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Visual thinking and cooperative learning in higher education: HOW does its implementation affect marketing and management disciplines after COVID-19?

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ABSTRACT

Students learn in different ways and in the wake of the COVID-19 pandemic, the higher education faculty needs to reinvent the educational experience for students. Recognizing the characteristics of cooperative learning as an integral and sustainable part of the solution is a source of motivation for the incorporation of entrepreneurial competencies in university curricula. This article proposes that cooperative learning and visual thinking tools in higher education can have a positive influence on improving the acquisition of core competencies in marketing and business administration subjects. The proposed relationships were evaluated using PLS-SEM (symmetric) and fuzzy set (asymmetric) approaches on a sample of 820 students. The PLS-SEM results revealed that the highest levels of acquisition of basic group competencies are through Social Skills, Interaction and Positive Interdependence. The results of the fuzzy sets (fsQCA) reinforced the symmetrical findings and revealed that Group Reflection and adequacy of Assessment were necessary and sufficient prescriptions for competence acquisition.

1. Introduction

The progressive incorporation of Information and Communication Technologies (ICT) in the classroom, and the scientific advances in the study of the teaching-learning process, have given rise in recent years to multiple innovations grouped under the denomination of 21st century pedagogies (Carbonell Sebarroja, 2015) or emerging pedagogies (Acton, 2019; Lew & Saville, 2021; Riebe et al., 2016; Robinson et al., 2018; Segura & Quintero, 2012). The diversification and diffusion of these alternatives appear in the form of innovation experiences, and after the COVID-19 crisis, a major challenge for education arises (Baber, 2021; Ratten & Jones, 2021), as limitations in physical contact have led to a massive and rapid shift to online teaching methods (Baber, 2021; Kang & Park, 2022; Ratten, 2020). In response to these changes, there has been a rapid acceptance of remote methods of education in business and economics. (Brammer & Clark, 2020; Mousa & Arslan, 2023), but they also run the risk of passing as an imprint of modernity that does not really permeate classroom practice (Montanero Fernández, 2019).

Montanero (2019) includes some of the lines of pedagogical innovation that have been disseminated in the educational system over the last two decades. Among them, he points out the visual thinking strategies (VTS) which, according to the author, are born from the didactics of Art History, developing the students' capacity for inquiry and critical thinking based on observation. In the study of Social Sciences, it is necessary to identify a complex and problematic social dynamic in order to reflect on the means available to us as a

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society to transform it. Furthermore, in the specific area of teaching business entrepreneurship, marketing and market research, it is essential to use visual resources to attract students' attention and keep their interest active in a playful way (Clarke, Flaherty, & Yankey, 2006).

This line of thought is supported by authors such as (Sudarwati, 2018) who establishes the need for more research on the use of audiovisual elements in teaching. This is perhaps due to the fact that visual thinking is capable of developing skills such as creativity and innovation (Reyes & Manipol, 2015) factors that the literature on entrepreneurship links to an increase in entrepreneurial intentions and the generation of new business opportunities (Mohedano-Suanes & Benítez, 2018; Popescu et al., 2015). However, entrepreneurship is only 6.4% in Spain (ONTSI, 2019) and taking into account that our economic future depends in part on the entrepreneurs (Vaicekauskaite & Valackiene, 2018), it seems necessary to focus higher education on helping young Spaniards develop entrepreneurial skills.

However, the use of active cooperative learning methodologies in the service of the educational task is not widespread in the Spanish educational context despite its infinite possibilities (Chang, 1991; Navarro-Pablo & Gallardo-Saborido, 2015). Yet, there are also examples of teachers who are committed to training in the didactic applications offered by this resource and to integrating it into their classes (Carlos Torrego-Seijo et al., 2021; Knoche, 2022; Maceiras et al., 2011; Pérez Urrestarazu et al., 2011). This study proposes the use of Visual Thinking (VTS) and group dynamics to present an educational innovation strategy in the Introduction to Marketing course for the first year of the Business Administration and Management Degree and in the Marketing Communication course in the third year of the Marketing and Market Research Degree, with the purpose to generate more transferable and lasting learning through the implementation of a combination of active methodologies that facilitate the participation and involvement of students in the classroom, as well as the development of their entrepreneurial skills.

In order to achieve this, the approach of this research seeks to answer the following questions: Are the cooperative learning methodology and learning resources linked to visual thinking significant for the acquisition of group basic skills? What combination of cooperative learning variables through VTS achieves more effectiveness in processing group work?

Therefore, the objective of this research is to analyze the incidence of cooperative learning methodology with visual thinking tools on the effectiveness of the acquisition of basic group competencies in Higher Education. For this purpose, our specific objective is to determine whether the Positive interdependence, Interaction, Social skills, Group processing, Heterogeneity, Assessment, and Mentoring variables are significant, as well as to find out which factors are most important when developing group competences and how they relate to each other.

2. Theoretical framework

2.1. Cooperative learning

Active methodologies are supported by cooperative learning structures, through which, by means of the joint resolution of tasks, the members of the group pool their knowledge and strategies. The acquisition of key competences will be achieved through the implementation of the cooperative learning methodology via which the students will be co-responsible for the learning of the group, by means of incentives and group goals (de Miguel Díaz, 2005). Undoubtedly, as pointed out by (Saez & Pérez, 2006), opting for cooperative learning implies changes in the teaching tradition, changes in the lesson-repetition, an individualistic and competitive structure, for a processual, interactive and constructivist model, which is the basis of the cooperative method. In this way, dialogue, debate and the confrontation of ideas and hypotheses will have to constitute the axes of any innovative and open methodological approach. Therefore, starting from what the students know and think about any aspect of reality, it must be possible to connect with their needs and interests, with their way of seeing the world, and a clear purpose or utility must be proposed in the application of the new learning that is being developed (Colomer et al., 2020).

It is also necessary to work with diverse information and create an environment of dialogue necessary for intellectual work. In educational practice, the diversification of information sources is of great importance for the socialization of students (Mcculloch, 2006). We consider as sources of information all those that are brought into play in the teaching and learning process, namely: those that come from the contributions made by the teacher, and the students themselves; those provided by the textbook, a Tik Tok video (López-Carril et al., 2022), a movie (Desai et al., 2018) or other didactic resources; those derived from the interactions that take place in the classroom; those that come from the cultural environment and the media, etc. When using a cooperative learning activity, grouping is the first and most important step of all. (Zhan et al., 2015). Cooperative learning is defined by seven fundamental dimensions (Atxurra et al., 2015).

The first of these, Positive Interdependence, implies the idea on the part of the group members that they must all achieve together the objectives set out in the design of activities, so that the efforts of each one are necessary for the common purpose. It is about understanding the individual responsibility necessary to carry out the common project. Interaction implies an environment where each person in the group can express his or her thoughts, opinions and feelings so that mutual support prevails. Social skills are related to the students' interpersonal relationship abilities, as well as to the skills necessary for favorable results in the proposed task or tasks. Group processing, on the other hand, implies the analysis of the learning process itself during the development of the dynamics that form part of the active methodological proposal. It is to do with reflecting on the process itself, the strengths and weaknesses of the group, as well as the possible solutions and proposals for improvement.

Heterogeneity is in line with the degree of diversity that characterizes the members of the group in terms of gender, ethnicity, previous academic background, psychosocial references, skills, likes or preferences. In terms of the tools available to the teacher as described by (Atxurra et al., 2015), we count on Assessment and Mentoring. Assessment refers to the clarity of the assessment system,

its adequacy to the teaching-learning methodology, the correct information of its criteria and that it is an equitable system. Mentoring is the tool available to teachers to follow up the teaching-learning process (Fauchald et al., 2022), so that they can plan the objectives and tasks to be achieved by the work groups and that all members know and understand the activities that are proposed and the means available to them to carry them out.

With the combination of active methodologies, we intend to create a situation of contrast between what the students know and what they should learn, to arouse in the students the doubt and interest in the questions that are presented to them and to try to open them to learning in a cooperative way in an environment of dialogue and didactic communication. In addition, the use of some visual thinking methodologies facilitates the creation of mind maps, one of the forms of visualization most used by entrepreneurs for problem solving and idea generation (Hayati & Umer, 2018).

In order to achieve the integration of students, didactic dialogue dynamics, the search for information, observation and viewing of audiovisual material, the preparation of group documents, the joint resolution of mathematical problems and exercises and the evaluation of all the elements and aspects of the teaching and learning process have been taken into account (Wilcox et al., 2005). Classroom work requires, in addition to some conditions, some ways of dealing with the issues, some resources and contrasted information to promote learning and the development of values with a certain intellectual autonomy.

Likewise, we have tried to involve all the students affectively and intellectually, and to transit their experiences, interests, needs and vital expectations. In this way, we will be able to attend to diversity (physical, psychological or socio-cultural) (Annan-Diab & Molinari, 2017) to compensate for deficiencies and guarantee a level of quality that facilitates social, educational and labor insertion (Del Rio et al., 2014).

2.2. Basic group competencies and visual processing

Teamwork is one of the generic competencies that best facilitates adaptation to the rapid changes in society and the world of work (Zúñiga, 2006). The ability to contribute to the work of the group and its integration is essential for today's labor market and an essential element of employability (Atxurra et al., 2015).

The Cooperative Learning methodology is student-centered and favors the development of certain social and professional competencies when effectively implemented. Therefore, it is proposed that the students, personally and in teams, elaborate and expose agreements on the dynamics and issues raised in class. The teaching and learning process must always guarantee the elaboration of knowledge and the maturation of mental schemes to continue intervening in the social dynamics. The contents (attitudes, procedures and concepts) must not be transmitted as something given, but must be elaborated by each person according to his or her peculiarities and for which innovative methodological strategies in relation to visual thinking and group dynamics are indispensable (Montanero Fernández, 2019). Considering that the current generation of university students is a very visual generation with strong visual skills (Lima et al., 2014), the methodology of visual thinking is based on the intertwined relationship between visual perception and cognition (Fernández-Fontecha et al., 2019). The visual thinking tools applied in this research combine written language, basic visual forms and graphics with popplet (e.g., diagrams, timelines, and mind maps) as well as audiovisual narratives, to process and clarify complex ideas, generate deep thinking in problem-solving tasks, and summarize main ideas. Various sources support the idea that the use of visual thinking strategies enhances the skills of observation, processing and subsequent reprocessing of information, in a given visual perception and cognition phenomenon (Castellano et al., 2014; Ellborg, 2018; Gielnik et al., 2012; Kickul et al., 2010). The implementation of VTS favors the dynamics for group work, since by interacting with images and videos, students begin to develop more empathy and take more into account different opinions, as the training also fosters critical thinking (Abaho et al., 2015; Karimi et al., 2016). In addition, individuals subjected to these tools are able to generate a greater number of new and original ideas, thanks to intuitive thinking, developing the creativity required to start a business (Popescu et al., 2015). Visual thinking practices, as defined in this article, are based on studies in the field of information design applicable to business management (Brown, 2015; Sibbet & Wendling, 2018; Tufte, 1993); from the field of cognitive psychology on language and diagram production and comprehension (Hoffmann, 2003; Schäfer & Keppler, 2013) as well as on the effects of different formats of visual thinking on different aspects of the teaching-learning process (Dexter & Hughes, 2011; Nesbit & Adesope, 2006).

According to (Johnson, 1994) Cooperative Learning has an effective level of structuring for learning basic content such as formulas, as well as developing a certain degree of individual responsibility in the achievement of common goals. In our approach, we combine group dynamics with VTS in the introductory marketing course where students must develop their mathematical competences individually (although active and collaborative learning is used for this purpose), as well as they can start from their previous knowledge to interpret the proposed audiovisual contents and share them with the group in the common strategy (Ramdeo et al., 2022). Many authors recommend the incorporation of cooperative learning in training programs, regardless of the degree or organizational context in which they are located (Biggs & Tang, 2011).

Dialogue, debate and confrontation of ideas and hypotheses must be the axis of any open methodological approach. A methodology is necessary that manages to connect with their needs and interests, with their way of seeing the world, and proposes a clear purpose or utility in the application of the new learning that is developed. In short, we propose a methodology that promotes the development of competencies through problem solving (Farashahi & Tajeddin, 2018), the interpretation of audiovisual content (Moghavvemi et al., 2018; Yang et al., 2021), the satisfaction of real needs, the resolution of conflicts and thus understand new phenomena, undertake a practical project or prepare a document.

The complexity of Social Sciences in general, and specifically in the fields of Marketing and Business Organization, is also manifested in the multi-causal explanations, the diversity of consequences that social facts provoke and the different developments that social facts produce. The teaching process is, therefore, an education that requires, throughout the entire Higher Education stage, a

progressive deepening in the interpretation of current societies. And it is precisely this global character of the Social Sciences that makes possible their contribution to the acquisition of basic competencies (García Raga & López Martín, 2011).

2.2.1. Positive interdependence

The fundamental element of cooperative learning is positive interdependence, since it is an active methodology based on the theory of social interdependence (Johnson et al., 2007; Johnson & Johnson, 2009). When a group works toward a common goal, each member is aware of his or her own responsibility and importance in achieving the group goal. In this process, the students identify themselves as more resolute as a group than as independent individuals (Viinikainen et al., 2022). In recent studies, such as those of (Gheorghe et al., 2022; Ramdeo et al., 2022), positive interdependence has been shown to have a positive influence on commitment to group work, while negative interdependence has a negative effect on commitment to teamwork. Thus, while negative interdependence results in oppositional interactions, Positive interdependence results in promoting interactions as people encourage others to achieve their goals. Therefore, we propose the following hypothesis regarding the development of teamwork skills:

H1. Positive interdependence is significant in the effectiveness of group competence.

2.2.2. The interaction

As higher education continues to internationalize, student groups become more culturally diverse (Gannon et al., 2016; Ohajionu, 2021) and the likelihood that students will participate in cross-cultural group work during their studies continues to increase (Poort et al., 2022). Although the literature examining the utility of group projects is extensive, the link between cooperative learning, group performance and competency development in multicultural higher education contexts remains unclear (Sweeney et al., 2008). Promoting Interaction in teamwork means that individuals help each other complete tasks to achieve the group's goal. Several lines of research have shown that active participation is beneficial to students' learning and performance (Chiu & Cheng, 2017; Reinke, 2019). According to (Kagan, 2009) regular active participation enhances student learning and produces simultaneous, rather than sequential, engagement. Given the essential role of active participation in student learning, motivating students to participate in class is a fundamental strategy for successful teaching (Reinke, 2019).

Therefore, the positive relationship between Interaction and the acquisition of basic group competence in higher education is proposed.

H2. Interaction is significant in the efficacy of group competence.

2.2.3. Social skills

Successful cooperation requires interpersonal relationships and small group skills. These skills are the condition for effective group work, and that is why students have to learn the necessary skills actively (Burga et al., 2023; Opdecam et al., 2014). Authors such as (Jurkowski & Hänze, 2015) have identified that students benefit from elaborating on peers' ideas while developing their own, as well as reaffirming thinking skills when they pursue a collective, practical goal. Previous studies (Buchs & Butera, 2015; Mendo-Lázaro et al., 2018) show that cooperative learning in university classrooms is effective as a method for developing the social skills necessary for teamwork. The present research hypothesizes that social skills are significant in terms of the effectiveness of the acquisition of competencies related to teamwork:

H3. Social skills are significant in the effectiveness of group competence.

2.2.4. Group processing

The Group processing variable implies the analysis of the learning process itself during the development of the dynamics that make up the methodological proposal. It is about reflecting on the group's own process of strengths and weaknesses, as well as the possible solutions and proposals for improvement, since the cooperative group works well when it reflects adequately on its performance (Prieto Saborit et al., 2022). In addition, according to the results of (Huggard et al., 2014) cooperative learning is a way of encouraging students to engage in critical reflection. Group processing, discussion and proposals for improvement among group members contribute to the effectiveness of teamwork:

H4. Group processing is significant in the effectiveness of group competence.

2.2.5. Heterogeneity

Students in higher education are becoming increasingly multicultural, therefore, university graduates will work in groups both nationally and internationally as part of their experience to face their future (Sundari et al., 2022). Under this premise, the ability to work effectively in culturally heterogeneous groups should be an integral part of students' competence, the literature having demonstrated the effectiveness of group work compared to other learning practices (e.g., individual or competitive work processes) in addition to a higher academic performance of the students involved (Hsiung, 2012). However, in the literature on group work, the variable Heterogeneity, sometimes linked to regional characteristics, has been neglected (Schlegel et al., 2022), as has been cultural, social, religious and economic characteristics (Devkota, 2021). In this sense, in the COVID-19 years, the heterogeneity of the group may have played a less important role since the members will not reach a level of familiarity with each other that would allow them to compare similarities and differences (Müller et al., 2022). But as the work groups are carried out in a face-to-face way, Heterogeneity must be taken into consideration as a fundamental variable for a correct effectiveness of the group competence. Therefore, working in groups of heterogeneous students can be positive and beneficial if the differences and similarities that arise are adequately managed

(Jimenez et al., 2017). Therefore, we propose the following hypothesis:

H5. Heterogeneity is significant in the effectiveness of group competence.

2.2.6. Assessment

In recent years, special importance has been given to the quality of teaching in higher education both nationally and internationally (Quarchioni et al., 2022), where teachers' skills play an essential and well-known role (Chan & Luo, 2022). This is why the Assessment process is constantly evolving (Ragusa et al., 2022). Moreover, group work provides social learning, social understanding and acceptance, as well as social recognition to foster social networking, so evaluators should not neglect to consider this type of competency (Wong et al., 2022). In addition, these evaluations can provide information about individual contributions to group work, effort, or leadership that educators might not otherwise know (Dingel et al., 2013).

But the issues and phenomena related to the assessment of group work and, therefore, to the selection of how to measure its results, communication, cooperation, role development and performance, and performance behavior are included as key variables (Müller et al., 2022). In this regard, there should be reasonable criticism of the fact that the assessment of group success generally depends on a single outcome (Wittenbaum et al., 2004). Therefore, assessment can have a significant influence on the efficacy of group competencies and the way of assessing should be taken into account, formulating the following hypothesis:

H6. Assessment is significant in the effectiveness of group competence.

2.2.7. Mentoring

To achieve an effective learning environment in work groups, tutors must act as facilitators and play an important role in guiding and supporting students (Wong et al., 2022). In this sense, tutors assist students in achieving pre-established objectives, model the reality of the students' practice and guide them (Oikarainen et al., 2022). This last activity is fundamental, since the commitment and resolution of possible doubts is decisive to contribute to effective, productive and collaborative group actions. So educators should know which factors promote or hinder the learning process (Poort et al., 2022; Truss & Anderson, 2023).

These factors need to be analyzed, as a common problem that can result is the failure of the group to work together effectively without a mentor to resolve various issues (Huxham & Land, 2000). Therefore, a fluent communication between the tutor and the group will be essential for the good functioning of the group competence (Yorgancıoğlu et al., 2022). Consequently, we formulate the following hypothesis:

H7. Mentoring is significant in the efficacy of group competence.

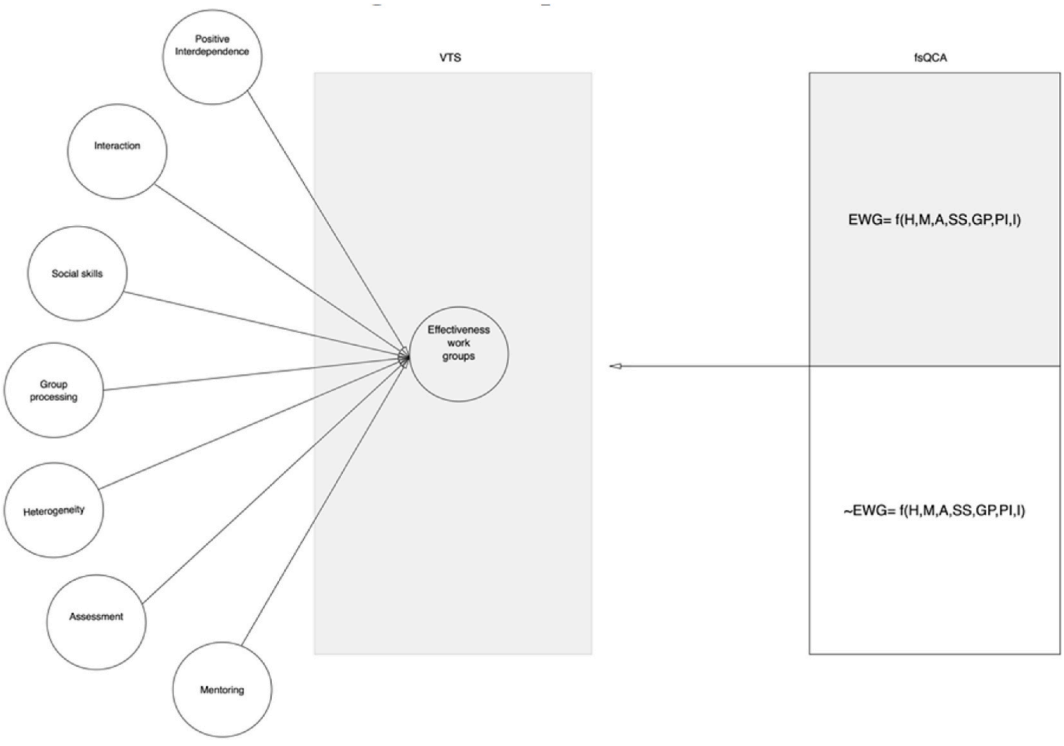

Fig. 1. Proposed model.

3. Methodology

Although courses that aim to improve the acquisition of the basic group competences through visual thinking skills in teaching business administration and marketing are not so common, we have analyzed the postgraduate course in visual thinking at the University of Dundee, applied to the business world, as well as the course designed by the international business school Otto Beisheim School of Management, for the design of a programme of group activities applied in marketing and business administration subjects during the academic year 2022/2023 including visual thinking techniques, specifically, through the use of images, videos and popplet. In the first part of the course, students were trained in the observation of visual and audiovisual pieces related to business management, to apply their observation skills in the successive group activities planned for the rest of the course.

3.1. Sample and data collection

The sample consisted of a total of 820 students of two subjects: Introduction to Marketing and Commercial Communication in the degree of Business Administration and Management and in the degree of Marketing, of the Faculty of Economic and Business Sciences of the Universities of Seville and Malaga. The questionnaire was administered in person during the month of December 2022. The composition of the sample responds to gender equity, with 48.6% of the respondents being women and 51.4% men, of whom 21.8% are in the first year of the degree, 27.4% in the second, 23.2% in the third and 27.6% in the fourth year.

3.2. Variable measurement

In order to determine the degree of application of the active methodology design in university classrooms, a scale was used to assess the degree of application of Cooperative Learning at the University (CLAS) designed by (Atxurra et al., 2015). The instrument, as indicated above, establishes seven dimensions: Positive interdependence, Interaction, Social skills, Group processing, Heterogeneity, Assessment, and Mentoring. For the responses, it uses a 7-point Likert scale ranging from 1 ″strongly disagree" to 7 ″strongly agree". These seven dimensions have been related to Effectiveness in the acquisition of basic group competencies using the scale designed by (Jaureg i et al., 2014), on the effectiveness of working groups , with the purpose of identifying the variables that have the strongest relationship with the good functioning of the group as can be seen in the proposed model (Fig. 1).

3.3. Data analysis

A PLS-SEM statistical tool was used to analyze and interpret the reliability and validity of the measurement scales and the structural model (Hulland, 1999). Specifically, this was the SmartPLS 4 software package for data analysis (Ringle et al., 2022) with a bootstrapping of 10,000 samples to estimate the significance of the parameters. We also used the fsQCA methodology to complement the results of the symmetric method, analyzing the cases and better capturing the complexity of the students' behavior (Rihoux & Lobe, 2009).

3.3.1. Measurement model

The results show that the measurement model meets all general requirements. First of all, all individual items meet the reliability requirement because all standardized loadings are greater than 0.7 (Table 5). Second, the model satisfies the construct reliability requirement because all consistent measures exceed the 0.8 threshold (Table 5). In addition, the average variance extracted (AVE) scores exceed the threshold of 0.5 (Table 5) for composite unidimensionality, so that these latent variables reach convergent validity. Finally, as can be seen in Table 1, all the variables reach discriminant validity, as indicated by the Heterotrait-Monotrait Ratio (HTMT) (see Table 2).

In order to assess discriminant validity, the Fornell and Larcker test shown in Table 1 was performed, and the validity was also assessed with a Heterotrait-Monotrait study (HTMT) (Sarstedt et al., 2014). Table 2 shows that in all cases the levels are below the recommended 0.9, except for mentoring with Group Processing, which is very close to 0.9.

The model fit analysis has been performed, where the SRMR must be less than 0.08 (Manzano Patiño, 2018). Table 3 shows that this criterion is met and the model fits correctly.

For the assessment of the structural model, the strength of the relationship between the dependent variable and the independent

Table 1
Assessment of the measurement model - Discriminant Validity: Fornell-Larcker Criterion.

	EWP	EWP	EWP	EWP	EWP	EWP	EWP	EWP
EWP	0.869							
ASS	0.285	0.892						
SS	0.644	0.342	0.883					
HET	0.623	0.259	0.472	0.800				
INT	0.690	0.383	0.652	0.552	0.901			
PI	0.615	0.112	0.389	0.569	0.439	1.000		
GP	0.389	0.509	0.491	0.249	0.476	0.234	0.910	
MEN	0.428	0.550	0.533	0.315	0.574	0.179	0.692	0.885

Table 2
Assessment of the measurement model - Discriminant Validity: Heterotrait-Monotrait Ratio (HTMT).

	EWP	EWP	EWP	EWP	EWP	EWP	EWP	EWP
EWP								
ASS	0.354							
SS	0.823	0.463						
HET	0.781	0.347	0.629					
INT	0.828	0.523	0.864	0.689				
PI	0.667	0.131	0.461	0.673	0.479			
GP	0.471	0.662	0.649	0.332	0.615	0.262		
MEN	0.538	0.753	0.732	0.423	0.765	0.212	0.913	

Table 3
Adjusted model.

	Saturated model	Estimated model
SRMR	0.079	0.079
d_ULS	0.986	0.986
d_G	0.620	0.620
Chi-square	245.225	245.225
NFI	0.612	0.612

variable was studied. In this case we can see the results obtained in Table 4.

The hypothesis contrast shows significance for the constructs Social Skills (p 0.039), Interaction (p 0.040) and Positive Interdependence (0.024). Analyzing the t-values, the three relationships present a similar intensity, with Positive Interdependence being somewhat more prominent.

4. Results

4.1. PLS-SEM

For data analysis, we used the variance-based, partial least squares structural equation technique (PLS-SEM). A two-step process for evaluating explanatory shape models with PLS-SEM has been outlined (Henseler et al., 2016). Firstly, the Assessment of the measurement model is performed and, secondly, the Assessment of the structural model is carried out. We use a bootstrap procedure (Chin, 1998) in order to find the significance of the indices. With this bootstrap, which is a resampling procedure, we can determine the significance of the path coefficients and the weights and loadings of the indicators for each composite (i.e., the latent variable).

A good measurement model must demonstrate sufficient reliability and validity. The most suitable consistent measures of internal consistency reliability are ρA, Jöreskog's rho and Cronbach's alpha (Henseler et al., 2016). While reliability values below 0.7 indicate adequate reliability in the early stages of the investigation, higher values, such as 0.8 or 0.9, which exceed the usual threshold values, should be achieved in more advanced research. The average variance extracted (AVE) serves as a measure of unidimensionality (Fornell & Larcker, 1981). Finally, the Heterotrait-Monotrait criterion (HTMT) provides evidence of discriminant validity (Hair et al., 2019).

4.2. fsQCA

In the final stage of data analysis and to respond to the second specific objective, we applied fsQCA, which is a qualitative-quantitative method that explains a multiple set in a given context of complex conditions (Ragin, 2009). This method has been

Table 4
Structural model contrast (Path Coefficients).

Hypotheses		β	t-value	p-value	Confidence Intervals		Supported
					2.5%	97.5%	
(EGC) Effectiveness of Group Competence - $R^2 = 0.614$							
H1	(PI) Positive interdependence	0,286	2.266	0.024**	0.274	0.041	Yes
H2	(INT) Interaction	0.295	2.064	0.040**	0.303	0.023	Yes
H3	(SS) Social skills	0.245	2.066	0.039**	0.242	0.017	Yes
H4	(GP) Group processing	0.006	0.067	0.947 ns	0.002	−0.175	No
H5	(HET) Heterogeneity	0.175	1.216	0.225 ns	0.175	−0.116	No
H6	(ASS) Assessment	−0.003	0.029	0.977 ns	−0.001	−0.178	No
H7	(MEN) Mentoring	0.019	0.144	0.886 ns	0.025	−0.218	No

***p < 0.001, **p < 0.01, *p < 0.05, ns: not significant (based on t (10,000), two-tailed test).

Table 5
Scales and measurement model.

Variables	Items	Loadings	AVE	Composite reliability	Cronbach's alpha	Rho_A
Effectiveness work group (EWP)			0.754	0.902	0.838	0.847
	There is dialogue and communication between group members.	0.835				
	All opinions are welcome.	0.884				
	Information is exchanged within the group.	0.885				
Assessment (ASS)			0.796	0.886	0.743	0.744
	If we work hard in this subject, we can achieve very good results.	0.888				
	In this class we all have the opportunity to do well if we put our minds to it.	0.896				
Social skills (SS)			0.780	0.876	0.718	0.720
	This subject favors the opportunity to interact with others.	0.874				
	In this subject, we exercise our social skills.	0.892				
Heterogeneity (HET)			0.640	0.842	0.722	0.740
	The members of my group have skills and abilities that complement each other.	0.765				
	The members of the group have different capacities that facilitate the accomplishment of the task.	0.842				
	In our group there is a diversity of opinions that help us in our learning process.	0.791				
Interaction (INT)			0.812	0.896	0.774	0.896
	In this subject, we have the opportunity to share our opinions among the group members.	0.932				
	This subject allows me to interact with my classmates.	0.869				
Positive interdependence (PI)			0.817	0.865	0.779	0.886
	In this subject, interaction with my fellow students is necessary to carry out the task.	0.933				
	When we work in a group, each member has a task to contribute to.	0.864				
	In this subject I need the help of my group mates to complete the task.	0.887				
Group processing (GP)			0.829	0.906	0.794	0.795
	The teacher guides us and helps us with the group task.	0.915				
	The teacher motivates us to move forward in the group task.	0.906				
Mentoring (MEN)			0.784	0.879	0.727	0.741
	The teacher is accessible to answer questions during the group work.	0.906				
	The teacher monitors the tasks performed by the group and each of its members to help us improve.	0.865				

previously used in the educational field (Fan et al., 2022). In addition, the use of this methodology adds value to the SEM results and reveals the causal complexity between the variables (Russo & Confente, 2019). Complexity theory focuses on complex systems with non-linear dynamics, in which the same outcome, i.e., the complex phenomenon, in this case Group Competition Effectiveness, is the result of different combinations of factors. (Pappas & Woodside, 2021). As such, the application of linear or symmetric analysis to a complex phenomenon does not determine the true antecedents (De Canio et al., 2020). Group Competence Effectiveness behaviors are the result of complex decision-making processes determined by Heterogeneity and asymmetry of factors (Wang et al., 2021). The sole application of a linear analysis will be limited to studying the main effect (positive or negative) of the relationship X→ Y, which does not always provide an adequate understanding of the complex phenomenon. Alternatively, it is possible to find multiple combinations of factors that explain the complex phenomenon using non-linear analysis.

Thus, we applied fsQCA to explore combinations of factors that may lead to ECGs that are not revealed using PLS-SEM. Specifically, we seek to discover ECG configurations, Therefore, for fsQCA, we convert the interval scale to a fuzzy set by calibrating the data (range from 0 = no membership to 1 = full membership, and 0.50 = crossover point). The recommended breakpoints are as follows: full set membership = 0.95, nonmembership = 0.05, and crossover points = 0.5 (Ragin, 2009). The fsQCA results presented in Table 6 highlight the coverage and consistency of the three combinations, which adequately describe ECG, indicating that several configurations emerge that cover a substantial proportion of the outcome variable. The results show that the overall solution coverage value is 0.740, and the overall solution consistency is 0.968, above the 0.8 recommended in the literature (Rihoux & Ragin, 2008). In addition, after the algorithm development, those solutions whose unique coverage was above 0.01 were selected (Pappas & Woodside, 2021).

First, according to the adjustments of the variables in their external aspect, the overall consistency is 0.9682, above the 0.8 required in the literature. The overall coverage of the solutions, which reaches 74.05%, provides a good explanation of the symmetric method. In addition, it is noteworthy that the algorithm initially provided nine general solutions, but following the recommendations of the literature, we have considered only those whose unique coverage exceeded 0.1.

The solutions offered by the asymmetric methodology indicate that the effectiveness of group competition can be achieved without the need for an excessive set of variables. All three solutions exceed a 0.95 consistency. The first solution presents a large single

Table 6
Truth table.

Solutions ECG	1	2	3
HET		○	●
MEN		●	●
ASS	●	○	○
SS	○	●	○
GP	●	○	●
PI	○	○	○
INT	○	○	●
Consistency	0.9863	0.9545	0.9957
Raw coverage	0.6448	0.2223	0.2024
Unique coverage	0.0545	0.0311	0.0117
Overall solution consistency	0.9682		
Overall solution coverage	0.7405		

● Presence of central condition ○ Negation of central condition ● Presence of condition ○ Condition negation

coverage, exceeding 5% (0.0545), making it the most noteworthy solution.

The presence of group reflection combined with correct evaluation appears as a determinant, while in the second solution, tutoring and social skills are the variables that make this possible, with a lower unique coverage (0.0311). The third solution implies the presence of four antecedents, heterogeneity, tutoring, group reflection and interaction. In this last case, with the combination of these four elements that characterize cooperative learning, the effectiveness of basic group competence would be achieved, with a negation of the condition of evaluation, social skills and positive interdependence.

Evaluation, social skills, group reflection, positive interdependence and interaction are conditions present, in one way or another (negation or presence), in all three solutions. Heterogeneity and Theory appear in only two solutions, while Group Reflection is the most important construct, since apart from appearing in all three solutions (as presence and negation), it is a central condition.

5. Discussion

The results obtained in our analysis allow us to achieve the research objectives. We note that the variables applied in this research show a particular behavior after the two analyses implemented, so we will analyze them in detail. Regarding the Assessment variable, our hypothesis test with PLS-SEM finds it not significant, while through the analysis with fsQCA the most direct solution indicates that to achieve the effectiveness of group competence an adequate assessment and group reflection as a central condition is necessary. This fact can be explained, in the first place, by the lack of integration of the assessment criteria by the students, in spite of the detailed explanation by the teachers of the relationship between the curricular contents, the activities designed for collaborative learning and the form of grading, at the beginning of the subjects. In this sense, it is necessary to work on a teacher training plan that enables them to develop the student's qualities, to identify their skills and interests, and to improve their competencies and confidence levels through the design of the active learning program and its assessment system. On the other hand, open questions have been used in other research to evaluate this dimension (Palomino, 2018), although it has been shown to decrease the possibility of coding. Other studies suggest that assessment should be performed for each proposed task, thus allowing the learner to be aware of the system at all times (Martín, 2020).

Social skills are significant in Group Competence Efficacy according to the analysis with PLS-SEM. This result is in line with other research (Del Barco et al., 2015) that has shown the importance of the presence of this construct in the prevention of social anxiety, although in university settings it has also had contradictory results (Cadoche, 2007). The relationship in the opposite direction, between the development of cooperative learning techniques and the improvement of social skills, has also been previously analyzed, with positive results (Ovejero, 1998). As for the analysis with fsQCA, social skills are found as a condition in the three solutions provided, but only in one of them with a presence, in solution two, together with that of tutoring. In this sense, the importance of Social Skills for learning in contexts of cognitive diversity has been reported by other authors (Lin et al., 2018) in relation to the effectiveness of group learning with adequate guidance from the teacher. The results indicate that, with this solution, the rest of the characteristics that make up cooperative learning would be present, but in a condition of negation.

Regarding group heterogeneity, the analysis with PLS-SEM does not show a significant result. The result obtained in this sense does not correspond to that obtained in similar studies in subjects related to marketing (Rodríguez Muñoz, 2018), although these were carried out with a previous selection process of students with similar profiles. The fsQCA analysis indicates that the heterogeneity variable is present as a central condition in the third solution, present in negation in the second solution and absent in the first solution. Heterogeneous grouping based on student performance seems to be an ideal approach as it could promote diversity of knowledge and exchange of experiences within the group (Burris et al., 2006). However, heterogeneous grouping could also incur an unexpected negative effect during collaboration (Thanh & Gillies, 2010) For example, students may have difficulty actively participating in group activities.

Similarly, both Interaction and Positive interdependence are reflected as significant relationships within the model analyzed with PLS-SEM. In the case of the first variable, Interaction, the literature indicates that its development in cooperative teams contributes to the advancement of cognitive skills (Aguilera, 2020). The very process of developing interactive methods for cognitive development is, according to some authors, characterized by the Interaction between students "working together to learn" (Aranguren Peraza & Zurita Aguilera, 2021). However, in other analyses, the results have not been as evident for (Morales-Maure et al., 2018), Interaction does not ensure an improvement in performance, since it is the nature of such interactions that is important. Yet, they coincide in the increase of Interaction during the analysis. Through the analysis with fsQCA, the interaction variable only appears in a presence condition in the third solution, together with tutoring and group reflection. In addition, it is possible that high and low achievers do not have a satisfactory interaction during group work.

Positive interdependence, related to the previous construct, expresses that goals should be structured in such a way that the student surpasses him/herself, and also feels interested in the performance of the rest of the group (Guerra Santana et al., 2019). In our case, this construct also finds a direct relationship with the effectiveness of Group Competence, according to the PLS-SEM analysis, it is also a condition present in the three fsQCA solutions but in a condition of negation. This result is in line with previous studies (Munayco Morán & Villacorta Curinuqui, 2020) emphasizing the importance of everyone's commitment to collaborative success.

Group processing appears as a central element in the solutions of the fsQCA analysis, coinciding with previous studies regarding its importance (Bustamante Pacari, 2017), where the need for consistency, reflection and criticism in terms of participation in work teams is discussed. Specifically, solution one indicates the most direct path toward the achievement of group competence efficiency with a correct evaluation and group reflection. On the other hand, in the PLS-SEM analysis group reflection is not significant. This can be explained by the lack of knowledge among group members, which does not allow discovering their strengths and weaknesses, which limits establishing approaches for improvement (Johnson et al., 1999). We must also point out that this construct, according to the statistical results in PLS-SEM, is very close to being significant, so we have to value it in a relative measure, since a new random application could obtain significant results. Finally, Mentoring is not significant for effectiveness in group competence in PLS-SEM but appears as a condition of presence in the second solution of fsQCA, together with social skills, and in the third solution, although it is true that its absence is notable in the first solution. According to the literature, behaviors important for cooperation such as supervision are integrated in dense networks, and therefore, behaviors focused on increasing aspects such as trust are not necessary, since trust is integrated in the social structure itself (Knoche, 2022). Some authors speak of a lack of perception on the part of the students when it comes to knowing the predisposition of their tutor to follow up on the assignments, or even that the students themselves are not accustomed to such procedures in the university environment (Katileva & Carbonell, 2019). In any case, the degree of difficulty of the process or task may require more or less support from the teacher. To avoid this dependence, some studies have introduced in cooperative learning processes the so-called "peer mentoring", where the students themselves, under certain guidelines, monitor, assess and support the tasks of their peers, obtaining very positive results (Martínez & Duran, 2021). In any case, teacher training must also be comprehensive and updated to establish a teaching staff that is capable of identifying educational needs in the different areas (cognitive, affective, social, etc.) as well as implementing an innovative teaching methodology based on Information and Communication Technologies (ICT) and student participation, maintaining coherence with the laws of educational improvement (Blatchford et al., 2003; Gillies & Boyle, 2010).

6. Conclusions

The present work presents important findings from an academic point of view, as well as a potential practical utility for the application of teaching and learning methodologies in the classroom. First, the article responds to the scarcity of work on active learning methodologies for higher education in Spain after Covid 19 and provides a starting point for research in a dynamic environment marked by the introduction of new technologies in the classroom. The research results support the potential of using visual thinking strategies as part of an active learning methodology to improve the effectiveness of group work by business administration and marketing students. The development of the research, as well as the methodology used, has allowed us to advance in the knowledge and effectiveness of active methodologies for the acquisition of basic skills in higher education, as well as to know certain behaviours during the implementation of the analysis model that are important for educational research and the subsequent transfer of knowledge to the business world.

The study presented here applies an educational innovation strategy anchored in the current visual generation of students, establishing learning synergies that can be developed through methodological designs based on visual thinking and cognitive process in future research. The results indicate that learning can have a more transferable and lasting composition, amplifying, in the case of Business Administration and Marketing students, their entrepreneurial competencies. The work responds to the research question posed, identifying that the cooperative learning methodology and the didactic resources linked to visual thinking are significant for the acquisition of group basic competences.

Regarding the individual significance of the variables, Social Skills, Interaction and Positive interdependence have been significant in the development of cooperative learning. Students have shown a high level of interpersonal relationship, as well as a high degree of freedom in the expression of their opinions and considerations with respect to those of the other members of the classroom. Students have integrated in their behavior the importance of individual responsibility in obtaining the common good, valuing individual and collective efforts in equal measure. The symmetrical statistical results presented show an inverse relationship between assessment and the effectiveness of group competence (−0.003 path), although this difference is not significant. This result is complemented by the asymmetric analysis that highlights as a direct solution Group Reflection together with an adequate Assessment to guarantee the effectiveness of the acquisition of basic group competences through cooperative learning with visual thinking tools. This result should be taken into account in further research to estimate the relationship between the Assessment variable together with group processing when designing active methodologies for Higher Education. Tutoring is significant for the effectiveness of group work when the Social Skills of the group are high, which may be related to the students' perception of their tutor's willingness to follow up the tasks.

Therefore, the proposed research also represents an important methodological contribution for subsequent studies, as it establishes that the PLS-SEM methodology coupled with fsQCA is a valid approach for use in the social sciences, and specifically in the analysis of teaching and learning processes. This analysis system combines the symmetric method, where the solutions are linear and discrete, with the complementary application of asymmetric methodologies that allow better capturing variations in human behaviour, and also offers a wider set of solutions that facilitates a greater breadth in the application of pedagogical solutions within the classroom. These different solutions provide an answer to the second objective of the research, establishing alternatives to achieve the objective of effectiveness in group competencies, by means of the combined value of the variables, which will allow successive research and practical developments to select those methodological solutions more in line with the characteristics of their different environments. This study is not without limitations. Its application has been carried out on students in an educational environment related to entrepreneurship, so future research would complement the results by expanding the sample base or completing the study longitudinally, comparing the design of the Teaching Learning project in different university educational environments.

Finally, the approach to the dynamics of active methodologies in subsequent research should include data on student performance in order to contrast academic grades with the students' perceptions taken into consideration in this research, so as to make it feasible to establish adaptive measures for the successful application of the educational program.

Authorship contributions

- **Author 1 (Belén Maldonado López):** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Supervision, Roles/Writing Original Draft, Roles/Writing -Review and Editing, Project Administration
- **Author 2 (Pablo Ledesma Chaves)**: Methodology, Data Curation, Sofware, Validation, Formal analysis, Investigation, Resources, Supervision, Roles/Writing Original Draft, Roles/Writing -Review and Editing
- **Author 3 (Eloy Gil Cordero):** Methodology, Data Curation, Sofware, Formal analysis, Investigation, Resources, Supervision, Roles/Writing Original Draft, Roles/Writing -Review and Editing, Visualization

Declaration of competing interest

None.

Data availability

The data that has been used is confidential.

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