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How Can We Explain the Relationship Between Quality Interaction and Quality Learning in E-Learning? A Maximum Variability Study in Four-Cases

Ana Elena Schalk Quintanar
Phd. In Education
Chile

1. Introduction

In this chapter, part of a research project developed over three years (2005-07) is presented. Its main objective consisted in describing the relationship between the quality of interaction in asynchronic discussion forums and the quality of learning achieved in experiences of e-learning formation. The current work identifies the way in which interaction actually contributes to the quality of learning. This is achieved on the basis of a descriptive research where the emphasis is on a positive relationship between the quantity and quality of the discourse of the participants, and the quality of the learning achieved and reflected in the different instances of the evaluation. All of this allows questions which motivate further investigation of this relationship in greater depth.

Whether e-learning theory sustains interaction is very important for quality learning, but up to now we have not known how to boost the value of constructing knowledge and learning with others in e-learning experiences. The results of the research were expected to explain if a relationship between interaction and learning exists and how it can be described.

The evidence collected allows us to recognize and to confirm the importance of facilitating cognitive discussions to build relevant and significant learning for students.

Although three of the four cases confirm the fundamental theory, the fourth opens new perspectives to be developed in the future as a research line.

1.1 Background

The current work comes on top of that which started to analyse and value the relevance of education via IT in the 1990s. Mason (1990) offered a framework for understanding communication through computers. In this framework synchronic and asynchronic communication are distinguished. Other investigative proposals have also appeared (Schotsberger, 2001; Van Dijk, 2000) which have analysed the discourse in depth from different viewpoints. This has shown us that it is not the *quantity* but the *quality* of interactions that makes it easier to investigate and try to comprehend the ways in which the learning process is developed through the interaction and exchange of ideas in computer-assisted communication.

Gunawardena, Lowe and Anderson (1997) undertook the task of defining an instrumental model which could be used to examine the construction of knowledge. Based on Vigotsky´s theory and using phases of discussion productively to determine the weight of the constructed knowledge, this analytical model offers relevant elements that allow the understanding of the construction process, both in teaching and in learning, in collaborative environments. This is because of its focus on interaction as a vehicle of knowledge construction and its ability to detect the construction of knowledge that emerges in a conference, quite apart from its consideration of the learning context with a relative strength in this model.

In turn, Rourke, Anderson, Garrison and Archer (2001) identified three elements of the investigative community. The first was social presence in discourse. The other two were cognitive and teaching presence. The researchers emphasized the relevance of the first element as essential to motivate students in their learning process. This social dimension was configured in three categories: affective responses, interactive responses and coherent responses.

Later on, Garrison, Anderson and Archer (2003) identified cognitive presence in a model of the investigative community. This presence reflected higher-order knowledge and an achieved application generally supported by literature and research related to critical thinking. They implemented four stages, initiation, exploration, integration and resolution, as moments of the cognitive dynamics. Another prominent contribution of this work was to use the complete message as the analysis unit. This decision regarding the analysis unit was tested by two reliability indexes: the Holsti and the Kappa coefficients, high-quality results being obtained in both cases. This resulted in future investigations related to the discourse analysis in asynchronic environments and the standardization of the complete message as the analysis unit.

At the same time, Anderson, Rourke and Garrison (2001) developed a proposal to analyse the presence of teaching in the frame of the investigative community.

They considered the following teaching roles: experience design, facilitation and co-creation. They also determined that for the production of a socially active environment, the teacher or tutor's mastery of the subject would allow the students to have access to direct instruction. Its reliability was proven by the Kappa's indexes, a high coherence level being obtained.

Along with these contributions, other works that identified the way in which communication between participants occurred were developed. They determined three specific dynamics: participation, interaction and interactivity. Participation is not interaction and the concepts must be distinguished. The first one refers to the number of messages that one person leaves in a discussion forum. The second one shows how those messages are answered by other people, generating a developing communicative activity. In 1992, Henri was one of the first to analyse the interaction quality of online forums. He differentiated between participative and interactive dimensions (Henri, 1992). He defined participation as the number of meaning units in a concrete forum. On the other hand, there is a fine distinction between interaction and interactivity.

Interactivity is the key variable in communication situations: it conveys the degree to which communication transcends reaction. It is a process variable, characteristic of communication situations. Interactivity is not a characteristic of the informational environment, since it has to do with the way in which messages follow a sequence and interrelate with each other and with previous messages (Perera, V; & Clarés, 2006).

On the basis of these investigative contributions, this study follows the line of knowledge production covered by investigators such as Marcelo (2002), Marcelo and Perera (2004) Torres (2002) and Perera (2007), who developed investigative works related to analysis of the discourse in Spanish-speaking asynchronic forums.

This work focuses on the integration of three relevant elements that interrelate with each other in a virtual learning experience. These elements are: the quantity and quality of interactions, learning results for the different units of formation and the quality of the final work, which should report the implementation of the expected learning process.
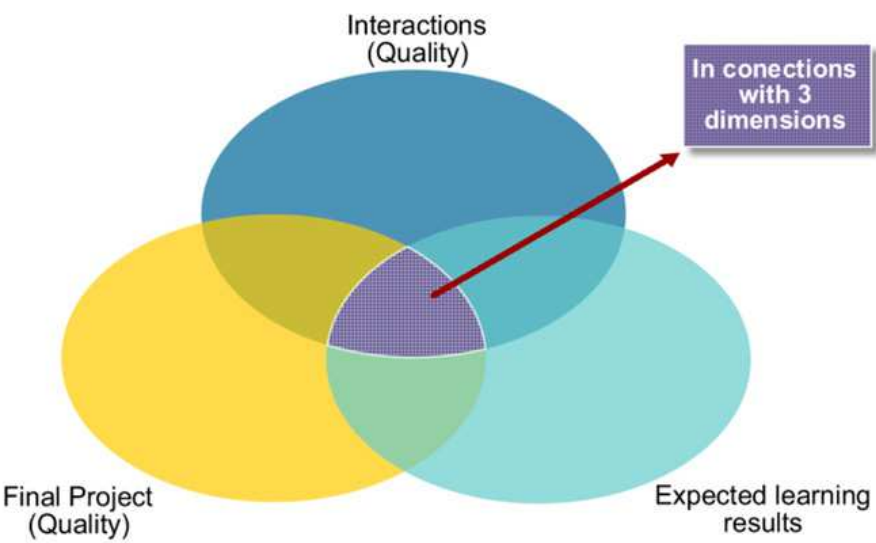

Fig. 1. Research Variables

Throughout this research it was considered that the combination of the e-learning elements would, on the one hand, make it possible to argue for the importance of participation, interrelation and collaboration on the net in order to achieve the expected learning progress, progress believed to go beyond the contents themselves and to be the basis for the development of actual competences. On the other hand, it should make it possible to provide scientific knowledge for the necessary modifications to increase the quality of the activity, considering that this is an aspect frequently challenged in virtual formation.

When this investigation refers to the "expected" learning results (and those proposed as goals but those obtained by the student throughout his/her learning process), they have a direct relation with the *mobilization of executed actions* and not only with understanding and repetition of concepts and learned subjects (declarative knowledge). Nor are they related to the mere ability to reproduce established procedures (such as, for example, any of the working actions of a technological platform).

These learning results refer to the integration of both declarative and procedural elements in an expected performance, which requires strategic learning results to be reflected in the valuation of concrete opportunities, decision-making related to knowledge and procedure and the design of possible alternatives for the solution of significant situations and their timely execution (Schalk, 2006).

1.2 Main question

Given the presentation of the core point where the three elements considered in a virtual formation experience are set out, the current investigation raises two questions: is there a relation between the quantity and quality of the participations and interactions that take place in the asynchronic discussion forums, and the quality of the expected learning results in the selected e-learning experiences? How does this relation become evident?

1.3 Secondary questions

From the previous question, the following are derived:

- What is the configuration of the quantity, dimension and category of participations for every case?
- Is it possible to establish a direct relation between the number of interventions and their quality and the results of the learning processes in every module within the context of the defined cases?
- Is it possible to prove a relation between the achievement level of the evaluation criterion considered in the final work project and the discourse quality previously analysed?

This study is based on the collected evidence from previous investigations of discourse analysis in asynchronic communication forums and on a number of studies of the learning experience using approaches such as the design model and didactics and evaluation. Consequently, the current investigation aims to find enough evidence to allow full understanding of the relation between interaction (in its three dimensions: social, cognitive and learning-wise) and the learning quality in a virtual modality. If such a relation exists, this investigation hopes to explain it.

If the study is successful it will allow deeper understanding of how students learn in a forum (asynchronic communication) and how this activity is related to the achievement of the expected learning results in virtual modality courses.

Finally, this study intends to contribute possible answers to the question still asked by many researchers as to how one can boost the value of constructing knowledge and learning with "others" in e-learning (De Wever, Schellens, Valcke, & Van Keer, 2006) (Fainholc, 2006; Marcelo & Perera, 2007).

2. Development of the research

2.1 Material, sample and methods

During 2005 and 2006 a preliminary investigation was carried out. It served as a first approach to analyse the relation between two variables (Schalk, 2007): the quantity and quality of interactions and the quality of expected learning results. From this it was concluded that there was a positive correlation between the discourse quantity and quality in discussion forums and the learning results in formation modules.

In order to study this phenomenon more deeply, the following sample was selected. It is constituted by post-degree formative activities.

- Analysis Group 1: Version October, 2005 to June, 2006. (Expert 2005)
- Analysis Group 2: Version October, 2006 to June, 2007. (Expert 2006)
- Analysis Group 3: Version October, 2006 to June, 2007. (SAE Course)

- Analysis Group 4: Version October, 2006 to June, 2007. (Master's degree)

All these courses were offered by Seville University between the academic years 2005 and 2007. The academic certification comprised "Expert" had a duration of 280 formative hours; and for "Master's degree" had a 340 hours in the second year along with the attached requirement of having approved the Expert level.

The total number of participants from all courses was 171, including students, guest teachers, tutors and curriculum directors distributed as follows: the 2005 Expert version had 63 participants; the 2006 version, 51; the SAE Expert version, 31; and the Master's degree version, 26. The number of analysis units increased to over 10,000.

Case methodology was used. Four cases of highest variability were formed. As shown below, a chart was drawn to describe every case.
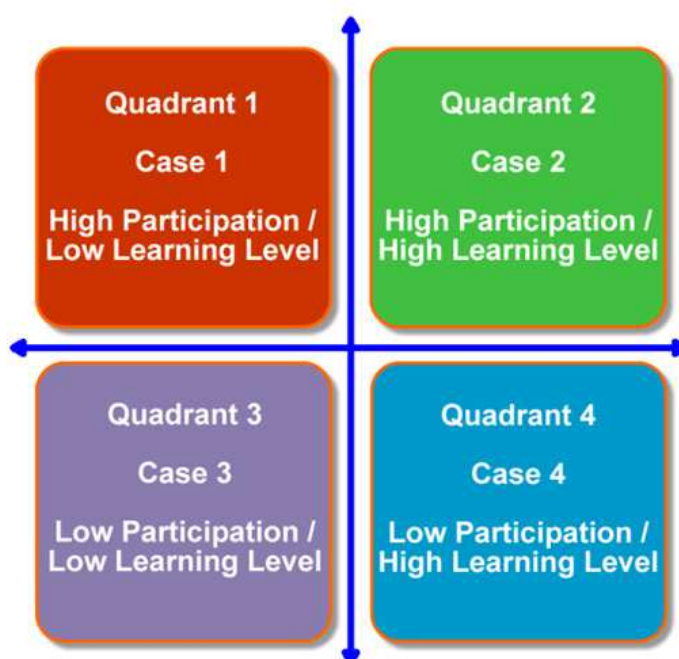

Fig. 2. Four Cases of Highest Variability

The horizontal variable (X axis) represents the evaluation variable (reflection of expected learning results) and the vertical variable (Y axis) represents the participation variable.

- Quadrant 1: students who showed a high participation level and a low evaluation level.
- Quadrant 2: students with a high evaluation and high participation.
- Quadrant 3: students with low participation and low learning results.
- Quadrant 4: students with low participation but high learning results.

The following criteria were set for the selection of students to form the cases:

1. To have all the evaluations of the 13 learning units.
2. All student interventions in forums and the respective discourse analysis to be based on the three dimensions of the discourse analysis model (social, cognitive and educational) (Rourke et al., 2001).
3. All intervention dynamics to contain the three elements of participation, interaction and interactivity.
4. Accredited evaluation of the final coursework, the said evaluation to be determined by 13 criteria: enable the core part of the course's, the communication areas, titles of the

subjects, introduction to the subjects, development and design of icons, agenda's, access to the subjects, resources', development of contents (two full units), and including the contents, the box of activities, and the right block and left block.

5.   Application profile of every student in every case available.
6.   Results of the self-evaluation tool applied six months after the formative period.
7.   Students classified in one of the four quadrants in its most extreme value

A total of 21 students met these criteria and therefore qualified as members of every one of the cases.

Those who clearly had the most valued characteristics were selected, and students who had intermediate values in some of the variables were omitted, so the highest variability condition was fulfilled. The following tables present the codes of students selected.

CASE 1			
Participant code	x514	xs02	x617
CALIF	8,122	6,86	5,08
INTERV.	166	30	82

Table 1. Participants of Case 1

CASE 2			
Participant code	xs15	x642	x609
CALIF	9,31	9,261	9,33
INTERV.	77	46	51

Table 2. Participants of Case 2

CASE 3			
Participant code	x608	x626	x606
CALIF	7,928	5,65	7,66
INTERV.	33	18	11

Table 3. Participants of Case 3

CASE 4			
Participant Code	x607	x621	xs11
CALIF	8,217	8,45	9,36
INTERV.	13	25	21

Table 4. Participants of Case 4

Since each case had three participants who fulfilled the criteria, a second exercise was carried out to determine who could fulfill the "highest" possible value in each quadrant. That was the main condition of the method research type (maximum variability), that is, the students selected were those who had the highest values of conditions and criteria. Therefore, the cases were classified as follows:

CASE 1		
Participant code	xs02	x617
CALIF	6,86	5,08
INTERV.	30	82

Table 5. Final Participants of Case 1

CASE 2		
Participant code	xs15	x609
CALIF	9,31	9,33
INTERV.	77	51

Table 6. Final Participants of Case 2

CASE 3		
Participant code	x626	x606
CALIF	5,65	7,66
INTERV.	18	11

Table 7. Final Participants of Case 3

CASE 4		
Participant Code	x621	xs11
CALIF	8,45	9,36
INTERV.	25	21

Table 8. Final Participants of Case 4

2.2 Case analysis method: Criteria

In this stage of the investigation an analysis of the cases by group was carried out to identify every possible interrelation between:

• Discourse dimensions for every participant (Rourke et al., 2001), that is, social, cognitive and didactic or learning dimensions.

- Dynamic of intervention according to the distinctions of participation, interaction and interactivity.
- Evaluations of each one of the modules.
- Final work (fulfilling all 13 evaluation criteria)
- Self-evaluation (post-formation)

The aim was to check in the databases that every case had elements that were similar and different which could offer relevant evidence to answer the research questions. Furthermore, it was deemed relevant to identify how the variables behaved under specific conditions in every case.

3. Conclusion

The first case, which relates high participation to a low level of learning, confirms what other studies have already revealed, namely that a high turnout does not necessarily reflect a high level in the achievement of expected learning outcomes, and that the quality of the discourse will therefore play a key role in such achievement.

Case 2 allows us to claim that a high turnout, translated into unintended interactions with learning objectives, reflects a high level of impact on the achievement of expected learning outcomes, and that the quality of learning plays a key role. It would then be a fundamental task of the tutor´s work to help of the students to develop a digital proficiency that allows them to learn in this modality.

Case 3 details the relationship between variables, where despite the apparent similarity of the quality of the discourse to the features of Case 1, which tends toward explicit interaction and a low presence of structuring and applications in its interventions, it can be inferred that the lack of participation and interaction produces a low learning level, so the relationship between quality of discourse and quality of learning is evidenced.

Finally, as noted before, the case that offers greater possibilities for further investigating the relationship between discourse quality and quality of learning is the fourth one. What we can conclude from this is that the greater the presence of the cognitive dimension, the greater the evidence of the relationship between interaction and learning expectancy, this being the first perspective which opens up possibilities for research development.

New questions also arise. In the fourth case, the students´ situation was different. We could not find if: did they have a previous set of skills that enabled them to meet the evaluation criteria? Do the clarity of design and the pedagogical model underpinning the selected courses permit self-learning, so that the interaction is not required for the achievement of learning? Did the way in which they were supplied with the forum discussions by tutors directly or indirectly influence the promotion of student participation, without it being detrimental to the quality of their learning? This analysis of experiences shows us that we still have some distance to cover between individual learning (self-study) and collective learning (social constructivism), and need to design courses that give more value to the process and interactive activity followed by the student.

Without a doubt, continuing investigation of the relationship of the variables quality of learning and quality of discourse , in e-learning, is required to discover why it is that students with very few interactions in e-learning courses achieve high levels of individual learning (learning through self-instruction), when the definition of this mode and the pedagogical model of the courses analysed are based on collaborative learning, the value of

community learning and the social construction of personal knowledge for the knowledge and learning society.

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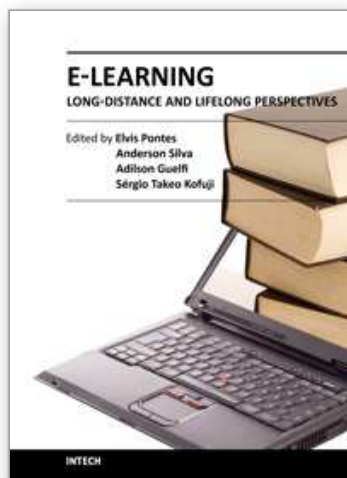
E-Learning - Long-Distance and Lifelong Perspectives

Edited by Dr. Elvis Pontes

E-learning enables students to pace their studies according to their needs, making learning accessible to (1) people who do not have enough free time for studying - they can program their lessons according to their available schedule; (2) those far from a school (geographical issues), or the ones unable to attend classes due to some physical or medical restriction. Therefore, cultural, geographical and physical obstructions can be removed, making it possible for students to select their path and time for the learning course. Students are then allowed to choose the main objectives they are suitable to fulfill. This book regards E-learning challenges, opening a way to understand and discuss questions related to long-distance and lifelong learning, E-learning for people with special needs and, lastly, presenting case study about the relationship between the quality of interaction and the quality of learning achieved in experiences of E-learning formation.

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