ARTICLE

Teamwork and leadership in a virtual learning environment

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Abstract

The aim of this article is to identify the relationships and synergies between two basic management skills – teamwork and leadership – in the virtual learning environment of a master's degree programme subject, whose purpose, among other things, is to enable students to acquire both competencies. A two-fold methodology was used: first, a qualitative analysis of a student survey specifically designed to gain an insight into teamwork and leadership practices; and second, a quantitative analysis of Moodle activity logs for each member of every team's use of communication spaces and methods (forums and chats). The results obtained from both analyses showed that the dynamics varied considerably from team to team; that there was a clear relationship between teamwork, leadership management and participation, and each group's performance; and that groups with a clear leader from the start obtained better results.

Keywords

teamwork, leadership, group dynamics, higher distance education, postgraduate study

Trabajo en equipo y liderazgo en un entorno de aprendizaje virtual

Resumen

El objetivo de este trabajo es identificar relaciones y sinergias entre dos habilidades básicas ligadas a la función directiva –trabajo en equipo y liderazgo– en el entorno de aprendizaje virtual de una asignatura que pretende, entre otras cosas, la adquisición de ambas competencias. La metodología utilizada fue doble: por un lado, encuesta diseñada al efecto y dirigida al alumno para conocer la forma y modo de trabajar en equipo y ejercer el liderazgo y, por el otro, el análisis y seguimiento de los registros o logs que genera la plataforma de e-learning Moodle en cuanto al uso de espacios y métodos de comunicación (foros y chats) por parte de cada uno de los miembros de los equipos de trabajo que se formaron. Los resultados de ambos análisis han permitido advertir dinámicas muy diversas entre los distintos equipos así como una clara relación entre el trabajo en equipo, la gestión del liderazgo, y la participación y el rendimiento obtenido por cada equipo. Se demuestra que los grupos con un líder claro desde el inicio son los que obtienen mejores resultados.

Palabras clave

trabajo en equipo, liderazgo, conducta de grupo, enseñanza a distancia superior, tercer ciclo

1. Introduction

This article presents a study of a teamwork dynamics and leadership experience conducted on the Information Services Management subject, with a course load of six credits, in the 2011/2012 academic year. It was a compulsory subject, offered in blended learning mode, on the Libraries and Digital Information Services' university master's degree programme at Carlos III University, Madrid.

Implemented in Moodle, a widely used virtual learning environment (VLE), the subject teaching methodology combined traditional methods (e.g., lectures and tutorials that had been adapted and reinforced with a selection of didactic materials and communication tools) and collaboration (as

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required by the blended learning mode), which were supplemented with a group work aspect. This aspect was considered essential in order to simulate the working environment of future libraries or digital information services' directors. In real-life situations, these directors have to collaborate in work groups that are generally diverse. Moreover, this collaboration often takes place virtually, thereby enabling the barriers of place and time to be overcome. Hence the use of a wide variety of communication tools, both synchronous (chat, VoIP, videos of face-to-face classes recorded with MediaSite, etc.) and asynchronous (discussion forums, e-mail, wikis, etc.). The ultimate goal was to ensure that the students acquired the necessary competencies to actively build effective work teams by "doing" things and "cooperating" with their fellow students. This implied listening, asking and summarising, as well as being flexible, proactive, assertive and open to criticism, and all within a VLE..

2. Teamwork and Leadership: Basic Management Skills

The ability to teamwork is a clearly recognised cross-disciplinary and interpersonal competency, on which a great deal of importance is placed in the framework of basic competencies that students need to acquire on the various degrees that have come into existence in the European Higher Education Area (EHEA). In the 1999 Bologna Declaration and in the definition of new degrees, there has always been unanimous agreement – irrespective of the knowledge area – on the fact that, among other cross-disciplinary competencies, graduates should be able to teamwork. There are several interesting methods and experiences for achieving this goal, especially in e-learning mode (Sigalés, 2004; Guitert, Romeo & Pérez-Mateo, 2007).

Besides strengthening teams, it is necessary to develop other skills as diverse as communication, motivation, leadership, delegation, assertiveness and problem-solving (Ballenato, 2005). There is a very close link between teamwork and leadership (Gil, Rico & Sánchez-Manzanares, 2008), with the latter being understood in an educational context as the ability to guide and promote teamwork, attempting to get everyone forming part of a group involved.

The competencies for professionals working in library and information services began to be defined in 1999 (ASLIB, 2000). These competencies were subsequently validated, monitored and expanded as a consequence of the profession's evolution, and culminated in the publication of *Euroguide LIS* (*Euroreferencial en Información y Documentación*, SEDIC, 2004). The white paper on the bachelor's degree in Information and Documentation issued by the Spanish National Agency for Quality Assessment and Accreditation (*Libro blanco del Título de grado en Información y Documentación*, ANECA, 2004) stipulated that teamwork was a cross-disciplinary personal competency for every professional leaning, and that management and leadership ability is systemic in nature.

The Libraries and Digital Information Services' university master's degree programme offered at Carlos III University, Madrid, includes the specific objective of training experts who are qualified to design, administer and manage quality digital information systems and services. Given that admin-

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istration and management are essential functions in this context, it is crucial to have a compulsory Information Services Management subject. Its objectives include the ability to::

- Form and manage teams, and obtain results.
- Put into practice a director's interpersonal functions, such as those directly affecting his/her co-workers: teamwork, training, informing, communicating and motivating..

Among a director's many skills, the ability to lead, to form teams and to develop relationships (Mochón, 2006) should always be present. Moreover, they are competencies that underpin the success of a person in a management role (Puga Villareal & Martínez Cerna, 2008). Library directors must also have such abilities to enable them to perform their functions effectively and efficiently (Young, Powell & Hernon, 2003).

3. Research Objectives and Questions

The study presented here had two main objectives: first, to ascertain whether the students were able to acquire the teamwork competency in a VLE; and second, to identify the features of group work dynamics in that environment, mainly regarding how leadership is exercised.

To that end, several research questions were formulated. These were:

- How do place and time constraints affect those that the students are under in the VLE when it comes to teamwork?
- What influence does the availability and use of synchronous and asynchronous communication tools have?
- Are the VLE and its associated tools a help or a hindrance when it comes to forming a team and exercising leadership?
- How does the subject's teamwork-based didactic proposal influence the acquisition of this competency and its relationship with leadership?
- How positive is it to conduct an open question survey for the purposes of reflecting on and self-assessing group and individual performance? What conclusions can be drawn from it with regard to the teaching methodology?
- Is it possible to identify any behavioural patterns for the two competencies and to assess their acquisition by means of a qualitative analysis of answers to an open question survey?
- Is it possible to identify any behavioural patterns for the two competencies by means of a quantitative analysis of a VLE's activity logs?
- Does the data obtained from the quantitative analysis corroborate the data obtained from the qualitative instruments?

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4. Methodology

The methodology applied to the study of the teamwork dynamics and leadership experience presented here was two-fold: first, a qualitative analysis of data that students provided via a survey; and second, a quantitative analysis of data generated by Moodle from the forums and chats used by the students to do the group assignments required by the subject. Before referring to each of the methods used in particular, it is expedient to describe the setting in which the research was conducted and, more precisely, the teaching methodology applied to the subject because of its close link to both.

4.1. Research setting

Given the current need to be able to teamwork in any working environment, and bearing in mind that it is one of the core topics of the subject, the subject lecturers decided that four of the six assignments that the students had to do in order to pass it should employ this technique. By doing so, the students would become aware of what a team is and how it works, thus creating favourable situations for exercising leadership through their own behaviour and actions: making and assessing proposals, organising a group, evaluating or assessing, enabling decision-making, solving problems, allocating tasks, etc. (Ballenato, 2005).

Eleven operational groups were formed, with between four and six members each. The number of students per group was limited because collaborative work in small groups has proven effective for successfully developing competencies such as teamwork, decision-making and problem-solving (Ruiz, Sierra & Sarasa, 2011).

In a face-to-face environment, identifying internal group dynamics and the existence of leadership is a complex matter. In a VLE, however, these dynamics can be observed and very valuable data can be obtained as soon as the specific communication spaces and methods for each work team are set up, such as forums, chats and other tools that Moodle offers. It has been demonstrated that this system fosters social relationships among students, thus contributing to better group work and higher student participation in a team (Aceituno, 2011). Indeed, forums and chats are essential e-learning communication tools (Pérez et al., 2004; García et al., 2004; Hernández Ramos, 2010).

The subject's communication and interaction mechanisms were:

- *Subject forum*: lecturers and students participated in this forum by asking and answering all kinds of subject-related questions.
- *Work group forum*: an independent, private forum for each work group set up to help the students do the group assignments for the subject.
- *Chat for each face-to-face session*: this allowed students following the sessions remotely to participate.
- *Chat for each group*: this facilitated synchronous communication and complemented forum communication, as it offered greater responsiveness.

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The students were also given the opportunity to suggest additional chat/tutorial sessions whenever they felt it was appropriate to do so.

4.2. Qualitative method: individual survey of the group work experience

As a complement to the four assignments done in teams, a compulsory individual activity was proposed, involving a personal assessment of this experience. Each student acted as the agent of the assessment, the aim of which was to enable him/her to become aware of the process of acquiring certain subject-related competencies, and also to reflect on the learning of such competencies and formulate value judgments, which is a recommended practice in higher education (Gil Flores & Padilla-Carmona, 2009).

On completion of all the group assignments, each student assessed his/her performance as well as the team members' performance using an open question survey designed for that purpose. By asking questions of this type, the goal was to use the comments made by the students in a qualitative manner. The 11 questions in the survey were designed to elicit data about the interaction between the two competencies – teamwork and leadership – with specific objectives for each one. The aim was to identify:

1. Whether there was any group work planning, how the tasks were allocated and who decided what steps had to be followed.
2. The roles played by the team members and by each student him/herself, thus enabling them to gain a better awareness of their particular actions and performance in the group.
3. The members who exercised leadership, assessing their performance.
4. The involvement and active participation of the team members in each of the assignments done, assessing various criteria on a scale from 0 to 2 (0 = Always complied; 1 = Partially complied; 2 Never complied): participation in the open forum; completion of assignments by the agreed deadline; optimum quality level of the assignments delivered; idea proposals; non-imposition of ideas on the other team members; and compliance with the group's rules and agreements.
5. Whether there was any cooperation, coordination and sharing.
6. Whether decisions were made by consensus or not.
7. The use of the teamwork methods and techniques explained in the subject.
8. Whether any conflicts arose and, if so, what type.
9. Each student's personal assessment of his/her experience (on a scale from 0 to 10).
10. Important teamwork skills in their fellow students, as well as those that were lacking.
11. Each student's assessment of this activity and its impact on future team assignments.

4.3. Quantitative method: analysis of the VLE's activity logs

Besides the data collected from the questionnaire, the number of student posts and contributions to the forums and chats was analysed. This is an assessment practice performed by online tutors and lecturers (García, 2009).

This was based on a quantitative analysis of data obtained from the activity logs generated by Moodle through its reporting module. The student activity and action logs that were most representative and had a greater impact on teamwork dynamics and leadership were selected, while those considered passive or non-contributory were disregarded. The three activities selected were: subject forum, group forum and group chat. The four actions selected were: forum add discussion, forum add post, forum update post and chat talk.

The activity log data were downloaded at the end of the subject teaching period in CSV file format and subsequently processed using MS Excel spreadsheets.

5. Results Analysis

5.1. Student survey results

The questionnaire was completed by 54 of the 60 students in the group. The answers are presented below:

1- Work planning
There was no planning in the strict sense of the term. The groups tended to adhere to the same methodology: there was always one student who spontaneously launched a discussion on the forum and came up with the initial steps or suggestions that ought to be followed, thus playing the role of instigator. From that point on, the most frequently used tool was the chat; it facilitated teamwork because it gave students the opportunity to communicate synchronously with each other.

The most significant aspects noted with regard to this question were:

- A general lack of planning, which even the students explicitly mentioned. They referred to it as confusion and disorganisation at the start.
- The effectiveness of applying teamwork and coordination techniques among members was greater as from the second assignment and after the students had seen the Teamwork topic, which demonstrated the utility and applicability of acquired learning in day-to-day work.
- The use of communication media other than the forum and chat tools that had been made available for communication purposes. Six students said they had used Skype, the telephone and e-mail because certain group members lived in countries in different time zones.
- A duplication of work in some teams because tasks had not been properly allocated. Instead, and depending on the circumstances, each student did what he/she saw fit.

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2- Roles played

Based on three well-known classifications (Ballenato, 2005; Belbin, 1996; Robbins, 2009), the answers are shown in Figure 1.
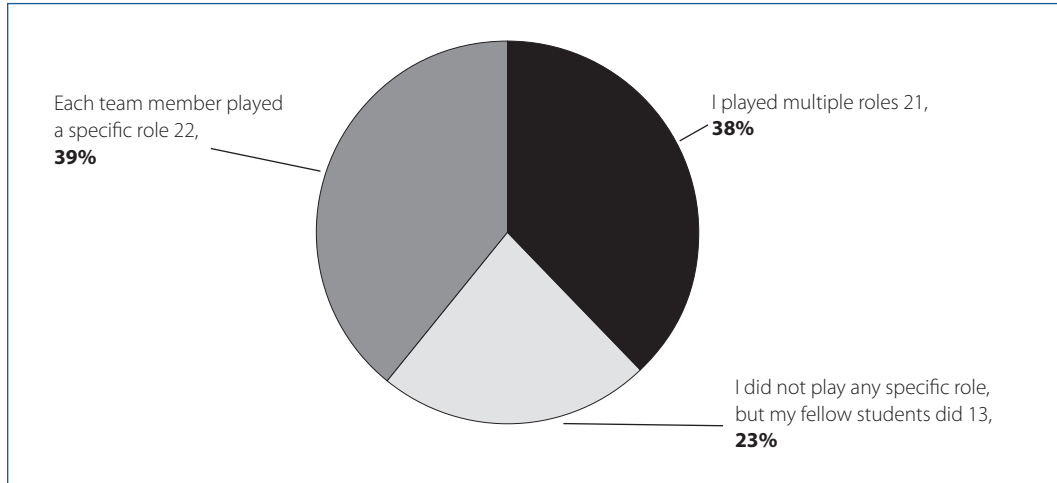

Figure 1. Roles played in teamwork

- In order of importance, the two main roles in every group were: organiser and coordinator. These were followed by controller, teamworker, completer finisher and shaper, all of which were mentioned the same number of times.
- Only one student stated that he/she had played the role of team leader.

3- Leadership

A leader could be identified in every work group, despite the fact that the answers provided the following data (Figure 2).
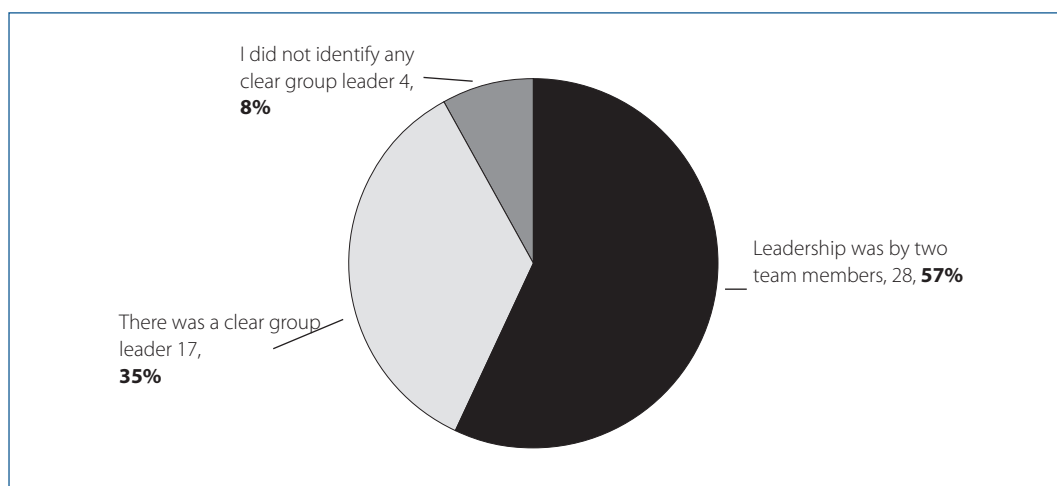

Figure 2. Identification of team leader

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4- Member involvement and participation

The results obtained from this question were hard to asses because the authors felt that it had not always been answered sincerely, thoughtfully or self-critically.

In those groups that had experienced some minor problems, especially in relation to their respective team members' uneven levels of performance, it was nevertheless possible to deduce that the survey reflected such situations; their members' assessments varied considerably from one student to another, and the conflictive members were clearly identified. Furthermore, these groups had lower assessment means than the groups that functioned effortlessly; the latter generally gave themselves the highest score. Overall, a lower score was found for the *Did not impose his/her ideas on the other team members* item.

5- Cooperation, coordination and sharing

Only one student stated that these elements were absent from his/her work team. Most of the students directly related them to the communication tools used: forum and chat. Ten students stated that these elements improved as they progressed through the subject assignments; in the earlier ones, they noted less cooperation, coordination and sharing.

6- Teamwork methods and techniques

The teamwork methods taught on the subject were hardly used or the question was not properly answered (Figure 3).
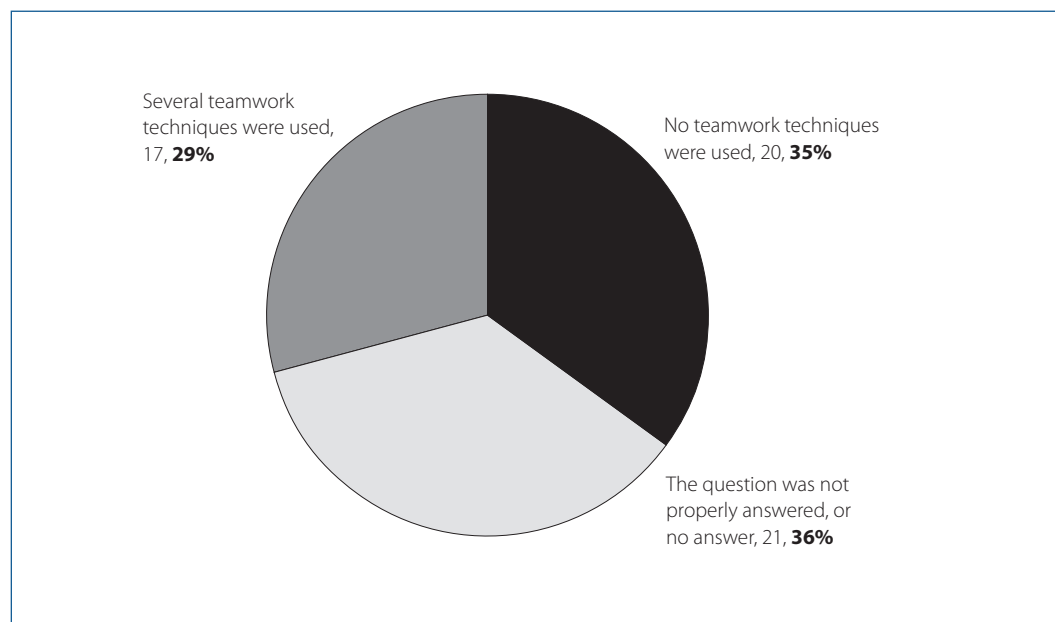

Figure 3. Use of teamwork methods and techniques

The 17 students who stated that they had used teamwork techniques identified the following, in descending order of references made to them (Figure 4).
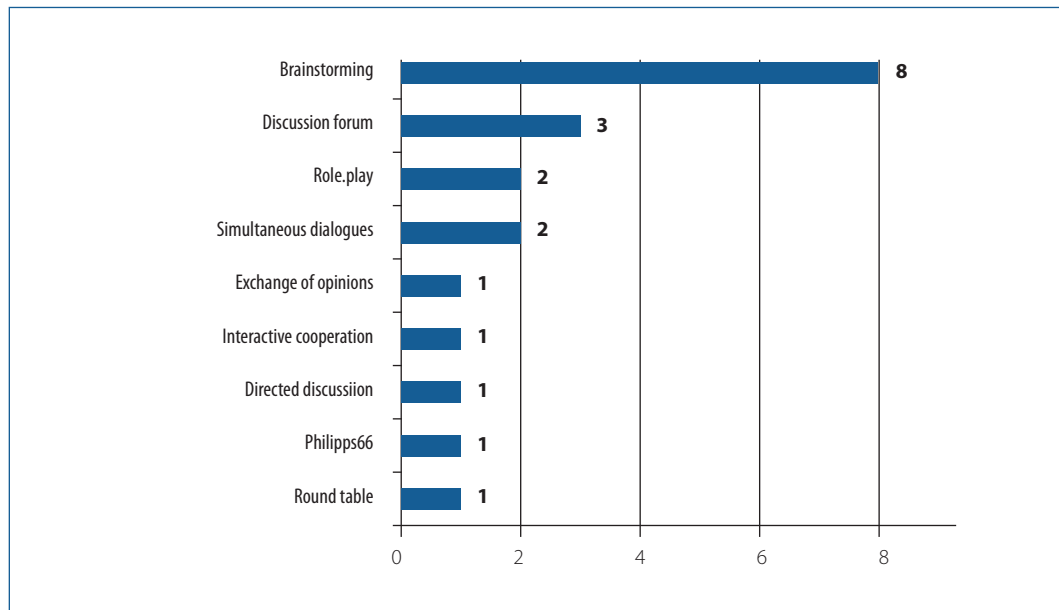
Figure 4. Teamwork methods and techniques

7- Conflicts

There were no significant conflicts on the assignments, as confirmed by 24 students. The remaining students referred to aspects that caused some uneasiness at certain times, though none of the groups considered it a source of conflict (Figure 5).
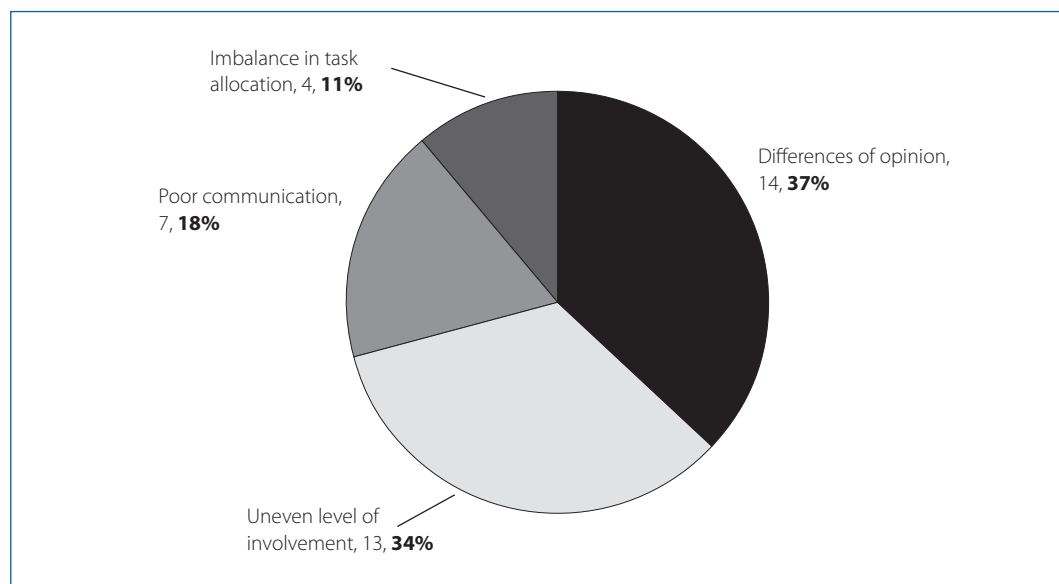

Figure 5. Aspects identified in teamwork

8- Personal assessment of the experience

On a scale from 0 to 10, the students assessed the teamwork experience as being highly satisfactory (Figure 6).

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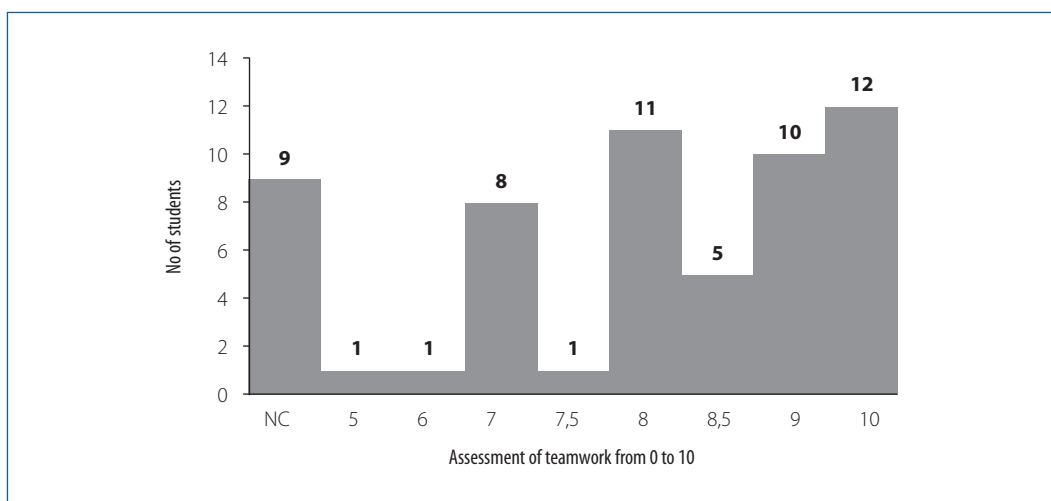de aprendizaje virtual

Figure 6. Assessment of teamwork experience

Regarding the overall assessment that could be inferred from the 11 groups:

- Nine of them assessed the experience positively. In fact, one of them stated that it had been the subject on which it had had the best teamwork experience out of the semester's six subjects.
- Only one of the groups described the experience as bad, and another group stated that, despite having had a good experience, it preferred individual assignments.

10- Teamwork skills
Given that a predetermined list of skills was not provided, the range was vast, with a total of 45 skills being considered necessary, and a total of 25 being considered necessary yet non-existent (Figure 7).
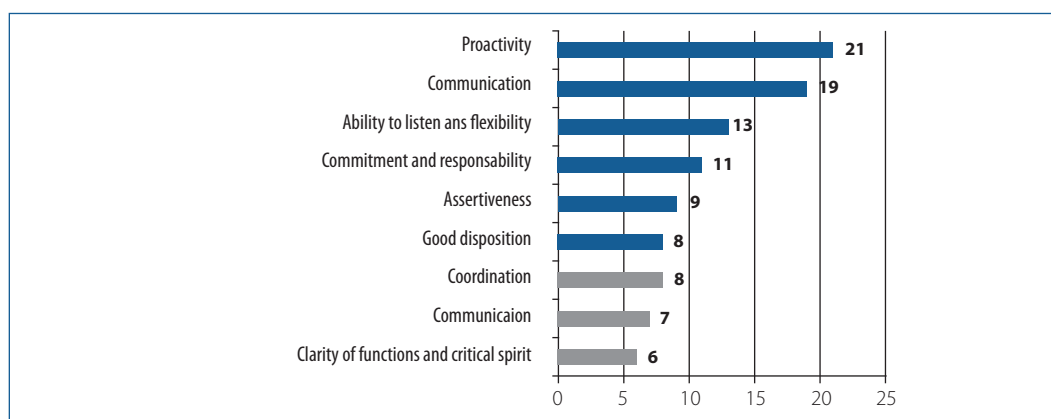

Figure 7. Teamwork skills

5.2. Activity log results

The students' use of forums and chats enabled the following data to be obtained. They are classified by means of communication medium.

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5.2.1. Subject forum

The subject forum logs enabled a series of indicators to be obtained for the number of open threads and new posts, distinguishing the actions performed by those students previously identified as leaders by means of the survey results.

In total numbers, 25 students added 36 discussions or new threads, and 47 students posted replies to the open discussion threads. In other words, while only 45% of the students added new discussions, 72% added posts. The logs enabled a set of highly participatory students (15%) to be identified. They added two thirds of the discussions, and the identified leaders could be found among them. Of the new threads, 33.3% was added by the leaders. A slightly lower 27.5% of posts was added by the leaders.

Regarding posts added to the subject forum, participation was more balanced. The number of students adding at least one post to a discussion increased to 43, with a total of 117 new posts. The mean number of posts per student was higher at the beginning of the discussions (2.73), without including those who did not post any.

5.2.2. Group forum

The group forum overview highlighted marked differences between the students and enabled behavioural and leadership patterns to be identified.

A total of 40 students (two thirds) added 160 new discussions. The leaders added 66 discussions (41.25%), thus accounting for a greater presence of leaders in the subject forum, where they added 33% of the discussions. Likewise, the leaders' participation in the group forum was more visible than in the subject forum, since 91.7% of them added group forum discussions while 66.7% of them added subject forum discussions.

Regarding the number of posts added, participation was clearly higher in the subject forum, with a total of 2,077 new posts. Nearly all of the students (59 out of 60) added at least one post, in a range of up to 84 per student. The mean number of posts per student was very high (34.62).

The leaders' protagonism was less significant in adding posts than in adding discussions. In this case, the leaders (20% of the students) added 27% of the posts, with a posts added mean some 13 points higher than the general mean (47.3 posts).

In short, taking into account the group forum data, the leaders were found to be less representative with regard to adding messages. They were the ones who encouraged the other students to initiate assignments and enabled leadership to be related to the initial direction and guidance of teamwork.

In addition to an overall analysis of the add post and add discussion data in the group forum for the whole subject, a specific analysis for each of the 11 active work teams was considered expedient. This analysis showed that the dynamics of the 11 teams were very diverse. For example, it was found that some groups had added up to 25 different threads, with a volume of up to 279 posts. In contrast, other groups had only added 6 different threads, albeit with a volume of up to 332 posts. The mean number of discussions added per group was 13.9.

When analysing the presence of leaders in each group in particular, it was found to be representative with regard to the number of discussions added: a total of 66 (41.25%) and a mean of 6. While the percentage of posts added fell, it was slightly higher than the mean for their group. In short, the leaders added more discussions, and that is how their leadership in the group began, as corroborated by the answers to the survey. However, their continued participation with regard to the number of posts quickly balanced out.

5.2.3. Group chat

Chat use was even more diverse than group forum use. Only six of the groups used it effectively. The remaining five simply used the forum or external tools.

In overall figures, chat use was very diverse. Taking into account only those chats in which 50% of the team members took part, the session figure fell to 42 (47% of logged chat sessions). The number of talks or lines of chat in these sessions accounted for 87%, and the mean duration was 65 minutes. A more detailed analysis of the data needs to be performed. For example, this could be done by grouping together contiguous chats on the same day and treating them as a single session, thus enabling their activity logs to be assessed with greater precision.

6. Conclusions

The survey data analysis allows several overall points to be made about the experience, which to a large extent respond to the research questions:

- It was useful for students to analyse and assess the teamwork experience and, in particular, the roles that each member played. Understanding their own specific role and the roles of other team members was of great help to them in terms of making the most of different aptitudes and interdependencies. Likewise, it enabled them to see diversity as something enriching, since it not only offered greater opportunities to get more and better results in their final assignment, but also enabled them to find out for themselves that teamwork was more than the sum of individual work. Moreover, individual self-assessment of the group's operation by means of the questionnaire – an experience developed in other works (Guitert, Romeo & Pérez-Mateo, 2007) – allowed the students to become aware of the process followed to detect weaknesses so that improvements could be made in subsequent experiences.
- The survey allowed the suitability and utility of the theory provided by the lecturer to be assessed, and areas for improvement to be identified, ready for implementation in the following academic year.
- The students who stood out as group leaders from the outset obtained better results, hence the interest in encouraging initial team coordination.

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- Spontaneous initial leadership was identified in each group, which was consolidated as the assignments progressed, providing the necessary drive to instigate and guide them.
- For future years, there was an acknowledgment of the expediency of placing emphasis on work planning prior to allocating tasks by analysing lines to follow, alternatives to consider and results to be achieved. As happened in other similar teamwork-related experiences in VLEs (Guitert, Romeo & Pérez-Mateo, 2007), the students became aware of the importance of good planning to the final result of their work, and of the variety of ways to approach it.
- The students positively assessed the virtual teaching-learning process in groups and in synchronous and asynchronous modes, despite their initial reservations. This mode forced them to modify their habits in relation to previously known forms of group work. The experience showed that they learnt to work collaboratively and that they acquired other competencies stemming from the group work undertaken in the VLE, such as reasoning, constructive critical analysis, tolerance, respect for the ideas of others, group decision-making, etc.

The data obtained from Moodle on the use of communication tools allow the following conclusions to be drawn:

- Group work in the VLE partly helped to overcome the students' reservations about participating and therefore increased the number of posts to the forums.
- In each group's working environment, it was found that the members were more comfortable than in the subject forum – taking into account the number of posts added and the tone of the posts – and that the differences between the leaders and other members of the team were less noticeable because the number of forum contributions was more balanced.
- The leaders were more participatory than other team members; their contributions were significant at the start and in the subsequent development of teamwork.
- The number of students per group did not seem to be a determining indicator of the degree of organisation or the number of contributions, as there were identified very different patterns.

This experience confirmed that the methodology applied to the subject in question was useful in this blended learning mode and in this subject devoted to management skills. The students acquired the teamwork competency and an understanding of how it functions in a VLE. It also demonstrated the utility of the VLE's activity logs as a quantitative and significant indicator of student activity and behaviour with regard to participation, group dynamics and leadership management, which in turn confirmed the data obtained from the qualitative analysis by means of an open question survey.

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