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TEAMWORK COMPETENCY SCALE (TCS) FROM THE INDIVIDUAL PERSPECTIVE IN UNIVERSITY STUDENTS

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Abstract

The main purpose of this study was to design and validate a scale to assess the teamwork competency of undergraduate students (TCS, Teamwork Competency Scale). The research instrument designed and subjected to validation has nine specific dimensions: Collective effectiveness, learning orientation, group goal setting, planning and coordination, communication, conflict management, problem solving, performance monitoring and supportive behaviour. The instrument was validated using a sample of 802 first-year students at a university in Chile. The method of partial least squares (PLS) was used within a structural equation modelling (SEM) framework for statistical analysis. The results show that the TCS is a valid and reliable research instrument for the assessment of teamwork competency in undergraduate students.

Keywords – Teamwork competency, Higher education, Instrument development, Psychometric testing.

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1. Introduction

The importance of teamwork in most workplaces and organisations (Lohmann, Pratt, Benckendorff, Strickland, Reynolds & Whitelaw, 2019; Matturro, Raschetti & Fontán, 2019; Nadal, Mañas, Bernadó, & Mora, 2015; O'Neill, Larson, Smith, Donia, Deng, Rosehart et al., 2019; O'Neill, White, Delaloye & Gilfoyle, 2018) and the complexity of knowledge (Figl, 2010), mean that collaboration and teamwork are ever more important in the society of today (Van den Bossche, Gijselaers, Segers & Kirschner, 2006). When people come together to perform collective tasks, they bring to bear their teamwork skills and capacities, which for the purposes of this study we have called teamwork competency. That competency can be defined in general terms as the set of knowledge, attitudes and skills required to work with others on tasks aimed at achieving common, shared goals (Torrelles-Nadal, Coiduras-Rodríguez, Isus, Carrera, París-Mañas & Cela, 2011). Teamwork competency is a question of personal disposition and the capacity

to work with others to carry out common activities and achieve common goals, exchanging information, taking on responsibilities, solving problems as they arise and contributing to the team's development and improvement (Torrelles-Nadal et al., 2011).

From the perspective of the individual, teamwork skills can be described as the characteristics that a person needs to have in order to be a successful member of a team (Baker, Horvarth, Campion, Offermann & Salas, 2005). Those skills are classed as generic when the individual is able to transfer and deploy them to work in any team (Figl, 2010). Those generic skills are important to the conception, design and provision of adequate training that helps participants to acquire teamwork competency (Baker et al., 2005; Figl, 2010). Chen, Donahue and Klimoski (2004) proposed that higher education should focus on developing transferable teamwork skills to provide graduates with a grounding to enable them to work effectively in a range of different teams and to work with different colleagues over the course of their careers.

The importance attributed to teamwork competency has awakened interest in incorporating teamwork training in university degree programmes (Atxurra, Villardón-Gallego & Calvete, 2015; Figl, 2010; Viles-Diez, Zárraga-Rodríguez & Jaca-García, 2013), whether as a generic competency (Figl, 2010) or tailored to the career which is the focus of a particular degree course.

Since the 1970s, there have been studies of how teams function; however, studies into teamwork competency have grown considerably in number recently (Torrelles-Nadal et al., 2011). An adequate way of measuring teamwork competency and the best ways to teach these skills have, even so, yet to be determined (Nadal et al., 2015).

Researchers have found that individuals in organisations may lack teamwork competency, particularly when they have been employed on the basis of their technical skills or know-how, despite efforts to provide training to develop teamwork competency (Nadal et al., 2015). This suggests that universities should offer more systematic training in aspects of teamwork competency (Jaca, Viles & Zárraga-Rodríguez, 2016).

This study contributes to the measurement of teamwork competency on the basis of students' self-perception, excluding the effect of involvement in actual teams and tasks. That allows trainers not only to measure the development of teamwork competency over time, but also to determine in advance of their starting to work in a team which specific components of the competency an individual possesses and which components they lack so that training can be focused on the skills that are lacking. It also allows students to reflect on their development of teamwork skills and capacities. Such measurement requires an exploration of which components of teamwork competency should be taken into account and how generic teamwork competency can be measured. The objective of this study is the design and validation of an instrument to measure teamwork competency on the basis of different factors that can improve the feedback given to students over the course of the different stages of the educational process. For purposes of the study, we developed a scale that was used in a broad sample of first-year university students. The results obtained from use of the instrument were analysed to reach conclusions.

Section 2 sets out the theoretical framework with description of the principal dimensions of teamwork competency. Section 3 describes the study methods including description of the sample, procedure and statistical analysis. The final section contains the results, discussion and conclusions.

2. Theoretical Foundations: Dimensions of Teamwork Competency

Evaluation of, and training for, teamwork requires identification of the dimensions of teamwork competency and an understanding of how to determine the training needs of individuals. Over recent years, a number of theoretical models have been put forward of the factors that explain the effective performance of teams and the members of teams. The most notable models in the literature at the level of team performance are the IPO team effectiveness model (McGrath, 1964) and the Big Five in teamwork (Salas, Sims & Burke, 2005). In terms of models centred on the teamwork competency of

individuals, we have teamwork KSAs (Stevens & Campion, 1994), the model of Cannon-Bowers, Tannenbaum, Salas and Volpe (1995), and the model in Rousseau, Aubé and Savoie (2006), and the ABCs of Teamwork (Salas & Rosen, 2013).

The ABCs of Teamwork (Salas & Rosen, 2013) provides a model of teamwork evaluation that can be used to measure teamwork competencies in different environments. Unlike other models of teamwork in the literature, this model includes both generic and specific dimensions of teamwork competency. It also has indicators for the evaluation of those dimensions that allow measurement of each dimension of competency in training or organisational environments with different teamwork requirements (Salas, Rosen, Burke & Goodwin, 2009). The competencies required for effective team performance include: team orientation, collective effectiveness, team cohesion, performance monitoring, supportive behaviour, communication and flexibility. The authors explain those competencies as attitudes, knowledge and skills, an understanding of which is useful for the formation of teams and the evaluation of their performance.

This model generates nine generic or transferable competencies (Cannon-Bowers et al., 1995) that individuals could in principle develop in higher education environments (Chen et al., 2004). Individual teamwork competencies are those that allow each member of a team to successfully participate in teamwork (Baker et al., 2005), whereas generic competencies are those that can be transferred by individuals to work on different teams. On that basis, we can identify the following competencies or dimensions:

Group Goal Setting. This dimension refers to the ability to establish common objectives. Setting group goals requires interpretation and evaluation of the team's mission and identification of the principal tasks and the resources needed to complete that mission (Salas et al., 2009).

Planning and Coordination. This is the ability to work sequentially in specific roles and effectively organise activities (Ellis, Bell, Ployhart, Hollenbeck & Ilgen, 2005). It is a dimension of self-management that implies that team members coordinate and synchronise activities, information, and tasks interdependently with other team members (Chen, Kirkman, Kanfer, Allen & Rosen, 2007).

Conflict Management. This is an interpersonal dimension and refers to the proactive or reactive way in which each team member deals with conflict. Effective conflict management includes mutual respect, willingness to compromise, and the development of rules that foster cooperation and harmony (LePine, Piccolo, Jackson, Mathieu & Saul, 2008). Team members may view conflict as an opportunity to improve the team through conflict resolution that requires identifying and negotiating the best way to resolve each conflict (Salas et al., 2009).

Problem Solving. This is the process of identifying any discrepancies between an existing situation and the desired situation and determining the strategies for bridging the gaps (Bonner, 2004). Team members adjust to carry out the team task (Torrelles-Nadal et al., 2011) by activating channels of participation to make shared decisions about which aspects of the problem should be solved and how (Chen et al., 2004; Salas et al., 2009).

Communication. This is important in all phases of teamwork for team members to provide important information and contribute to the development of a shared vision (Fransen, Kirschner & Erkens, 2011). Team members therefore require the capacity to understand the information that it is exchanged over their networks and to use those networks to share information (Ellis et al., 2005). This dimension implies that team members make sure that the message they have sent has been understood by checking the information with others. They also mobilise information within the team by seeking information from different sources and proactively exchanging information (Salas et al., 2009).

Collective Efficacy. In team contexts, *collective efficacy* refers to team members' beliefs about the ability of the team to accomplish tasks (Alavi & McCormick, 2018). Cannon-Bowers et al. (1995) argue that it is important to determine attitudes towards teamwork because those attitudes are key factors in determining the effectiveness of a team. Therefore, just as self-efficacy or a person's perception of their own

competency in specific tasks has been related to individual performance, the concept of collective efficacy has been related to individual performance within the team context, understood as self-efficacy (Chen et al., 2004). In educational contexts, the role of collective efficacy is critical to the performance of a team because students who consider their learning teams to be capable of performing tasks are likely to readily participate in team processes. However, there has been relatively little research into this personal belief (Alavi & McCormick, 2018).

Performance Monitoring. This is one of the most influential dimensions of teamwork and involves being aware of and monitoring other team members' performance to ensure that everything is working as it should. It is a property of effective teams, whereby teams maintain awareness of the team's functioning by mutual monitoring among team members (Salas et al., 2005).

Supportive Behaviour. This is the ability of members of a team to help other members to do their job in the best possible way. This help can be indirect (feedback or training) or direct (assistance with a task or taking on a task from a teammate who needs help) (LePine et al., 2008). This is a skill that has to be developed by each team member to anticipate the needs of the of other members of the team, which in turn requires an understanding of the responsibilities of all team members and the ability to balance workloads (Salas et al., 2005).

Learning Orientation. This is characterised as a process by which team members weigh internal feedback and ask for external feedback to evaluate performance, discuss errors and generate team change (Savelsbergh, van der Heijden & Poell, 2009). Members who are learning oriented maintain a focus on learning objectives. Those who guide the scope and meaning of persistent learning behaviours within the team, i.e., team members who present this competency, encourage proactive learning and development of competency within the team (Bunderson & Sutcliffe, 2003).

Those nine proposed dimensions allow us to describe the complexity of teamwork competency not only with respect to the skills that each team member can develop to work effectively, but also with respect to attitudes considered essential for integration of the different teamwork skills of each team member to produce the desired collective performance (Cannon-Bowers et al., 1995).

Teamwork competency training in higher education needs the support of processes of evaluation in order to assess the effect of interventions and training courses on teamwork (Adams, 2003). Measuring teamwork competency can contribute to its assessment and be used to give students feedback on their development (Figl, 2010). Knowing the level and quality of teamwork competency is of interest both to the organisations in which those students will eventually work and to the universities and institutions of higher education that educate and train them (Nadal et al., 2015). Consequently, recent years have seen a number of studies on the evaluation of teamwork competency. Some are based on observation of team and individual performance (Kemery & Stickney, 2013) while others measure knowledge of and attitudes towards teamwork (Baker et al., 2005). Stevens and Campion (1994) designed and validated Teamwork KSAs (Knowledge, Skills, and Abilities) to measure teamwork in organisations from a cognitive and behavioural perspective. While that scale has been the basis for the development of other scales and studies in higher education (Chen et al. 2004), Teamwork KSA takes account only of the behaviours that form part of teamwork competency and it has been shown to have serious limitations in predicting worker performance (O'Neill, Goffin & Gellatly, 2012).

The measurement of teamwork presents challenges because it is a complex, dynamic and multidimensional phenomenon. Any evaluation system must take those characteristics into account (Salas, Burke, Fowlkes & Priest, 2004). Most of the instruments found in the literature (Teamwork Skills Inventory (TSI) of Strom and Strom (2011); Learning Partner Rating Scales (LPRS) of Kemery and Stickney (2013); the CATME system of Loughry, Ohland and Woehr (2013) and the ITPmetrics.com of O'Neill et al. (2019), do not address teamwork competency individually, but rather focus on competency at the level of the team. One of the main challenges a few years ago was to detect and evaluate teamwork and the competencies demonstrated by team members during the execution of a team task (Thiruvengada

& Rothrock, 2007). Now there is a need to measure teamwork competencies that can be transferred to different team environments (Driskell, Salas & Driskell, 2018). It is also the case that few instruments are suitable for determining the level of teamwork competency in university students when they are accepted into academic institutions to follow a course of study. Teamwork competency is not usually assessed in an academic context: it is rather the result of a team's work that is assessed (Fidalgo-Blanco, Lerís, Sein-Echaluce & García-Peñalvo, 2015). In addition, some dimensions, such as performance monitoring and learning orientation, are not examined. Those unassessed dimensions depend on the development of other basic aspects of teamwork and are difficult to measure by direct observation of behaviour within the team (Ellis et al., 2005). Such direct observation is the strategy underlying most teamwork measurement scales.

We therefore propose the creation of a scale for the measurement of teamwork competency based on the model ABCs of Teamwork by Salas et al. (2009), which breaks teamwork competency down into 30 dimensions of teamwork to construct a scale applicable in organisational environments. This reflects the complex, multidimensional nature of teamwork competency. The ABCs model measures teamwork competency by measuring the knowledge, skills, and attitudes required for effective teamwork (ABCs of Teamwork). The model favours training in the generalisable dimensions of teamwork competency that can be used in different teams, tasks, and contexts (Salas, Lazzara, Benishek & King, 2013).

3. Methods

3.1. Sample

The participants were 802 first-year students aged 17-32 years old (M = 19.62 years; SD = 1.57 years; 52.40% female), at a university in the central southern region of Chile. They were classified as first-year students because they were not part of formal learning teams at the time of data collection. That made it easier for students to respond in general terms about their competency rather than reflecting their specific experience of working on a particular team or being influenced by differences between the learning processes at the university. A stratified random sample was taken in which each faculty, and each of its degree programmes and courses were treated as strata to ensure that the sample was representative. With this type of sampling, the sample's total error cannot be greater than the error of the lowest stratum, which was set at 5%, with a confidence level of 95%. Of the students in the sample, 30.5% were from the Faculty of Engineering (the students in the faculty represent 27% of the student body); 14.1% from the Faculty of Medicine (19% of the total); 8.4% from Economics (10% of the total); 25.4% from Education (24% of the total); 17.6% from Communication, History and Social Sciences (11% of the total); and 4% from Science (3% of the total). First-year students in the different degree programmes had similar admission profiles and, consequently, comparable prior experience of teamwork. Likewise, although the different degree courses approach teamwork in different ways, the students had not yet received any specific teamwork training. The sample size was confirmed to be adequate for the 30 items in the applied scale, under the criteria in Hair, Risher, Sarstedt and Ringle (2019) according to which the ideal sample size is at least ten times the total number of items in the study.

3.2. Procedure

The scale was developed and tested in five stages (Figure 1).

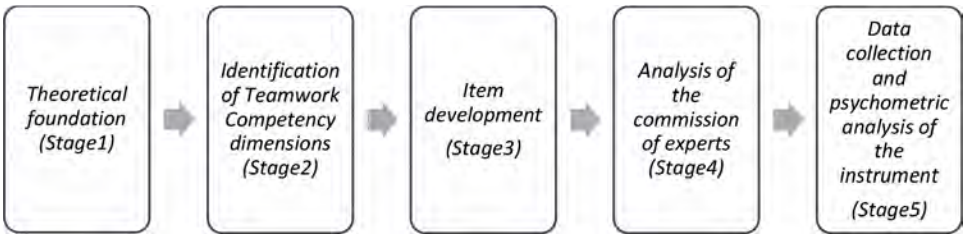

Figure 1. Scale creation process

In Stage 1, following a literature review, the theoretical basis and the dimension structure of the instrument were determined based on the model of Salas et al. (2009), which systematises the dimensions of teamwork competency. In Stage 2, a study was carried out to identify the dimensions of teamwork competency in university students through six group interviews conducted with a total of 36 students. Stage 3 was the preparation of the individual items. In Stage 4, the items were evaluated by an expert committee to determinate the appropriateness of the items and their importance. Finally, data were collected using the instrument and psychometrically analysed in Stage 5. Data collection took place between 2015 and 2017. The instrument in its original form was in Spanish.

3.2.1. Stage 1. Theoretical Foundation for the Teamwork Competency Scale (TCS)

The basic theoretical foundation for the instrument was the model of Salas et al. (2009), which systematises the dimensions of teamwork competency in organisations. That model was used to exhaustively review the dimensions of teamwork competency in its three components: attitudes, skills and knowledge. Dimensions were selected for inclusion in the new model based on the focuses of higher education programmes aimed at developing transferable teamwork competency, according to Chen et al. (2004), i.e., a set of general competencies. It was assumed that after graduating from university, students would go on to join various teams and work with various colleagues. Consequently, dimensions were selected on the basis of two criteria: suitability for development through training in higher education settings and transferability from team to team.

3.2.2. Stage 2. Identification of Teamwork Competency Dimensions on the Basis of the Perceptions of University Students

Following determination of the theoretical basis of the instrument, a study was carried out to identify the dimensions of Teamwork Competency self-perceived by university students. The dimensions of teamwork were explored as part of a subject called Team Management. Six group interviews were conducted with a total of 36 students. The teams were formed on the following basis: (1) students who had been working as a team for at least six months, (2) teams that had performed best in terms of innovation, social impact and delivery on time and to budget. Of the total sample, 67% were business administration students and 33% were studying accountancy.

Ninety-minute group interviews were held with each selected team. The questions put to the students were based on the IPO model of Sivasubramaniam, Liebowitz and Lackman (2012), who exhaustively analysed the dimensions of effective teamwork in the IPO model in teams developing new products through a meta-analysis of 312 studies. The students were asked three open-ended questions about the profile of the team they had worked in, how they had worked as a team to develop a common product, and what the outcome had been for the team and the product they had developed. The sessions were sufficiently flexible to allow supplementary questions to the students as they were speaking so as to collect as much information as possible.

The information from the students' responses was organized in a coded matrix. The information was then grouped into emergent categories that were compared with theoretical models of workplace team performance and the selected dimensions emerged from that comparison. To ensure that information coding was objective, it was triangulated by the research team: the matrix was reviewed by two experts (a person with 20 years' experience leading workplace teams and a teamwork researcher). The categories that had emerged from the coding process were reviewed in the light of the views of trainers of workplace teams to confirm validity (triangulation). The teamwork performance model for the students who took part in this first study showed the dimensions that (a) could be identified as part of each student's teamwork competency during ongoing teamwork process and in the outcome and that (b) were capable of being trained in higher education. Those dimensions are the capacity for continuous learning, group goal setting, planning and coordination, communication, conflict management, and problem solving.

On the basis of all the foregoing, we determined the nine dimensions described in Section 1: *Group Goal Setting* (the capacity to set common objectives), *Planning and Coordination* (the capacity to work sequentially in specific roles and effectively organise activities), *Conflict Management* (the proactive or reactive way in which each team member deals with conflict), *Problem Solving* (the process of identifying discrepancies between an existing situation and the desired situation and identifying strategies to eliminate those discrepancies), *Communication* (the capacity to understand information exchanged through a team's communication networks and to share information through those networks), *Collective Efficacy* (each member of a team's individual assessment of the team's capacity to accomplish tasks), *Performance Monitoring* (mutual awareness and monitoring of team members' performance in order to ensure that everything is working as it should), *Supportive Behaviour* (the capacity of members of a team to help each other to do their job in most effective way), and *Learning Orientation* (the capacity to absorb internal feedback and to ask for external feedback in order to evaluate performance, discuss errors and generate team change). Those dimensions were used to design the Teamwork Competency Scale, as described in the next stage.

3.2.3. Stage 3. Item Development

From the results of the group interviews and based on the model proposed by Salas et al. (2009), 40 items in Spanish were pulled across the nine dimensions. The process for item selection followed the following sequence. First, through the qualitative analysis of the interviews, we identified teamwork behaviours and attitudes in each category that emerged from the information coding process. Those behaviours and attitudes were compared with Salas et al. (2009), which sets out not only an exhaustive catalogue of the dimensions of teamwork competency, but also a description of the different behaviours and attitudes disaggregated into each dimension of the Salas model.

An example from the first dimension 'Group Goal Setting' is the item "I help to set specific, challenging goals". This item refers to a central feature of goal-setting: the collaborative efforts of team members to set clear and challenging goals (Salas et al., 2009). The dimension 'Planning and Coordination' refers to the sequential performance of identified roles to organise the team's activities in an effective manner (Ellis et al., 2005). An example of an item from this dimension is "I collaborate in order for us to plan our work". The third dimension 'Conflict Management' posits conflict as an opportunity to improve the team, which includes analysing and negotiating the best resolution (Salas et al., 2009). An example of an item related to this is: "I look for solutions to conflicts in the team that are mutually beneficial for all members of the team".

The fourth dimension 'Problem Solving' refers to the adjustments that team members make to carry out the team's task (Torrelles-Nadal et al., 2011). This implies knowledge of the task. An example of an item is "I identify the most important aspects of the problem for completing the task".

A cross-cutting dimension of all phases of teamwork is 'Communication'. An example of an item in this dimension is "I check information with my colleagues to see whether we have all understood the same thing". This item reflects an important aspect of communication within teams: sharing important information that contributes to the development of a shared vision (Fransen et al., 2011).

An example of an item for the Collective Efficacy dimension is "I share positive opinions about the team's ability to achieve objectives with my colleagues". This item relates to team members' assessment of the team's ability to accomplish tasks (Alavi & McCormick, 2018). 'Performance Monitoring' is one of the most significant dimensions of teamwork that affects various aspects of teamwork competency such as Supportive Behaviour and Learning Orientation. It involves activities to monitor the performance of team members. An example item is "I acknowledge it when a team member is performing very well".

'Supportive Behaviour' in a team can take different forms such as balancing workloads, anticipating the needs of peers or providing support in tasks (Salas et al., 2005). An example of an item is "I help my colleagues when they need it without them having to ask". For the Dimension 9, 'Learning Orientation',

which comprises activities of search and delivery of feedback to improve performance (Savelsbergh et al., 2009), an example of a proposed item is "I seek feedback from outside the team".

3.2.4. Stage 4. Review by the Expert Committee and Pilot Test

Following extraction of the 40 items, they were reviewed by a panel of ten experts who assessed the appropriateness of the items in the nine dimensions and considered their importance on a five-point Likert scale from 1 (Not important) to 5 (Very important). The experts had access to the online tool and were given three weeks to complete their review. Based on their responses, 36 items were selected and refined and included in the preliminary version of the instrument. The selection criteria were that the average importance of an item as rated by the experts was greater than three, that the items had been correctly positioned in their dimensions, and that the dimensions were balanced. The validity of the scale was then assessed in a pilot sample of 154 students using exploratory factor analysis following the unweighted least-squares method and direct Oblimin rotation. Some items (Items 18, 25, 24, 26, 32 and 36 of the preliminary version of the scale) had factorial loads below 0.4 or were saturated in more than one factor to a similar extent, such that it was necessary to remove those items for goodness-of-fit of the model.

3.2.5. Stage 5: Data Collection and Psychometric Analysis of the Instrument

Finally, the psychometric capacity of the instrument was tested. Participation was completely anonymous and voluntary. Before starting the questionnaire, the students were informed of the nature and objectives of the research. They all signed an informed consent. The data was collected from August to September of 2017, during university term time in Chile. It took approximately 15 minutes to complete the instrument. Subsequently, the psychometric capacity of the scale was analysed. The results from that analysis are presented below. As suggested in the literature (Plumed, Prado-Gascó, Badenes, López & Barrón, 2013), the properties of the items and the reliability of the instrument were first analysed. Its psychometric capacity was then tested using exploratory factor analysis (EFA), confirmatory factor analysis (CFA), average variance extracted (AVE) (Dingler, von Davier & Hao, 2017) and composite reliability (CR).

3.3. Instruments

The final version of the instrument (Teamwork Competency Scale, TCS) consisted of a self-reported scale composed of 30 items grouped into nine different dimensions: group goal setting, planning and coordination, conflict management, problem solving, communication, collective efficacy, performance monitoring, supportive behaviour and learning orientation. The scale is based on a five-point Likert scale (from 1 "Never" to 5 "Always"). Table 1 below lists the dimensions and the items with the correct nomenclature.

Dimension	No.	Items
Collective efficacy	EFI1	I share positive opinions about the team's decision-making ability with my colleagues.
	EFI2	I share positive opinions about the team's ability to achieve objectives with my colleagues.
	EFI3	I share positive opinions about the team's ability to motivate each other to complete tasks with my colleagues.
Learning orientation	ORI1	I give my colleagues feedback about their performance.
	ORI2	I look for feedback outside of the team.
	ORI3	I ask my colleagues for feedback about my performance.
	ORI4	I integrate what I have learned from past performance.
Planning and coordination	PLA1	I collaborate in defining the specific desired results.
	PLA2	I review how actions can be carried out.
	PLA3	I collaborate in order for us to coordinate our work.
	PLA4	I collaborate in the distribution of roles and responsibilities.

Dimension	No.	Items
Performance monitoring	PER1	I know exactly what my colleagues' workloads entail.
	PER2	I recognize when my teammates make mistakes.
	PER3	I recognize when a team member achieves superior performance.
Supportive behavior	SUP1	I help my colleagues when they need it without having to ask.
	SUP2	I ask my colleagues for help when I am unable to finish my part of the work.
	SUP3	I collaborate in redistributing tasks.
Establishment of group objectives	EST1	I talk to my colleagues in order to establish common objectives for all of us.
	EST2	I talk to my colleagues about how to apply our resources in order to fulfil the team's objectives.
	EST3	I help establish specific, challenging goals.
Problem solving	PRO1	I determine the important aspects of the problem in order to complete the task.
	PRO2	I help my team in order to reach a mutual understanding of the problem in order to complete the task.
	PRO3	I provide solutions for the problem inherent in the task.
Conflict management	MAN1	I look for solutions to team conflicts that are mutually beneficial for all of my colleagues.
	MAN2	I help my colleagues implement appropriate strategies in order to resolve team conflicts.
	MAN3	I speak openly with my colleagues about team conflicts.
Communication	COM1	I make sure that what I communicate is understood.
	COM2	I check information with my colleagues to see if we all have understood the same thing.
	COM3	I search for all possible sources of information.
	COM4	I submit relevant information without having to be asked.

Table 1. Nomenclature (NOM) and description of items for each dimension

3.4. Statistical Analysis

Statistical analysis was performed using SPSS (*Statistical Package for the Social Sciences*, Version 22) and SmartPLS version 3.1, (Ringle, Wende & Becker, 2015), and FACTOR (Lorenzo-Seva & Ferrando, 2006). The absence of normality was determined using Mardia's coefficient (Mardia, 1970). Then, the properties of the items were analysed on the basis of item-total correlation coefficients, variations in the Cronbach's alpha coefficients when items were removed, and the reliability of the instruments. Psychometric evaluation tested the instrument's construct validity (exploratory factor analysis (EFA) and confirmatory factor analysis (CFA)) and reliability (Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE)) (Fornell & Larcker, 1981) in a study sample of 802 students. Following EFA, CFA was used to validate the factorial structure of the scales, using SEM-PLS. For PLS, the database was first purged using the listwise method to eliminate missing values (Little & Rubin, 1987) and atypical values using the Mahalanobis distance (D2), which allows detection of extreme observations, such as questionnaires in which all of the questions were scored 1. We eliminated seven missing cases and three cases with extreme values. Finally, we tested asymmetry and kurtosis, which showed that the variables did not show multivariate normality.

Analysis began with principal component analysis, followed by structural equation modelling (SEM) using partial least squares (PLS). Factor analysis assessed the use of different correlations between items to explain the variables based on an anti-image matrix. The values for the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were required to be above 0.7 and significant, respectively.

PLS is a multivariate technique that combines factor analysis with linear regression. PLS does not assume that the distribution is a normal multivariate distribution and that the observations are independent and is recommended when there is comparatively little theoretical knowledge on a certain topic (Benitez, Henseler, Castillo & Schubert, 2020). There is also a greater probability of obtaining poorer model adjustments with covariance-based methods when the theoretical structure is complex (Benitez et al., 2020).

For PLS, the scale was assessed using reliability and validity tests to confirm that the measurement instruments did not contain any random errors (reliability of items and variables) and that the constructs had the capacity to show true differences between objects in terms of the characteristic being measured (discriminant and convergent validity).

The recommendations of Hair et al. (2019) were followed for assessment of the results of PLS. Individual reliability was tested using the quotient obtained from dividing the items' loadings by their respective variables, which is required to be significant and greater than 0.7. The composite reliability index and Cronbach's alpha were used to measure the reliability of the variables. All coefficients exceed 0.7 and 0.8, respectively, which are the minimum thresholds for acceptable reliability.

In relation to convergent validity, the minimum threshold for the average variance extracted (AVE) is usually set at 0.5 (Hair et al., 2019). Three methods were used to assess discriminant validity in PLS (Henseler, Ringle & Sarstedt, 2015): (a) the Fornell-Larcker criterion for determining whether the correlations between the dimensions are less than the square root of the AVE (Fornell & Larcker, 1981); (b) HTMT criterion (heterotrait-monotrait ratio of correlations) by Henseler et al. (2015), who set 0.9 as the maximum value of HTMT between two constructs; and (c) cross-loading through the correlations crossed with AVE (Henseler et al., 2015).

Lastly, the Standardized Root Mean Square Residual (SRMR) coefficient was calculated (Henseler et al., 2015) as a measure of model fit. Values below 0.08 are acceptable.

4. Results

4.1. Item and Scale Reliability

The final instrument consisted of 30 items distributed in nine dimensions. The scale as a whole presented reliability of 0.93 (α=0.93). The reliability of the different dimensions ranged from 0.68 to 0.81. (α=0.68-0.81). Table 2 shows the reliability of the dimensions (Cronbach's alpha and Composite reliability), the average for all items, the standard deviation, the item-total correlation, the Cronbach's alpha value if an item was removed, and values for asymmetry and kurtosis.

Complete Questionnaire (α= .92)	**M**	**SD**	**r_{jx}**	**α-x**	**A**		**K**
Collective efficacy α= .81; CR= .89; AVE= .72							
EFI1	3.84	.807	.643	.753	-.440	.367	-.440
EFI2	3.79	.824	.707	.687	-.328	-.085	-.328
EFI3	3.82	.852	.625	.773	-.350	-.470	-.350
Learning orientation α= .74; CR= .83; AVE= .55							
ORI1	3.58	.891	.506	.686	-.309	-.116	-.309
ORI2	3.48	.966	.604	.627	-.344	-.193	-.344
ORI3	3.33	1.022	.609	.623	-.285	-.339	-.285
ORI4	3.83	.843	.394	.742	-.510	.137	-.510
Planning and coordination α= .77; CR= .85; AVE= .59							
PLA1	3.83	.756	.471	.761	-.356	.201	-.356
PLA2	3.88	.793	.546	.725	-.325	-.137	-.325
PLA3	4.07	.755	.618	.687	-.469	-.108	-.469
PLA4	4.05	.829	.644	.670	-.635	.013	-.635
Performance monitoring α= .68; CR= .82; AVE= .61							
PER1	3.86	.848	.475	.602	-.373	-.279	-.373
PER2	3.84	.781	.509	.556	-.079	-.550	-.079
PER3	4.20	.791	.484	.588	-.790	.398	-.790

Complete Questionnaire (α= .92)	M	SD	r_{jx}	α-x	A		K
Supportive behavior α= .70; CR= .83; AVE= .62							
SUP1	3.92	.826	.499	.628	-.409	-.272	-.409
SUP2	3.80	.847	.510	.614	-.348	-.218	-.348
SUP3	3.94	.804	.537	.580	-.313	-.498	-.313
Establishment of group objectives α= .74; CR= .85; AVE= .56							
EST1	3.89	.833	.543	.668	-.382	-.359	-.382
EST2	3.79	.808	.632	.563	-.306	-.113	-.306
EST3	3.82	.835	.506	.712	-.304	-.199	-.304
Problem solving α= .78; CR= .87; AVE=.69							
PRO1	3.85	.808	.603	.722	-.431	.233	-.431
PRO2	3.92	.809	.669	.649	-.370	-.146	-.370
PRO3	4.09	.787	.587	.738	-.651	.563	-.651
Conflict management α= .79; CR= .87; AVE=.71							
MAN1	3.92	.803	.636	.698	-.377	-.173	-.377
MAN2	3.80	.835	.620	.714	-.575	.554	-.575
MAN3	3.92	.861	.619	.717	-.626	.326	-.626
Communication α= .72; CR= .83; AVE=.54							
COM1	4.00	.805	.460	.693	-.600	.366	-.600
COM2	3.83	.841	.549	.641	-.433	-.001	-.433
COM3	3.91	.834	.523	.657	-.413	-.185	-.413
COM4	3.78	.867	.520	.659	-.341	-.175	-.341

Mean (M), standard deviation (SD), item-total correlation (r_{jx}), Cronbach's alpha if it eliminates the element (α-x), asymmetry (A), kurtosis (K), composite reliability (CR) and average variance extracted (AVE).

Table 2. Analysis of the 30 items of the Teamwork Competency Scale

In general terms, all items appeared to contribute adequately to the construction of the scale. All dimensions had acceptable coefficients except that Performance Monitoring had a coefficient of less than .70. To verify the normal distribution of item scores, the values for asymmetry and kurtosis were calculated. As shown in Table 2, those values are within the range +2 – -2, and it can therefore be assumed that the distribution is approximately normal. In addition to analysis of multivariate normality, Mardia's test (Mardia, 1970) was carried out. In both cases, Skewness (76.13) and Kurtosis (1124.97) results (>5) suggested non-multivariate normality.

4.2. Validity

After analysing the items, the internal validity of the instrument was verified using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The sample was divided into two parts of the same composition in terms of age, sex distribution and entrance examination score, with Sample A (male 53.7%; age 19.7 SD = 1.6; university entrance examination = 592) subject to EFA; CFA was then performed using Sample B (male 48.9%; age 19.5 SD = 1.5; university entrance examination = 593).

4.2.1. Exploratory Factorial Analysis

EFA was carried out using the procedure recommended by Lloret-Segura, Ferreres-Traver, Hernandez-Baeza and Tomas-Marco (2014) using the method of unweighted least-squares, parallel analysis and direct Oblimin rotation. First, the suitability of the data for factor analysis was assessed by calculating the Kaiser-Meyer-Olkin (KMO) sampling adequacy statistic, which was 0.91 (BC Bootstrap 95% confidence interval for KMO = 0.910-0.922), and by Bartlett's sphericity test, which was statistically significant $p < 0.001$. Both tests confirmed that the analysis was adequate. EFA was carried out with FACTOR (Lorenzo-Seva & Ferrando, 2006) with the 30 items. Parallel analysis suggested that all items

could be attributed to a single factor, but because the theory required them to be attributed to nine dimensions, the items were in the event grouped into these nine dimensions. That solution has adequate fit, with RMSR of 0.0251 (<0.05) (Harman, 1980) and GFI of 0.996 (>0.95) (Tanaka & Huba, 1989). The variance explained by these nine dimensions was 73.39%.

4.2.2. Confirmatory Factorial Analysis

We then evaluated the organisation of the items in the tetra-factorial structure based on these results using CFA, calculating the configuration coefficients for each factor with Oblimin oblique rotation. All items had at least one factor loading over 0.4 in their respective dimensions (Hair et al. 2019). Below are the results of CFA using PLS. All the reliability and validity indexes listed in Table 2 and 3 are above the recommended values for the items' average extracted variance (AVE > 0.5), composite reliability (> 0.79), and factor loading and are significant.

Table 4 compares the square root of the AVE (diagonally through the table) with the correlations of the latent variables (parameters below the diagonal) for each of the variables. All the reflective constructs are more closely related to their own measurements than to other constructs. For HTMT, all the indicators are below the recommended value as set by Henseler et al. (2015) at 0.9.

Dimension	M	SD	AVE	α	CR	Factor loading
Collective efficacy	3.75	.81	.61	.77	.81	.81 - .87 ***
Learning orientation	3.24	.79	.67	.78	.87	.57 - .79 ***
Planning and coordination	3.59	.81	.72	.81	.88	.73 - .84 ***
Performance monitoring	3.78	.45	.65	.74	.85	.69 - .78 ***
Supportive behavior	3.65	.94	.54	.72	.83	.71 - .79 ***
Establishment of group objectives	3.77	.87	.53	.71	.82	.74 - .85 ***
Problem solving	3.84	.68	.61	.78	.86	.81 - .85 ***
Conflict management	3.91	.91	.68	.78	.86	.72 - .76 ***
Communication	3.69	.93	.55	.76	.79	.69 - .83 ***
Model				.87		

*** p<.001. Mean (M), standard deviation (SD), Composite reliability (CR), Cronbach's alpha (α), average variance extracted (AVE) and items' factorial loading over the variables

Table 3. Assessment of the measurement model

	SUP	EFI	PRO	EST	COM	ORI	PLA	MAN	PER
SUP	.77	.74	.61	.83	.61	.47	.71	.77	.76
EFI	.55	.83	.54	.86	.61	.47	.78	.73	.71
PRO	.453	.44	.84	.61	.53	.53	.56	.63	.45
EST	.61	.65	.47	.81	.71	.58	.76	.83	.72
COM	.44	.46	.42	.53	.73	.41	.64	.81	.54
ORI	.32	.35	.41	.39	.29	.72	.61	.38	.32
PLA	.56	.62	.45	.58	.51	.44	.78	.69	.75
MAN	.56	.56	.51	.63	.61	.28	.54	.82	.64
PER	.51	.48	.33	.49	.37	.21	.52	.44	.74

Supportive Behavior (SUP), Collective Efficacy (EFI), Problem Solving (PRO), Establishment of Group Objectives (EST), Communication (COM), Learning Orientation (ORI), Planning and Coordination (PLA), Conflict Management (MAN), Performance Monitoring (PER).
Note: Discriminant validity values according to the Fornell-Larcker criterion showing under the diagonal. Also, square root of average variance extracted (AVE) values on the diagonal and the heterotrait-monotrait ratio of correlations (HTMT) criterion analysis values over the diagonal.

Table 4. Discriminant validity

Finally, Table 5 shows crossed correlations (Criteria C) and confirms that no item has stronger loadings in a construct other than its own respective constructs, demonstrating the scale's discriminant validity.

	SUP	EFI	PRO	EST	COM	ORI	PLA	MAN	PER
SUP1	.79	.44	.39	.48	.28	.28	.41	.43	.44
SUP2	.69	.28	.26	.34	.31	.22	.39	.33	.31
SUP3	.83	.52	.37	.55	.42	.25	.55	.52	.41
EFI1	.42	.82	.35	.56	.34	.28	.47	.44	.36
EFI2	.46	.87	.41	.56	.38	.28	.52	.46	.43
EFI3	.49	.81	.34	.59	.43	.31	.56	.51	.41
PRO1	.37	.31	.81	.37	.32	.33	.36	.41	.21
PRO2	.38	.34	.85	.37	.32	.35	.34	.38	.25
PRO3	.39	.45	.87	.45	.41	.36	.43	.46	.34
EST1	.57	.52	.41	.84	.47	.33	.53	.57	.47
EST2	.49	.51	.39	.84	.45	.31	.45	.53	.37
EST3	.39	.57	.34	.74	.37	.32	.43	.43	.34
COM1	.31	.38	.32	.41	.72	.16	.45	.46	.49
COM2	.35	.33	.31	.39	.74	.23	.33	.45	.29
COM3	.25	.25	.27	.31	.72	.22	.28	.41	.21
COM4	.36	.37	.32	.44	.75	.25	.37	.48	.16
ORI1	.26	.29	.37	.34	.24	.78	.36	.25	.14
ORI2	.28	.25	.28	.39	.21	.75	.27	.21	.22
ORI3	.19	.21	.27	.26	.18	.77	.27	.18	.15
ORI4	.21	.24	.25	.23	.29	.57	.39	.17	.15
PLA1	.42	.43	.44	.45	.35	.48	.73	.43	.34
PLA2	.35	.38	.31	.39	.36	.29	.73	.33	.29
PLA3	.47	.51	.34	.43	.41	.26	.81	.44	.46
PLA4	.51	.57	.32	.53	.42	.36	.84	.46	.49
MAN1	.46	.47	.47	.51	.53	.22	.47	.84	.43
MAN2	.45	.44	.38	.59	.45	.21	.43	.81	.29
MAN3	.49	.47	.39	.55	.52	.28	.42	.82	.37
PER1	.37	.41	.33	.43	.35	.15	.44	.37	.74
PER2	.29	.34	.17	.32	.22	.23	.38	.25	.69
PER3	.45	.34	.25	.35	.24	.18	.35	.35	.78

Table 5. Discriminant validity according to the cross-loadings criterion

The correlations between the scores for a construct and the items within it are the loadings. The correlations between the scores for a construct and the scores of the items that are part of other constructs are the cross-loadings.

The structural model was assessed using SRMR (Henseler, Hubona & Ray, 2016). Our model produced a coefficient of 0.068, which is an acceptable fit for the proposed model.

5. Discussion

The purpose of this study was to design and validate an instrument to evaluate generic and individual teamwork competency in university students. The results of the study confirm nine dimensions based on the theoretical model devised by Salas et al. (Salas et al., 2009) to conceptualise generic and transferable competencies (Cannon-Bowers et al., 1995) as subsequently revised by Chen et al. (2004) in relation to teamwork competency of individuals deployed in higher education environments. Those dimensions are the following: group goal setting, planning and coordination, conflict management, problem solving,

communication, collective efficacy, performance monitoring, supportive behaviour and learning orientation.

A reliable, valid scale was designed and confirmed by the indicators recommended in the literature in relation to the goodness-of-fit of the model and discrimination of variables. Specifically, the scale presents an adequate degree of individual reliability for each of the items and variables, as demonstrated by the coefficients for composite reliability, average variance extracted, factor loading, and Cronbach's alpha, and adequate capacity for independently and unequivocally measuring the concepts under HTMT, Fornell-Larcker and cross-loading criteria. SRMR demonstrated the goodness-of-fit of the model was adequate.

This study contributes to the existing theory of teamwork competency given that there are only a few, relatively recent studies of teamwork competency, and even fewer studies from an individual perspective, focused on the individual's knowledge, abilities and attitudes towards the group of people that make up a team (Torrelles-Nadal et al., 2011). The majority of the studies reviewed (Chen et al., 2004; Fransen et al., 2011; Kemery & Stickney, 2013; Loughry et al., 2013; Strom & Strom, 2011) use scales to assess team members' perceptions after carrying out a team task; i.e., they focus on evaluating teamwork and team members' competencies as they perform a specific task (Thiruvengada & Rothrock, 2007) rather than measuring each student's generic teamwork competency. Most of those scales emphasise observed competencies. The objective of this work, unlike others, was to focus on self-perceived competencies, and so cause students to reflect on their individual learning process in teamwork competency. That in turn generates greater student involvement in learning activities (Sadeghi, Azad-Mousavi & Javidi, 2017) and enables them to monitor their own learning (Thomas, Martin & Pleasants, 2011).

The scale also allows us to evaluate aspects of teamwork competency that are not part of other scales, such as collective efficacy, learning orientation, supportive behaviour and performance monitoring. Those dimensions are significant – for example, collective efficacy is measured from an individual perspective with questions that provide information about students' willingness to share positive opinions with their peers about the team. This dimension allows us to measure the level of self-efficacy with which students face a team task. Such self-efficacy also allows students to eventually transfer the teamwork competency that they acquire at university to their jobs in commercial environments (Chen et al., 2004). Additionally, the extent to which team members show collective efficacy can influence the team's learning and performance. That learning is also affected by the degree of learning orientation, a dimension of the individual that is an important determinant of overall team learning (Decuyper, Dochy & Van den Bossche, 2010). The assessment of performance monitoring skills provides important information for feedback among team members. Improvements in a team's functioning can be assessed through team members' requests for feedback and discussion of mistakes made in the course of monitoring (Kirkman, Rosen, Tesluk & Gibson, 2006).

The evaluation of the degree of the students' acquisition of these aspects of teamwork competency can help guide teaching strategies for training in this competency. In other words, assessing teamwork competency allows us to design methods based on the main focuses of teamwork as it is taught at university. The use of the instrument designed in this study can help to improve teamwork training by providing feedback to team members about their performance within the team. The feedback from this assessment of students' individual performance in a team environment allows them to gradually improve their teamwork competency (Jaca et al., 2016) and transfer it to other contexts in which teamwork is required (Ellis et al., 2005). In order to provide this feedback, it is first necessary to assess the degree of development of the competency from a multidimensional perspective. The design of new tools to evaluate teamwork from different perspectives is in itself a contribution, as new techniques for measuring team dynamics over time hold great potential for improving education and professional outcomes (Dingler et al., 2017).

Despite the value of this research, it is not without its limitations. First, the sample in this study. The sample was selected at a single university by convenience sampling, so the results cannot be generalised. It

would therefore be of interest to broaden the sample studied to other contexts using probabilistic selection. Similarly, given that the instrument uses self-reported measurements only, measurements that are heavily influenced by societal norms, it would perhaps be of interest to compare part of the information obtained with other types of instruments completed by persons other than the subject, for example, by teaching staff. It would also have been of interest to include within the process of validation of the instrument comparison of the measurements obtained with the study instrument with measurements using other similar scales to offer more empirical evidence of the convergent validity of the instrument. Finally, the procedure for selecting items using expert review should have followed the procedure reported by O'Neill et al. (2012).

Despite all that, as a final conclusion we can say that the study presented here is of particular interest because it describes an instrument created and validated in a Spanish-speaking context that will allow evaluation of the teamwork competency acquired through university education, including dimensions that do not feature in other scales such as collective efficacy, learning orientation, supportive behaviour and performance monitoring. All of that will open the door to intervention programmes and educational policies to be developed so that they support improvement of the education and training of university students.

In terms of practical applications, this scale allows teamwork competency to be evaluated following a straightforward procedure (that requires no training) in different actors in business schools and business management. The scale allows diagnosis of teamwork competency before specific teamwork training is provided in those settings. It also allows assessment of the teamwork competency of students and measurement of their progress over the course of their studies and identification of areas requiring urgent improvement at each level of training and assessment of teamwork competency of employees in different businesses and organisations.

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