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WhatsApp usefulness as a communication tool in an educational context

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Abstract

Although the negative effects of mobile instant messaging have been stressed, its exponential increment justifies studying its application in education. This paper analyses whether college' students perception of WhatsApp usefulness influences cognitive processes important for teamwork (i.e., specialization and coordination), specifically for complex decision-making assignments. Additionally, it seeks to clarify to what extent the relationship between perception of WhatsApp usefulness and these cognitive processes could exert some influence on team efficacy, both perceived and objective (grades). For that purpose, a role-play was specifically designed in which WhatsApp played a mayor function as a communication tool. A sample of university students ($N = 200$) worked in teams to reach decisions. A student in each team was set apart all team members could only communicate through WhatsApp. Findings confirm the relationships between perceived WhatsApp usefulness and specialization and coordination, as well as perceived WhatsApp usefulness and perceived team efficacy. Both the role-play case designed and results obtained are relevant since show that WhatsApp could be applied as a communication tool in team activities, due to the fact that the perception of its usefulness could help to develop positive attitudes towards teamwork (i.e., team perceived efficacy). From an applied perspective WhatsApp could be used for virtual teamwork through, for example, the proposed role-play case shown.

Keywords Whatsapp · Mobile communication · Collective memory · Complex thinking · Third sector · Communicative processes · Solving problems · Teamwork

Palabras clave Whatsapp · Comunicación móvil · Memoria colectiva · Pensamiento complejo · Tercer sector · Procesos comunicativos · Solución de problemas · Trabajo en equipo

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1 Introduction

Although information and communication technologies (ICTs) have been extensively applied at the University since the European Higher Education Area became a reality, its main focus has been on providing resources to improve on-line teaching. However, the types and quality of the initiatives carried out by lecturers demand an in-depth review (Urbina and Salinas 2014). ICTs provide new possibilities for lecturers to facilitate student-centred, active and participative learning processes (Esteve and Gisbert 2011). Social networks and mobile instant messaging (MIM) can be used as participative tools thanks to their possibilities to in-group/inter-group interaction, breaking the spatial and temporal requirements of the classroom (Elhay and Hershkovitz 2018).

Studies on mobile technologies state that MIM users will grow from 1423 million in 2014, to over 3, 8 billion by the end of 2018. Specifically, WhatsApp has increased the number of messages per day accounting for three-quarters of all mobile messaging traffic in 2018 (Yoon et al. 2015). According to Statista (2018), WhatsApp was the third most popular global social network accounting for 1, 5 million users. Due to the growth of WhatsApp, several studies analysed this tool from a pedagogical perspective founding it useful for both affective and cognitive interactions (Kim et al. 2014).

After reviewing the literature on this subject, two opposed perspectives arose. The positive approach comprises promising findings on MIM contributions such as cognitive interactions improvement or cognitive load reduction (Gao et al. 2017; Kim et al. 2014; Rambe and Bere 2013). The negative approach by which the use of MIM are negatively evaluated while attending lectures or working on assignments, and their learning results are also widely undermined (Hawi and Samaha 2016; Jahnke et al. 2017; Rubio-Romero and Perlado 2015; Santos et al. 2018).

Another important theme for this study is the fact that, carrying out team-based assignments and projects is a common methodology in education that requires cooperation in order to exchange and process information among team members. But to reach a common decision is not an easy task, as it requires complex activities (Gewerc et al. 2014). So, team decision-making assignments can be an essential tool within educational contexts for students to incorporate team work skills (Baghaei et al. 2007). According to Ren and Argote (2011) coordination and specialization are important dimensions for team decision-making. Team coordination refers to the effectiveness while sharing information and knowledge among team members to accomplish the task, while team specialization comprises the differentiated knowledge that members have, and the shared belief in «who knows what». A team in which a certain level of specialization is installed, will allow its members to perform their tasks more effectively. Although studies are scarce on these constructs in educational contexts, Neville et al. (2013) reported that students liked to share their knowledge to better understand their future workplace, and to develop more professionally oriented perceptions.

Since the positive and negative perspective coexist, further research is necessary in order to examine the role that MIM could play in educational contexts in greater depth. In this context, the present paper seeks to shed some light on whether WhatsApp could play a positive role in team learning activities. In so doing, this paper contributes to pushing forward the studies on MIM as learning tools through facilitating interaction and communication in teamwork activities.

2 Theoretical framework

Previous research stresses how technological tools can facilitate the natural creation of a continuous learning process as a result of natural cooperation facilitating interaction and communication within a group (Ogara et al. 2014; Ortega and Gacitúa 2008; Sultan 2014). In this context, recent research has been conducted on the incidence of the mobile phone (Sevillano-García et al. 2016) and social networks, particularly Twitter (Cabero Almenara and Marín Díaz 2013; García González and García Ruíz 2012; Denker et al. 2018). From a teamwork perspective, over the past decades, as technology has been improving, teams have had more opportunities to perform their tasks involving the necessary people regardless of where they are located. As a result, mediated teamwork has been an important field of research (Gilson et al. 2015).

Despite the widespread use of both technology and teams, little is known on why some people are more likely to adopt technology than others. Findings suggest that female students tend to use MIM to communicate more than their male peers do (Pierce 2009). Further empirical results revealed that perceived usefulness is an important factor (Chuah et al. 2016). A recent meta-analysis on students' attitudes towards technology usage, reported significant differences between male and female college students in beliefs and self-efficacy, whereas no significant differences were found in affects and attitudes (Cai et al. 2017).

In addition, this paper analyses whether gender and some factors linked to the academic context (e.g., degree, year of study, previous experience working together) could be involved in explaining the perception of WhatsApp usefulness, team results and team cognition.

2.1 Mobile instant messaging (MIM) and learning

As was mentioned, social networks and mobile instant messaging (MIM) can be used to increase participation in the classroom, and, consequently to improve learning. From an educational perspective, MIM can be characterized as timeless, user-friendly, cost-free, and multi-modal tools (Tang and Hew 2017). MIM learning opportunities are enormous since it could be carried out spontaneously, almost everywhere and could be personalized (Motiwalla 2007; Ryu and Parsons 2012).

Research on learning through MIM could be divided into four main categories. Firstly, some studies analysed the effects of MIM on the learning process and on its outcomes (e.g. promotion of positive habits –Middelweerd et al. 2015). Secondly, pedagogical effects of mobile devices were also analysed through the design of learning scenarios (Sung et al. 2016). Thirdly, some studies underscore the positive effects of MIM on key learning variables, such as cognitive and emotional interaction and

teamwork (Rambe and Bere 2013; Kim et al. 2014). Finally, MIM were also analysed as a support and communication tool in the transition from university to professional life as a means of knowledge reinforcement and reduction of feelings of professional isolation (Pimmer et al. 2019). Along this positive perspective, research has also focused its attention on the negative consequences of MIM. In a wider context, addictive behaviour linked to an excessive use of technologies has found some support (Hong et al. 2012), and it is generally accepted that socializing through MIM does not meet the standards of a healthy socialization process (Anderson et al. 2012). Hawi and Samaha (2016), in a sample of university students reported high percentages of in-risk of smartphone addiction, and the link between this risk and lower academic achievements. Particularly, MIM could be assessed as problematic when it is used compulsively or when people are permanently connected (Gao et al. 2014; Salehan and Negahban 2013). Adult-learners expressed ambivalence about MIM for academic objectives since they were disruptive of family life (Rambe and Bere 2013). In a university sample Heflin et al. (2017), also found that mobile technology was associated with disengagement during the class in collaborative learning contexts. Furthermore, Gutiérrez-Porlán and Román-García (2018) reported that university students do not perceive Internet as a learning tool, fact that could move Universities to optimize the possibilities of their platforms to learn collaboratively. From a cognitive perspective, critical thinking worsened when it was conveyed through a mobile device (Heflin et al. 2017). According to Hwang and Tsai (2011), these negative findings could arise from merely highlighting the quality of the learning outcomes while blurring the learning process in itself.

2.2 Technologies and collaborative learning

Technology can intensify the students' reflection on how to carry out their task collaboratively. For instance, and as was previously mentioned, Kim et al. (2014) stated that MIM is good for interactions and teamwork. According to Voyiatzaki and Avouris (2014), technology supports active and collaborative learning as it facilitates group activities and helps the teacher in his or her role. Synchronous and asynchronous communication is allowed by technology, which facilitates interaction and collaborative learning (Kienle 2009). Because of those benefits, since Johnson and Johnson (1996), several technological tools were implemented to increase cooperation in learning (e.g., computer supported collaborative learning such as the so-called "KOLUMBUS"). Additionally, Gilson et al. (2015) acknowledged that younger generations consider working in virtual teams as commonplace, since work-life balance and instantaneous access to information are very important to them. Young generations also evaluate communication technologies as a way of erasing boundaries and increasing collaboration in a less hierarchical relationship structure (Myers and Sadaghiani 2010). In fact, technology provides an environment that increases collaboration between students to enhance their learning processes (Kreijns et al. 2003), facilitates collective learning (Pea 1994), and stimulates group cognition (Stahl 2006). Lancaster et al. 2007 found that MIM was clearly the most preferred communication tool among college students. Further research confirmed that WhatsApp was also very popular, and it has almost replaced the traditional mobile phone call among this group, who saw WhatsApp as a space for sharing experiences (Rubio-Romero and Perlado 2015).

Likewise, MIM reduce some of the inconveniences of mediated technology since it occurs in real time and could consist of texting, voice mail, video or a combination of all three of these (Purvanova 2014).

As teams are more than ever the most common way of job organization in actual work settings (Rico et al. 2017), learning activities based on teams are a widespread tool since they can help to share and construct academic knowledge as well as to develop valuable generic competences in the current job market (Huang 2016).

2.3 Technologies and team cognition

Team tasks such as decision-making require cooperation between team members and in so doing team members exchange, process information and determine the next appropriate actions towards team' goals (Olson et al. 2007; Prayitam and Dooley 2009). To achieve effective teamwork, members need to develop team cognition to exchange their competences and collaborate on the common task.

Team cognition is define as the process through which team members understand how the key knowledge to team effectiveness is mentally held and distributed within the team. Team cognition also provides the basis for team members to coordinate their actions (DeChurch and Mesmer-Magnus 2010). Specifically, decision-making could be influenced by one type of cognitive process that is the transactive memory systems (TMS). More particularly, TMS could be described as a shared system including both (1) team members and their expertise and knowledge, and (2) the links between team members representing other's awareness of that expertise and knowledge (Contractor et al. 2006).

The perceived cognitive interdependence in teams is firstly dependent on tasks complexity and group coordination. If team members perceive cognitive interdependence, they will establish links between them, their knowledge, and task characteristics (Peltokorpi 2008). When people know each other well, they form a system of common or complementary knowledge stored in their memories. Thus TMS provides a basis for understanding teamwork dynamics in terms of the processing and the exchange of information among individuals (Chou et al. 2012). The transactive memory systems (TMS) could be viewed as meta-knowledge about what other people know and about the accessibility of that knowledge (Lewis 2003). As Wegner (1987) posited TMS describe how team members use their peers as "external memory aids" that complement their own personal knowledge.

From the information processing perspective, technologies such as MIM can reduce cognitive load and minimise uncertainty, resulting in a more effective teamwork (Rambe and Bere 2013). In addition, technologies could also promote knowledge generation specifically by increasing the level of student's motivation (Heflin et al. 2017).

To sum up, this paper explains the relationships between the perception of WhatsApp usefulness and team results, based on a teamwork decision-making role-play designed for this study. Specifically, as MIM could facilitate team cognition, indirect relationships between the perception of WhatsApp usefulness and team results through coordination and specialization are also examined. Furthermore, since personal and other academic variables could also play a role in technology adoption by individuals, gender, grade, year of study and previous experience working together

are analysed as well. This paper aims to clarify the positive role that WhatsApp can play in team-based collaborative learning activities as a tool for communication, interaction and coordination in a sample of university students.

3 Research questions

The above-mentioned objectives will be achieved through responding to the following research questions:

RQ1. Does perceived WhatsApp usefulness improve specialization and coordination?
RQ2. What is the role of perceived WhatsApp usefulness on team efficacy and team results?
RQ3. To what extend does perceived WhatsApp usefulness affect team efficacy though specialization and coordination?
RQ4. To what extend does perceived WhatsApp usefulness affect team results though specialization and coordination?
RQ5. Since personal variables are involved in the adoption of technology, are gender and the academic variables (degree, year of study and previous experience working together), related to the perception of WhatsApp usefulness, specialization and coordination, and team results?

This study was focused on responding to the above mentioned questions by testing the following hypotheses:

Hypothesis 1: Perceived WhatsApp usefulness establishes a *direct positive* relationship with *team specialization* (H1a) and *team coordination* (H1b).
Hypothesis 2: Perceived WhatsApp usefulness establishes a *direct positive* relationship with *perceived team efficacy* (H2a) and *team results* (grades – H2b).
Hypothesis 3: Perceived WhatsApp usefulness establishes an *indirect positive* relationship on *perceived team efficacy* through its influence on *specialization* (H3a) and *coordination* (H3b).
Hypothesis 4: Perceived WhatsApp usefulness establishes an *indirect positive* relationship on *team results* (grades) through its influence on *team specialization* (H4a) and *team coordination* (H4b).

Since extant literature showed contradictory findings among gender and academic variables, this paper addresses these relationships without delineating specific relationships.

Hypothesis 5: Hypothesis 5: Gender could be related to *perceived WhatsApp usefulness* (H5a); *specialization* (H5b); *coordination* (H5c); *perception of team efficacy* (H5d); and *team results* (H5e).
Hypothesis 6: Hypothesis 6: Academic variables could be related to *perceived WhatsApp usefulness* (H6a); *specialization* (H6b); *coordination* (H6c); *perception of team efficacy* (H6d); and *team results* (H6e).

4 Material and methods

4.1 The case and the role-play

In order to adjust both technology and a team decision-making activity (Heflin et al. 2017), a role-play case was designed and specialized technical roles for each team member were configured as well as a set of common instructions and assignment' objectives.

The case presented the situation of a non-profit organization confronted with cutbacks due to the financial crisis and the dilemmas that the CEO and her board had to face in order to improve that situation. The case describes the moment before a managerial meeting, where decisions to improve the situation of the organization should be taken. Apart from this common information, specific instructions for each role were also conveyed. Common information was uploaded on the university virtual platform since its reading was required before the role-play took place. The role-play was conducted in a class within the semester calendar. Small teams were formed based on the students' own preferences. Then teams decided which role each member was going to play and accordingly, the specific information was handed out (e.g. financial statements to the financial manager role, customers' data to the business development manager role, etc.). Students already divided into teams conducted a meeting where decisions for the future of the organization were discussed. Each student played a specific role in the meeting: financial manager, business development manager, production manager and CEO. Before team discussion started, business development role (he or she was visiting clients out of town),

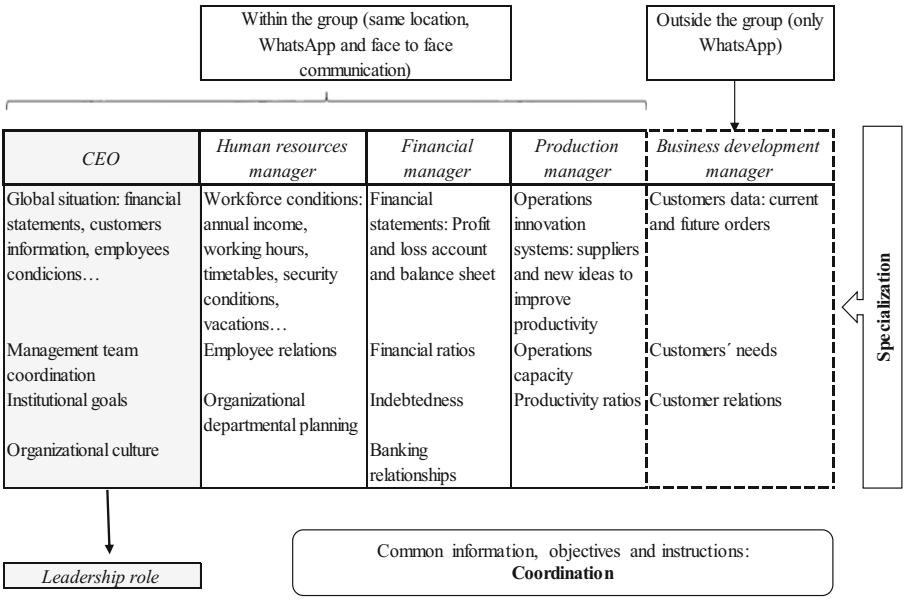

Fig. 1 Technical roles (specialization) and common information and objectives (coordination)

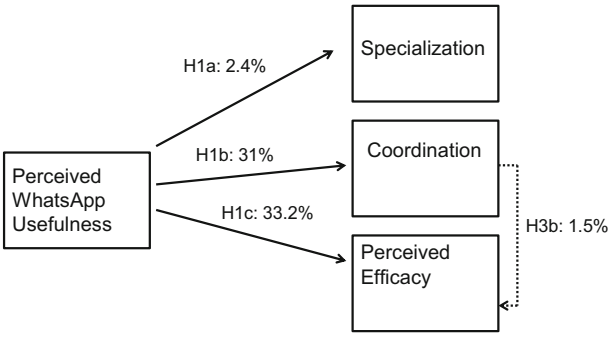

Fig. 2 Hypotheses confirmed and variance explained

was physically isolated from the rest of the team in another place (e.g. library, another classroom), and both the team and this member could only communicate through WhatsApp until the task was fully completed (decisions were written down and handed out to the researchers). Teams' goal was to take decisions that would permit the sustainability of this organization. Fig. 1 presents these roles and the common information the participants received. The role-play took 2 hours, and several teams worked simultaneously in a formal class-session. At the end of the task, each team should write down and explain their decisions. The last task was to fill out a questionnaire uploaded on the virtual platform including the dimensions of this study. In addition, data about gender, degree course, year of study and previous work together were also collected. Researchers involved in this activity jointly assessed team results based on common criteria and grades were given through assessing the rationale behind the measures proposed, their quality, and their level of innovation Fig. 2.

4.2 Participants

Sample size consisted of 200 university students (66.3% female and 33,7% male) from various Schools from the same University. Randomization of data was obtained since participants were the students enrolled in the subjects were this activity was carried out. The sample highest number consisted of Social Work students (35.7%), followed by Business Administration students (33.7%). Law and Engineering represented respectively 20.9% and 9.7%. The sample consisted of Second year students (64.8%), followed by third-year (24%) and first-year students (11.2%). Finally, three out of four were students who had worked together on previous assignments (75.5%).

4.3 Instruments

Variables were measured using a Likert's scale-type questionnaire ranging from 1 (totally disagree) to 5 (entirely agree). All items are shown in Table 1.

Perceived WhatsApp usefulness: This scale was designed for this study after reviewing the one from Yoon et al. (2015). It consists of four items ($m = 3.5$; $\sigma = 0.76$; $\alpha = 0.72$).

Table 1 Scales items and reliabilities (Cronbach's alpha)

Item	Mean	SD
Perceived WhatsApp Usefulness ($\alpha = .72$)		
1. We agreed on the usefulness of instant messaging.	3.30	1.16
2. Although one team member where not physically present, we rapidly agreed on the way of working.	3.81	.83
3. Although one team member was not physically present, communication was constant and fluid.	3.81	.95
4. The fact that one team member was not physically present clearly influenced the results of the team (r).	3.05	1.12
Team Specialization ($\alpha = .75$)		
1. Each team member has specialized information on some aspects of the assignment.	4.03	.77
2. I have some information on the assignment that nobody else has within the group.	4.14	.82
3. Different team members are responsible on having specific information about certain aspects.	4.12	.72
Team Coordination ($\alpha = .73$)		
1. The team works in a coordinated way.	4.11	.79
2. As a team we have made few mistakes on what we have to do.	3.56	.70
3. The assignment was done in a fluid and efficient way.	3.93	.73
4. We had some confusion and doubts on how to carry out the assignment (r).	3.21	1.08
Team Efficacy ($\alpha = .81$)		
1. We agreed on the assessment of our skills and knowledge.	3.74	.75
2. We quickly got an agreement on what we could do within the given time.	3.89	.82
3. We over-reached the objectives of the given assignment	4.03	.62
4. We completed the task in the given time.	4.51	.65
5. We responded quickly and effectively when a problem arose.	3.92	.66
6. We were an effective group.	4.18	.71

Team specialization It was measured with three items of the Lewis's scale (2003), measuring to what extent each individual had specialized information on some aspect of the case, and to what extent they knew which peer had what information to solve the case («Different team members are responsible for expertise in different areas») ($m = 4.09$; $\sigma = 0.64$; $\alpha = 0.75$).

Team coordination It was also measured with four items of the Lewis's scale (2003). Items ask as to what extent the team is working in a coordinated way or the confusion about how they would accomplish the task («Our team had very few misunderstandings about what to do») ($m = 3.70$; $\sigma = 0.61$; $\alpha = 0.73$).

Team efficacy perception This scale consists of six items ($m = 4.10$; $\sigma = 0.47$; $\alpha = 0.81$) that measured to what extent the participants thought they achieved the goals of the role-play, met the deadline, and worked efficiently («We over-reached the objectives of the given assignment»). This scale was also developed for this study.

Objective results (grades) Were divided into five categories: cost reduction, income growth, innovation, debt reduction, and refinancing. Grades were given depending on the solutions proposed by the research team (m = 6.80; σ = 1.15).

4.4 Data analysis

This study is cross-sectional and correlational. In order to test the hypotheses 5 (*gender* and the rest of the variables under study) and 6 (academic variables and the rest of the variables under study), mean comparison analyses were conducted. As significant differences were found between gender, degree course, year of study, previous work together, and the variables under study, a post-hoc analysis (Duncan) was also carried out. To test the rest of the hypotheses (H1 to H4), hierarchical regression analyses were run introducing gender and the academic variables as well as *perceived WhatsApp usefulness* and *specialization* and *coordination* as predictors of *team efficacy*. Since no significant relationship was found between *perceived WhatsApp usefulness* and *grades* (as measures of objective results), *grades* were not included in the subsequent regression analyses Table 2.

5 Results

5.1 Academic variables

With regard to academic variables, Table 3 displays, significant differences between *degree* and *grades*, *perceived WhatsApp usefulness* and *specialization* ($\chi^2 = 10.275$, $p < .05$; $\chi^2 = 10.283$, $p < .05$; $\chi^2 = 13.886$, $p < .01$). Post hoc contrast on *degree* shows that Social Work students get the best grades (M = 7.23, SD = .75), Business Administration students are the ones perceiving *WhatsApp* as the more useful (M = 3.73, SD = .69), and Engineering and Business Administration students achieve the highest levels in *specialization* (M = 4.35, SD = .46; M = 4.32, SD = .48). *Year of study* establishes significant relationships with *perceived WhatsApp usefulness* and

Table 2 Means, standard deviations, correlations, and scale reliabilities

Variables	Items	M	SD	1	2	3	4	5	6
1. Gender		1.33	.47						
2. Previous Experience		1.24	.43	.24**					
3. WhatsApp	4	3.47	.75	−.04	−.08	(.72)			
4. TM Specialization	3	4.10	.64	−.09	.06	.15*	(.75)		
5. TM Coordination	4	3.70	.61	−.19**	−.08	.56**	.05	(.73)	
6. Team Efficacy	6	4.10	.47	−.19**	−.17*	.44**	.01	.59**	(.81)
7. Results (grades)		6.80	1.16	−.20**	.32**	−.03	−.03	.09	.07

Cronbach' alphas are between brackets in the diagonal

*$p < .05$; ** $p < .01$; *** $p < .001$

Table 3 Mean comparison between academic variables and the variables under study

	Perceived WhatsApp usefulness		Team coordination		Team specialization		Team efficacy		Team results (grades)	
Year of Study	M	SD	M	SD	M	SD	M	SD	M	SD
1										
2	3.22	0.79	3.67	0.49	4.38	0.49	3.88	0.51	6.43	1.49
3	3.37	0.74	3.65	0.61	3.98	0.68	4.13	0.45	6.85	1.17
Chi-square	3.88	0.65	3.86	0.66	4.30	0.49	4.11	0.49	6.85	0.92
Degree	14.13**		1.82		8.19*		1.44		0.41	
Social Work										
Business Administration	3.38	0.78	3.70	0.67	3.88	0.70	4.19	0.48	7.23	0.75
Engineering	3.73	0.69	3.79	0.60	4.32	0.48	4,10	0.51	6.62	1.26
Law	3.27	0.82	3.53	0.63	4.35	0.46	3.95	0.41	6.72	1.01
Chi-square	3.28	0.69	3.62	0.48	4.00	0.70	4.00	0.38	6.80	1.16
	10.28*		3.06		13.88**		5.37		10.27*	

*$p < .05$; ** $p < .01$; *** $p < .001$

specialization ($\chi^2 = 14.135$, $p < .01$; $\chi^2 = 8.189$, $p < .05$). Third-year students achieved the highest scores in *perceived WhatsApp usefulness* (M = 3.88, SD = .65), and both third-year and first-year in *specialization* (M = 4.38, SD = .49; M = 4.30, SD = .49). From these results, hypotheses 6a, 6b and 6e for *degree* are confirmed. As Table 4 shows *gender* does not establish any significant relationship with the dependent variables, except for *grades* ($r = .21$; $p < .01$), accordingly hypotheses 5 but H5e have to be rejected.

5.2 Predictive variables and team efficacy

Table 4 depicts the results of hypotheses 1a and 1b. Only *perceived WhatsApp usefulness* contributes to explaining *Team* S*pecialization.*

The model is significant ($F = 4.80$, $p < .05$) and explains 2.4% of the variance of *perceived WhatsApp usefulness*. Likewise *perceived WhatsApp usefulness* establishes a positive link with *coordination* ($F = 88.55$, $p < .001$) explaining 31% of the variance of this variable. From these results, H1a and H1b can be accepted.

For t*eam efficacy,* all steps of the hierarchical regression are significant. Moreover, steps 2 and 3 increase the variance explained on *team efficacy*. Step 1 accounts for 4.6% of the variance ($F = 5.840$, $p < .01$), meaning that female students perceive their teams as more effective ($\beta = -.16$, $p < .01$) than their male peers. Step 2 explains 21.8% of *team efficacy* ($F = 44.332$, $p < .001$) whereas 39.5% is explained by step 3, although F change is lower than in step 2 ($F = 29.570$, $p < .001$). These results show that *perceived WhatsApp usefulness* contributes to explaining perceived *team efficacy* by establishing a positive relationship with it ($\beta = .42$. $p < .001$). In addition, its predictive power is maintained ($\beta = .14$, $p < .05$) even when introducing *specialization* and *coordination*. From these results only H2a can be accepted. With regard to indirect relationships,

Table 4 Hierarchical regression analysis: Dependent variables specialization, coordination and team efficacy

	Team specialization		Team coordination		Team efficacy		
Variable	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 3
Control Variables							
Gender	−.14	−.11	.00	.01	−.11	−.09	−.07
Previous Experience	.09	.09	−.08	−.03	−.14*	−.15*	−.16**
Main Effects							
WhatsApp		.15*		.56**		.43***	.15*
Specialization							.05
Coordination							.50***
R^2	.01	.03	.01	.30	.05	.38	.40
Model F change	1.70	4.80*	0.64	88.55***	3.67**	53.49***	4.88*
ΔR^2	.01	.02	.01	.31	.07	.33	.01

All entries are standardized regression coefficients. $N = 200$

* $p < .05$; ** $p < .01$; *** $p < .001$

perceived WhatsApp usefulness positively influences *team efficacy* by *coordination* ($\beta = .51$, $p < .001$) but not by *specialization* ($\beta = -.05$, $p > .05$), consequently H3b can be accepted.

6 Discussion and conclusion

This paper studied the role that perceived WhatsApp usefulness could play as an interaction and communication tool for teamwork complex learning activities with university students, since both ICTs and teamwork competence are highly valued in the European Higher Education Area (Esteve and Gisbert 2011). Since the perception of WhatsApp usefulness can be a predictor of its adoption (Cai et al. 2017), this study also sought to analyse the effect that this perception could exert on team efficacy and team results (grades) both directly, and through its influence on specialization and coordination. Contrary to the idea that WhatsApp could play a disruptive role (Hawi and Samaha 2016), our study was focused on the effects of WhatsApp on the learning process and its outcomes, contributing to reinforcing this positive perspective (Holtgraves 2011). This study is focused on analysing the relationship between the use of MIM and cognitive processes (Gao et al. 2017; Rambe and Bere 2013). In this context, this paper analysed the connexion of perceived WhatsApp usefulness and specialization and coordination while teams are performing complex tasks (Jarvenpaa and Majchrzak, 2008; Vista et al. 2016). For that purpose, a specific role-play case was designed in which WhatsApp played a key role as a communication and interaction tool.

Additionally, the exponential growth of WhatsApp, particularly in our sample, the favourable attitude of this age group towards this tool, and the fact that it is low cost, are some other important facts that also justify this study.

As extant literature had reported relationships between gender and learning contextual variables in the adoption of ICTs (Pierce 2009), we also considered the role that gender and some academic variables (degree, year of study, previous work together) played on the perception of WhatsApp usefulness, team specialization, coordination, perceived efficacy and team results (grades).

Our findings showed that after using WhatsApp to solve a complex assignment, students reported that its use was effective. This finding is aligned with others that point to university students showing positive attitudes towards social networks (Cabero Almenara and Marín Díaz 2013). Additionally, this attitude contributes to developing key processes for teamwork, which in turn could impact on team results. It was also found that students reported being highly satisfied with the assignment, and from the lecturers' perspective, obtained grades (objective results) were also high.

Degree and year of study were linked with perceived WhatsApp usefulness. Business students that also happened to be third-year students had the best attitude towards perceived WhatsApp usefulness. Further analysis should be done on this finding in order to clarify these relationships. The analysis shown perceived WhatsApp usefulness was strongly related with team coordination (H1a). From this result we could surmise that perceived WhatsApp usefulness could influence task planning, making team transition processes (i.e. shared objectives, chosen methods) more salient since students already know they will communicate through this tool (Maynard et al. 2012). Conversely, as the activity was a role-play, specialization was only based on the different information (not on real knowledge based on differential expertise), and this fact could explain that weaker relationship. We assume that these relationships might have been stronger if students had had more time to prepare and adopt their particular roles.

Likewise, students with positive attitudes towards WhatsApp assess their teams as more effective than individuals with a poorer attitude. Apart from this direct relationship, WhatsApp is also positively linked with team efficacy indirectly through coordination (H2a). This is an important finding since coordination is a key team process essential for achieving good results when students have to deal with cooperative activities. The fact that communication is essential for an effective coordination reveals the usefulness of WhatsApp as an interaction tool. These results are in line with theories that stress how attitudes could predict intentions and how these are the most proximal antecedents of behaviour, even more than results or other variables (Ajzen 1991). Along the same lines, recent studies also reported a strong relationship between perceived usefulness of MIM and behavioral intention towards adopting them (Yoon et al. 2015). It is worth underlining the positive reaction of students when they were informed that the role-play would require the use of WhatsApp.

Conversely, no significant relationship was found between perceived WhatsApp usefulness and grades as measures of objective results (H2b, H4a and H4b). It seems that grades are better explained by gender, and other variables from the academic situation. Female students achieving better results have previously been reported (Hawi and Samaha 2016). However in this sample, female students outnumber their male counterparts, and obtained differences could also be based on this fact. Apart from gender, grades were better explained by degree course (social work students came up with more innovative solutions), and previous work together (the highest contribution). These categories of students also achieved the highest scores on team efficacy (although the difference between degree courses was not significant). It seems that when

students want to ensure good grades, previous experience in working together is an important strategy (Engeström 2009). However the lack of significant relationships between the predictor variables (i.e., perceived WhatsApp usefulness, specialization and coordination), and grades could also be explained by the lower variability of this criteria since grades were the very same for each team. Additionally, this lack of significant relationships might be explained by other cognitive variables not included in this study.

On a whole, these findings could indicate that perceived WhatsApp usefulness could help to establish (or reinforce) teamwork in line with extant studies (e.g., Jarvenpaa & Majchrzak, 2008), and to contribute to developing the perception of team efficacy. Developing a team norm on perceived WhatsApp usefulness could be beneficial for teams using this App as a mediated interaction tool. Moreover, these results could be fundamental in widening WhatsApp application in «serious» contexts (e.g., educational contexts), beyond merely being used for sending simple messages, sharing links or delivering announcements. Finally, perceived WhatsApp usefulness would be helpful to develop not only positive teamwork attitudes, but also some team processes through enhancing specialization and coordination particularly among university students when working on complex learning activities involving decision-making.

To sum up the perception of WhatsApp usefulness, as a shared team attitude, could positively influence the perception of specialization, coordination and team efficacy. This attitude could increase an effective use of WhatsApp as a communication tool, since working through it sends a clear signal to team members about the importance of establishing a method to best coordinate individual efforts.

From a research perspective, this paper presented a scale to measure perceived WhatsApp usefulness and specialization and coordination scales were also adapted to an educational setting. From an applied perspective, this study could help to clarify the role that some variables from the academic context could play in the positive role of WhatsApp. This study also shows how to develop an innovative curriculum activity, which provides the opportunity for students to participate effectively in mediating decision making through WhatsApp, which is motivational in itself for this age group. From a theoretical perspective, as teamwork is an essential competence to be developed at all educational levels and contexts, these findings indicate that a shared perception of WhatsApp usefulness could be useful to improve some team processes.

As with any other empirical research, this study has some limitations. Given the differences found in academic variables, a more in-depth analysis would be important to clarify their specific role in teams that communicate using WhatsApp. Moreover, further studies would be needed: (1) to validate the specific mechanisms through which MIM could relate to cognitive processes, (2) to understand how perception of WhatsApp usefulness could positively influence on other team results (e.g., remain in the team), and (3) the role of emotions (e.g., trust). This complementary research would contribute to a better understanding of the processes by which WhatsApp could influence teamwork. In addition, since perceived WhatsApp usefulness could exert a positive influence on team efficacy and teamwork, to test this model in other types of education such as long-life learning or those within professional groups could be very enlightening. Even though scales applied in this study, particularly perceived WhatsApp usefulness, represents an innovation, further analysis should be done in order to consolidate them. Larger samples should be gathered in order to conduct team-

level analysis. Longitudinal studies could also contribute to testing WhatsApp effects over time. Particularly on task oriented communication at the initial stages of team life about how frequent communication should be in order to develop an effective cooperation within the team (Kanawattanchai and Yoo 2007). Last but not least, team-level analyses, longitudinal studies, and more research with other types of education could help to generalize these findings.

7 Contributions

According to the results obtained, perceived WhatsApp usefulness played a double role. Firstly, as a shared attitude, that helps team members to perceive positive relationships with team processes and team results, and secondly, as a useful communication and coordination tool in a complex cooperative team assignment. In so doing, this paper reveals two possible mechanisms through which perceived WhatsApp usefulness can be related to two cognitive team processes, and team perceived results. This study reinforces the positive perspective on MIM applied to education, particularly in teamwork assignments with university students.

8 Notes

(1) Case is available upon request to the corresponding author.
(2) Further information available upon request to the corresponding author.

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