Use of Twitter in MOOCs: New ways of youth interaction and their influence on learning

Carmen Marta-Lazo [CV] [ ] [ ] Profesora titular del Grado de Periodismo- Universidad de Zaragoza, España cmarta@unizar.es

Diana Valero-Errazu [CV] [ ] [ ] Profesora del Máster Oficial en Tecnologías de la Información y la Comunicación para la Educación y Aprendizaje Digital de la Universidad Antonio de Nebrija. dvalero@nebrija.es

José Antonio Gabelas Barroso [CV] [ ] [ ] Profesor Contratado Doctor del Grado de Periodismo-Universidad de Zaragoza, España jgabelas@unizar.es

Abstract
Introduction: This article analyzes the new forms of interaction of young people within a non-formal learning environment, in teaching through MOOC. The objective is to identify how feedback that is given through Twitter influences students' learning. **Methodology:** first, we carried out a multiple regression analysis to determine which factors have the greatest effect on learning and, subsequently, to determine the extent to which feedback, both given and received, influences different variables: commitment, motivation, participation, enjoyment / satisfaction, self-assessment and learning outcomes, by contrasting means by segments. **Results:** it is verified that giving feedback through Twitter positively influences learning, while receiving it passively does not obtain conclusive results. **Discussion and Conclusions:** both the motivation and participation of students and the satisfaction with the use of the Twitter dialogue have a positive effect on learning.

Keywords
1.Introduction. 1.1. Interaction and feedback as part of active learning. 1.2. Twitter as an educational tool. 2. Methodology. 2.1. Hypothesis. 2.2. Characteristics of the sample and obtaining of the data. 2.3. Measurement of the variables. 3. Results. 3.1. Exploratory and reliability factor analysis on the exogenous and endogenous variables. 3.2. Multiple regression analysis. 4. Conclusions. 5. Bibliography

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1. Introduction

The use of social networks is growing, especially among young people. For example, in 2017, the penetration rate of networks in Spain reached 86% (Statista, 2018), with Facebook and Twitter being the most used. This implies new forms of language and interaction with an important pedagogical potential.

Social networks are increasingly incorporated into pedagogy as a means for online collaborative learning. In relation to Twitter, one of the most used networks, as some research points out, microblogging has the potential to encourage participation, commitment, and deeper reflection, as well as collaborative learning under different learning scenarios (Gao, Luo, & Zhang, 2012), even appearing as informal peer support networks online (Badge, Johnson, Moseley, & Cann, 2012). Dialogical possibilities and collective authorship, with tools like Twitter, allow for interesting multimedia development. "The premise from which it starts is to create spaces that facilitate individual and collective exploration, participation, critical analysis and production, all with a prominent component of recreation. Thus, reflection and creation are interconnected, taking into account also the search for playful learning" (Marta-Lazo & Gabelas Barroso, 2016:144).

Similarly, individualist learning, in a unidirectional and behaviorist sense, has given way in the last decades to a constructivist model in which the student is the architect and protagonist of his formative process. The new media and social networks have made it possible to take the learning paradigm one step further, and connectivism (Siemens, 2005) is one of the most relevant models in the new ways of learning. The relationships established between students and teachers allow a more horizontal and dialogical learning.

This study aims to analyze the reasons why this social network is interesting as a way to generate significant feedback among students, taking into account the following variables: engagement, motivation, participation, enjoyment/satisfaction, self-assessment, and learning results. To this end, we selected a MOOC whose theme is fully adapted to what we wish to study, entitled "Communication and mobile learning," within the framework of the "E-learning, Communication and Open-data: Massive Mobile, Ubiquitous and Open Learning" (ECO), with the participation of 26 partners, including universities from different countries, such as the Sorbonne, Manchester, Zaragoza, Valladolid, and the Polytechnic of Lisbon, among others (Marta-Lazo, Frau-Meigs & Osuna-Acedo, 2018).

1.1. Interaction and feedback as part of active and collaborative learning

Active learning is defined as "the result of a deliberate and conscious attempt by the teacher to cause students to participate openly in a lesson" (Pratton & Hales, 1986, p. 211). This refers to practices that involve students in the learning process and includes techniques that encourage students to speak, write, reflect, discuss… in opposition to traditional techniques more focus on listen passively to a lecture. Active learning involves speaking and listening, writing, reading and reflecting, and can improve the results of traditional formats (Knight and Wood, 2005, Yoder and Hochevar, 2005). According to the generative theory of learning, students learn best when they participate in active cognitive processing (Mayer and Wittrock, 2006, Prince, 2004).

One of the most important methods of active learning is collaborative learning. Collaborative learning is defined as a learning philosophy that involves the exchange of knowledge, experiences, and authority, in which students teach and learn from each other and develop positive interdependence (Panitz, 1999). This increases the ability to think critically (Angeli, Valanides, and Bonk, 2003) and students are encouraged to participate in giving the answer, explaining and justifying their opinion (Garrison, Anderson, and Archer, 2001). In this context, students become active agents in their learning process and collaborate into the creation of their own knowledge, increasing the probability that all group members will learn the subject and decreasing that only a few students understand the subject material (Sóller, 2001).

Promoting interaction and feedback is crucial, as it leads to more effective learning (Bannan-Ritland, 2002, Erickson and Siau, 2003), becoming sources of success in education (Chou, 2003, Siau, Sheng, and Nah, 2006). In this line, Blasco et al (2012) point out citing Prince (2004), collaborative learning "occurs when students work together in small groups toward a common goal, creating meaning, exploring a topic, or improving skills" (Blasco et al, 2012, p. 105). It arises under the idea that collaboration and cooperation work better to achieve certain competences than competition among students or work individually. For example, collaborative learning develops the ability to think critically (Angeli, Valanides, & Bonk, 2003), because students are encouraged to participate in giving the answer, explaining, and justifying their opinions (Garrison, Anderson, & Archer, 2001).

This might seem to be harder to get into a virtual context, but there is an agreement that "one of the strategies that should be developed with tele-training is collaborative and cooperative learning, and this initially involves empowering the creation of a sense of community among the different participants, which will be at the same time the basis of a virtual community" (Cabero, 2006, p. 8).

Collaborative learning, both face-to-face and on-line, is not merely "work in group" this work has to be aligned to get 5 conditions: positive interdependence (students understand and share that they can only achieve a certain result if they work together); promotive interaction (students support each other´s learning); individual and group accountability (the individual results of group members should reflect the knowledge of the group, so that the group is encouraged to support at each time the member who needs more help and not that each member of the group only acquires a part of the knowledge); social skills (such as communication or leadership), and; group processing (exchange and reinterpretation of information collectively) (Johnson, Johnson, & Holubec, 2013)

Trying to apply this 5 components there are two main points: interaction and feedback. Students need to work together, to interact, but in order to do it successfully they need to continuously give and receive feedback, both from the teacher and from the peers.

Promoting interaction and feedback is crucial as it leads to better and more effective learning (Bannan-Ritland, 2002; Erickson & Siau, 2003), making it a key source of success in education (Chou, 2003; Siau, Sheng, & Nah, 2006). This concept has been considered as one of the main pedagogical issues in the classroom, especially for the larger classes and courses related to technology.

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In virtual teaching this interaction is carried out through non-contact tools, in the sense that connectivism (Siemens, 2005) suggests, regarding the distribution of knowledge and learning as a process of growth in a virtual community (Conole, Galley, & Culver, 2011). In the present analysis, the object of study is the interaction that is projected and established during the learning process by students in a MOOC, using the social network Twitter as a tool for discussion and feedback.

1.2. Twitter as an educational tool in MOOC

The effect of active collaborative learning on student performance is even greater when combined with the use of technology (Stowell & Nelson, 2007). Other authors who support this view suggest that when students use technology, they incorporate a higher rate of collaboration in their learning process (Kryder, 1999). The growth in the use of technology to promote collaborative learning has attracted a growing number of studies (Resta & Laferrière, 2007), which collectively support the idea that technology improves learning processes (Kreijns, Kirschner, & Jochems, 2003).

It is evident and widely accepted that traditional learning methods can hinder classroom interactions (Cotner, Fall, Wick, Walker, & Baepler, 2008). Limited class time, fixed seating arrangements, and students' reservations about classroom speech have been identified as important barriers to interaction in the classroom (Draper & Brown, 2004; Liu, Liang, Wang, Chan, & Wei, 2003). However, advancements in technology have changed the way students and teachers interact in the classroom, and have provided new opportunities to improve interaction.

Twitter is a powerful tool to boost Personal Learning Networks (PLN), which lead to so-called connected learning or network learning (Dirckinck-Holmfeld, Hodgson, & McConnell, 2012; Tur & Marin, 2015).

According to Duque, Pérez and Guevara (2012, p. 29), there are five characteristics that make Twitter useful for education and learning: the agile interaction between teachers and students (Junco, Heibergert, & Loken, 2011; Stepanyan, Borau, & Ullrich, 2010); overcoming physical and temporal spaces to interact by emitting, reading, and receiving messages (Stieger & Burger, 2010); the possibility of returning to the messages emitted, read, and received as well as their monitoring (Ebner, Lienhardt, Rohs, & Meyer, 2010); the multimedia format itself that facilitates communication and learning (Grosseck & Holotescu, 2010).

Among their use in education, specifically in higher education, research highlights two areas. On one hand are those that promote the student's relationship with the institution and its image, and on the

other hand, those that are focused specifically on the educational benefits for the student. In our case, we focus on the latter. Among its benefits in educational use are the following:

(1) It allows to overcome the physical limits of the class in its interaction with the teachers, to respond in real time to student problems, and to disseminate updated information on the course (Kassens-Noor, 2012; Ebner, Lienhardt, Rohs, & Meyer, 2010).

(2) It allows greater connection between the students and the content of the course, promoting students' spending more time on the course and promoting greater and deeper discussions about the course content among the students (Domizi, 2013; Wright, 2010; Kassens-Noor, 2012).

(3) It promotes greater engagement with the course, especially when the course's faculty is also involved (Junco, Elavsky, & Heibergert, 2013, Greenhow & Robelia, 2009).

(4) It promotes continuous communication and transparency, facilitating immediate feedback (Ebner, Lienhardt, Rohs, & Meyer, 2010).

(5) It allows for more flexible work between peers, regardless of physical or temporal space (Ebner, Lienhardt, Rohs, & Meyer, 2010).

(6) It promotes the creation of a community of learners and the possibility of connecting with a network of professionals who put the course into practice, increasing the sense of community and improving the possibilities of building relationships and increasing communication (Lomicka & Lord, 2012; Wright, 2010; Dunlap & Lowenthal, 2009; Holotescu & Grosseck, 2010).

(7) Deeply linked to the above, the use of Twitter as an educational tool increases social interactions and connections between students and teachers, even promoting a connection beyond academic environments (Munoz, Pellegrini-Lafont, & Cramer, 2014; Dunlap & Lowenthal, 2009).

(8) For the teaching staff, it allows documentation of the process (Ebner, Lienhardt, Rohs, & Meyer, 2010).

Although virtual learning has important advantages, the literature has echoed the risks of the use of Twitter in the classroom, among them the fact that it has a very marked use restrictions, for example, in extension of the messages, which in a way limits the ability to interact (Ebner, Lienhardt, Rohs, & Meyer, 2010). Likewise for the students themselves, it presents privacy problems, especially when they are minors (Grosseck & Holotescu, 2008) or it may be a covert system of control (Bouchard, 2011). On the other hand, problems arise from student's misuse, as it can be that they do not take it as a serious learning tool or because of its distracting character (Shafique, Anwar, & Bushra, 2010; Clarke, 2012). Likewise, it has also been shown that character limitation can make self-reflection and critical thinking difficult (Kassens-Noor, 2012). Similarly, Grosseck and Holotescu (2008) argue that Twitter, far from allowing the group to be strengthened, can make group work difficult in specific tasks.

Therefore, authors such as Kirschner and Karpinski (2010) or Junco, Heibergert, and Loken (2011) point out that the use of social networks as an educational tool is controversial and may lead to an increase in negative results and a reduction of hours dedicated to the study.

The challenges for connectivist learning to be of quality go through the degree of presence that the student has, the autonomy he/she demonstrates in learning, and the critical literacy he/she possesses. These variables will influence the production process in social networks to be more or less active and creative (Kop, 2011).

Despite the possible negative effects, it has been demonstrated that the use of Twitter can positively influence the learning process (Grosseck, 2009; Ebner, Lienhardt, Rohs, & Meyer, 2010). However, the agreement is higher when we use it as a tool of communication in the interaction between students and between them and the teacher (Rodríguez, García, Ibáñez, González, & Heine, 2009; Bazzo de Espíndola, Struchiner, & Rabetti, 2010; Shafique, Anwar, & Bushra, 2010; Özsoy, 2011; Carpenter, 2014).

The use of social networks is especially appropriate and interesting in Massive Online Open Courses (Massive Online Open Courses), where it has been proven that there is significant interaction between peer interaction and the utility of the network as a means of promoting collaborative learning (Castaño Garrido, Maiz Olazabalaga, & Garay Ruiz, 2015).

In addition, MOOCs based on the construction of internal and external connections allow students not only to solve problems, but also to improve their own self-learning skills thanks to the management and organization that they must continually develop to find collaborative solutions that adapt to each learning situation, in which interactions through environments such as Twitter are based on the so-called "relational factor" (Hergueta Covacho, Marta-Lazo, & Gabelas-Barroso, 2016).

2. Methods
2.1. Dialectic Twitter

To carry out the investigation we used the Twitter dialectic, a technique that we describe below-
One of the main objectives of the MOOC "Communication and mobile learning", which serves as case analysis for this research, was: "learning to communicate effectively, playfully, creatively and educationally in social network learning communities and through mobile devices". Therefore, among other learning methodologies carried out in different social networks, we designed as a first activity to put students in contact with the "Dialectic Twitter". The purpose of this practice was to talk about one of the topics of the first module, media education, through the use of the common hashtag # ECO_CAM_1a.

The mechanics consisted of developing an online conversation about a general topic that would allow the analysis in the experimentation, from and with the socialnetwork itself, through the inclusion of arguments about the role of media education in a context of mobile learning. This conversational design was intended to start the MOOC by designing a practice of creating a common discourse on the same subject, through a technique of collective authorship in a chain. In this activity, the students fed back to their own peers, by including active responses to the tweets, which could consist of giving or receiving feedback, depending on the meaning of the dialogue. In this way, it is a question of awakening interest in the exchange of information on the same topic, including in some cases entries, links or other contributions.

Thus, the feedback given was related to the number of interactions in which the student responded with new messages to his classmates, or he nodded his speech through a liking or projected it through a retweet. On the other hand, the feedback received occurred in the opposite direction, when other colleagues carried out these actions with respect to a specific tweet.

This practice was initially promoted by the teachers of the module, to offer guidelines for the operation of the activity and to arouse interest in the students to carry it out. As a reward, once a follow-up was carried out by the students themselves through co-evaluation, if the practice had been overcome, badges were obtained. It should be noted that more than a third of the students who completed the

questionnaire were young, who had completed the MOOC, so their performance was effective and achieved positive results.

2.1. Methodology Proposed hypotheses

Hypothesis 1: The student's engagement has a positive effect on learning.

Hypothesis 2: Student motivation has a positive effect on learning.

Hypothesis 3: Student participation has a positive effect on learning.

Hypothesis 4: The student's self-assessment of learning has a positive effect on learning.

Hypothesis 5: Student enjoyment/satisfaction with the use of Twitter dialogue has a positive effect on learning.

Therefore, the student's attitude model towards learning through Twitter is as follows:

$$LO = \beta_0 + \beta_1\ ENGAG + \beta_2\ MOT + \beta_3\ PART + \beta_4\ SELFEV + \beta_5\ SATIS + \varepsilon_i$$

where,

BETA is the constant

LO, variable to explain: learning outcomes

ENGAG: engagement

MOT: motivation

PART: participation in class

SELFEV: self-evaluation

SATIS: enjoy the student with the use of the dialogue on Twitter (satisfaction)

2.3. Characteristics of the sample and data collection

Table 1 shows the technical file of the study. As can be seen, the total sample was 91 students enrolled in the MOOC course entitled "Communication and mobile learning" which represent 38% of the students in the module. Method used for the collection of the information was a self-administered online questionnaire. The sampling procedure was for convenience, and the date of completion of the field work corresponded to the months in which the course developed its fifth edition (March–April 2016). The questionnaire was completed by the students who finished the course and participated in the dialectic activity Twitter of them approximately 2/3 were under 30 years. Regarding their educational level and previous experiences with the use of Twitter, it should be noted that 11% had not finished their university studies yet, 45% were graduates and 44% had completed a master's or doctorate. Also, although 90% had used Twitter before, only 47% had used it as an educational tool

Table 1. *Technical Sheet*

Sample size	191 students (40.65% male and 59.35% female)
Method of collecting the information	Self-administered online questionnaire
Sampling procedure	Sampling for convenience
Date of realization	March–April 2016

2.4. Measurement of variables

The literature review allows us to select the items considered for each of the exogenous variables of the proposed model (see Table 2). These indicators are an adaptation to the specific context of MOOC learning environments and the use of Twitter.

All indicators are measured using a 7-point Likert scale. Note that the exogenous variables of engagement, motivation, class participation, and self-assessment have been measured through four items, while the variable enjoyment/satisfaction with the Twitter dialogue is measured with a single item. In addition, the endogenous variable learning outcomes has been measured through three items.

Table 2 *List of Variables and Items*

Variable	Item	References
Engagement (This course…)	(X1) Has made me feel that my opinions have been taken into account in this course (X2) Has made me feel valuable (X3) Has favored my personal relationships with my peers and my teachers	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); Higgins, Hartley, & Skelton, 2002); Greenhow & Robelia (2009); Junco, Heibergert, & Loken (2011); Johnson (2011)
Motivation (The use of Twitter ...)	(X4) Increases my enthusiasm to study the material of this course (X5) Motivates myself more to learn in this course (X6) Motivates me to relate to course content	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); López Zapico & Tascón Fernández (2013)
Class participation	(X7) It makes me feel more involved in the course (X8) I perceive that there is more participation in class	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); Dunlap & Lowenthal (2009);

	(X9) Increases my interest in what we do	Rinaldo, Tapp, & Laverie, (2011); Munoz, Pellegrini-Lafont, & Cramer (2014), Knox (2014)
Self-assessment	(X10) I find it easier to know if I master the class material (X11) Makes me feel more confident about how I'm doing in class (X12) Helps me determine more easily what I am doing in the course	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); Grossec & Holotescu (2008); Caldwell (2015); Tur & Marín (2015)
Enjoy the Twitter dialogue	(X13) I enjoyed using the Twitter dialogue	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); Zerega-Garaycoa (2015); Marta-Lazo, Marfil-Carmona, & Hergueta-Covacho (2016)
Learning outcomes	(X14) The topics covered in the course using Twitter have helped me complete my training (X15) The approach on Twitter has helped me to discover new learning (X16) The dynamics of Twitter have helped me to advance in my learning	Blasco-Arcas, Buil, Hernández-Ortega & Sesé (2013); Ophus & Abbitt, (2009); Ebner, Lienhardt, Rohs, & Meyer (2010); Junco, Elavsky, & Heibergert (2013); Abella García & Delgado Benito (2015)

3. Results

The results of the research obtained through the statistical program SPSS 22.0 are presented below. First, an exploratory factorial analysis (AFE) was performed. Next, multiple regression analysis (MRA) was performed, with the aim of contrasting the proposed hypotheses.

3.1. Exploratory factor analysis and reliability on exogenous and endogenous variables

Exploratory factorial analyzes (EFA) were performed for each of the four proposed exogenous variables (note that the enjoyment variable presents a single item and does not require EFA) and for the endogenous variable object of study. It was observed that there is one-dimensionality for all variables. In addition, for all cases the explained variance is higher than 70% and Cronbach's factorial loads and alpha coefficients have values higher than the recommended minimum (see Table 3). In this

way, the internal consistency of the one-dimensional scales obtained is reflected (Hair, Anderson, Tatham, & Black, 1999).

Table 3. *Results of AFE and Cronbach's Alpha of Exogenous and Endogenous Variables*

(Variable 1) Engagement	Factor 1	Explained variance	Cronbach's alpha
(X1) It has made me feel that my opinions have been taken into account in this course	0.918		
(X2) It has made me feel valuable	0.905	84.39%	0.906
(X3) This course has favored my personal relationships with my peers and my teachers	0.934		
(Variable 2) Motivation	**Factor 1**	**Explained variance**	**Cronbach's alpha**
(X4) It increases my enthusiasm to study the material of this course	0.928		
(X5) It motivates me more to learn in this course	0.922	79.98%	0.874
(X6) Motivates me to relate to course content	0.830		
(Variable 3) Participation in class	**Factor 1**	**Explained variance**	**Cronbach's alpha**
(X7) It makes me feel more involved in the course	0.947		
(X8) I realize that there is more participation in class	0.922	89.25%	0.939
(X9) Increase my interest in what we do	0.965		
(Variable 4) Self-assessment	**Factor 1**	**Explained variance**	**Cronbach's alpha**
(X10) I find it easier to know if I master the class material	0.944		
(X11) Makes me feel more confident about how I'm doing in class	0.952	89.95%	0.944
(X12) Helps me determine more easily what I am doing in the course	0.950		
(Endogenous variable) Learning outcomes	**Factor 1**	**Explained variance**	**Cronbach's alpha**

(X14) The topics covered in the course through Twitter have helped me complete my training	0.947		
(X15) The approach on Twitter has helped me to discover new learning	0.963	91.83%	0.955
(X16) The dynamics of Twitter have helped me to advance in my learning	0.964		

3.2. Multiple regression analysis

The unidimensionality of the exogenous and the endogenous variables serves to justify the use of the variables through the scores of the components that have been extracted for each one. In this way, the model contrast and assumed relationships between the variables are performed through multiple regression analysis (MRA). The stepwise procedure is used to test the multicollinearity between the variables.

The results of the adjusted coefficient of determination are shown in Table 4. As can be seen, the exogenous variables explain 77.9% of the variability of the students' learning results. The variables motivation, participation in class, and enjoyment/satisfaction of the students are determinants for learning outcomes.

In this sense, it was observed that motivation has a positive influence ($\beta_2 = 0.314$) on the variable learning outcomes. This fact leads us to accept Hypothesis 2. In addition, the variable participation in class ($\beta_5 = 0.355$) and enjoyment of the student with the dialogue on Twitter ($\beta_5 = 0.225$) have a positive influence on the endogenous variable, that is, on learning outcomes. Thus, we accept Hypotheses 3 and 5. However, the engagement and self-assessment variables do not determine student learning outcomes. Therefore, we reject Hypothesis 1 and Hypothesis 4 (see Table 5).

Finally, it is important to highlight the order of importance of the exogenous variables to explain the variability of the endogenous variable. Thus, it was observed that participation in class is the variable that determines the learning outcomes of the student the most. The motivation and the enjoyment of the student are placed in second and third place, respectively.

Table 4. *Results of ARM Learning Outcomes*

Model	Non-Standardized Coefficients		t	Sig.
	B	Standard error		
1 (Constant)	-6.475	.055	.000	1.000
Motivation	.852	.056	15.338	.000
2 (Constant)	-1.413	.374	-3.783	.000
Motivation	.603	.083	7.257	.000
Satisfaction	.260	.068	3.820	.000

3	(Constant)	-1.224	.364	-3.364	.001
	Motivation	.314	.126	2.489	.015
	Satisfaction	.225	.066	3.395	.001
	Participation	.355	.120	2.957	.004

Table 5. *Hypothesis Contrast Results*

Proposed hypothesis	Result
Hypothesis 1: The student's engagement has a positive effect on learning.	IS DENIED
Hypothesis 2: Student motivation has a positive effect on learning.	IS ACCEPTED
Hypothesis 3: Student participation has a positive effect on learning.	IS ACCEPTED
Hypothesis 4: The student's self-assessment of learning has a positive effect on learning.	IS DENIED
Hypothesis 5: Student enjoyment with the use of Twitter dialogue (satisfaction) has a positive effect on learning.	IS ACCEPTED

Objective 2

Once established that motivation, enjoyment/satisfaction, and participation in class are the variables that, according to our analysis, influence learning, we defined a second objective, which is to determine how much influence has feedback, given and received, in these variables.

We have hypothesized that the students who obtain the highest feedback will be those who obtain higher scores.

In order to make an exploratory study of this situation, we performed a mean difference analysis between groups using non-parametric Kruskall-Wallis contrast. For this, we used the statistical program SPSS 22.0

Four categories were established for which students were asked to respond to the amount of feedback given and received (number of tweets/re-tweets, comments, and liking tweets) by establishing four groups: none; from 1 to 5; from 6 to 10; more than 10.

The variables used and the sample are the same as those used in the first objective discussed in the article and, therefore, have been measured through a Likert scale of 7 points; but we focused the analysis on the three variables that through study 1 have been shown to have an influence on learning, i.e., participation in class, enjoyment and motivation.

Table 6. *Feedback Given and Received by the Student*

		Feedback given		Feedback received	
		Mean	Standard deviation	Mean	Standard deviation
It increases my enthusiasm to study the material of this course (x1)	None	4.5	1.08	4	1.732
	From 1 to 5	5.29	1.051	5.24	1.05
	From 6 to 10	5.44	0.726	5.5	0.941
	More than 10	5.88	0.947	5.78	0.902
It motivates me more to learn in this course (x2)	None	4.7	1.16	4.33	2.082
	From 1 to 5	5.56	1.183	5.47	1.172
	From 6 to 10	5.22	0.833	5.36	0.929
	More than 10	5.79	0.977	5.78	0.951
It motivates me to relate to the content of the course (x3)	None	5.4	1.43	4.67	2.517
	From 1 to 5	5.58	1. 069	5.63	1.058
	From 6 to 10	5.33	1	5.43	1.016
	More than 10	6.17	0.565	6.13	0.458
It makes me feel more involved in the course (x4)	None	4.6	1.174	4.33	2.082
	From 1 to 5	5.27	1. 026	5.2	1.02
	From 6 to 10	5.22	0.972	5.43	1.089
	More than 10	5.75	1.032	5.65	0.982
I perceive there is more participation in class (x5)	None	4.4	0.966	4	1.732
	From 1 to 5	5.25	1.021	5.16	1.027
	From 6 to 10	5.44	0.726	5.57	0.852

	More than 10	5.88	1.154	5.78	1.126
Increased my interest in what we do (x6)	None	4.7	1.16	4.33	2.082
	From 1 to 5	5.44	1.183	5.31	1.14
	From 6 to 10	5.33	1	5.64	1.151
	More than 10	5.79	1.062	5.74	1.01
I enjoyed using the Twitter dialogue (x7)	None	4.9	1.37	4	2
	From 1 to 5	5.25	1.361	5.27	1.358
	From 6 to 10	5.44	0.726	5.5	0.855
	More than 10	6.04	0.751	5.96	0.706

Table 6 shows the mean contrast scores for the seven variables as a function of the four groups of students segmented according to the amount of feedback given and received. A non-parametric Kruskall-Wallis test was used for this, since normality tests indicate that the variables do not follow a normal frequency distribution. In this contrast, the null hypothesis to be contrasted proposes that there are no differences in the mean scores of each variable according to the group to which each student belongs. The alternative hypothesis points out the opposite; that is, there are significant differences in the mean scores for each variable according to the group to which the student belongs.

The results of the analysis show significant differences in the mean scores considering the amount of feedback given and received as a segmentation variable. In this sense, it can be seen that the students belonging to the group that did not receive or give any feedback have lower mean scores than the other groups of students in all the variables. The difference with respect to students who have indicated feedback above 10 is especially significant. Specifically, this difference is greater than one point with respect to the group with the highest feedback for all variables, both when the student gives feedback and when he/she receives it.

However, when analyzing differences between the students belonging to Group 2 with respect to the students in Group 3, it was found that the differences were not higher than a point for any of the variables; in fact, although in general, we may observe that the amount of feedback influences learning, this relationship is not always positive.

Among the students who received and gave more feedback, it was found that they gave the highest mean scores for all variables. In this sense the variables (x7) "I have enjoyed using the dialogue on Twitter" (6.04; 5.96) and (x3) "Motivated me to relate to the content of the course" (6,17; 6,13) are the most significant variables for both, given feedback and received feedback.

As can be observed, the greater the feedback both given and received, the higher the mean scores obtained for the seven variables analyzed. This means that feedback has a direct influence on each of the proposed variables.

Table 7. *Kruskal-Wallis Contrast*

Items	Feedback given		Feedback received	
	p-value	Hypothesis	p-value	Hypothesis
It increases my enthusiasm to study the material of this course (x1)	0.005	Reject null hypothesis	0.041	Reject null hypothesis
It motivates me more to learn in this course (x2)	0.062	Reject null hypothesis	0.329	**Retain null hypothesis**
It motivates me to relate to the content of the course (x3)	0.041	Reject null hypothesis	0.059	**Retain null hypothesis**
It makes me feel more involved in the course (x4)	0.026	Reject null hypothesis	0.073	**Retain null hypothesis**
I perceive there is more participation in class (x5)	0.034	Reject null hypothesis	0.193	**Retain null hypothesis**
Increase my interest in what we do (x6)	0.003	Reject null hypothesis	0.026	Reject null hypothesis
I enjoyed using the Twitter dialogue (x7)	0.076	**Retain null hypothesis**	0.218	**Retain null hypothesis**

** Significant for $p < 0.05$

Finally, the Kruskall-Wallis non-parametric contrast results indicate that the null hypothesis is rejected for six out of the seven variables proposed in the investigation (p-value <0.05) in the case of the given feedback. However, in the case of feedback received, the results are different and the null hypothesis is rejected for the following variables: "Increases my enthusiasm for studying the material of this course" (x1), "Motivates me to relate to the content of the course" (x3), "It makes me feel more involved in the course" (x4), and "Increases my interest in what we do" (x6).

4. Conclusions

In the present investigation, we have been able to conclude that although for the case of the feedback all our preliminary hypotheses have been confirmed, for the received feedback the results are not conclusive. That is, it has been shown that giving feedback through Twitter positively influences learning, but it has not been confirmed that receiving it is influential in the same way.

Significantly, the fact of actively interacting, such as giving feedback, has a positive influence, while for passively receiving, it is not conclusive.

It has been observed that the feedback traditionally associated in the context of mass media to a bidirectional nature, in the case that concerns us, integrated in a social-media context, is multidirectional. Which opens different perspectives of study in the field of educommunication, and allows to optimize the interactions between the participants.

As for the analyzed variables, we were able to corroborate and validate the hypotheses related to the fact that both the motivation and the students' participation in the class as well as the students' enjoyment or satisfaction with the use of the Twitter dialogue have a positive effect on learning.

Conversely, neither the engagement nor the self-evaluation that the students make about their learning have a positive effect on learning.

All this is especially important in the case of young people, because we have already seen how, in their case, it has a greater educational impact to give feedback than to receive it, that is, to actively engage in the activity through Twitter and interact with other colleagues has a greater impact than receiving feedback, which contrasts with the view that young people only seek reaffirmation through networks, a greater number of "likes" etc. Although at a social level these affirmations may be true, at an educational level for young students, the evaluation of their peers through Twitter has less impact.

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