

# Assessment of Interaction in Multinational Projects: A Gender Comparison

Jaime Nuñez, Ph.D.<sup>1</sup>, Ivan Esparragoza, Ph.D.<sup>2</sup>, Sheila Lascano, Ph.D.<sup>1</sup>, Jared Ocampo, M.Sc.<sup>3</sup>,  
Jorge Duque, M.Sc.<sup>4</sup>, and Roberto Viganò, Ph.D.<sup>5</sup>

<sup>1</sup>Universidad Técnica Federico Santa María, Chile, jaime.nunez@usm.cl, sheila.lascano@usm.cl

<sup>2</sup>Penn State University, USA, iee1@psu.edu

<sup>3</sup>Universidad Tecnológica Centroamericana (UNITEC), Honduras, jared.ocampo@unitec.edu

<sup>4</sup>Escuela Superior Politécnica del Litoral, Ecuador, jduque@espol.edu.ec

<sup>5</sup>Politecnico Di Milano, Italy, roberto.vigano@polimi.it

*Abstract– The development of multinational collaborative projects in the academia is becoming a practice to educate students with global competencies. This educational approach is being used to expose students to an international experience through project based learning experiences in multinational settings. However, the effectiveness of this approach has not been rigorously assessed. The research team has been working in the understanding of this practice to enhance the overall experience and create a learning environment that fosters the development of global competencies. According to the literature, the interaction among distributed teams is critical in achieving the goals of the team. Therefore, the interaction of students participating in multinational collaborative projects has been a focus of interest for the research team. The aim of this work is to compare, based on the gender, the level of interaction of participants and the use of social interaction during the development of a multinational design project. This paper presents a description of the findings based on the data collected and is the beginning of a subsequent inferential analysis.*

*Keywords— Collaborative projects, multinational, teams' interaction.*

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<sup>1</sup>Universidad Técnica Federico Santa María, Chile, [jaime.nunez@usm.cl](mailto:jaime.nunez@usm.cl), [sheila.lascano@usm.cl](mailto:sheila.lascano@usm.cl)

<sup>2</sup>Penn State University, USA, [iee1@psu.edu](mailto:iee1@psu.edu)

<sup>3</sup>Universidad Tecnológica Centroamericana (UNITEC), Honduras, [jared.ocampo@unitec.edu](mailto:jared.ocampo@unitec.edu)

<sup>4</sup>Escuela Superior Politécnica del Litoral, Ecuador, [jduque@espol.edu.ec](mailto:jduque@espol.edu.ec)

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## I. INTRODUCTION

Many organizations are developing collaborative environments to foster innovative solutions by using the skills and knowledge of distributed teams working virtually [1]. This rapidly growing tendency requires the formation of future professionals with the necessary competences to successfully participate in those multinational collaborative environments. This new way of working demands for innovative professionals who are capable of working in distributed, multidisciplinary and multinational teams; capable of using new information and communication technologies (ICTs), understand other cultures, communicate properly and build trust within the teams. As a result, engineering programs are emphasizing the development of global competencies in their students in addition to the technical knowledge of a particular discipline.

In order to educate world-class engineers, many engineering programs are incorporating multinational collaborative projects through their curriculum. These projects are characterized by teams geographically dispersed working on a common design project. The development of these projects follows inductive teaching methods in the form of

problem-based learning. The use of inductive teaching methods is becoming more common in academia instead of deductive methods. The literature demonstrates that the inductive approach engages students in learning [2-4] and serves to better prepare them to the corporate jobs [5]. This last aspect is more evident when inductive teaching methods are applied in teams. In this case, the interaction of students participating in the project could become subject of analysis in order to define the mechanisms of the collaboration and the more adequate tools to encourage it.

In this work, a multinational project involving students from US, Latin America and Europe is used as a subject of study. The international collaboration takes place through clusters of multinational teams working together in a structured format during the solution of a design task. Formal virtual sessions are scheduled so that the teams interact at different stages in the development of the project. These sessions are held using a professional virtual meeting platform allowing students getting also acquainted with these technologies. Teams are also encouraged to use other means to maintain communication beyond the formally scheduled meetings, those include social media [5], with the aim of increasing the interaction and facilitate the work.

The literature recognizes that teams achieve better results when the interaction is strong and the social level of interaction is significant [6], and also that the working environment is more conducive to a positive experience when social interaction is built [7, 8]. Barron [9] focused his work in understanding how the interaction among team members influences the team's overall behavior and the individual's learning. In his work, Barron [9] states that collaboration is a dual-problem space where the content space, which refers to the problem to be solved, and the relational space, related to interactions, must be attended by the participants. That author states that the way in which team members behave in both spaces is critical to the outcome of their work [9]. The frequency and quality of the interaction among the teams, then, is considered key for the success of global collaborative projects.

Consequently, the interaction in multinational projects is a critical issue of study [5]. The aim of this work is to compare the interaction of participants in a multinational

design project based on gender. This study compares the level of interaction and the use of social interaction during the collaborative project. As teams are composed by both female and male students and the way they manage the interactions in the collaborative projects is considered important not only for the project success but also for the improvement of the collaborative experience, it is important to understand the gender differences with regards to how they interact in the collaborative project setting.

## II. BACKGROUND

### A. *Studying Gender Differences*

Even though in general circumstances the differences between male and female are small when compared to the differences within each gender, researchers have always found interest in gender comparison and the factors that qualify them as these are usually consequential and provide insights that are important in fields such as psychology and marketing [10]. From the literature it can be gathered that there are three main theoretical approaches under which gender differences can be categorized: (a) socio-cultural (differences inherent to genders' physical capacities), (b) evolutionary (changes developed by our ancestors in response to the environment), and (c) hormone and brain science approaches [10, 11]. These theories are used to explain the difference in behavior between genders in different situations under study.

There is a real effort being done through several initiatives to reduce the existing gap of women in engineering [12]. This means that the number of women being part of multidisciplinary engineering teams will be increasing, making it necessary to consider if there are any gender differences to take into consideration so men and women can make a better use of collaborative tools and have more meaningful and efficient interactions within those teams.

There have been several studies done in the area of gender differences in online behavior. For instance, Muscanell & Guadagno [13] indicate that "while research indicates that there is no gender difference in the overall amount of Internet use..., there are gender differences in motivations for Internet use and utilization of time spent online." Previous research has shown that men and women use the Internet for different things [14]. For instance, since text-based computer-mediated communication (CMC) is a more impersonal form of interaction, it is expected that this style of communication fits better the male gender role which expects man to be more task oriented. Women on the other hand are more inclined to establish bonds with social interactions, therefore they would be expected to prefer more traditional forms of communication such as face-to-face or telephone [15]. However, although previous research proved that assumption to be true [16], a recent study shows that women have surpassed men in the use of text-based communication [15]. This study even suggests that "over the course of a few years, women had developed communication styles for text-based

interactions and were even using e-mail more than men" and in more efficient ways than them [15].

Trends are similar in the social networks. A study on the use of social networking sites supported the expectation based on gender that women are more likely to use this technology for social interaction and maintaining relationships than men who are more likely to use it for task-focused activities [13]. Other study reports that women are using social network sites such as Facebook more than men [15]. As it can be seen from these examples, the difference in behavior in the use of online communication between men and women may change over time and it is important to understand when and how these changes take place so these tools can be better used in working teams geographically dispersed.

### B. *Objective, Research Questions and Scope of the Paper*

Due to globalization and the advances in ICT, companies are using globally distributed teams (also known as global virtual teams) to capitalize on their human resources and expertise present throughout the company. Due to the existing necessity that engineering students develop the competencies which are required to be successful in this global environment, many engineering programs are adopting programs that expose them to international experiences and help them develop the required professional skills [5, 17]. One of these programs is the one established among institutions from Chile, Colombia, Ecuador, Honduras, Italy and USA which takes place during one academic semester. During this time clusters of between two and five multinational teams composed of engineering students work collaboratively to solve a common design challenge [5].

The experience gained over the course of several years has improved the organizational and structural process being followed; however, a real challenge has been creating an effective interaction among the participating students and maintaining their engagement and motivation in their learning process [5]. Due to this problem, an instrument to assess the students' interaction in multinational collaborative projects was developed. The main objective of this study is to evaluate the interaction among the students focusing in its nature, preferred communication tools and perceived value, with a special interest in the observed differences between genders. To achieve this goal the following aspects were studied: i) the differences in the frequency, quantity and nature of the social interaction among students based on gender; ii) the preferred communication tools as they relate to students' gender.

In this first paper a description of the findings is presented based on the data collected in relation to the nature of the interaction, communication tools preferred and about the value of collaborative experience among students, with special focus on gender-based differences. This initial work is the beginning of a subsequent inferential analysis.

### C. Multinational Collaborative Project

The multinational collaborative project was designed to last eight weeks and the instructions given to the students clearly describe the statement of the design problem, establish the required audio-video conferences, suggest other means to maintain the teams interaction, and define the deliverables expected for the project. The collaborative project follows a

parallel project approach in which the teams in each country work independently on the same design project but they have to share information and ideas with international partners to enhance and globalize their solutions. For this purpose, a collaborative network was formed to foster the international collaboration as shown in Fig. 1.

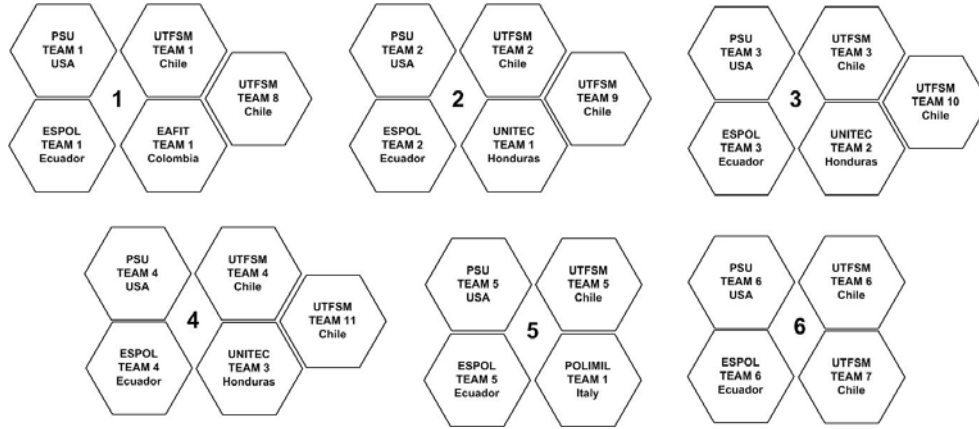


Fig. 1. Collaborative Network of Multinational Design projects.

### III. METHODOLOGY

The multinational collaborative design project, which is being used as a learning tool, needs constantly to be evaluated to gather information about the teaching-learning process and use this information to make improvements [18]. In this investigation, the interaction during this experience was evaluated through an "ad-hoc" instrument to determine the frequency, quantity and nature of social interaction, the preferred communication tools, the effects of this global collaborative project and basics demographic information allowing comparisons between perceptions and effects between the participating women and men.

The questions of the instrument were grouped into five categories: I. *Demographic Questions*: (2 items) on basic information such as gender and location (country). II. *Interaction means used, frequency and nature*: (5 items) in order to determine the most used means of communication, how often they interacted with international partners using ICTs, how often they attended scheduled meetings, hours spent and what kind of contact information was shared. III. *Evaluation of collaborative experience*: (17 items) questions focused on the amount of information given and received, quality and usefulness of information received, benefits of the collaborative experience, and personal willingness to collaborate and team commitment. Responses for each one of these items were rated by using a five-point Likert scale (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree). IV. *Purpose of interaction for*

*the project*: (2 items) to know what kind of information regarding the project was shared and whether the information received from international partners contributed to complete the project. V. *Open questions*: to inquire what they did well as a team, what problems encountered and suggest improvement actions.

#### A. Procedure

The student completed the questionnaire after they had completed the project. The survey was designed to be completed online using Qualtrics platform. Students were told that their participation was voluntary, that non-participation would not affect their academic results or future studies, and that all information would be confidential. Descriptive statistics was performed using STATGRAPHICS Centurion XVI.

#### B. Participants

The data was collected from 100 students participating in the global collaborative project. These participants were primarily first, second and fourth year engineering students from different fields. The participants consisted of (82%) male and (18%) female having the following geographic distribution by gender: Chile (22% Female, 37% Male), Colombia (17% Female, 0% Male), Ecuador (28% Female, 28% Male), Honduras (11% Female, 5% Male), Italy (6% Female, 5% Male) and USA (17% Female, 26% Male) as shown in Fig. 2.

**Location by Gender distribution**

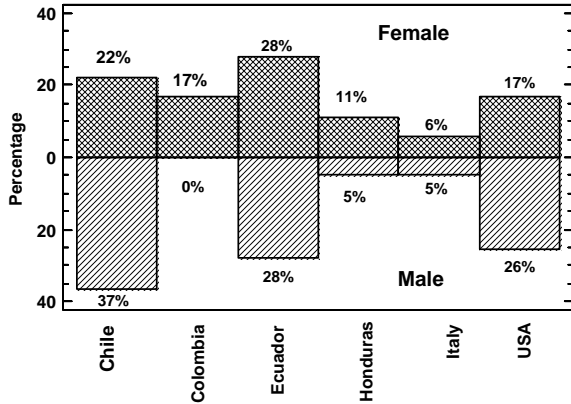


Fig. 2. Location by gender distribution

Both Female (66%) and Male (70%) participants acknowledge that their scholar experience (know-how) was adequate to participate into this collaborative experience. However as shown in Fig. 3, a higher percentage of women (33%) strongly agree that their scholar experience (know-how) to face the collaborative experience was adequate.

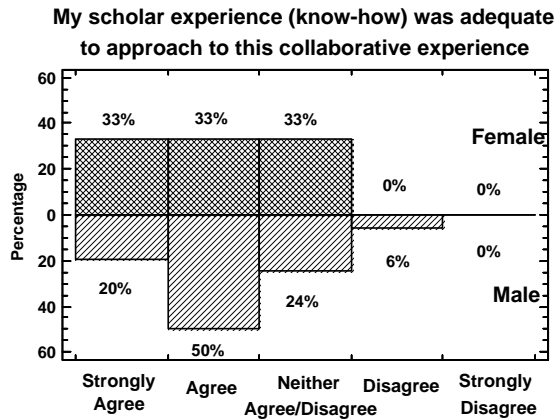


Fig. 3. Individual preparedness for collaborative experience by gender

**IV. FINDINGS AND DISCUSSION**

The results of the survey that addresses relevant indicators necessary to compare the frequency, quantity and nature of social interaction, preferred communication tools and effects of this global collaborative project are presented.

**A. Frequency, Quantity and Nature of Social Interaction**

The frequency, quantity and nature of social interaction were measured in terms of:

- Frequency of interaction using information and communication technologies (ICTs)
- Quantity or time disposed to attend the activities and work with the international partners

- Equitable contribution of the teams and their willingness with the work
- Type of information shared during the project

Concerning to the frequency in the use of ICTs, the results show that 50% of the female and 48% of the male participants interacted sometimes (3-5 times) with their international partners using any means of communication. It also shows that 28% of the women interacted often (5-10 times) and none of them interacted very often (>10 times), unlike men that although only 17% interacted often, 7% interacted very often as shown in Fig. 4.

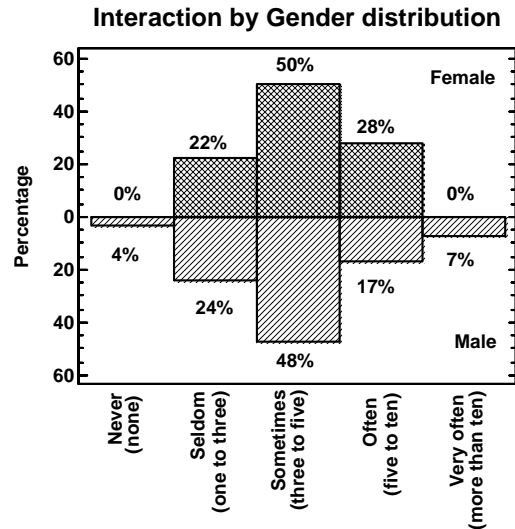


Fig. 4. Interaction frequency using ICTs by Gender distribution.

The frequency of meeting attendance reflects that 33% of the women participants and 41% of the men always attended as is illustrated in Fig. 5. It is also shown that 50% of women did it often or very often, and 0% never attended; in contrast, 35% of men did it often or very often while 4% never attended.

**Meeting attendance by Gender distribution**

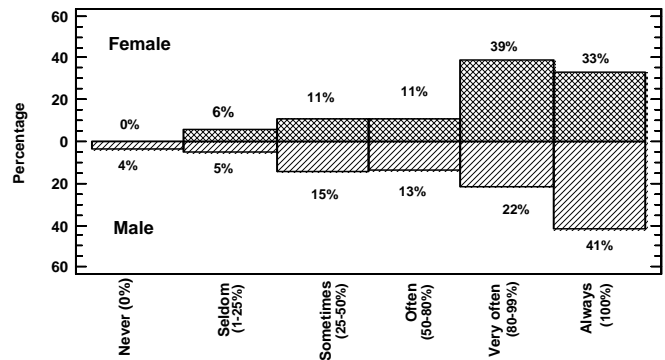


Fig. 5. Frequency of meeting attendance by Gender distribution.

In relation to the time disposed to the project by female and male participants, Fig. 6 shows the time spent working with international partners. It is observed from this figure that 50% of the women and 49% of the men spent around 1-2 hours per week, 28% of the women and 34% of the men among 2-3 hours, and 17% of the women and 11% of the men did not dedicate time to work with their international partners.

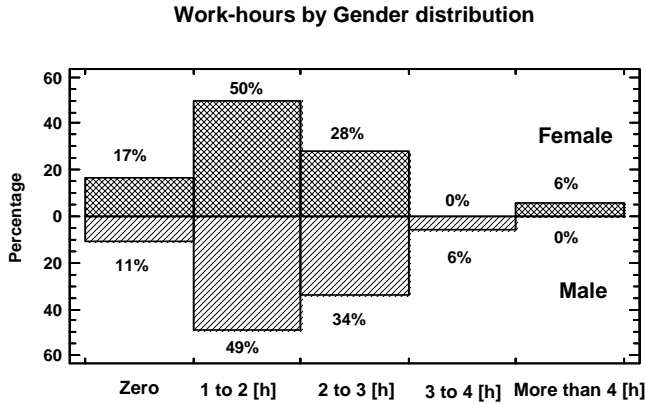
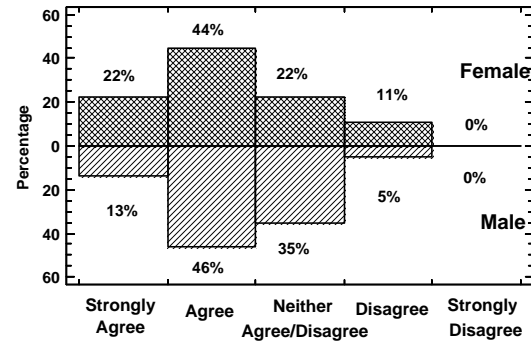


Fig. 6. Hours dedicated to work with international partners by Gender distribution.

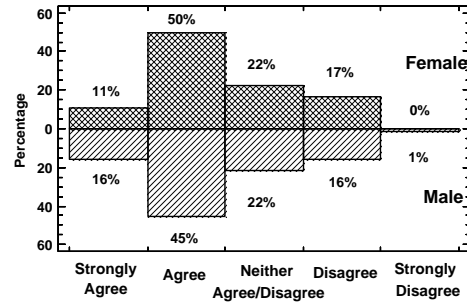
In this project, the students needed to use at least one hour per week to attend a scheduled meeting and share pertinent information for the project. Therefore, students needed to complete specific tasks before and during each meeting. Fig. 7 shows the results on the adequacy of the amount of time available before and during the videoconference to accomplish the established tasks. Most participants (66% of the women and 59% of the men) recognized that the amount of time before the meeting was adequate. On the other end, 11% of the women and 5% of the men students agreed that the time provided before the meetings was insufficient, as shown in Fig. 7(a). Likewise both women and men (61%) acknowledge that the amount of time during the meeting (videoconference) and the time scheduled to develop each assignment were adequate. Nevertheless, 17% of the women and 17% of the men acknowledge that the time allocated for scheduled meetings (videoconference) was limited or insufficient (Fig. 7(b)).

The amount of time provided before the meetings was adequate to develop each assignment for the collaborative project



(a)

The amount of time provided for the meeting (Videoconference) was adequate for the collaborative project



(b)

Fig. 7. Amount of time provided for the project by Gender distribution: (a) before the meetings; (b) during the meetings

Fig. 8 presents the results regarding the equal contribution of the teams in the clusters. It is observed that 55% of the women and 50% of the men participants considered that all the teams in their cluster contributed equally to the collaborative project. However, 23% of the women and 25% of the men said that the contribution was not equitable.

All teams in our cluster contributed equally to the collaborative project

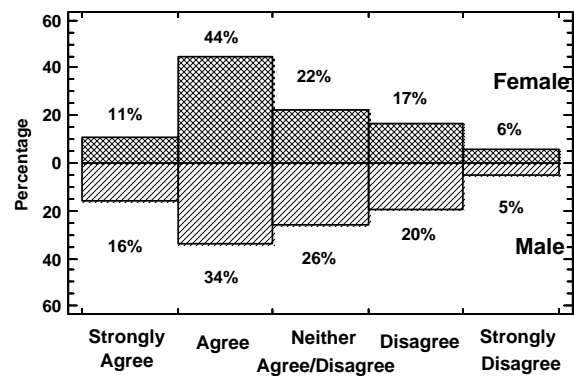


Fig. 8. Opinion about equal contribution of the teams participating in the cluster by Gender distribution.

Fig.9 summarizes the responses of the participants about the appropriateness of their personal willingness to work in the project and that of their partners. Most participants (72% of the women and 78% of the men) agreed that their team was always prepared for meetings, participated actively and shared the information on time, as is illustrated in Fig. 9(a). Similarly, 45% of the women and 55% of the men recognized that their international partners behaved the same way. However, on the other end, 33% of the women and 19% of the men considered that their international partners were unwilling to collaborative work, as shown in Fig. 9(b).

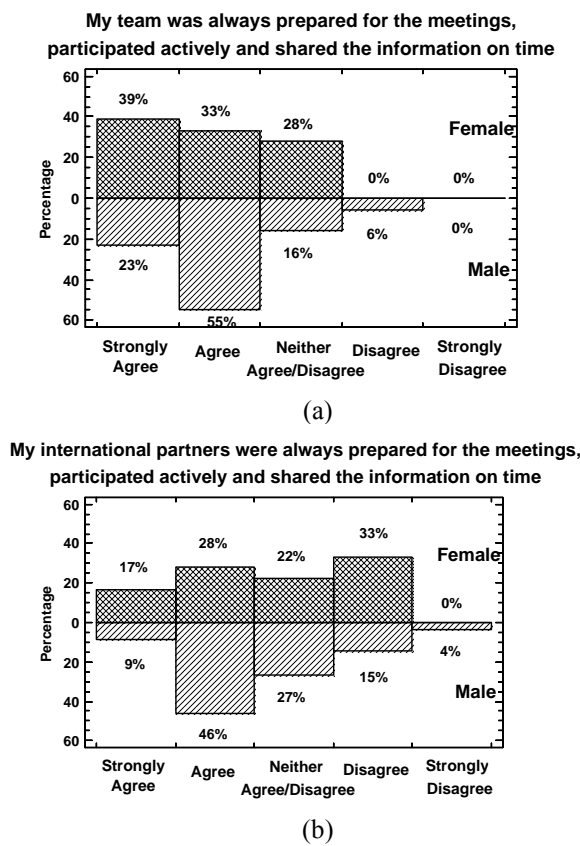


Fig.9. Opinion about willingness of the teams to work collaboratively by Gender distribution: (a) appropriateness of their personal willingness; (b) appropriateness willingness of partners.

Another aspect taken into consideration was the personal and technical information regarding the project shared during the collaborative experience. The first aspect tried to evaluate the importance of the personal interaction on the flow of information and if it was a relevant factor in building trust.

The results show that for 61% of the women and 66% of the men the personal interaction was important to build trust and to facilitate communication (Fig. 10(a)). In fact, 61% of the women and 62% of the men agree or strongly agree that personal interaction contributed to the flow of information for the project (Fig. 10(b)). In contrast, 17% of the women and 10% of the men recognized that for them personal interaction

was not important to build trust and facilitate communication, and 11% of the women and 8% of the men disagree or strongly disagree that personal interaction contributed to the flow of information for the project.

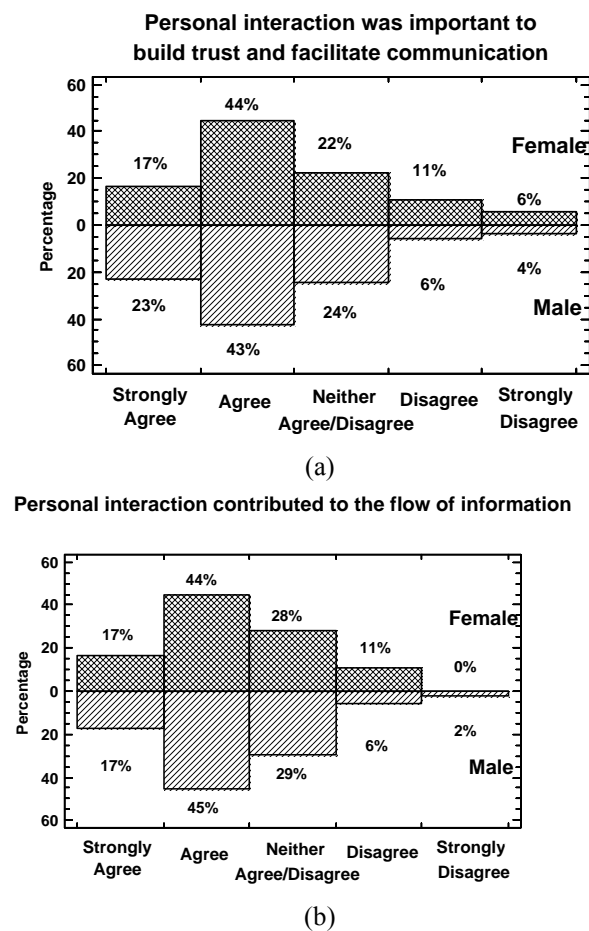


Fig. 10. Results about personal interaction by Gender distribution: (a) opinion about the importance to building trust and facilitate communication; (b) opinion about the contribution to flow of information.

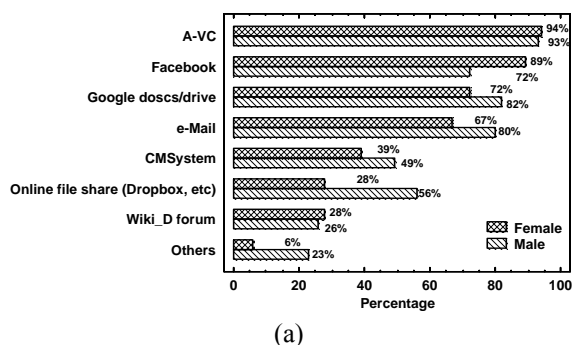
### B. Preferred Communication Tools

The means used by the students for their interactions with their international partners as well as the intensity of their use were evaluated. As it can be seen in Fig. 11(a), the survey revealed that both women (94%) and men (93%) participants preferred Audio-Video Conference (A-VC). Women acknowledge the Audio-Video Conference (A-VC), Facebook, Google docs/drive, and e-mail as their most common ways of communication, in that order of importance while for men, Google docs / drive are second, and Facebook appears in fourth place.

The analysis regarding the intensity of use of different means (Fig. 11(b)) reveals that the communication media most intensely used (often or very often) were: Audio-Video Conference (A-VC) (67% of the women and 61% of the men),

Facebook (67% of the women and 38% of the men), Google docs/drive (39% of the women and 45% of the men), e-mail (12% of the women and 34% of the men), and Online file share (Dropbox) (17% of the women and 22% of the men).

Communication media used by Gender



(a)

Media	Gender	Intensity of Use				
		Very Often (75-100%)	Often (50-75%)	Regularly (25-50%)	Occasionally (1-25%)	Never (0%)
A-VC	Female	50%	17%	22%	6%	6%
	Male	34%	27%	15%	17%	7%
e-mail	Female	6%	6%	28%	28%	33%
	Male	10%	24%	23%	23%	20%
CM System	Female	6%	17%	6%	11%	61%
	Male	6%	15%	18%	10%	51%
Google docs/drive	Female	11%	28%	6%	28%	28%
	Male	23%	22%	15%	22%	18%
Wiki / Forum	Female	6%	0%	6%	17%	72%
	Male	1%	7%	10%	7%	74%
Online file share (e.g., Dropbox)	Female	6%	11%	6%	6%	72%
	Male	7%	15%	16%	18%	44%
Facebook	Female	28%	39%	22%	0%	11%
	Male	23%	15%	23%	11%	28%
Others	Female	0%	0%	6%	0%	94%
	Male	1%	6%	4%	12%	77%

(b)

Fig. 11. Means of interaction and intensity of use by Gender distribution: (a) communication media used; (b) intensity of use

Furthermore, the type of contact information shared during the project was evaluated. The Fig. 12 shows the results. In general, Social network and e-mail were the type of contact information preferred by both. Women shared more by using social network, while men prefer e-mail communication. Although phone number was the contact information less shared, a reduced group of men preferred Whatsapp. Interestingly, women shared their Whatsapp,

Skype and Messenger contact meaning that face to face is important for the female gender.

Type of Contact information shared by Gender

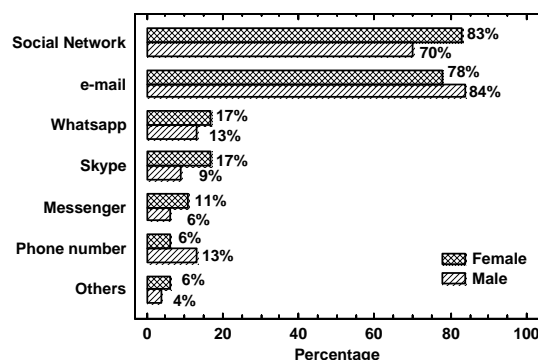


Fig. 12. Type of contact information shared during the project classified by gender.

This aspect observed during the study regards the typology of preferred communication tools is very important. The academic environment of the study has permitted the use of many different communication tools, some of them not used or even prohibited in many companies environments. Therefore, the results could be analyzed trying to identify the more useful tools to support the collaborative projects. Social network tools usually allow obtaining fast answers in short time, without the constraints due to more traditional asynchronous communication tools. In this way, the development of specific communication tools or the use of existing ones could better satisfy the evolution of the technical communication into the companies with regard to the users.

## V. CONCLUSIONS

The analysis of the results does not provide a significant difference between males and females participating in the multinational collaborative projects in most of the items evaluated. However, the data coincide with previous studies showing that women are surpassing the men in the use of text-based communication. Another interesting result is that while women use more social media stressing the importance of stretching bonds by social interactions, men use more Google drive stressing the importance of the task over the social relation.

The results also show that women are more likely to share the type of contact information associated with synchronous media or face to face, such as social networks, Whatsapp, Skype or Messenger, unlike men who show greater preference to share the type of contact information asynchronous, such as email.

Additional differences between genders are that men seem to put more hours to work with their international partners than women (Fig. 6). As it can be seen, although a small group of women worked more than 4 hours, a greater



percent of men (40%) worked more than 2 hours in contrast with women (34%). Another difference is that the perception of the preparedness of their international partners was different among genders, as women were more critical than men (difference of 10%).

Results about the perception of the overall interaction in the development and completion of the project as part of this study will be provided in future publications.

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