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Interaction through mobile technology in short-term university courses

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ABSTRACT

Nowadays, online or distance learning postgraduate schools program the academic period in different sequentially developed modules. This article assesses the impact of the programming of short-term university courses (30–60 days) on the frequency and quality of interaction when communication takes place through mobile technologies. Frequency corresponded to the messages generated by actors in learning environments, and quality was quantified using a scale of interaction levels operated by assessing the content of the messages issued by the actors. Results revealed that there is no correlation between interaction and academic performance in short-term courses. Additionally, a downward trend was observed in the number of individuals involved and in the frequency and quality of interaction throughout the course.

1. Introduction

Given that the effectiveness of collaborative learning (Mei & May, 2018) and the benefit of social interaction for meaningful learning (Oztok et al., 2015) has been proven, peer interaction and collaborative learning mediated by information and communication technologies (ICTs) have been further consolidated as subjects of interest in education (Aghaee and Keller, 2016). The major reason for this is the fact that interaction has evolved into a key element for success in e-learning and b-learning environments (Blaine, 2019).

Concerning e-learning or distance learning postgraduate schools, modular programming of academic periods involving the sequential opening of modules has gathered strength. Time reduction directly impacts interaction and collaboration because as the course progresses, students feel more comfortable participating and, thus, their interaction increases (Weiser et al., 2018).

This article assesses the impact that the programming of short-term university courses (30–60 days) has on the frequency and quality of interaction when communication takes place by means of mobile technologies. To this end, it addresses the following issue in particular: interaction and academic performance in one of the group activities of a course designed to foster student interaction.

1.1. Technology-mediated social interaction and collaboration for learning

Social interaction is a novel epistemological orientation wherein the basic unit of analysis is a system made up of the relationship between subjects and the relationship between the subject and context (Marc and Picard, 1992); therefore, its study is relevant for all social science subjects. In particular, for education, social interaction has been identified as a defining and crucial component of the educational process (Shu and Gu, 2018), which benefits meaningful learning and the deep processing of course material (Oztok et al., 2015).

In the same vein, Vygotsky (1978) pointed out that interaction is pivotal to cognitive development, as it takes place in two different ways: interpsychological (between people) and intrapsychological (within the individual). Likewise, Garrison (1991) emphasized that it is a key element of critical thinking, as problem definition (i.e., one of the five stages of the critical thinking cycle) can be done individually; however, it is more commonly carried out through interaction with other individuals.

Interaction among students has a significant effect on students' performance in online courses (Kurucay and Inan, 2017), as it strengthens the sense of belonging and promotes adherence to the platform in question (Luo et al., 2017), improves the course's success rates (Cung et al., 2018), and positively influences the quality of collaborative learning (Aghaee and Keller, 2016). In this regard, interaction patterns provide information not only on the individual learning process but also on the cooperation among groups and relevant dynamics (Kent et al., 2016).

Collaboration is a form of social interaction, but providing students with opportunities to interact with each other does not automatically result in collaboration, although the collaboration activities deliberately incorporated do favor learning much more than the interaction situations not promoted on purpose (Borokhovski et al., 2016). This encouraged

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professors to design learning environments fostering collaboration (Mei & May, 2018). The development of institutional programs has become necessary to support the design of strategies that allow for orientation of interaction in distance and online learning environments (Joksimović et al., 2015).

In particular, collaboration takes place in online and blended environments, depending on different communication tools such as forums, wikis, blogs, and videoconferences (Wang et al., 2017). Furthermore, interaction is wider and fairer when communication is mediated by a computer, as it tends to be less hierarchical and more decentralized (Zheng and Warschauer, 2015).

The use of computers in collaborative learning environments positively influences the acquisition of knowledge, skills, performance in group activities, and social interaction (Chen et al., 2018). The incorporation of social technologies (or Web 2.0) enhances collaboration (among students as well as between students and professors); promotes critical thinking (Hamid et al., 2015), increases students' involvement and interaction, and improves their academic performance (Zheng and Warschauer, 2015). In general, collaboration skills provided by technological tools substantially contribute to learning (Borokhovski et al., 2016).

The quality of peer interaction in a learning environment is affected by various factors, including the level of supervision and control, clarity of instructions, and motivation (Aghaee and Keller, 2016). Notably, there are different types of interaction, some of a social nature, some related to the development of the activities proposed by professors, and some others concerned with group management. The most common type regarding learning environment focuses on tasks, followed by emotional interactions and interactions related to group organization (Michinov & Michinov, 2008). Chang et al. also found that work-related interactions are most frequently found in a group over time (Chang et al., 2003).

1.2. The "time" variable in interaction in a learning environment

Interaction manifests itself in several ways throughout a course. At the beginning, the level of engagement of students is lower and requires clearer incentives from professors. However, as the course progresses, students become more engaged and require less motivation from professors (Weiser et al., 2018). Zheng and Warschauer (2015) state something similar in this regard: as the course progresses, the interaction network dominated by professors transforms into a student-centered one. The second network emerges in the last two months.

In addition, by the end of the course, the use of synchronous communication and need for face-to-face contact increase (Michinov & Michinov, 2008). While the depth of interactions among students increases since the beginning of the course until mid-course, it reaches a relatively stable state from that point up to the course's end (Shu and Gu, 2018). Task-centered participation and interactions decrease as the deadline approaches, while interactions targeting emotional regulation and coordination increase (Michinov & Michinov, 2008). Particularly in b-learning environments, collaboration within the group is strengthened, which is then followed by cooperation with remote collaborators (Beauchamp et al., 2019).

In summary, social interaction is a defining component in education, as it is the basis for cognitive development and critical thinking. In addition, collaboration is a form of social interaction that provides educational environments with multiple benefits, and the incorporation of technological tools for communication purposes encourages interaction. Finally, time is a variable that must be handled carefully if the aim is to achieve an intense and deep interaction that allows for setting up a student-centered network.

2. Materials and methods

The data presented in this article were collected within the framework of the project entitled "Learning network as a theoretical and methodological alternative for the promotion of interaction in university learning scenarios of virtual modality," which was approved in the Bioethics Subcommittee of Bogotá Campus of the Cooperative University of Colombia. Participants gave their consent to the first session of the course through the characterization survey.

This research employed a mixed-methods approach, as the rating scale of constructed interaction was managed through the content analysis technique, although interaction (frequency and quality) was also quantified to assess its correlation with academic performance.

2.1. Participants

The study involved the participation of 27 students from the Education Research course, which is part of the postgraduate degree "School Learning and its Difficulties" at the Cooperative University of Colombia. Students were divided into six groups of four to five.

2.2. Environmental design

The environment was designed to encourage interaction and collaboration by the actors, according to the following stages (Mena-Guacas, 2018):

- Characterization: Data collection from students for the composition of the groups
- Connection: Motivation moment that gives rise to a cognitive moment
- Social-preliminary: Introduction of the course subject and interaction directed by professors
- Individual-database: First individual approach to the subject by using information from academic databases
- Social-current cases: Support for the connection stage and interaction with lower stimulation by professors
- Social-asynchronous: Solid activity to be developed throughout the course and submission progress
- Individual-closure: Consolidation of the subject's internalization to provoke student's reflection

2.3. Characterization and group composition

Participants were distributed into groups based on the role assignment according to information provided in a characterization survey, which was developed using Google forms. The roles included distributor, narrator, compiler, and reviewer. Wherever possible, each group was formed with at least one person in each role. Nevertheless, this article does not focus on role assignment; therefore, for further understanding of this process, the work by Mena-Guacas and Santoveña (2019) should be referred to.

2.4. Role play group activity

The course involved three activities. Interaction data were collected from the second one named "role play group activities." This is part of the social-current cases stage, and listed in item 2.2 of this article.

The activity consisted of searching for two research articles that, given their characteristics, deal exclusively with a different paradigm each (wither empirical, hermeneutic, or critical social paradigms). The class was divided into groups of four or five students, who were assigned roles as specified in the preceding item. The activity included two crucial moments: (1) summary of the objective and methodology of each article and (2) revision of the work prepared by the other group and feedback generation. One document was prepared from each moment, which had to be sent to the teacher for him/her to assign a group score.

The teacher asked the students to interact on a WhatsApp group exclusively created to this end.

Four criteria were taken into account to assign the score: role performance and group participation (1 point), revision of two articles and justification of their association with the paradigm (1.5 points),

argumentative contribution to the other group (2 points), and application of the APA regulations (0.5 points).

2.5. Interaction data

2.5.1. Categorization process

The categories define the levels of quality of interaction, from the most basic to the most complex (see Table 1).

The following steps were implemented to define the categories:

- Completion of the course
- Analysis of the content of the messages sent on the WhatsApp group and their classification into different categories
- Tabulation of messages in matrix tables, including the following information: student's name and code, interaction date, message category, and score achieved (in accordance with the description in item 2.5.3)

Given that this study was developed as part of a doctoral thesis, the thesis supervisor reviewed and followed the categorization process.

2.5.2. Means of communication

The mobile application WhatsApp was used as the means of communication. A WhatsApp group was created on this platform for each of the six groups formed.

2.5.3. Frequency and quality of interaction

The frequency of interaction corresponds to the number of messages issued by each actor in the given environment. Quality was defined through the analysis of the content of each message, which allowed for placing them in the appropriate category. Once classified, a score was assigned to the message as follows: Parallel: 1 point; Opinion: 1 point; Two-way: 3 points; Reactive: 26 points; and Complete: 104 points. This score was assigned from the minimum score possible (1 point) and was increased considering the first three categories represent poor quality of interactions, while the following two imply high quality of interactions. Thus, the scores refer to the quality of interaction. For more understanding in this regard, the work by Mena-Guacas and Santoveña (2019) can be referred to.

As the WhatsApp group was used to record student interaction during the development of this activity, the teacher's participation was minimal, or even inexistent, in some of them, only intervening when questions were directly addressed to him/her.

2.5.4. Activity wherein data were collected

The interaction data were only collected in the context of the aforementioned social-asynchronous stage. For this stage, a role play group activity was designed, wherein the interaction of each student was rated, assigning a maximum score of 1 of the five possible points of the final score. The number of messages issued within the framework of this activity was 1136.

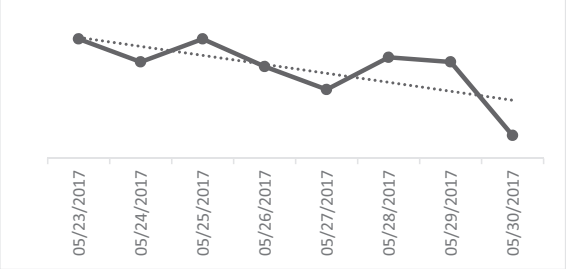

Figure 1. Number of people interacting, by date.

2.6. Correlations

Correlations were made between academic performance (taken as the activity grade) and the data of frequency and quality of interaction. The data used for this calculation were individual. SPEARMAN was implemented, as data were not normally distributed, and the amount of data was lower than 30. Considering part of the role play group activity's grade corresponded to the interaction achieved by each person, the relevant part was subtracted from the final grade before making the correlations. This was because such part of the grade shows the same behavior as the interaction, resulting in biased calculation.

3. Results

Table 1 shows the categories defined for this research.

Figure 1 shows a downward trend in the number of people involved in the activity although with a slight increase in the days before the course ended. A similar behavior, albeit more dramatic, can be observed in the frequency and quality of interaction (see Figure 2).

With regard to the levels of interaction, they all show rather similar behavior with a downward trend. As it can be observed, “opinion” stands out as the category showing the largest number of messages, while the “two-way” category had the lowest amount (see Figure 3).

Figure 4 presents the trend line per category only for the first part of the activity, i.e., from May 23 to 26. In the second part, the trend is clearly negative for all cases (see Figure 3, May 27 onward).

Table 2 indicates that all correlations are positive, but none of them pass the significance test because for “Group activity grade,” the Rho estimated is 0.382, with $N = 27$ and significance at 5%. For “Number of people,” the Rho estimated is 0.738, with $N = 27$ and significance at 5%. Under these conditions, with 95% confidence, the following can be stated:

- There is no correlation between the number of participants and frequency of interaction.
- There is no correlation between the number of participants and quality of interaction.
- There is no correlation between the quality of interaction and group activity's grade.

Table 1. Interaction analysis categories.

Category	Description
Parallel	When individuals work next to each other, without communicating with each other or Messages not related to the work subject, such as greetings, goodbyes, and thankyous
Opinion	Flow of communication between two individuals wherein messages are inconsistent
Two-way	Response from one individual to the other, showing agreement or disagreement, with no arguments
Reactive	Coherent response from one individual to another, showing agreement or disagreement, with arguments or Simple question
Complete	Coherent conversation, including more than two messages, showing agreement or disagreement, with arguments or Question developed in the context of a conversation involving more than two messages

Source: Mena-Guacas and Santoveña (2019).

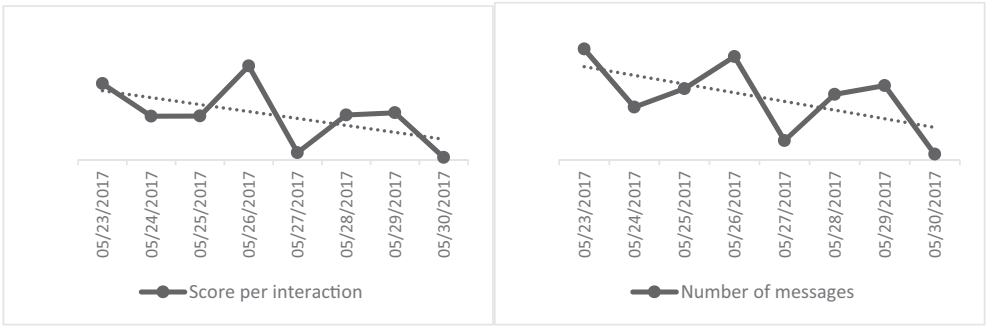

Figure 2. Score per interaction and number of messages.

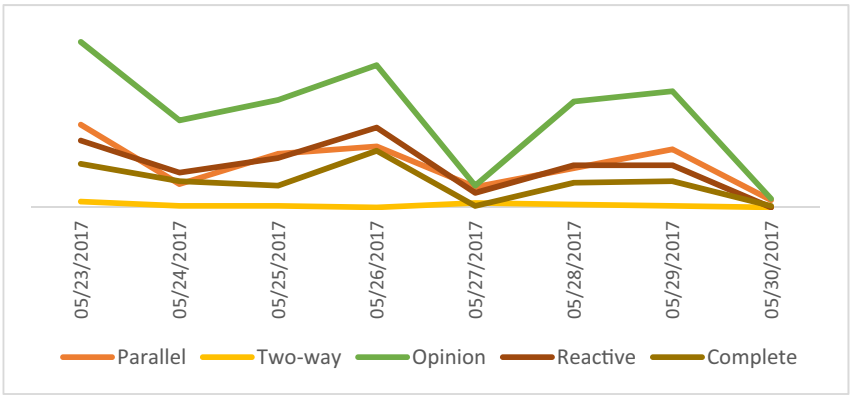

Figure 3. Number of messages per category, according to the date.

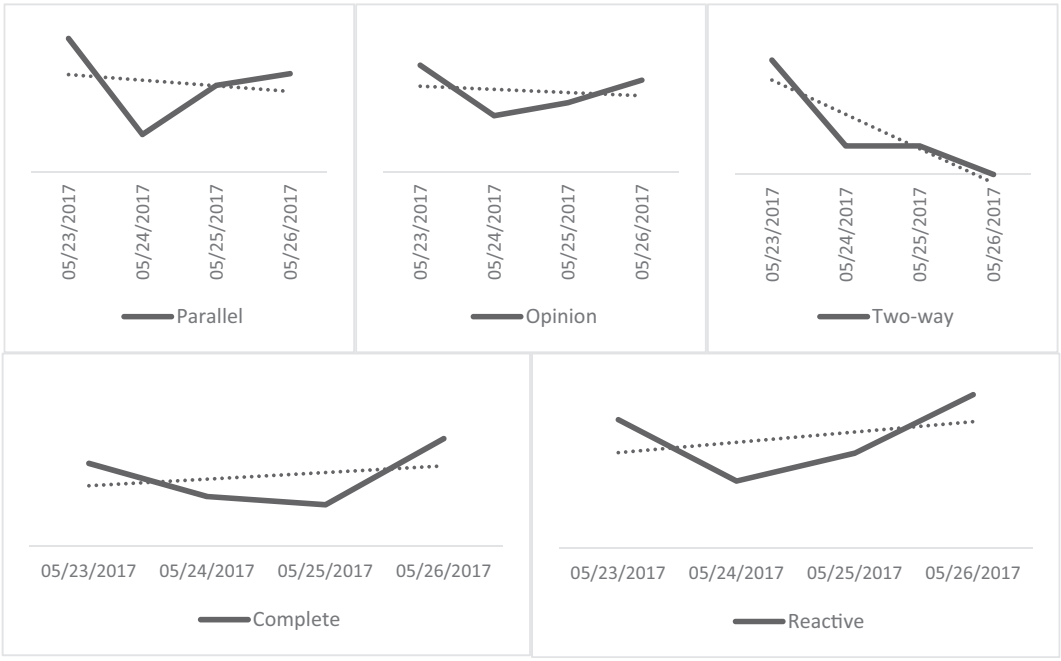

Figure 4. Trend for the number of messages by date in the first part of the activity (May 23–26).

Table 2. SPEARMAN's correlation.

	Messages	Score per interaction
Number of people	0,6309524	0,4880952
Group activity's grade	0,3374542	0,3037241

- There is no correlation between the frequency of interaction and group activity's grade.

4. Discussion

In line with the aforementioned observations, the concerned professor should be actively involved at the beginning of activities, as the number of people interacting in a learning environment displays a downward trend with the course's progression. Therefore, the professor shall make the most of the moment wherein students show the greatest interest to strengthen the basis of a long-lasting learning network. However, these results are not in agreement with the findings by Weiser et al. (2018) who point out that there is less involvement at the beginning of the course. The reason for this discrepancy may lie in the course's short duration and the activity of this study. This is because in these conditions, there is no wait margin and students feel pressured to be actively involved since the course's beginning. The problem with this situation is that the individual internalization stage proposed by Vygotsky (1978) may be omitted.

A deeper analysis requires contrasting the downward trend of the involvement of people with the interaction categories. When the time spent on an activity is divided into two halves (from May 23 to 26 and from May 27 to 30), it can be seen that growing trends can be observed in high-level interactions (reactive and complete) of the first group, whereas low-level interactions are negative although not equally sloped (except in the two-way group). However, this category showed low behavior in the entire activity (see Figure 4). These results are in line with part of the findings of Shu and Gu (2018) who point out that the depth of interactions among students increases from the beginning until mid-course.

These observations reinforce the idea that in case of short-term courses, the concerned professor should make the most of the first half of the group activities to consolidate the basis of a learning network.

The behavior of high-level categories throughout the time spent on the activity is somehow consistent with the findings by Michinov and Michinov (2008) who point out that task-centered interactions decrease as the deadline approaches. However, in case of short-term courses, not only task-centered interaction but also interaction in general, including high level interaction, decreases. The second type of interaction is the one that actually contributes to the development of the task.

Around the middle of the activity (see Figures 1, 2, and 3), a breakdown can be observed, wherein interaction is rather limited. Therefore, it is necessary to plan strategies to address this situation.

Although Figures 1, 2, and 3 indicate a downward trend in people's involvement and in the quality and frequency of interaction, Table 2 indicates that, in reality, there is no correlation between the number of people that participate and their interaction. This proves that a good number of participants is not enough; it is also necessary to design specific strategies to foster interaction. Likewise, there is no correlation between interaction and academic performance in the activity, which suggests that in short-term courses, interaction does not have a marked impact on learning.

5. Conclusions

The lack of correlation between interaction and academic performance observed in short-term courses may be the result of the following two aspects: fostering interaction in these courses is not important and interaction cannot be strengthened when time is limited. Therefore, it does not have a positive impact on academic performance.

In either case, an interesting field of study concerning the impact of time on interaction for learning is presented. In addition, in this regard, it would be useful to consider the following analysis elements: role of professors, strategies to foster interaction, professors' intervention moments, periods of low engagement, behavior of interaction according to the level (or categories), and deadline.

5.1. Limitations

The study was performed on a single course activity because it aimed at validating the impact of the programming of short courses on activities, but the analysis could be extended to an entire course, enabling a broader perspective of the actual situation.

Declarations

Author contribution statement

A. Mena-Guacas: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

C. Velandia: Analyzed and interpreted the data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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