Internal Structure of Virtual Communications in Communities of Inquiry in Higher Education: Phases, Evolution, and Participants' Satisfaction

Abstract

This study investigates the phases of development of synchronous and asynchronous virtual communication produced in a community of inquiry (CoI) by analyzing the internal structure of each intervention in the forum and each chat session to determine the evolution of their social, cognitive, and teaching character. It also analyzes the participating higher education students' satisfaction with the activities, with the professors' actions, and with themselves. We use a mixed methodology that includes content analysis of the virtual communications by crossing two categorization systems: (a) type of communication according to the model adopted from Garrison, Anderson, and Archer (2000)—social, cognitive, and teaching presence; and (b) phases in the evolution of the communication—initiation, proposal, development, opinion/closing, and good-byes. The data are relevant to the students' satisfaction and grades earned. The results suggest differences in the quantity and content of the communication in each phase and an evolution from social to cognitive elements, ending with social contributions. The students are satisfied with the virtual

communications related to both the activities and the professors and evaluate themselves positively.

Introduction

Numerous studies have been performed that attempt to explore the progression of online communication. These studies analyze a broad time period and state understanding asynchronous communication as their main objective. However, learning communities composed of social, cognitive, and teaching elements also require analysis of the evolution and transformation of communication throughout the virtual encounters.

The goal of our research is to discover the pattern of development in the synchronous and asynchronous communications in a b-learning learning environment. Based on the theoretical model CoI and on previous studies related to the phases of virtual communication, we propose a methodology that uses cross-tab analysis to cross the data obtained—on the one hand, social, cognitive, and teaching elements and, on the other, the different phases of communication. The research draws conclusions about similar patterns of evolution with synchronous and asynchronous tools, the type of communication in each of the phases analyzed, and the students' satisfaction.

Theoretical Background

There are two ways of analyzing the phases of virtual communication. One approaches the process from the macro-perspective, that is, as it develops over longer or shorter period of time in which the communications are established. This category includes studies by Gilbert and Dabbagh (2005), Hara, Bonk, and Angeli (2000), Henri (1992), Pérez-Mateo and Guitert (2012), and Salmon (2000) for asynchronous communication; and Akayoğlu, Altun and Stevens (2009) for synchronous communication. These studies analyze the evolution of the cognitive, metacognitive, social, or facilitating aspects over a time period of at least one semester or develop theoretical issues, as in the case of the studies by Salmon (2000) and Henri (1992).

Analysis has also been performed using the theoretical framework of Community of Inquiry (CoI) through studies that focus on forums (Akyol & Garrison, 2008, 2011b; Akyol, Garrison, & Ozden, 2009; Akyol, Vaughan, & Garrison, 2011; Shea et al., 2010) and chats (Wanstreet & Stein, 2011). These studies relate the passage of time to the evolution of the elements of the CoI model, indicating that the progression of the virtual communications produces changes in the social, cognitive, metacognitive, and teaching elements, except in the study by Wanstreet & Stein (2011), which does not find evolution. These studies start from the analysis of at least 9 weeks of communication and use content analysis or a mixed methodology to obtain their findings.

We tackle this topic by considering each communication as a unit, an approach that enables us to observe the evolution of the communications on the micro-level. This approach is used in contributions by Tancredi (2006) and Winiecki (2003). For the case of synchronous communications, the model developed by Tancredi (2006) indicates that three phases are established in the chat: (a) Initiation: The purpose of the communications is to prepare for and present the session and provide formal information. (b) Development: The goal is to deploy the instructional technique with a view to achieving the objective agreed upon. (c) Closing: The goal is to close the session and conclude the global strategy planned for the session. These phases can be used to observe the development of the virtual educational communications.

The conceptual model used (CoI) explains the components in the virtual educational groupings that are oriented to achieving the learning objectives. This model has been used internationally at different educational levels and in a variety of academic fields (Akyol et al., 2011; Baturay, 2011; Kim et al., 2011; Remensal & Colomina, 2013). The model considers the community as a social activity in a constructive-cooperative framework of new construction of experience through collaboration (Garrison, Anderson, & Archer, 2010) to achieve better learning results.

The model establishes three interrelated elements in the virtual communications (Shea & Bidjerano, 2009). Cognitive presence refers to the extent to which the students are able to construct meaning through continuous reflection in a critical research community (Arbaugh, 2007; Darabi, Arrastia, Nelson, Cornille, & Liang, 2011; Garrison, Anderson, & Archer, 2001). Cognitive processes and results form the core of these interactions. Garrison and Anderson (2003) define cognitive presence as the intellectual environment that serves as the basis for sustained critical discussion and the

acquisition and application of high-level knowledge. It is composed of triggering events, exploration, integration, and resolution.

Social presence is the capability of the participants to project themselves socially and emotionally as real people in order to stimulate direct communication between individuals by representing themselves as persons (Akyol et al., 2009; Garrison & Anderson, 2003). Social presence is thus composed of affective communication, open communication, and group cohesion, which make it possible to mark the difference between a collaborative research community and the mere process of downloading information (Garrison, Anderson, & Archer, 2000). Teaching presence is defined as the action of designing, facilitating, and orienting cognitive and social processes to obtain the results expected according to the students' needs and capabilities (Kupczynski, Ice, Wiesenmayer, &McCluskey, 2010; Shea, Sau Li, & Pickett, 2006). Further, teaching presence is responsible for guaranteeing sufficient transactional balance and, with students, for managing and monitoring the results obtained according to a timeframe established by the teachers and accepted by the students (Garrison & Anderson, 2003). Teaching presence is composed of aspects of design and organization, facilitation of discussion, and direct teaching. Recent studies analyze a new element in the model, an element related to metacognition and self- and co-regulation in virtual communications (Akyol & Garrison, 2011a; Garrison & Akyol, 2013; Shea & Bidjerano, 2012; Shea et al., 2012). Although much research has been based on the theoretical CoI model, this model has received some criticism for its lack of attention to both the multidimensionality of communication (Xin, 2012) and the real extent of co-construction of knowledge and interrelation among presences (Annand, 2011).

The concept of participant satisfaction refers to the degree to which an experience meets the participant's needs or expectations. The prior literature establishes a relationship between student satisfaction and diverse aspects of the experience, such as social presence (Gunawardena & Zittle, 1997; Swan, 2005), collaborative learning (So & Brush, 2008), sense of community (Overbaugh & Nickel, 2011), perception of cognitive learning (Baturay, 2011), professors (Swan, 2005), social, cognitive, and teaching presence, perception of utility and facility (Joo, Lim, & Kim, 2011), cognitive presence (Akyol & Garrison, 2011b), and integration of media (Kim, Kwon, & Cho, 2011). Following the study by Shea, Pickett, and Li (2005), professor satisfaction is

related to the levels of interaction, technical support, learning opportunities, factors specific to each discipline, and continuous commitment to innovation.

Some studies analyze gender differences in virtual learning environments. The study by Akyol, Vaughan, and Garrison (2011) indicates differences in the development of social, cognitive, and teaching presence in comparing short and long courses. Hakkarainen and Palonen (2003) find different patterns related to the contents and guidelines for participation in collaborative learning environments. Finally, Remensal and Colomina (2013) indicate the plausibility of gender differences in social presence. These studies suggest that gender may be a variable that influences the data obtained in analyzing the computer-mediated communication.

Methodology

Research Questions

Our study focuses on synchronous and asynchronous communications, analyzing them in independent timeframes. We explore the quantity and content of the interventions to provide answers to the following research questions:

– Does the content of the communications vary in each phase of development of the virtual encounters?

– Can one distinguish different content in the communication depending on whether synchronous or asynchronous tools are used?

– Are students satisfied with the communication structure in the synchronous and asynchronous communications?

Data Collection Procedure

The sample consists of 96 Spanish university students from two one-quarter courses from different academic years (2009-10 and 2010-11), with two different groups of students—two comparable cohorts. The distribution by gender is 88.35% women and 11.65% men, percentages that reflect the feminization of teacher education in Spain.

We analyzed (a) 46 chats (9905 thematic units) from different sections of a one-quarter course "Information and Communication Technologies Applied to Education," taken in students' third and last year of university study. Since the chats were taken from this course, they were selected by convenience. The activities performed in the

chats and forums were optional. The sessions lasted 30-40 minutes and were conducted over a period of four weeks each year. They were performed by grouping the students in 14 rooms. We also analyzed two forums (454 messages, 1896 thematic units) developed in the same course. The forums were open for a period of three months after the chat sessions each year. The syllabus was composed of various activities related to ICT in education that students were to perform, among them chat and forum. The forum was postponed until the last part of the course for reasons of course planning, since it is a useful tool for personal and collective reflection (Garrison, Anderson, & Archer, 2000). The professors' role consisted of proposing the activities, organization, active participation, a guide, monitoring, and evaluation of the chat and forum activities.

The instructional design (Figure 1) was based on an individual analysis of the study material (web pages, reports, forums, wikis, ebooks, videos, blogs) and a subsequent collaborative project prepared in the virtual community. An educational platform was used as the basis for communication.

Figure 1 here.

The communications revolved around the learning objectives and were developed through two face-to-face sessions in which the professors explained the work method, learning objectives, agenda, form of evaluation, etc. This information was collected in a document in the platform and was freely accessible to students. In the face-to-face information session on the chat, the professors communicated the course objectives for the online discussions through questions like the following: What is ICT Plan 2.0? What kind of student will we be teaching? Is the structure of resources envisioned similar? What kind of learning does each resource analyzed serve? What is the role of teachers in planning ICT-based activities? Are the resources suitable to the objectives proposed? What is the best visual format for the interface? What does the legislation stipulate concerning internet security in the classroom? What measures should we consider for security? The discussions were to respond to these questions based on the material provided by the professors and, if students wished, by supplementing this material with material they found on their own.

The information session on the forum communicated the discussion threads open and the possibility of opening other new threads if required by the students and related to the course objectives. This was the case for the thread on internet security.

Reading of the work documents was sequenced and planned so as to be completed before the chat and forum sessions. After the virtual sessions, the participants completed one questionnaire on the communication in the forums and another on communication in the chats.

Data Analysis

We constructed two categorization systems, one to analyze social, cognitive, and teaching presence and the other to analyze the phases developed in the communications (Initiation, Proposal, Development, Opinion/Closing, Good-byes). These systems were then crossed to obtain the necessary information (Figure X2).
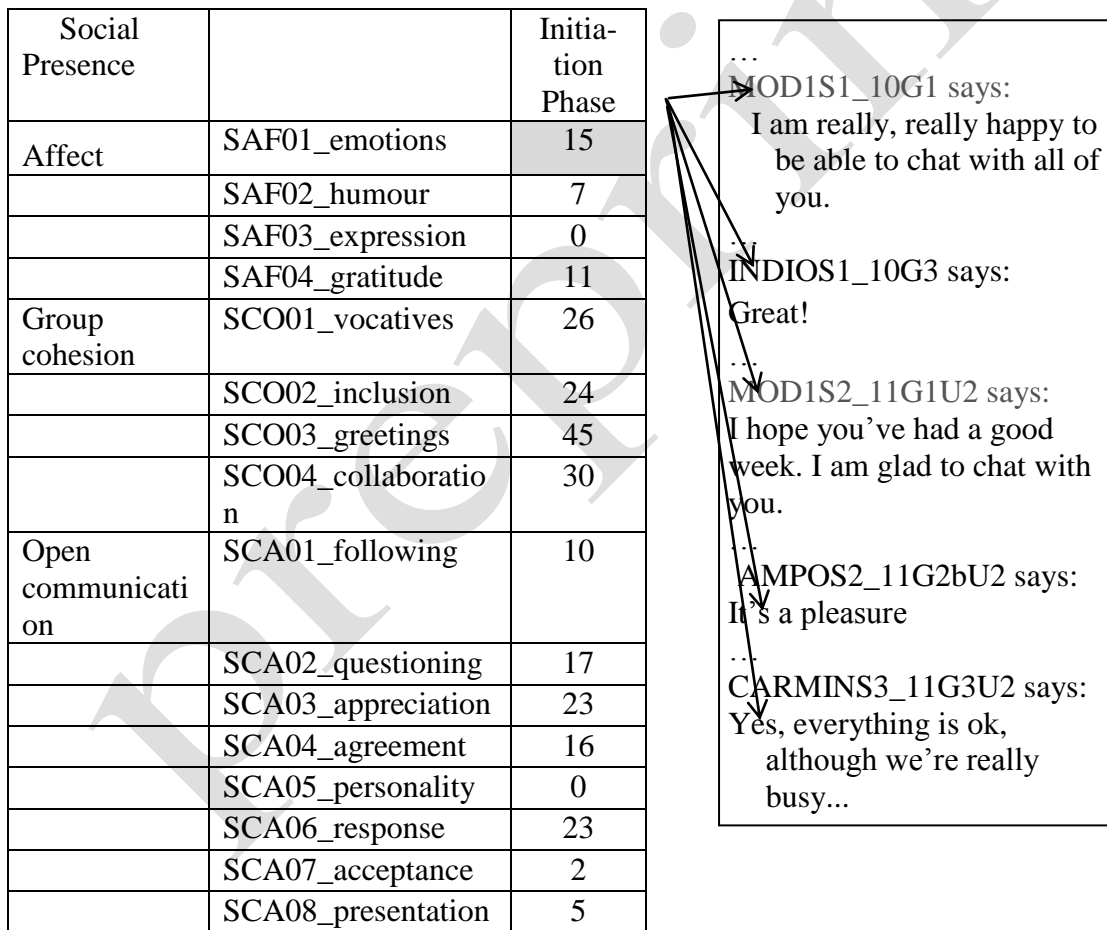
Social Presence		Initiation Phase
Affect	SAF01_emotions	15
	SAF02_humour	7
	SAF03_expression	0
	SAF04_gratitude	11
Group cohesion	SCO01_vocatives	26
	SCO02_inclusion	24
	SCO03_greetings	45
	SCO04_collaboration	30
Open communication	SCA01_following	10
	SCA02_questioning	17
	SCA03_appreciation	23
	SCA04_agreement	16
	SCA05_personality	0
	SCA06_response	23
	SCA07_acceptance	2
	SCA08_presentation	5

Box excerpt:

…
MOD1S1_10G1 says:
 I am really, really happy to be able to chat with all of you.

…
INDIOS1_10G3 says:
Great!

…
MOD1S2_11G1U2 says:
I hope you've had a good week. I am glad to chat with you.

…
AMPOS2_11G2bU2 says:
It's a pleasure

…
CARMINS3_11G3U2 says:
Yes, everything is ok, although we're really busy...

Figure X2. Crossing of the categories Social Presence and Initiation Phase and excerpt from one box.

The first, used for analysis of the presences, was based on the model proposed by Garrison et al. (2000) and modified by drawing on other literature (Akayoğlu et al.,

2009; Garrison, Cleveland-Innes, & Fung, 2004; Garrison, Cleveland-Innes, Koole, & Kappelman, 2006; Park, 2009; Perera, 2007). We found thematic units that could be classified into more than one category (12.66% of the thematic units). In these cases, we opted for including the units in as many categories as necessary (for example, "I don't think we are 100% prepared for this kind of thing, and I think we should prepare much more if we want to be on the same level as some of the kids"). We modified 11 operative definitions of indicators, eliminated three, and created one.

The CoI framework is a qualitative approach that provides a method for understanding the educational communication by quantifying frequencies (Garrison et al., 2006). The frequencies are used for descriptive, not inferential, ends. According to Gerbic (2005), content analysis is a qualitative tool that is subsequently reduced to numerical descriptions that can be analyzed statistically. Thus, the content analysis proposed by Garrison and Anderson (2003) is an excellent way to understand the qualitative nature of online discussion and then quantify it by examining the frequency of ocurrrence of the indicators.

In contrast to the study by Garrison et al. (2006), our study classifies the thematic units into up to three different subcategories and thus does not miss possible meanings of the students' interventions. This corresponds to the procedure described by Rodríguez-Gómez, Gil, & García-Jiménez (1996).

The unit of analysis is the unit of meaning, or the thematic unit, defined by Henri (1992) as identifying a consistent ''theme'' or ''idea'' (unit of meaning) in a message and similar to the idea as the unit of analysis used in the CoI framework by Rourke, Anderson, Garrison, and Archer (1999). As Muukkonen, Lakkala, and Hakkarainen (2001) indicate, it is the part that represents a single idea.

According to De Weber, Schellens, Valcke, and Van Keer (2006), using the unit of analysis breaks the general discussion down into more manageable units for subsequent coding and thus reflects the true content of the original discussion.

The second system refers to the phases in the virtual communications, using the contributions by Tancredi (2006) and Winiecki (2003) and the categorization process. The categorization system was constituted as follows: (a) Initiation: a stage that considered thematic units referring to salutations and social contact. (b) Proposal: the issues to be treated are explained. (c) Development: includes thematic units related to

the development and achievement of the learning objectives and discussion. (d) Opinion/Closing: gathers opinions on the development of the virtual training sessions and concludes the topics treated. (e) Good-byes: thematic units that refer to social matters, in this case to farewells. This category structure was chosen for its potential to develop the research goals.

To find the distribution of the presences in the virtual communications, we combined the two classification systems. This allowed us to obtain the evolution of each of the presences, organizing them according to their appearance in one or another of the virtual communications. The use of NVivo v.8 software enabled us to perform an ordered, manageable content analysis, facilitating new levels of analysis by crossing the two classification systems (presences and phases).

The reliability of categorization of the communications was determined in two ways: first, ensuring that the categorization system was sufficiently clear by confirming that the categories were defined correctly (three researchers, CCI 0.58 [.25, .78] (p<.001), through the model two factors, mixed effects); and, second, ensuring that the process assigned the correct thematic units to indicators by performing a double revision of categorization and crossing matrices for all indicators.

To analyze the students' satisfaction, we created two similar questionnaires (see Appendix; eight expert evaluators considered the items to be appropriate). One questionnaire referred to the communication in the chats ($a = .87$) (27 items) and the other to communication in the forums ($a = .94$) (26 items). Both were composed of Likert-type questions (4=Agree completely with the statement; 1=Disagree completely with the statement) and open response questions. The questionnaires contained items on three issues: (a) satisfaction with the activity, (b) self-satisfaction, and (c) satisfaction with the professors.

Table 1 here.

Results

Phases in the Chats

The data obtained on the phases of each chat session show the following percentages: Initiation (7.30%), Proposal (3.46%), Development (72.72%), Opinion/Closing (9.49%), and Good-byes (7.02%).

Figure 2 shows the elements according to the CoI model in each phase:

Figure 2 here.

Table 2 shows the contributions of the subcategories in both communication tools (chat and forum) to each phase:

Table 2 here.

The sequence of conversation in the chats started with a beginning (Initiation and Proposal phases) characterized by social relations. In this phase, 3.8% of the communications referred to Cohesion (use of vocatives, addressing or referring to the group with inclusive pronouns, and greetings) and 2.03% to Open Communication (commenting on a previous sentence, asking questions of other participants on issues not related to the topic of study, expressing appreciation, formulating agreement, and responding to questions). In the Proposal phase, students began to define the learning objectives through Integration (expressing agreement with a message, integrating or synthesizing information, and responding to questions related to the topic of study). An example of cohesion in the Initiation phase reads, "I agree with Ampo that we should exchange the links with our classmates," whereas we observe Integration in the Proposal phase in the comment, "I agree with Opalino that it takes time and dedication on the part of the teachers."

In the Development phase, students shared opinions and analyzed, compared, and explained the topics in the study program for each session. We see that a significant percentage of the communications, 22.75%, refer to Exploration (information exchange and request for clarification). Further, 21.33% include sentences related to Integration, and 6.18% to Resolution (confirming a fact based on one's own experience, defending a position, expressing an opinion about the tools and study material). We find pedagogical issues related to Facilitating Discourse (encouraging contributions and drawing out participants' opinions) and social aspects of Group Cohesion (9.65%). Exploration occurs in this phase in comments such as, "Cobre doesn't understand your position. Would you please explain it?" We see Resolution in the contribution, "After the practical training period in the school, I can appreciate that new technologies play a very important and essential role in education, which was not the case years ago when I was in elementary school."

The communications then flowed toward the Opinion/Closing phase, with opinions on the development of the session and summary of the topics treated. 3.41% of the communications refer to Resolution and social matters of Affect (gratitude and expression of emotions), Cohesion, and Open Communication. Some communications also refer to Design/Organization (sentences oriented to use of the technology tool and presentation of observations). In the Opinion/closing phase, we find communications stating, "The students also have a right to intimacy and to use the internet for other leisure activities; I don't think excessive control over what they do is positive, since control can affect the free, motivating nature of this resource." Finally, the Good-bye phase contains the highest percentage of cohesive and affective communications (for example, "Thanks again for being here").

We find social presence in all phases of the chats (especially in the Initiation and Good-byes phases). Cognitive presence appears particularly in the Development phase and teaching presence in all of the phases, but especially in the Development phase.

Phases in the Forums

The forum contributed fewer thematic units than the chat, due to low student participation in the forum (approximately 19 thematic units per student vs. 103 in the chat).

In the forums, 92.41% of the communications corresponded to the Development phase, 3.01% to Initiation, 1.37% to Proposal, 0.37% to Opinion/Closing, and 5.64% to Good-byes. Figure 3 shows the relationship between the evolution of the communication and the presences, expressed in percentages.

Figure 3 here.

We can see that both communication tools produce a similar pattern of development. Approximately 5–8% of the total communication occurred during the Initiation and Proposal phases, followed by a significant increase in the Development phase and a return to levels close to 6% in the final phases of the educational sessions. Figure 4 shows the similarities.

Figure 4 here.

Table 2 presents the contribution of each subcategory to the phases of communication in the forums. In the case of the forums, the Initiation phase shows a higher incidence of communications on social questions referring to Group Cohesion. In the Proposal phase, we see communications involving teaching issues related to Design/Organization (especially those referring to efficient use of the communication tool). The Development phase contains extensive communication concerning cognitive issues (information exchange, synthesis of information, confirmation of a fact or comment from one's own experience, presentation of solutions, and defence of a position or fact). We also observe social issues (Cohesion and Open Communication) and pedagogical issues (communication of knowledge from different sources and summary of the contents of the discussion). We find less variety of issues in the forum communications but observe a higher percentage of cognitive communications.

If we compare the different phases in the social presence forums, we see that social presence is more abundant in the Initiation and Good-bye phases, cognitive presence is clearly developed in the Development phase, and Teaching Presence occurs especially in the Development phase.

Learning and Students' Satisfaction

The students were very satisfied with in the three facets analyzed, especially with the professors' actions (Table 3). The standard deviations are low, from which we can conclude that a high percentage of the students perceived the virtual communications as fruitful and pleasant. The means and standard deviations were obtained using the program SPSS v. 20.

Table 3 here.

We also analyzed 76 thematic units from the open response items on the questionnaires. Here, the students (53%) expressed the opinion that development of the virtual activities did not need to be changed at all. 30% felt, however, that the chat sessions should have been longer, and 5% found the graphic format of the forum confusing.

In spite of the high satisfaction with the chat and forum activities, some aspects could be improved, especially those related to the time-length of the chats. The 30-40 minutes for each chat session were not long enough to develop the topics proposed.

Student satisfaction is related to the student's learning (Akyol & Garrison, 2011b; Akyol & Garrison, 2008). Studies find that, the greater the students' satisfaction with social, teaching, and cognitive issues, the better their perception of learning.

In our study, student learning was established according to the grades the students earned. The grade-point averages (on a scale of 1 to 10) according to participation in the chat and forum activities were: participation in both activities ($\bar{x} = 7.46$); participation in the chat activity only ($\bar{x} = 6.04$); participation in the forum activity only ($\bar{x} = 5.41$). The average grade of the students who did not participate in any activity was ($\bar{x} = 4.57$).

Participation of professors/students

The distribution of the virtual communications (Table X) confirms the level of participation by students and professors in each of the presences:
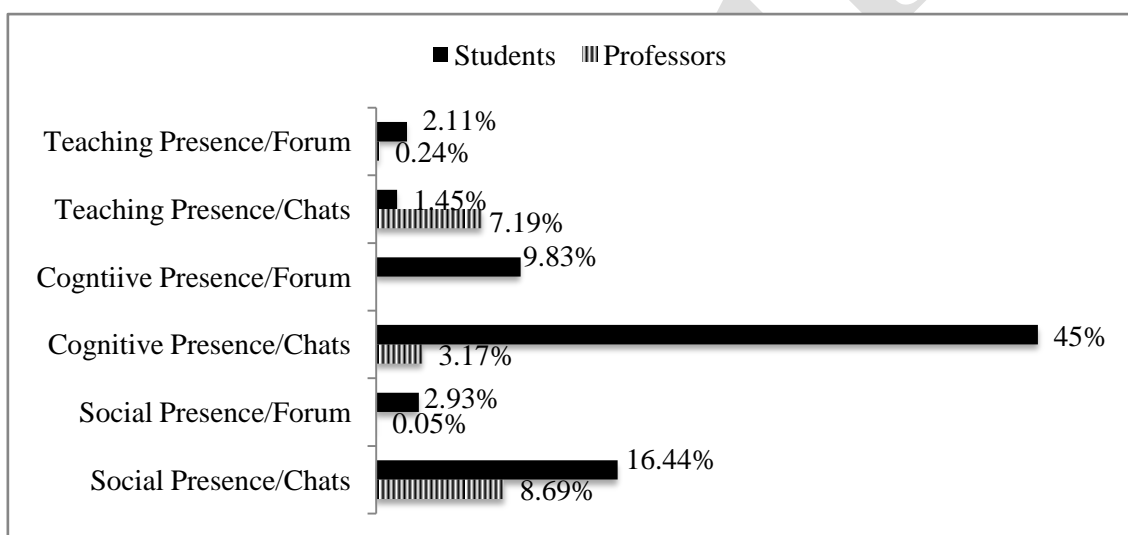
Figure XX. Distribution of the virtual communications by tool

If we examine all of the phases as a whole, the large number of contributions from students is significant, especially for Cognitive Presence in the chats. The absence of professors' this type of presence for professors in the forums is due to the instructional design, in which the instructor only performed the work of control and monitoring.

Discussion

The results permit a discussion of our research goal, to determine the internal structure of the virtual communication in a community of inquiry and to determine

whether the students were satisfied with these synchronous and asynchronous communications. Through content analysis and surveys, we were able to confirm the evolution of the communications and the students' perception of their satisfaction. The activities performed in the chat and forum helped to improve students' learning.

The Initiation and Proposal phases contain a low percentage of virtual communications. The first phases are characterized by social communication, and our data agree with the study by Chen, Chen, and Tsai (2009), which finds more social messages at the beginning and end of the synchronous discussions. This social character is especially related to group cohesion (Akyol et al., 2009) in b-learning courses, and other studies establish trust and group identity (Akayoğlu et al., 2009; So & Brush, 2008). More variety and a greater number of social communications occur in the chats than in the forums. While we find communication related to affect and cohesion in the forum and aspects of open communication in the chats as well. This result may be due to the more informal and social character of the chat tool (Johnson, 2006).

The Development phase shows a higher percentage of virtual communications, as it included discussion related to achievement of the learning objectives, in which the community reached its full potential as a place for the development of high-level critical thinking. As in the study by Johnson (2006) that includes both tools, we observe substantive communications directly related to the study topic. Our study agrees with that by Akyol et al.(2009) in finding very weak communication related to triggering events, due possibly to explanation of the course programme in the face-to-face sessions and to the accessibility (in the platform used) of the documents on objectives and development of the activities. We thus see an evolution of the virtual educational communication from social relationships to cognitive objectives. The students' commitment and maturity are confirmed by the large number of cognitive issues (Conrad, 2005). We also see that participants perform more exploration in the chats and more resolution in the forums, possibly due to the more reflexive character of the latter communication tool. For both tools, a significant percentage of cognitive communication is related to integration, especially in the forum. This result agrees with the study by Akyol et al. (2011). The students showed their agreement with their classmates' proposals, synthesized the contributions, and answered the questions posed.

The Opinion/Closing phases, which conclude students' collaboration on the topics treated, and the Good-bye phase also had a low percentage of communications. This

may be attributed to the fact that these phases are required for the optimal functioning of the community but do not form the central axis of the learning objective.

Teaching presence may be characterized as moderate throughout the phases to enable the constant participation of the students and thus to facilitate and guide the pedagogical interaction. Direct instruction had considerable weight in the forums during the central phase of the communication, focusing the debate, providing information, and summarizing the topics treated. It was exercised to a greater extent by the professors in the chats (see Figure XX).

Students' satisfaction with the virtual communication developed was very high. This was especially true for students' evaluation of the professors (Akyol & Garrison, 2008) but also for the instructional design based on collaboration (So & Brush, 2008). The high level of communication on both cognitive issues (Baturay, 2011) and social and pedagogical issues (Joo et al., 2011) implies a high degree of satisfaction. The communication process that evolved through the phases analyzed produced satisfaction among the students, especially satisfaction with the professors, but also satisfaction with the forum and chat activities and students' satisfaction with themselves.

Conclusions

In view of the data obtained, we can conclude that each phase had a clearly determined function in the virtual communications. Social issues were treated especially at the beginning and end of the communication. Cognitive issues proliferated in the central phase, and teaching issues—which guided and organized the communications—played a role throughout the entire process, especially in the forums. The internal structure of the communications was very similar in the chats and forums. We believe knowledge of the processes and evolution of virtual educational communication is important for teachers because it facilitates organization of the virtual classroom according to the objectives planned.

The data obtained enable us to adapt the communicative process in virtual education environments: the Initiation and Proposal phases to cohesive and open communications, the Development phase to discussion related to achievement of the learning objectives, the Opinion/Closing and Good-byes phases to cohesive and affective communications. We also observe high cognitive communication in the

development phase of the chats. We thus confirm that chats can also be a tool for the development of the learning objectives. In the forum, however, we did not observe high social communication, leading us to believe that the forum is not a valuable tool for social issues. Although their pattern of development is similar, both tendencies could help the virtual professors in using a combination of the two tools to achieve both the learning objectives and student satisfaction.

The social, cognitive, and teaching elements are considered to compose communication in learning environments, in different educational situations (Joo et al., 2011; Kaczynski et al. 2010), in different cultures (Akyol et al., 2011; Baturay, 2011; Kim et al., 2011; Remensal & Colomina, 2013), and in various academic fields (Kaczynski et al., 2010; So & Brush, 2008; Wanstreet & Stein, 2011). It is thus possible to employ the research methodology in other contexts different from ours. Future studies should consider the metacognitive element of the CoI model.

The model proposed for analysis can be useful for research because it corresponds to the research goals: (a) in integrating the classification systems, we obtained information on the evolution of the communications, (b) we observed differences between the synchronous and asynchronous tools, and (c) we confirmed that students were very satisfied, according to the questionnaire results. Further, the students who participated in the chats and forums earned better grades in the course, as shown by comparing participants and non-participants in the chats and forums.

Since the students are very satisfied with the communicative development described in this study, we can conclude that communication that undergoes the phases described is valid in the virtual teaching-learning process.

Implications for Practice

Based on these results, we believe that our study has implications for practice. Professors can orient the communications in their exchanges with the students, taking into account the number of social, cognitive, and teaching elements in each of the phases—in our case, with implications for satisfaction and grades earned. For learning designers, optimal design is design that strengthens social communication at the beginning and interaction at the end, a concentration of cognitive elements in the central phase, and maintenance of the teaching elements throughout the interaction. We believe

that all of the phases are important for students to learn properly. Each phase analyzed—and the type of communication developed in it—is a part of the process fundamental to optimizing learning and student satisfaction.

In the light of our findings, we advise professors of the utility (on the level of learning and student satisfaction) of promoting their active participation.

Given the international use of the CoI model, it is possible that the analytical model used can be replicated in other contexts. We hope that future studies will serve to contrast our results.

Limitations

This research has limitations for generalization from the results due to the number of members in the community. Because of this limitation, we believe it is important to perform similar investigations with larger samples, with participants from different academic environments, with other learning designs, and with a similar number of male and female participants.

We understand that the results obtained cannot be extrapolated to a solely online learning environment (one without any direct instruction component). As indicated by Shea and Bidjerano (2013), "students in hybrid courses tend to rate their instructors' teacher presence behaviours significantly higher, to perceive their own learning as better," and to feel more satisfied with affective and social issues. We hope that future studies clarify this issue.

References

Akayoğlu, S., Altun, A., & Stevens, V. (2009).Social presence in synchronous text-based computer-mediated communication. *Eurasian Journal of Educational Research, 34*, 1–16.

Akyol, Z., & Garrison, D.R. (2008). The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *Journal of Asynchronous Learning Networks*, *12*(3–4), 3–22.

Akyol, Z., & Garrison, D.R. (2011a). Assessing metacognition in an online community of inquiry. *Internet and Higher Education*, *14*, 183–190. doi:10.1016/j.iheduc.2011.01.005

Akyol, Z., & Garrison, D.R. (2011b). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning. *British Journal of Educational Technology*, *42*(2), 233–250.

doi:10.1111/j.1467-8535.2009.01029.x

Akyol, Z., Garrison, D.R., &Ozden, M.Y. (2009). Online and blended communities of inquiry: Exploring the developmental and perceptional differences. *International Review of Research in Open & Distance Learning*, *10*(6), 65–83.

Akyol, Z., Vaughan, N., & Garrison, D.R. (2011). The impact of course duration on the development of a community of inquiry. *Interactive Learning Environments*, *19*(3), 231–246. doi:10.1080/10494820902809147

Annand, D. (2011). Social presence within the community of inquiry framework. *International Review of Research in Open and Distance Learning, 12*(5), 38–54.

Arbaugh, J.B. (2007). An empirical verification of the community of inquiry framework. *Journal of Asynchronous Learning Networks*, *11*(1), 73–84.

Baturay, M.H. (2011). Relationships among sense of classroom community, perceived cognitive learning and satisfaction of students at an e-learning course. *Interactive Learning Environments*, *19*(5), 563–575. doi:10.1080/10494821003644029

Chen, Y., Chen, N.S., & Tsai, C.C. (2009).The use of online synchronous discussion for web-based professional development for teachers. *Computers& Education*, *53*, 1156–1166. doi:10.1016/j.compedu.2009.05.026

Conrad, D. (2005). Building and maintaining community in cohort-based online learning. *Journal of Distance Education*, *20*(1), 1–20.

Darabi, A., Arrastia, M.C., Nelson, D.W., Cornille, T., & Liang, X. (2011).Cognitive presence in asynchronous online learning: A comparison of four discussion strategies. *Journal of Computer Assisted Learning*, *27*(3), 216–227. doi:10.1111/j.1365-2729.2010.00392.x

De Weber, B., Schellens, T., Valcke, M., & Van Keer, H. (2006). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: A review. *Computer & Education, 46*(1), 6–28. doi:10.1016/j.compedu.2005.04.005

Garrison, D.R., & Anderson, T. (2003). *E-learning in the 21st century: A framework of research and practice*. London: Routledge Falmer.

Garrison, D.R., Anderson, T., & Archer, W. (2001). Critical thinking and computer conferencing: A model and tool to assess cognitive presence. *American Journal of Distance Education*, *15*(1), 1–18.

Garrison, D.R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *Internet and Higher Education*, *13*(1–2), 5–9. doi:10.1016/j.iheduc.2009.10.00

Garrison, D.R., &Akyol, Z. (2013). Toward the development of a metacognition construct for communities of inquiry. *Internet and Higher Education*, *17*, 84–89. doi:10.1016/j.iheduc.2012.11.005

Garrison, D.R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *Internet and Higher Education*, *11*(2), 1–14. doi:10.1016/S1096-7516(00)00016-6

Garrison, D.R., Cleveland-Innes, M., & Fung, T. (2004). Students' role adjustment in online communities of inquiry: Model and instrument validation. *Journal of Asynchronous Learning Networks, 8*(2), 61–74.

Garrison, D.R., Cleveland-Innes, M., Koole, M., & Kappelman, J. (2006). Revisiting methodological issues in transcript analysis: Negotiated coding and reliability. *The Internet and Higher Education, 9*, 1–8. doi:10.1016/j.iheduc.2005.11.001

Gerbic, P., & Stacey, E. (2005). A purposive approach to content analysis: Designing analytical frameworks. *Internet and Higher Education, 8,* 45–59. doi:10.1016/j.iheduc.2004.12.003

Gilbert, P.K., &Dabbagh, N. (2005). How to structure online discussions for meaningful

discourse: A case study. *British Journal of Educational Technology*, *36*(1), 5–8. doi:10.1111/j.1467-8535.2005.00434.x

Gunawardena, C.N., &Zittle, F.J. (1997). Social presence as a predictor of satisfaction with a computer-mediated conferencing environment. *American Journal of Distance Education*, *11*(3), 8–26. doi:10.1080/08923649709526970

Hakkarainen, K., &Palonen, T. (2003). Patterns of female and male students' participation in peer interaction in computer-supported learning. *Computer& Education,40,* 327–342. doi:10.1016/S0360-1315(02)00134-3

Hara, N., Bonk, C.J., & Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science*, *28*(2), 115–152.

Henri, F. (1992). Computer conferencing and content analysis. In A.R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden papers* (pp. 115–136). New York: Springer.

Johnson, G. M. (2006). Synchronous and asynchronous text-based CMC in educational contexts: A review of recent research. *TechTrends*, *50*(4), 46-54.

Joo, Y.J., Lim, K.Y., & Kim, E.K. (2011). Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computers & Education*, *57*(2), 1654–1664. doi:10.1016/j.compedu.2011.02.008

Kim, J., Kwon, Y., & Cho, D. (2011). Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education*, *57*(2), 1512–1520. doi:10.1016/j.compedu.2011.02.005

Kaczynski, L., Ice, P., Wiesenmayer, R., &McCluskey, F. (2010). Student perceptions of the relationship between indicators of teaching presence and success in online courses. *Journal of Interactive Online Learning*, *9*(1), 23–43.

Overbaugh, R.C., & Nickel, C.E. (2011). A comparison of student satisfaction and value of academic community between blended and online sections of a university-level educational foundations course. *The Internet and Higher Education*, *4*(3), 164–174. doi:10.1016/j.iheduc.2010.12.001

Park, C.L. (2009). Replicating the use of a cognitive presence measurement tool. *Journal of Interactive Online Learning, 8*(2), 140-155.

Perera, V.H. (2007). *Estudio de la interacción didáctica en e-learning*.(Doctoral dissertation, Universidad de Sevilla, 2007).[Perera] Universidad de Sevilla, Fondos Digitales. Retrieved online 21/4/2012 at: http://fondosdigitales.us.es/tesis/tesis/703/estudio-de-la-interaccion-didactica-en-e-learning/

Pérez-Mateo, M., &Guitert, M. (2012). Which social elements are visible in virtual groups? Addressing the categorization of social expressions. *Computer & Education*, *58*, 1234–1246. doi:10.1016/j.compedu.2011.12.014

Remesal, A., &Colomina, R. (2013). Social presence and online collaborative small group work: A socioconstructivist account. *Computers & Education,60,* 357–367. doi:ht10.1016/j.compedu.2012.07.009

Rodríguez-Gómez, G., Gil, J., &García-Jiménez, E. (1996).Aspectos básicos sobre el análisis de datos cualitativos. In Metodología de la investigación cualitativa (pp. 197–218). Málaga, Spain: Aljibe.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (1999). Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education, 14,* 51–70.

Salmon, G. (2000).*E-moderating. The key to teaching and learning* (2nd ed.). London: Kogan Page.

Shea, P., &Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster «epistemic engagement» and «cognitive presence» in online education. *Computers & Education*, *52*(3), 543–553. doi:10.1016/j.compedu.2008.10.007

Shea, P., &Bidjerano, T. (2012). Learning presence as a moderator in the community of inquiry model. *Computer & Education*, *59*(2), 316–326. doi:10.1016/j.compedu.2012.01.011

Shea, P., & Bidjerano, T. (2013). Understanding distinctions in learning in hybrid, and online environments: an empirical investigation of the community of inquiry framework. *Interactive Learning Environments, 21*(4), 355–370. doi:10.1080/10494820.2011.584320

Shea, P., Hayes, S., Smith, S.U., Vickers, J., Bidjerano, T., Pickett, A., … Jian, S. (2012). Learning presence: Additional research on a new conceptual element within the Community of Inquiry (CoI) framework. *Internet and Higher Education*, *15*(2), 89–95. doi:10.1016/j.iheduc.2011.08.002

Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., … Rangan, P. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *Internet and Higher Education*, *13*, 10–21. doi:10.1016/j.iheduc.2009.11.002

Shea, P., Pickett, A., & Li, C. S. (2005). Increasing access to Higher Education: A study of the diffusion of online teaching among 913 college faculty. *International Review of Research in Open and Distance Learning*, *6*(2), 1-27.

Shea, P., Sau, L.C., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college course. *The Internet and Higher Education*, *9*(3), 153–244. doi:10.1016/j.iheduc.2006.06.005

So, H.J., & Brush, T.A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computer & Education*, *51*(1), 318–336. doi:10.1016/j.compedu.2007.05.009

Swan, K. (2005). Developing social presence in online discussions. In S. Naidu (Ed.), *Learning and teaching with technology: Principles and practices* (pp. 136–153). London: Taylor & Francis e-Library.

Swan, K., & Ice, P. (2010). The community of inquiry framework ten years later: Introduction to the special issues. *Internet and Higher Education13*(1-4). doi:10.1016/j.iheduc.2009.11.003

Tancredi, B. (2006). La comunicación síncrona en el e-learning: Cómo gestionar el chat. In *Prácticas de e-learning* (pp. 137–162). Barcelona, Spain: Octaedro.

Wanstreet, C.E., & Stein, D.S. (2011). Presence over time in synchronous communities of inquiry. *American Journal of Distance Education*, *25*(3), 162–177. doi:10.1080/08923647.2011.590062

Winiecki, D.J. (2003). Instructional discussions in online education: Practical and research-oriented perspectives. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 193–213). Mahwah (NJ): Lawrence Erlbaum.

Xin, C. (2012). A critique of the community of inquiry framework. *Journal of Distance Education, 26*(1).[WWW document] URL http://www.jofde.ca/index.php/jde/article/view/ 755/ 1333.

Block 1.
Characteristics and social and educational impact of the audiovisual and digital culture.

Block 2.
Communications media and critical education of citizens.

Block 3.
Design, development, and evaluation of the teaching-learning processes with ICT.
Block 4.
Pedagogy of virtual teaching environments.

Blocks 3 and 4: Chats and forums studied in this investigation

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Information session on the chat.

Week 1: ICT Plan 2.0.
Week 2: Role of the teacher.
Week 3: English and French for Elementary Education.
Week 4: Contrast of materials. Internet Security.

Information session on the forum.

Online discussion threads
− Welcome.
− Organization and questions.
− Computer-mediated communication: learning and knowledge creation.
− Social character of virtual communication.
− Computer-mediated communication and the role of the teacher.
− Teaching competencies: at the beginning of the course (how to acquire the competencies we don't have?) and at the end (where and how we have acquired these competencies).
− Needs of future teachers.
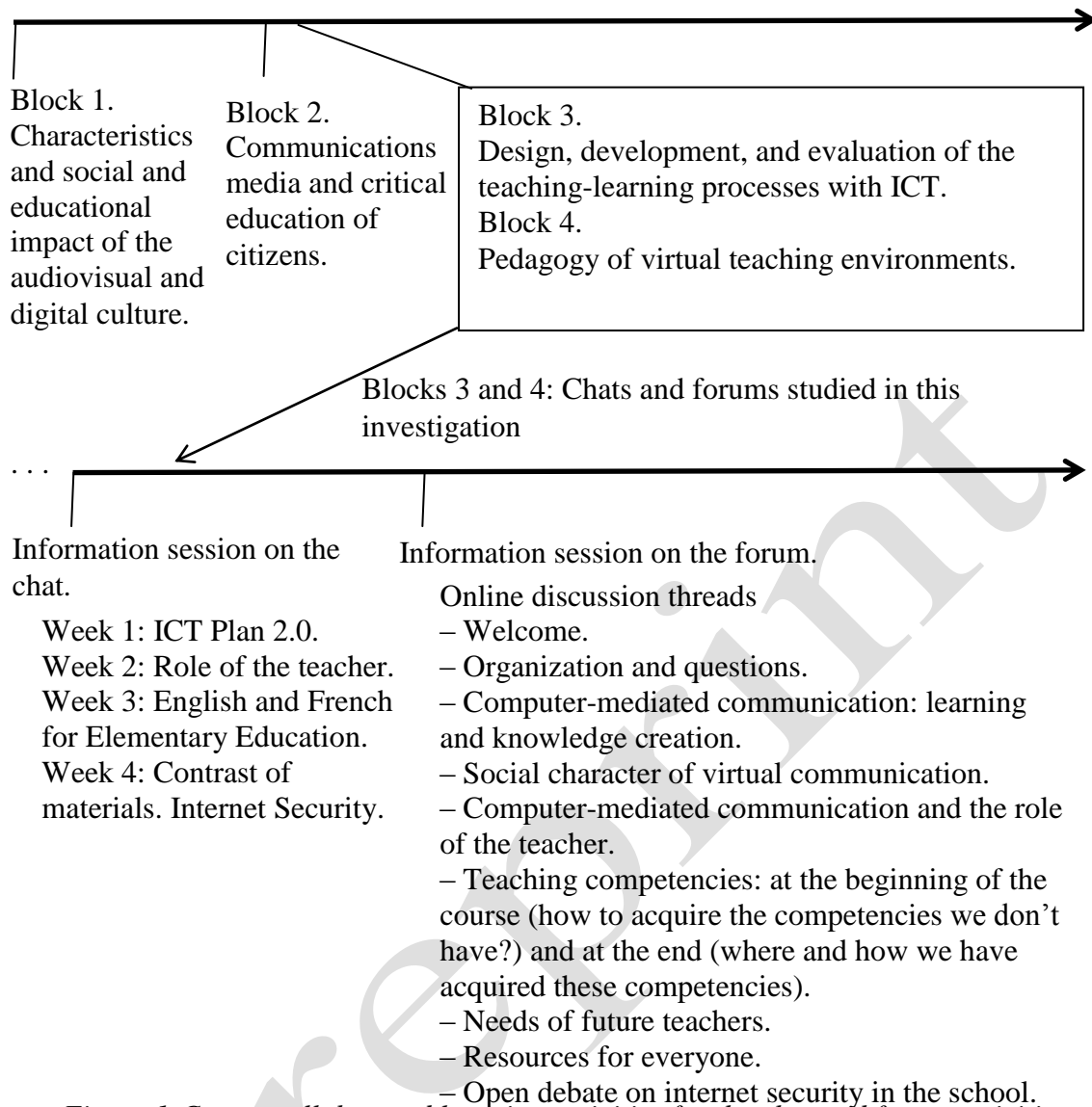− Resources for everyone.
− Open debate on internet security in the school.

Figure 1:Course syllabus and learning activities for the chat and forum activities

Table 1: Friedman's Test

| | Mean rank | | | | | |
	Satisfaction with activity	Self-satisfaction	Satisfaction with professors	Chi-Square	df	Asymp. Sig.
Chat	2.61	1.25	2.15	67.80	2	.000
Forum	1.37	2.17	2.46	42.86	2	.000

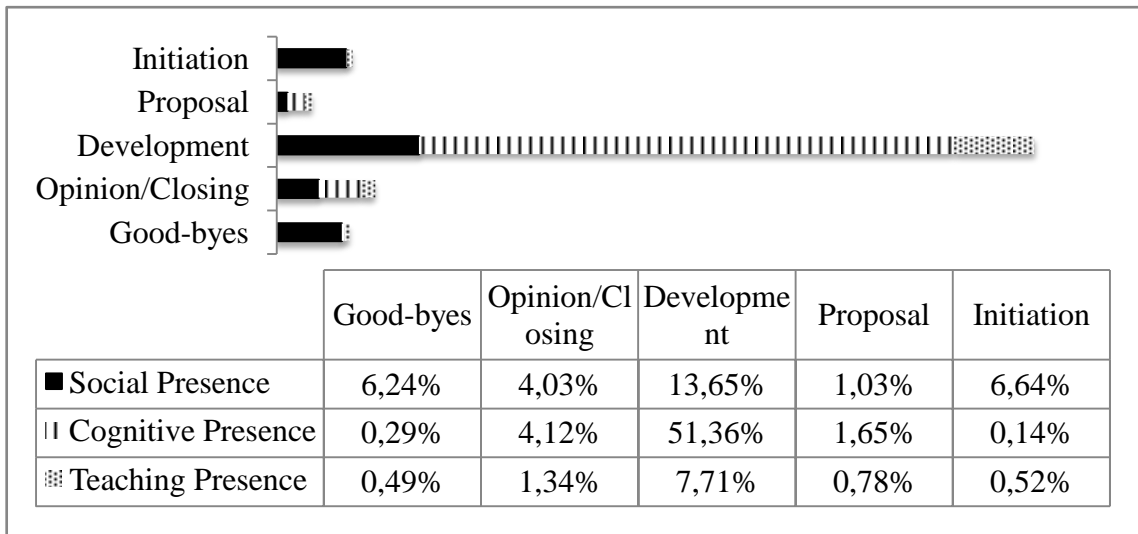|	Good-byes	Opinion/Closing	Development	Proposal	Initiation
■ Social Presence	6,24%	4,03%	13,65%	1,03%	6,64%
‖ Cognitive Presence	0,29%	4,12%	51,36%	1,65%	0,14%
▦ Teaching Presence	0,49%	1,34%	7,71%	0,78%	0,52%

Figure 2: The presence of each phase in the chats

Table 2: Components of both communications tools

Subcategory	Initiation (%)		Proposal (%)		Development (%)		Opinion/ Closing (%)		Good-byes (%)	
	C*	F**	C	F	C	F	C	F	C	F
Social presence										
Affect	0.65	0.05	0.14	—	1.40	1.58	1.44	0.05	2.10	0.16
Cohesion	3.80	2.37	0.41	0.21	9.65	7.91	1.47	—	3.38	2.58
Open Communication	2.03	—	0.45	—	1.96	4.54	1.06	—	0.74	0.11
Social—other	0.17	—	0.02	—	0.64	0.32	0.05	—	0.02	—
Cognitive presence										
Triggering Event	—	—	—	—	1.10	0.53	0.03	—	0.02	—
Exploration	—	0.05	—	—	22.75	0.21	0.22	—	0.05	—
Integration	0.10	—	1.14	—	21.33	30.54	0.45	—	0.01	—
Resolution	0.04	0.05	0.29	0.05	6.18	18.88	3.41	—	0.21	—
Teaching presence										
Design/ Organization	0.42	0.42	0.32	0.84	1.69	0.95	1.25	0.32	0.41	—
Direct Instruction	—	—	0.27	0.05	1.84	10.92	—	—	0.02	—
Facilitating Discourse	0.10	0.05	0.18	0.21	4.19	1.79	0.09	—	0.06	—

* Chat tool.

** Forum tool.

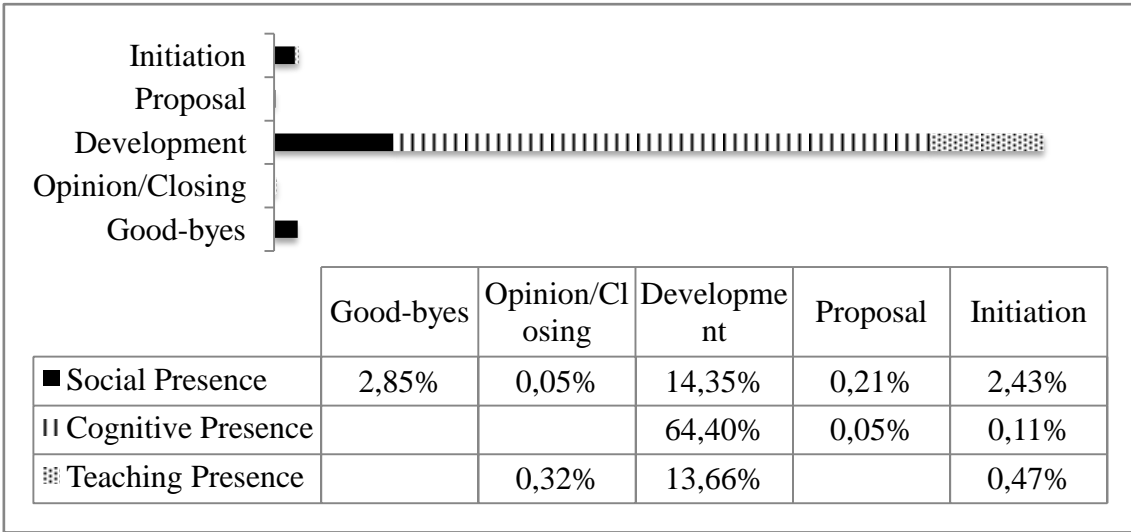|	Good-byes	Opinion/Closing	Development	Proposal	Initiation
■ Social Presence	2,85%	0,05%	14,35%	0,21%	2,43%
⋼ Cognitive Presence			64,40%	0,05%	0,11%
⁙ Teaching Presence		0,32%	13,66%		0,47%

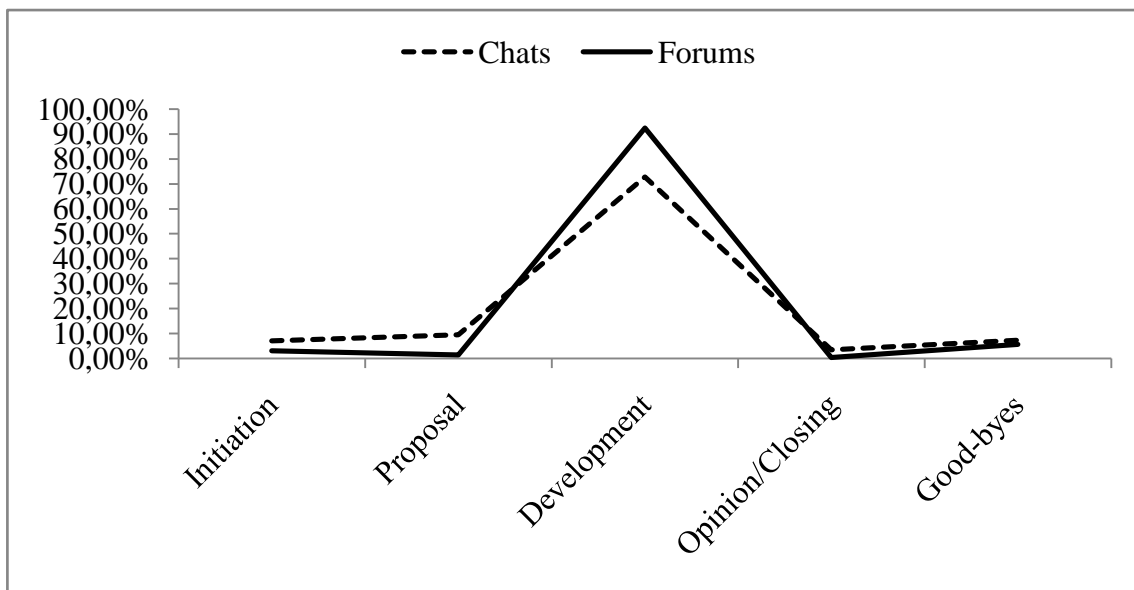*Figure 3: The presences in each phase of the forums*

Figure 4: Comparison of the pattern of development for both tools

Table 3: Descriptive statistics for student satisfaction

Tool	Student satisfaction: activity		Self-satisfaction		Student satisfaction: professor	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Chat	3.43	.32	3.70	.31	3.78	.23
Forum	3.58	.46	3.58	.65	3.74	.30

Appendix

The study used two similar questionnaires, which are summarized below