What Do Undergraduates Perceive About Teamwork?*

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According to the European Higher Education Area (EHEA), training programs should be built on on a set of competences that could lead to higher employability and transferability. Among these competences, teamwork is shown to be a highly desirable skill by employers, but not always achieved by graduates. It is suggested that students learn more from good team experiences than they do from bad experiences. The work presented herein is focused on students' perception of teamwork, since by identifying their perceptions we would be able to build positive students' experiences in teamwork.

The aim of this paper is to establish a catalogue of students' perceptions about teamwork to help faculty members in the identification and analysis of their students' perceptions. In order to obtain students' perceptions, open coding is used. Students' perceptions are drawn from their answers from an open-ended survey that were processed by using the professional software tool Atlas.TI. Eighty-seven third year students participated in this study. The evolution of students' perceptions along an academic year was analyzed. Perceptions of teamwork were measured at both the beginning and end of the academic year in two groups of students. Since teamwork activities of the two groups were different, the relevance of the relation between perceptions and activity's nature has been also considered.

Keywords: teamwork; professional skills; students' perceptions; higher education

1. Introduction

The European Higher Education Area (EHEA) was meant to ensure more comparable, compatible and coherent higher education systems in Europe [1]. According to the main guidelines set by EHEA, training programs should be built on a set of competences looking for high employability and transferability [2, 3]. In this context, all degrees and master studies in engineering must define a profile of competences that students should acquire by the end of their university period, including both specific and generic competences. The later ones are those that are neither technical nor specific in a certain knowledge area. In general, the term is used to refer to those competences that can be applied across different job and life contexts. Since these competences are not specific to any given job or work role, they can be key skills to success across different job types [4]. This type of competence may be developed through different courses, or even subjects, as a complement of other contents. Therefore, generic competences are one of the foundations of students' integration into working life and professional development [5].

Analyzing generic competences, '*being able to work in teams*' is a fundamental one due to several reasons. On the one hand, they are so for educational issues. Teamwork helps students to construct understandings by relating them to their prior knowledge and improving their communication [6]. For this reason, it is an important strategy for

faculty seeking to help students engaging more meaningfully in their learning [7]. However, as any other learning strategy, it has not only benefits, but also drawbacks. This issue has been well documented in the literature on the topic, as for instance in Hansen [8]. On the other hand, another reason for the importance of this competence is the fact that, in the labour market, high teamwork capabilities are remarkably sought after by employers [9–12]. This is due to the fact that Engineering graduates are increasingly expected to work, among other contexts, in team-based product and process design projects [13]. Therefore, it can be stated that by improving teamwork skills, engineering students' employability is enhanced [9, 14]. Thus, there is a need to develop teamwork skill among students during their university studies.

Despite the relevance of this competence, defining teamwork is not an easy task [15]. When the term teamwork is used herein, it is referred to a small number of interdependent individuals with complementary skills who interact in order to acquire knowledge, skills or attitudes, and produce joint results towards a shared goal [16, 17].

Teamwork is neither a new nor a revolutionary tool in teaching in higher education. By reviewing the most relevant literature on the issue, it can be found a lot of studies related. They can be classified into two different approaches, those focused on the teamwork activity's nature, and those focused on students' intrinsic characteristics.

As far as the works dealing with the design of the

teamwork activity, they focus on teamwork design variables over which faculty has direct control. On the whole, they look for the best configuration of teamwork variables that allow students to improve their effectiveness and their learning. There is a great amount of variables to be considered. As for instance: the way to select team members [18–20]; team size [15, 19, 21]; team longevity [15, 19]; design and description of the activities to be performed, i.e. the definition of how the group should perform team tasks [8, 15, 18–22]; expected results considering whether handouts [11, 23] or students' learning outcomes [17, 18, 21, 22, 24, 25]; or the way to assess teamwork [15, 19, 26].

Regarding students' intrinsic characteristics, they are not that alterable by faculty. The most relevant examples are students' profile [22, 26, 27] and learning style [22, 27–30].

According to the literature reviewed, we conclude that when designing team activities, faculties should think hard, both in activity's nature, and in students' intrinsic characteristics, in order to achieve teamwork success. This should be always done before performing any team activity.

It should be noted that the new EHEA paradigm is student-centred. However, it is a fact that in the literature there seems to be much focus on the voice of faculty and academics (professor-centred) [31] rather than the voice of the students [5].

By reviewing student-centred literature, the most relevant addressed issues are detailed below. They analyze different academic settings, both scientific, engineering, and management. Tran [5] identifies students' perceptions about generic competencies in general, but he does not offer any catalogue or any clue for improvement in terms of teamwork. In Bacon et al. [19], the worst and best experiences in teamwork are analyzed through a closed-ended survey. The main conclusion drawn is that students learn more about teams from good team experiences than they do from bad experiences. It is vital to attempt to build positive students' experiences in teamwork. In Anson et al. [22], through a closed-ended survey, clues are given as to how to increase both students' motivation and their outcomes among engineering students by taking into account their profiles. In Schultz et al. [32], students' outlook on team-based assignments is analyzed with an open-ended survey. This work identified both positive and negative aspects of teamwork. These authors propose several solutions to reinforce strengths and to correct weaknesses. In Kidder et al. [33], they analyze the way to design team projects and its influences on the perception of instructor's fairness and, therefore, the evaluations they receive from the instructor. The main conclusions drawn from the survey suggest that team

project design decisions considerably affect perceived fairness and evaluation of instructors. They identify design factors, such as the grading system or the use of class time for the team work. A determinant key of dissatisfaction among students found is discrepancies between initial perceptions and final outcomes. In Ramirez et al. [34], the perception that chemical science students have of teamwork is analysed in different courses. The methodology employed to collect information is a close-ended question survey conducted at the end of the semester. The aim of this work is to help instructors enhance students' perception of teamwork by making them aware and by providing them guidelines for the design and implementation of strategies in different academic years. In Li et al. [35], they obtain in-depth information regarding Chinese students' group work experiences and draw a comprehensive picture of students' group work in the Chinese context. Data is collected using individual semi-structured interview and video-stimulated recall interviews.

Nevertheless, it should be noted that although they have been labelled as student-centred studies, most of them pose closed-ended surveys. These surveys aim to collect students' concern about teamwork; however the perceptions offered to the students are based on perceptions previously posed by faculty or researchers.

Among papers considering students' perceptions, there seem to be consensus on the importance of students having a positive perception of teamwork. Acquisition of this skill requires students to be predisposed to teamwork and to, therefore, have a positive perception of this methodology [18]. Besides, students learn more from good team experiences than they do from bad experiences [19]. And on the other way around, students who have had poor previous experiences with teamwork would lead to negative attitudes toward team assignments [33]. Therefore, students' perception should be also taken into account since being able to build positive students' experiences in teamwork is essential.

Despite the extensive research conducted on teamwork, it is a fact that it cannot be claimed nowadays that all undergraduate students finish their studies after having really acquired this competence [10, 13, 36, 37]. Consequently, there is still room for research in this topic.

The work presented herein is focused on students' perception of teamwork. Particularly, it aims to establish a catalogue of students' perceptions about teamwork. According to the reviewed literature, to date there is no other perceptions catalogue as put forward in this paper.

In order to obtain students' perceptions, open

coding is used. In doing so, students' perceptions are drawn from their evoked answers from an open-ended survey. This poses a new approach in the way to obtain perceptions. This catalogue is shown as a facilitator to the faculty in the identification and analysis of their students' perceptions.

Moreover, in this paper, evolution of students' perceptions along an academic year is analyzed. Perceptions of teamwork are measured at both the beginning and end of the academic year in two groups of students. Teamwork activities' nature in those two groups was different. This fact allowed us, not only to analyze the evolution of students' perceptions based on the catalogue, but also to consider the relevance of the relation between perceptions and activity's nature.

Summing up, this work pursues two objectives: on the one hand, to categorize undergraduate students' perceptions of teamwork in the form of a catalogue; and, on the other hand, to apply the perceptions of this catalogue to draw conclusions about the evolution of this perception as a result of conducting different activities during the course (specific interventions). These objectives are arisen in the following research questions:

Q01: What sort of perceptions of teamwork do students have?
Q02: Overall, how do students' perceptions about teamwork evolve from the beginning of the course to the end?
Q03: What designing factors affect how the overall perception develops?

This paper is arranged as follows; Section 2 describes the study context, and in so doing, provides details of the actions implemented in each course. Section 3 presents the participants and methodology employed to carry out the analysis. Section 4 provides the results of analysis. At this section, a qualitative analysis is developed. It allows us to obtain the catalogue of perception. Later on, a further analysis is conducted to assess evolution of students' perceptions; the perceptions are also connected to the activity's nature (i.e. design factors). Next, Section 5 discusses the limitations and implications of the study carried out. And finally, the last section 6 shows the conclusions drawn from the study.

2. The study context

The study was conducted during lab sessions of two courses in a large university in the East Spain with an enrolment of nearly 30 thousand students. Participants, as detailed in next section, were students of business administration module; concretely cour-

sing 'Business Organization' and 'Marketing and Legal Aspects' in the third and four year of engineering degree respectively.

In both courses, the ninety-four enrolled students were divided into four organizational units for the lab sessions. In each lab session, in both courses, Business Organization and Marketing and Legal Aspects, there were between 20 and 25 students approximately working in teams during each session.

The way to address team work in each course has some common aspects, but some other different.

In 'Marketing and Legal Aspects', teamwork was designed by considering teams formed by four students, self-selected members and with stable composition throughout the course (same members during the whole course). The outcome of the learning process was a project, in particular, a marketing plan. All the training activities were organized around that project. The activity was designed by considering not only the use of class time, but also additional time apart from the lab sessions. Students were expected to meet and work approximately 20 additional hours. The mark of the final project consisted in two sub-aspects: one being the mark of written work, and the other sub-aspect was the mark of the oral presentation delivered by team members. The course had a total of 15 hours of training (lab sessions) that comprises 7 lab sessions 2 hours long.

As far as 'Business Organization' is concerned, the content of each lab session is independent, and there is no direct continuity in either the work performed during each lab session or in the team composition. However, the team formation criteria remain unchanged: four members and self-selected. The working contents during each lab session are quite diverse: public presentation, value stream maps, motivation and leadership, production scheduling and ERP systems. Every lab session was independently assessed. There are specific handouts per session. All in all, the students worked in teams. They were divided into small groups in which they worked in a coordinated manner to solve academic tasks and to develop their own learning. The course had a total of 10 hours of training (lab sessions) that comprises 5 lab sessions 2 hours long.

Regarding the intervention carried out in both courses ('Business Organization' and 'Marketing and Legal Aspects'), it is noteworthy that students were not specifically trained for undertaking teamwork. However, they were provided with guidelines to promote successful teamwork such as: prior preparation of the work to be done, clear deadlines for each handout, conflict resolution practices during lab sessions or expected well-defined work content [11, 38].

3. Data analysis method

3.1 Participants

Eighty-seven students participated in this study. The participants were students of business administration module of a university in the East Spain. Specifically, this study analyses teamwork experience of undergraduate students enrolled in 'Business Organization' in the 3rd year and undergraduate students enrolled in 'Marketing and Legal Aspects' in the 4th year. There were 94 students enrolled in 'Business Organization', and 42 students (44.7%) completed an open-ended survey. In the case of Marketing and Legal Aspects, respondents were 45 out of 94 students (47.9%). So, students' participation in both surveys was nearly 50% (44.7% for 'Business Organization' and 47.9% for 'Marketing and Legal Aspects'). Therefore, we obtained nearly 50% student response rate, which is much higher than the 10–30% response rate that characterizes most voluntary surveys [21]. In fact, a 50% return rate is usually considered by statisticians sufficient to make the sample bias negligible.

It is interesting to remark that survey participation was not compulsory. However, students were encouraged to participate in two ways. On the one hand, the purpose of the research project was explained to the students according to the ethics guidelines. On the other hand, students obtained extra mark as a reward if they participated in the survey (0.3 extra points over the final course mark).

3.2 Data Collection/procedure

The study included two qualitative surveys. The surveys consisted in a couple of open-ended questions with a limited space response. The first survey was undertaken at the beginning of the term, and the second one at the end of it. Questions included in both surveys were essentially the same as shown below.

The questions posed in the first survey were:

1. Briefly explain what teamwork means for you. Identify at least three features.
2. Identify the advantages and disadvantages of teamwork.

The questions posed in the final survey were:

3. After this teamwork experience, please briefly explain what teamwork means for you. Post at least three characteristics.
4. After this teamwork experience, identify the advantages and disadvantages of teamwork.

The fact of using the same sample base to carry out two similar surveys but at different times enriches the obtained results. In this way, bias is reduced when identifying the catalogue of students' perceptions.

Moreover, as two surveys are available at different times, we can also analyze the evolution of students' perception of teamwork. In other words, we can analyze how they changed and evolved from the initial situation (before performing any activity) to the end of the course (after carrying out teamwork activities).

The surveys were spread through the institutional teaching platform on-line based on Sakai [39]. They were available from a specific opening date to a closing date. Students could not respond beyond this period to avoid disrupting the obtained information. Only the respondents having participated in both surveys have been considered in the study. All of these students had access to a computer and the Internet either at school or home.

3.3 Analysis method

Information collected from the surveys was analyzed by a qualitative methodology. Data were analyzed using open coding scheme [40, 41]. The process of coding represented the operations by which data were broken down, conceptualized, and put back together in new ways. It represents the central process by which theories are built from data [42]. The specific software used was ATLAS.TI [43] a computer program based on the exploratory analysis. For that, responses from the surveys were imported in ATLAS.TI from the institutional teaching platform in csv format.

In the first stage, sentences were chosen as a unit of analysis, according to the purpose of the study. Responses from the surveys were read by the researches through several times. Each researcher looked for themes or patterns in each response and identified each of them with a code. The memos option as notes was used, in order to complete description when necessary. After, the codes were analyzed to find similarities in meaning between them. Codes with the equivalent meaning were grouped into categories.

In this way, new codes emerged until theoretical saturation was reached. At that point, an increased sample does not provide extra categories to the results [17]. In this study, theoretical saturation was reached when 45% of the primary documents were processed. However, researches continued processing all the primary documents (up to 100%) since they were not only seeking to identify students' perceptions, but also their evolution along the courses. The process of coding the students' answers generated a final list of 14 categories of perceptions. The credibility of the research was enhanced by researcher triangulation and peer debriefing.

4. Results and analysis

In this part of the article, results are presented and analysed based on the questions initially posed in the study.

4.1 Q01: What sort of perceptions of teamwork do students have?

Having analyzed all the student surveys at the beginning of the term and at the end of it, 14 perceptions of teamwork were obtained, and therefore, 14 ATLAS.ti codes. They can be found in Table 1. The students were asked to evoke their perceptions regarding teamwork, both at the beginning and by the end of the course. Due to the fact that the responses were qualitative, the relevance of the obtained results focuses on the emerged quotes rather than the frequencies or number of occurrences (Table 2). In fact, if the survey had been repeated using a closed-ended questionnaire based on the identified quotes, it is highly probable that the obtained frequencies were higher. For that

reason, all perceptions have been considered relevant, even if their frequency of occurrence was low.

When observing all teamwork perceptions identified by students, the first seven in Table 1 are positive perceptions (i.e., they refer to positive effects of this type of work). However, it is noteworthy that although the first five perceptions themselves are, in pure theory, positive perceptions of teamwork, perceptions 6 and 7 are not truly positive perceptions because they do not meet the full definition of teamwork. Specifically, for perception 6, "An opportunity to do less work or under less pressure", students give an avoiding responsibility approach. Like perception 7, "A way of working that implies job tasks division" it corresponds to group work, but not teamwork. However, they remained in the study because the objective was not to identify the ability or knowledge of the teamwork definition, but the development of students' perception of this way to work. Perceptions numbered between 8 and 14 were considered negative perceptions of teamwork (or related to adverse effects of such work).

Table 1. Catalogue of engineering students' perception of teamwork

Perception of teamwork

1. An ideal way of working
2. An opportunity to enhance friendship
3. An opportunity to learn new concepts
4. An opportunity to get better results
5. An opportunity to help others
6. An opportunity to do less work or under less pressure
7. A way of working that implies job tasks division
8. A way of working that wastes more resources than individual work (time, coordination, planning)
9. A way of working in which, as a consequence of job tasks division, there are always problems for integration
10. A way of working that involves conflicting opinions (you can't do whatever you want)
11. A way of working that can imply problems in time availability
12. A way of working that can imply that the leader imposes his/her criteria on the rest of team members.
13. A way of working in which you may work with people with different requirement levels, and that can imply differences in workload and responsibilities and therefore unfair results
14. A way of working that may imply a source of personal problems

Table 2. Frequencies of students' perception of teamwork

Nº Perception	'Business Organization'				'Marketing and Legal Aspects'			
	Initial	%	Final	%	Initial	%	Final	%
1. Ideal	1	0.68	2	1.37	0	0.00	2	1.37
2. Friendship	2	1.37	2	1.37	5	3.42	4	2.74
3. Learn	11	7.53	17	11.64	21	14.38	23	15.75
4. Better Results	24	16.44	26	17.81	17	11.64	21	14.38
5. Help other	15	10.27	15	10.27	14	9.59	14	9.59
6. Less pressure work	10	6.85	9	6.16	2	1.37	1	0.68
7. Task division	4	2.74	1	0.68	3	2.05	0	0.00
Total Positive	67	45.89	72	49.32	60	41.10	65	44.52
8. More waste	18	12.33	23	15.75	18	12.33	4	2.74
9. Integration problem	0	0.00	0	0.00	1	0.68	3	2.05
10. Conflicting Opinions	15	10.27	9	6.16	25	17.12	3	2.05
11. Time Availability	2	1.37	1	0.68	10	6.85	11	7.53
12. Leader imposes	16	10.96	7	4.79	2	1.37	0	0.00
13. Differences Workload	11	7.53	22	15.07	24	16.44	12	8.22
14. Personal problem	17	11.64	12	8.22	15	10.27	3	2.05
Total Negative	79	54.11	74	50.68	95	65.07	36	24.66

In order to deepen in students' positive and negative perceptions of teamwork, frequently quotes have been selected, and they are discussed below. So, according to Table 2, we note from the positive perceptions that the most frequent, in both courses, and in both surveys (initial and final one) is perception number 4. This perception asserts that teamwork is 'an opportunity to get better results'. Some of the students' quotes who raised this perception were:

> *"The final work is more complete, thanks to pooling all the members of the team". "The advantages of teamwork are working together and dialogue, which is much more mature in my opinion".*

It also highlights frequency in perception number 5, which states that teamwork 'is an opportunity to help others'.

> *"Helping provide ideas and solutions. Collaborate in developing the project". "Helping each other".*

Perception 3, which states that teamwork is 'an opportunity to learn concepts, is also quite common':

> *"I have learned to distribute, manage and combine work together. I also had a good time, and obtained ideas and objectives synchronization". "Learning from fellow students". "I've learnt to do market research as accurately as possible".*

Regarding the negative perceptions, the most frequent quotations are those which refer to perception number 13. This perception asserts that teamwork 'is a way of working, and is a problem because students work with people at different levels of requirement to their own, which can be unfair in terms of differences in workload/responsibility':

> *"Part of the group always has more workload than others and, in most cases, there is no same level of commitment among them". "Some members of the group work more than others". "Lack of partners' commitment."*

Perception number 8 also stands out for its frequency, which states that teamwork 'is a form of work that consumes more resources (time, coordination, planning) than individual work':

> *"One disadvantage is that if group members do not work well together, they cannot reach the desired goal, and they may even require a higher level of planning". "So much time is lost when planning and dividing work". "The time required to complete the project or activity is longer since it is more difficult to reach a consensus on the solution to adopt than if the work was carried out by just one person".*

In the initial surveys for both courses, it is worth highlighting the frequency of perception 10, which states that teamwork is a way of working and is an issue that involves conflicting opinions,

> *"Difficult to choose or agree", "Often there is no way to agree". "Non-conformity of opinions".*

This perception finds its limit when teamwork is a problem because what you want is not done:

> *"Things do not occur the way you think". "Maybe the end result is not 100% to your own liking, it is difficult to adapt to everyone's ideas, not always your opinion is the one conducted". "Power of decision is not as wide as if working individually"*

However, the frequency of perception number 10 vastly reduced in both courses after the semester finished, and was more pronounced manner than in 'Marketing and Legal Aspects'. Something similar occurred with perception number 14, which is much more frequent in both courses in the initial situation, than at the end. In the final stage, this perception appears less, and this is slightly more marked in 'Marketing and Legal Aspects'. Some quotations related to perception number 14, 'a form of work that is a source of personal conflicts', were:

> *"You never know what kind of people you will find to form the team and they may not be to your liking". "There is a good atmosphere and relationship between team members; you cannot perform any team project if members do not get on well". Team members' character clash".*

Perception number 12 is also noteworthy, 'A way of working which can imply that the leader imposes his/her criteria on the other team members'. This perception initially appeared to be more marked in the 'Business Organization' course, but its frequency reduces, and even disappears in 'Marketing and Legal Aspects'.

4.2 Q02: Overall, how do students' perceptions about teamwork evolve from the beginning of the course to the end?

The answer to this research question is discussed in two stages. In the first stage, the number of positive and negative students' perceptions is analyzed. In the second stage, as students can show both positive and negative perceptions of teamwork simultaneously, a new variable, called overall students' perception of teamwork, is posed. This new variable allows the researcher to find when any given student has a larger proportion of positive perceptions than negative ones, or the other way around. With this approach, an analysis of how the overall perception develops from the initial situation to the final one can be performed.

4.2.1 First stage

Fig. 1 illustrates the students with 0, 1, 2 or >2 positive or negative perceptions for both courses at both the beginning and the end of the term. The solid line in Fig. 1 shows the average number of
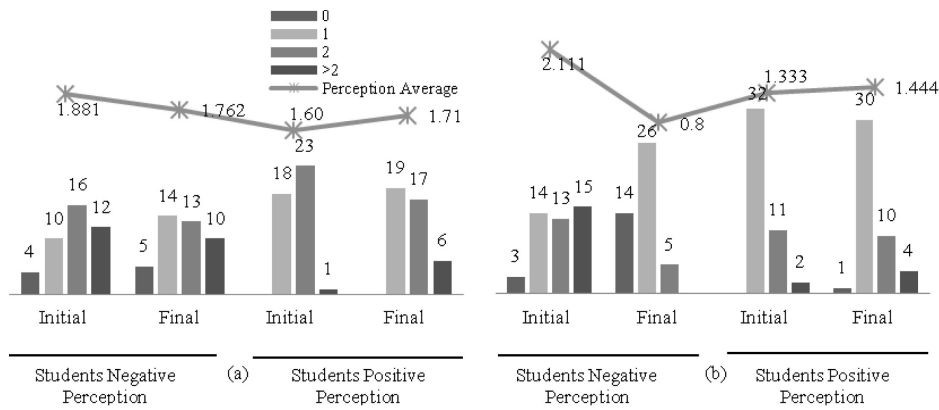
Fig. 1. Number of Students according Number of Perceptions and Perception Average (a) Course 'Business Organization' (b) Course 'Marketing and Legal Aspects'.

perceptions per student in each situation. In this figure, the development of students' perception can be graphically compared from the situation at the beginning of the term to the end of it.

With the 'Business Organization' course, we can see in Fig. 1(a) that no significant changes were found for the number of students' positive and negative perceptions between the beginning and the end of the term in frequency distribution terms. The average number of negative perceptions lower discreetly, while the number of students' positive perceptions increases discreetly.

In the 'Marketing and Legal Aspects' course, see Fig. 1(b), pronounced changes in the number of perceptions are seen. For the negative perceptions, the number per student significantly reduced. This situation caused the average negative perceptions to sharply drop from 2.111 at the start of term to 0.8 at the end of term. The distribution of the positive perceptions remained fairly stable with a slight improvement on the average.

4.2.2 Second stage

In order to assess the development of students' perceptions, a criterion to define students with positive, negative and neutral overall perception of teamwork was established.

It is considered that any student has overall positive perception when the number of positive perceptions is higher than the negative one; i.e. (Perception+) – (Perception–) $\geq$ 1. Otherwise, i.e. (Perception+) – (Perception–) < 1, it is considered that the student has an overall negative perception. When the student has an equal number of positive and negative perceptions, i.e. (Perception+) – (Perception–) = 0, it is considered that his/her overall perception is neutral. Table 3 shows the number of students in each category, as well as the average, standard deviation and variance of the overall perception.

According to the data shown in Table 3, the results for 'Business Organization' course of the

Table 3. Students' vision regarding teamwork

			(Percep+)-(Percep-)≥1		(Percep+)-(Percep-)<1		(Percep+)-(Percep-)=0	
			Positive Vision		**Negative Vision**		**Neutral Vision**	
			Initial	Final	Initial	Final	Initial	Final
BO		Students	8	14	18	18	16	10
	(Percep+)-(Percep-)	Average	**1.5**	**1.357**	**-1.333**	**-1.471**	**0**	**0**
		SDeviation	0.535	0.506	0.594	0.624	0	0
		Variance	0.286	0.256	0.353	0.396	0	0
MAL		Students	8	17	23	12	14	16
	(Percep+)-(Percep-)	Average	**1.25**	**1.938**	**-1.864**	**-1.083**	**0**	**0**
		SDeviation	0.488	0.772	0.889	0.289	0	0
		Variance	0.238	0.596	0.790	0.083	0	0

initial and final surveys are similar to those of 'Marketing and Legal Aspects' course. This fact was likely to happen given the result of the previous analysis performed in the first stage. In 'Business Organization' course, all the students with an overall negative perception of teamwork maintained their overall perception at the end of term. The average, standard deviation and variance of the negative overall perception remained stable. The number of students with an overall positive perception of teamwork increased from 8 to 14. This was caused by students failing to have a neutral overall perception of teamwork. However, at the end of the term for 'Business Organization', the average overall positive perceptions decreased.

In 'Marketing and Legal Aspects' course, it is clearly shown how the number of students with an overall negative perception lowered from 23 to 12 students. It is also observed that the number of perceptions identified to be negative overall perception also lowered. The number of students with an overall positive perception increased from 8 to 17, and the number of perceptions identified in the positive overall perception also rose. We should pay attention to the fact that the number of students with a neutral overall perception increased from 14 to 16.

To summarize this section, it may be asserted that when analyzing both particular and overall perceptions for 'Business Organization' course, teamwork perception improved throughout the term, but only very slightly. During 'Marketing and Legal Aspects' course, the number of negative perceptions expressed by students at the end of the term considerably dropped. Regarding the overall perception of 'Marketing and Legal Aspects' course, the study reveals a marked improvement in students' overall perception of teamwork, with a considerable decrease in the number of students with an overall negative perception and a larger number of students who have an overall positive perception.

4.3 Q03: What designing factors affect how the overall perception develops?

As described in section 2, the approach to teamwork in both courses, 'Marketing and Legal Aspects' and 'Business Organization', differs slightly. Due to the fact that it was found that evolution of the overall perception of teamwork differed in both courses, the formulation of research question Q03: 'What designing factors affect how the overall perception develops?' as being appropriate was confirmed.

To address this question, the study focused first on those designing factors that differed in both courses.

Team Longevity is one of the main differences between them.

It was observed that in the course where the team

was maintained for the whole term ('Marketing and Legal Aspects'), the overall perception of teamwork improved much more than for the other course ('Business Organization'). In 'Business Organization' course, and during every lab session (2.5 h long), a different team was formed, unlike in 'Marketing and Legal Aspects' where the team remained unchanged for the whole course. Moreover, in 'Marketing and Legal Aspects' course, where team longevity was longer, teams were working on the same project during the whole course. It is important to highlight at this point that, the main assignment remained constant throughout the course, and this fact improved team cohesion. Additionally, students enrolled in 'Marketing and Legal Aspects' course were required to work additional hours apart from the time spent in class (approximately 20 extra hours). This extra dedication, outside class hours, meant a higher number of negative perceptions relating to this fact, as seen in Perception 11 (Table 1): 'A way of working that can imply problems in time availability'. This perception rose to 7.53% at the end of the term (Table 2). This fact did not, however, significantly affect the fact that the overall perception of teamwork in 'Marketing and Legal Aspects' substantially improved.

In 'Business Organization' course, where the improvement in the overall perception of teamwork was subtle, the work done during every lab session was independent of the previous session and, as previously mentioned, it was done even with different team mates. However it was not necessary to work outside class times, so Perception 11 in Table 2 hardly appeared at the end of term (0.68%).

Regarding the common factors employed (self-selection and team size), since the development in the overall perception of teamwork was positive in both courses, it can be stated that both factors were adequate.

5. Discussion

Our aim in this article was twofold. On one hand, to categorize undergraduate students' perceptions of teamwork in the form of a catalogue; and, on the other hand, to apply the perceptions of this catalogue to draw conclusions about the evolution of this perception as a result of conducting different activities during the course (specific interventions).

The aim of studying these perceptions is based on the fact that they are important for students to develop the teamwork skill. The main reason for this, as discussed above, teamwork is a highly sought after skill in the workplace to be acquired by future graduates.

Our starting point was based on the assumption that given the relevance of teamwork skill within the

EHEA framework, acquisition of such skill requires students to be predisposed to teamwork and to, therefore, have a positive perception of this working methodology [18].

Summarizing the obtained results, a catalogue of 14 students' perceptions of teamwork was obtained, the evolution of students' perceptions of teamwork has been assessed and the nature of the teamwork activities (design factors) has been also analysed.

Regarding the catalogue of students' perceptions, it has been obtained by using open coding for the qualitative analysis: The processed data was obtained from an open-ended survey undertaken with students at the beginning and end of term. These 14 perceptions have been classified as those representing students' positive teamwork perception and negative teamwork perception. These catalogues of perceptions, has been obtained by using open coding methodology. In doing so, students' perceptions are drawn from their evoked answers from an open-ended survey. Therefore, the relevance of the obtained results focuses on the emerged quotes rather than the frequencies or number of occurrences. This poses a new approach in the way to obtain perceptions. This catalogue is shown as a facilitator to the faculty in the identification and analysis of their students' perceptions.

Additionally, perceptions identified by the catalogue were used to assess the development of students' perceptions of teamwork throughout the term. Particularly, their overall perception of teamwork at the beginning of term and the end of term was analysed.

Finally, nature of teamwork activities (design factors) was analysed in order to seek those that imply an improvement in the perception of students studying engineering. In doing so, the development of the overall perception of undergraduate students on two specific courses of an engineering degree was studied in detail. These courses differed in terms of their approach to teamwork activity. It was observed that, regarding the course in which team members remained working together throughout the term (longer team longevity); the overall perception of teamwork showed much more marked improvement. It also appeared that maintaining a central thread of the work to be undertaken by teams during the term also improved the overall perception of teamwork more sharply than when independent activities were performed throughout the term.

In addition, since in both courses the overall positive perception of teamwork improved in a more or less marked way, it can be stated that in this context, both factors (self-selection and pre-set team size) were sound decisions to achieve or maintain an overall positive teamwork experience.

6. Conclusions

This work has analysed teamwork perceptions of students in engineering at a university at the East of Spain. The research questions pursued in this study are all answered in section 4 and discussed in section 5.

A catalogue of 14 students' perceptions of teamwork has been obtained. According to the reviewed literature, though some works can be found dealing with students' perception of teamwork, there is no other catalogue of students' teamwork perceptions similar to that provided herein. This catalogue of perceptions can be used to identify what student's overall perceptions of teamwork are like, based on the fact that the better teamwork experiences that students are involved in, the more they improve this skill.

Additionally, a clear relationship between the design of teamwork activity and evolution of students' perceptions throughout the term was confirmed. These aspects have been previously studied in the literature, but they have never been evaluated from the perspective of this catalogue of perceptions. As a conclusion, faculty should pay special attention to design teamwork activities that considers all the factors that can improve the overall perception of teamwork. The aim of this process is to assure that students were more successful at acquiring the teamwork skill.

From the results obtained in this work, ample opportunities for future research are opened. For example, based on the catalogue of perceptions identified herein, researchers are now able to conduct a larger study with a bigger sample population (in this case, a quantitative study) that associates all these categories of perceptions with certain design factors of teamwork activities.

Therefore, with this research, a powerful tool has been provided to faculties which may allow them to adapt the design of teamwork activities in a particular course, based on students' initial perception, to achieve a better teamwork experience and, therefore, the acquisition of the aforementioned skill will improve.

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