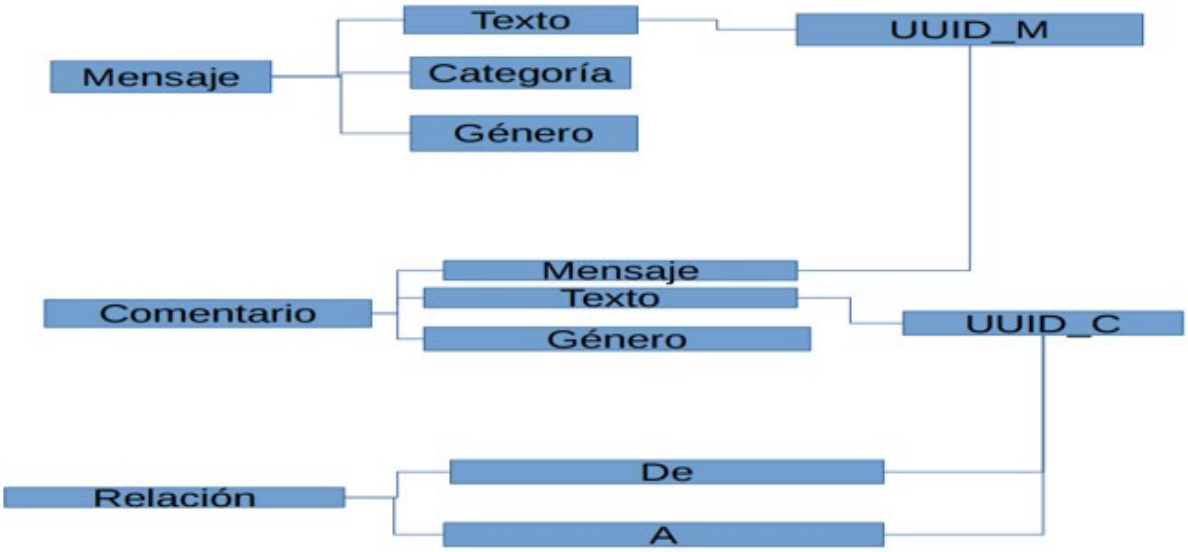

Figure 2. Relationship between message and interaction and its classification by categories

C. Finally the methods of Ssocial Network analysis are applied

- Indicators are obtained
- Graphs are obtained

In **Figure 2**, we can see the relationship between message and collaborative interaction (reply). The attributes of each message are: text (which determines its category), the category and gender of the person who formulates it. The attributes of each interaction are: the message, text and gender. The relationship is *from to*. An identifier is associated to each message and interaction.

We classify category: *notes, theory, practice, advices and generals*

USED TOOLS

In order to apply this methodology, we have:

A. Python Software

We have designed a set of scripts in Python to perform the collection, classification and transformation of data to be later analyzed.

B. Excel

Then the database processing and classification properties of Excel are applied to the data obtaining a new file

C. Gephi

Gephi is an open-source analysis and visualization software package written in Java and that allows to obtain graphs and analysis social networks indicators.

COMPARISION BETWEEN MALE AND FEMALE STUDENTS

We can see different applications or experiment that permit us to observe the method. We will establish the gender category, and we ask ourselves if there is a correlation between the participation of the Facebook collaborative groups and the students enrolled in this University.

We can see in **Figure 3-5** that the participation goes hand in hand with the number of students enrolled in each subject and with the participation in the didactic group of Facebook. It should be noted that the total number of female students enrolled in this university is 53.6 %.

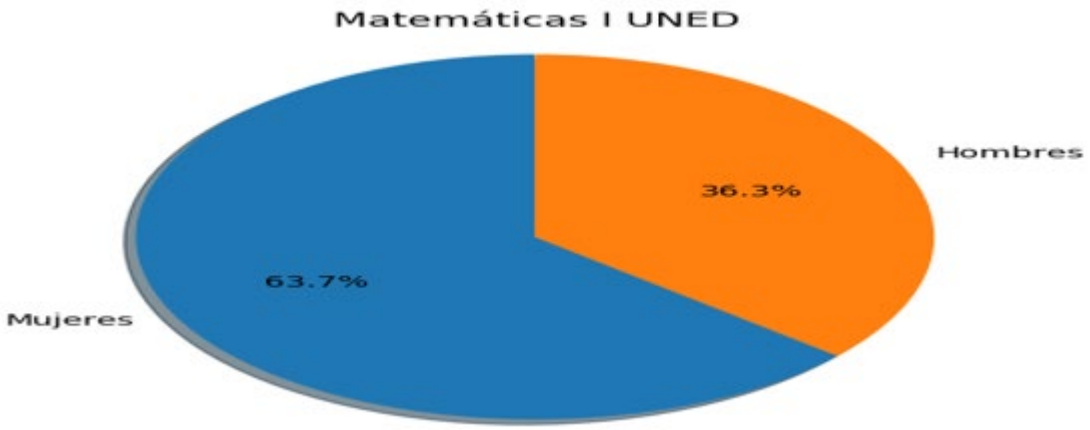

Figure 3. Female students vs. male students in one of the subject

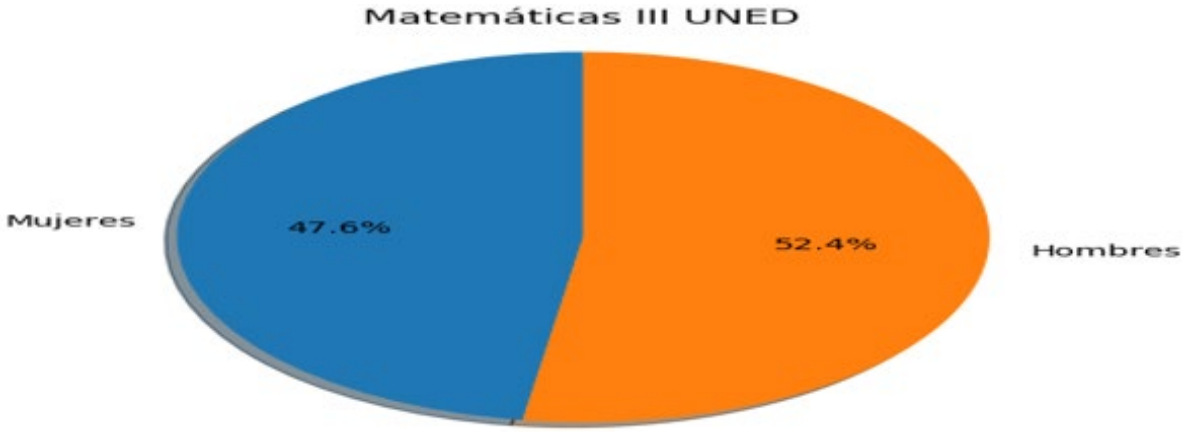

Figure 4. Female students vs. male students in the other subject

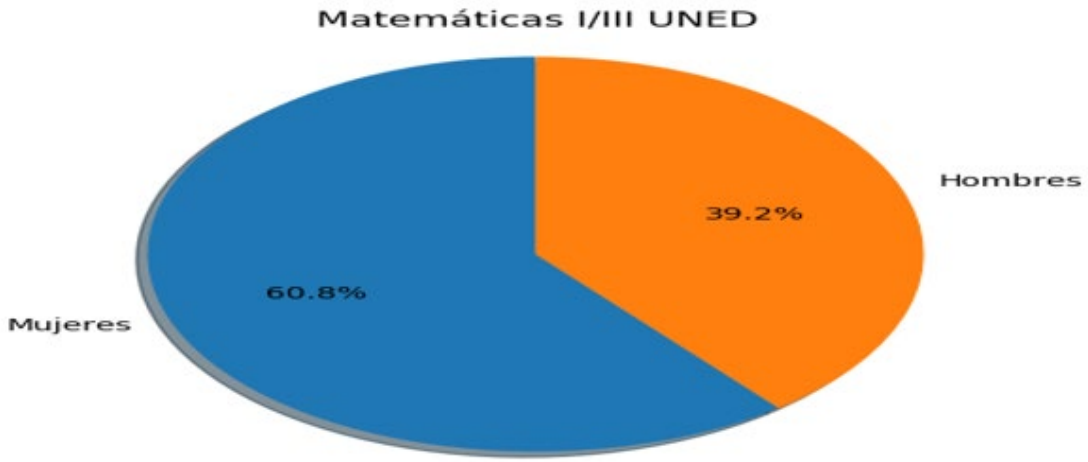

Figure 5. Female students vs. male studenst in both of them

COMPARISION AMONG INSTRUCTIONAL MATERIALS

In what follows, we will show a set of graphs in which we can see the collaborative work done by the students in the Facebook groups through the messages and interactions.

Figure 6 is a graph made to generate the list of nodes and edges from a csv database

Figure 7 contains the same information as the graph of de **Figure 12**, it made with the Gephi software.

Figure 8 shows that the participation of female students is higher than that of male students, and this is due to the higher number of female students. It's worth noting in practical exercises.

In **Figure 9** we can see the importance of the didactic materials in the texts of the messages. It should be noted that the collaboration through the notes is superior to theoretical questions or practical exercises.

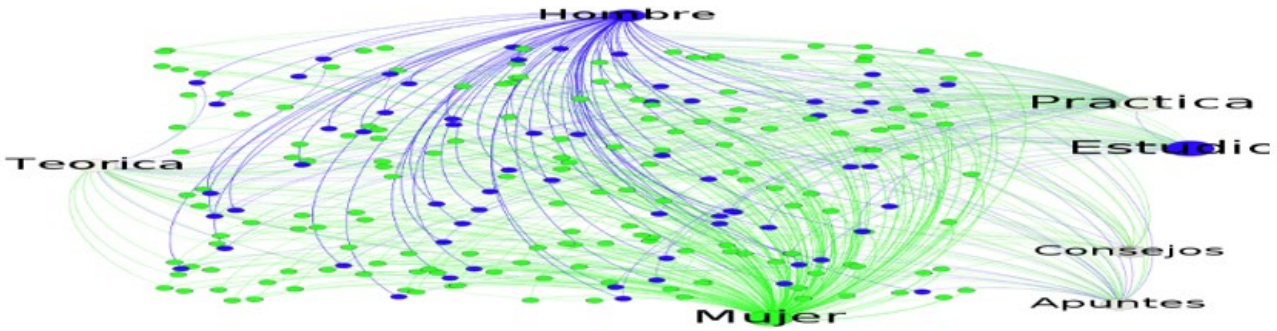

Figure 6. Female and male students and comparison among instructional materials

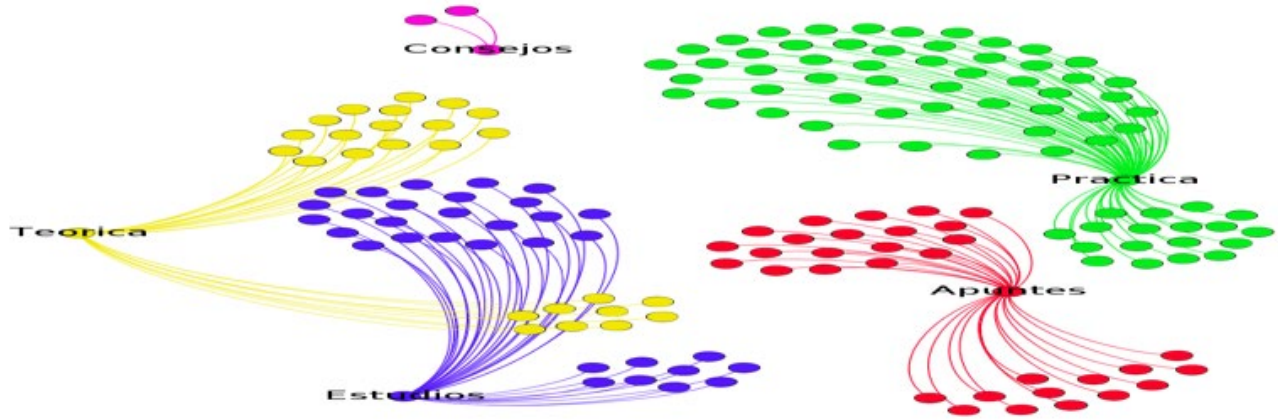

Figure 7. Comparison among instructional materials

Figure 8. Comparison among instructional materials

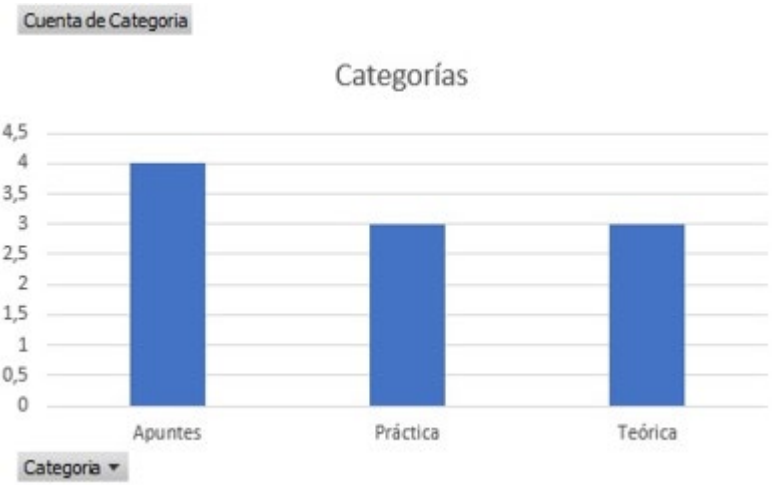

Figure 9. Comparison among instructional materials

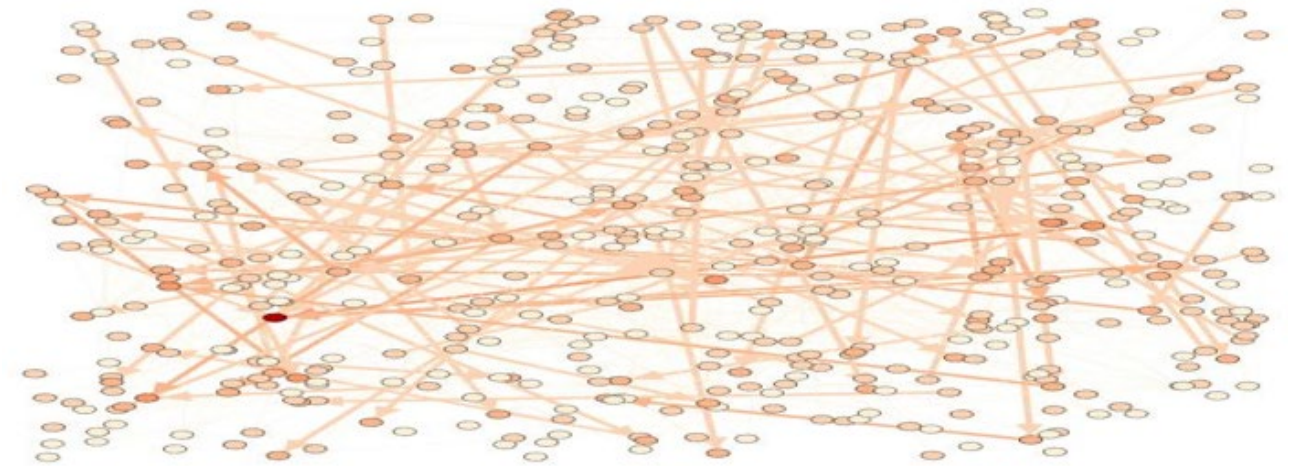

Figure 10. Graphs of messages without categories according to their repercussion

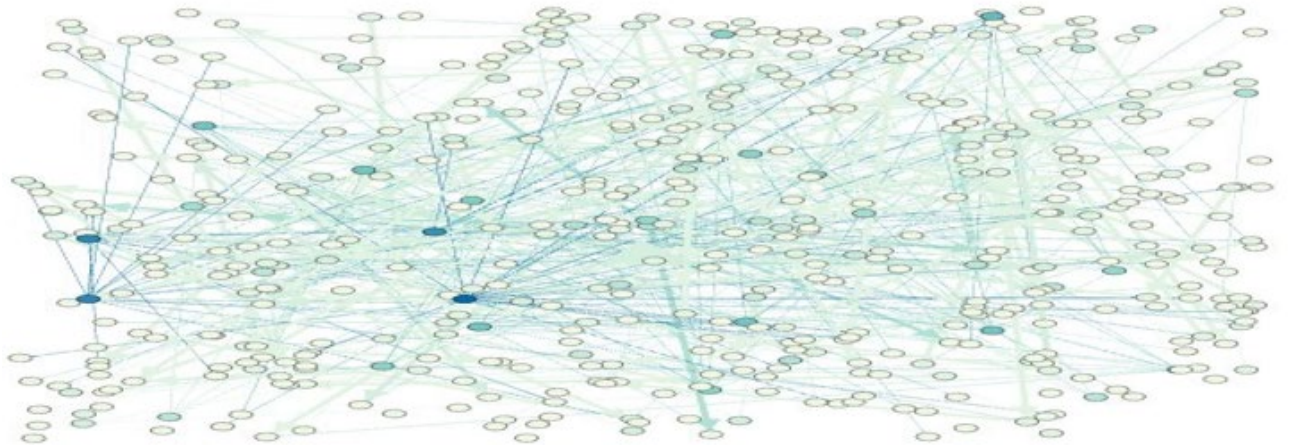

Figure 11. Graphs of messages without categories according to their repercussion

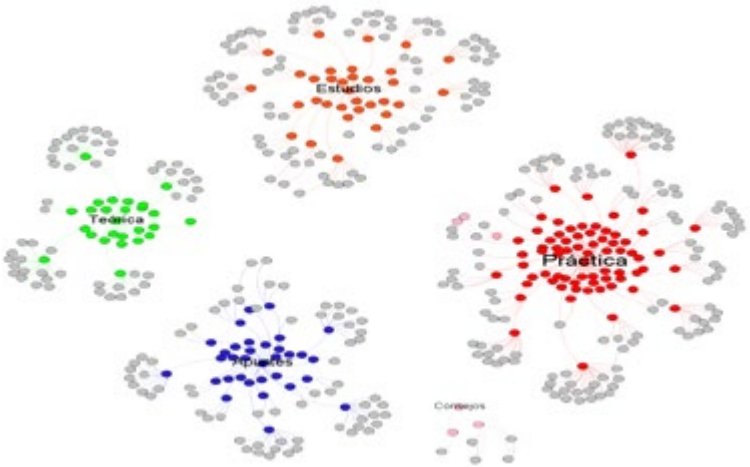

Figure 12. Graphs sorted

Figure 10 is a graph made with the Mathematics I database without sorting by message type. You can see the relationship between the interactions, that is, which messages have been most answered and / or cited. Since those will be those that have had the most impact in the collaborative work and are shown more intensely.

Figure 11 unlike in the previous graph, this has been colored to see the relationship between the messages, that is, which messages have had the most comments. Which are those of more intense color. That is, there are approximately 4 messages that have a lot of comments in relation to others.

Figure 12 is a graph also made with the Mathematics I database in which the messages and comments have been organized according to the category to which they belong and the messages have been colored, leaving the

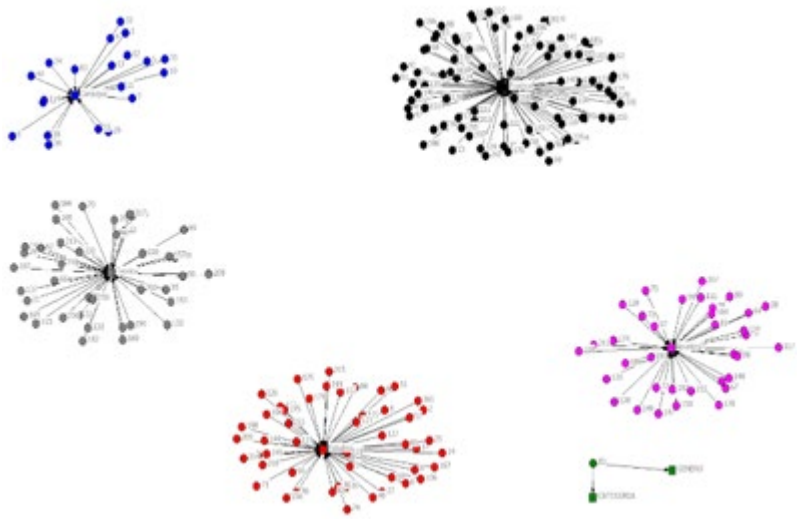

Figure 13. Graphs of messages without categories according to their repercussion

interactions gray. In this way, we can see what, for example, in the practical category there are many messages, but many of them are not answered, and those that are generate a lot of activity.

Figure 13, the only graph made with UNCINET (another social network analysis software), the interactions with their respective categories contained in the Mathematics I database. It serves as a check that the script responsible for assigning unique identifiers to the messages worked correctly.

CONCLUSIONS

In the present paper, starting from a preliminary work, we have presented a methodology and its tools to analyze the work of the students of an online University.

In this previous work, the transition from the didactic forums to the Facebook groups and other similar tools could be seen. These groups are formed spontaneously by the students. Therefore, they constitute a collaborative tool of great importance, but not coordinated by the teaching teams.

Then, a methodology, which recovers and analyzes the collaboration between students with different tools, is presented.

Finally, we present some applications with graphics and with different categories that are analyzed.

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