

Facebook or LMS in Distance Education? Why University Students Prefer to Interact in Facebook Groups

Esteban Vázquez-Cano and Paz Díez-Arcón

Volume 22, Number 3, August 2021

URI: <https://id.erudit.org/iderudit/1082088ar>
DOI: <https://doi.org/10.19173/irrodl.v22i3.5479>

[See table of contents](#)

Publisher(s)

Athabasca University Press (AU Press)

ISSN

1492-3831 (digital)

[Explore this journal](#)

Cite this article

Vázquez-Cano, E. & Díez-Arcón, P. (2021). Facebook or LMS in Distance Education? Why University Students Prefer to Interact in Facebook Groups. *International Review of Research in Open and Distributed Learning*, 22(3), 119–141. <https://doi.org/10.19173/irrodl.v22i3.5479>

Article abstract

This article describes an investigation into the level of satisfaction among students at Spain's National Distance Education University (UNED) regarding use of Facebook groups as an environment for learning. Based on a structural equation methodology, the research analyzed the most relevant personal and socio-educational factors that affect satisfaction. The sample consisted of 418 undergraduate and master's degree students at UNED's Faculty of Education; participants were consulted in three semesters between September 2019 and January 2021. The results showed that students who participated in Facebook study groups achieved better results than those who did not, and that they interacted more frequently in these groups than in UNED's official learning management system. The main latent variables that influenced satisfaction with Facebook study groups were the perception of efficacy they elicited as a complement to distance learning by enabling greater interaction with other students, and the feeling of course companionship they provided. The absence of teacher control also influenced student satisfaction, which allowed students to focus on learning and achieving better results in tests and exams.

Copyright (c) Esteban Vázquez-Cano and Paz Díez-Arcón, 2021



This document is protected by copyright law. Use of the services of Érudit (including reproduction) is subject to its terms and conditions, which can be viewed online.

<https://apropos.erudit.org/en/users/policy-on-use/>

August – 2021

Facebook or LMS in Distance Education? Why University Students Prefer to Interact in Facebook Groups

Esteban Vázquez-Cano and Paz Díez-Arcón

Universidad Nacional de Educación a Distancia (UNED)

Abstract

This article describes an investigation into the level of satisfaction among students at Spain's National Distance Education University (UNED) regarding use of Facebook groups as an environment for learning. Based on a structural equation methodology, the research analyzed the most relevant personal and socio-educational factors that affect satisfaction. The sample consisted of 418 undergraduate and master's degree students at UNED's Faculty of Education; participants were consulted in three semesters between September 2019 and January 2021. The results showed that students who participated in Facebook study groups achieved better results than those who did not, and that they interacted more frequently in these groups than in UNED's official learning management system. The main latent variables that influenced satisfaction with Facebook study groups were the perception of efficacy they elicited as a complement to distance learning by enabling greater interaction with other students, and the feeling of course companionship they provided. The absence of teacher control also influenced student satisfaction, which allowed students to focus on learning and achieving better results in tests and exams.

Keywords: Facebook groups, distance education, learning management system, university, interaction

Introduction

The use of Facebook groups to support distance learning in higher education has been less researched than the use of this medium to complement different types of in-person tuition. Facebook is currently the most prominent social network, with an estimated 2.85 billion users, according to data for the first quarter of 2021 (Statista, 2021). University students continue to prefer Facebook to other social networks for academic work (Arteaga et al., 2014; Chiroma et al., 2016; Lambić, 2016). This study analyzed the level of satisfaction among distance learning students enrolled in Spain's National Distance Education University (UNED) regarding their use of Facebook study groups, free of teacher vigilance, as an educational resource in support of their learning process. The development of this study enabled us to discover the variables that had greatest influence on the adoption of Facebook groups as opposed to UNED's own learning management system (LMS), and to understand the implications for LMS design and teaching methodology in distance learning.

Facebook Groups for Learning

Virtual learning environments are an ideal context in which to examine how learning theories explain the effect of social factors on learning processes. Social cognitive theory (Bandura, 1999) has stated that people observe, imitate, and model the behaviour of others; social media, can foster the development of cognitive elements such as attention, memory, and motivation (Deaton, 2015). Furthermore, Siemens (2005) and Downes' (2007) connectivism proposed a conceptual framework in which learning is greatly influenced by technology, socialization, and the connection of specialized nodes or information sources to support knowledge flow. According to social constructivism (Vygotsky, 1978) knowledge is the result of one's environment, dialogue, and interaction with others. Social constructivist applications in social media learning environments enable students to take an active role in knowledge creation, fostered by social media's participative nature (Churcher, 2014).

Most study of the educational use of Facebook has emerged in the last decade (Arteaga et al., 2014; Chiroma et al., 2016; Kitsantas et al., 2016; Lambić, 2016; Niu, 2019; Sharma et al., 2016). These studies showed that the main reasons for using Facebook as a learning tool were its ease of use and popularity as a social network familiar to nearly all students worldwide (Giannikas, 2020; Moghavvemi et al., 2017; Moorthy et al., 2019). The creation of Facebook groups or educational communities has allowed students at distance learning institutions to feel companionship throughout the tuition process, generating a feeling of belonging and a sense of identification with the coursework undertaken together (Callaghan & Fribbance, 2016; Sheeran & Cummings, 2018). Due to its familiar features, the use of Facebook groups avoids technological frustration related to other distance education environments (Manca & Ranieri, 2013).

Facebook has supported social presence that is valued positively by students in non-face-to-face education environments (Akcaoglu & Lee, 2018). It has exemplified how social presence can be improved by the characteristics of the communication medium (Stacey, 2001), making verbal and nonverbal communication possible, for example (Rice, 1993). Research has suggested social presence is an important factor for building educational communities as it is strongly connected to online interaction (Gunawardena, 1995; Gunawardena & Zittle, 1997; Tu & McIsaac, 2002), and potentially enables learning in online environments (Oztok & Brett, 2011). Social presence has been broadly defined (Feng et al., 2016; Sung & Mayer, 2012; von der Pütten et al., 2010) and in the context of this study,

implies the degree to which a student feels connected with another student in an online learning community. Establishing social presence as a means for interaction has been associated with higher levels of cognitive analysis through active engagement (Stacey, 2001).

Various studies have shown that the use of Facebook groups engendered increased connections among students, and the interactions there, whether active or passive, were associated with a significantly greater commitment to the course compared to courses that did not establish an official Facebook study group (Chugh & Ruhi, 2018; Sheeran & Cummings, 2018). Such activity also strengthened commitment to content and learning among course colleagues, and in many cases, encouraged critical thinking, stricter monitoring, and questioning of the learning process. These groups provided an attractive, interactive, and motivating environment for the development of dialogue and bonds between colleagues and, if designed as such, among students and teachers, too (Al-Rahmi et al., 2015; Bahati, 2015; Davidovitch & Belichenko, 2018; Fiock, 2020; Moghavvemi et al., 2017). In this sense, Facebook's social function has been used for academic purposes such as promoting positive feedback by students (Arteaga et al., 2014; Davidovitch & Belichenko, 2018; Moghavvemi et al., 2017; Niu, 2019). That said, the use of Facebook groups in educational settings has appeared to be more effective when adopted alongside other applications or digital resources, or as a support to an LMS (Chiroma et al., 2016; Chugh & Ruhi, 2018; Kaya & Bicen, 2016). This is due to Facebook's organizational shortcomings, which have prevented its groups from becoming the one and only tool for managing learning in virtual environments (Barrot, 2016; Chen, 2018; Kalelioğlu, 2017; Niu, 2019).

According to Lambić (2016), interaction in informal groups was substantially greater than in groups with teacher involvement, as they tended to provide a space that students found less intimidating (Giannikas, 2020). Dalsgaard (2016) pointed out that the potential of Facebook groups as a learning tool unmediated by teachers was that they stimulate learning among equals through actions such as group discussion of concepts, or presentation and debate of results among students. Aaen and Daalsgard (2016) described Facebook study groups set up by students as a third space, a midway point between groups established by teachers and private groups outside the academic sphere. The Facebook learning environment, suited to autonomous tuition, has provided an experience for flexible in space and time that enabled the student to manage course material, communication, and involvement in collaborative work (Chiroma et al., 2016; Datu et al., 2018; Niu, 2019).

On the other hand, there is considerable scientific literature that has questioned the educational value of Facebook. Chen (2018) found no positive indicators for Facebook as a platform that foments the creation of learning communities, due to the lack of specific functions to enable participants to work on group projects. Others have recorded discourse on this social network that was "prosaic, mundane and occasionally anti-intellectual" (Selwyn, 2009, p. 170), which undermined its use as a tool to support learning and as a complement to assist students in formal study (Bahati, 2015). According to Bahati (2015) this medium was more closely related to the individual's sense of identity as a student, which added to the value of the student experience at university but diminished its value as an educational tool. Moorthy et al. (2019) described how only those students with a high level of self-sufficiency found Facebook study groups useful and accepted them as part of the academic context, although doubtful of their real educational value. In many cases, the educational and social value of belonging to these groups overlapped, with no clear perception of the academic usefulness of membership, which generated reluctance to join Facebook study groups (Manca & Grion, 2017). It has even been suggested that the usefulness of these groups in learning terms is marginal compared to their social potential (Hew, 2011). Other studies on use of Facebook for academic purposes have shown that, as with other simultaneous

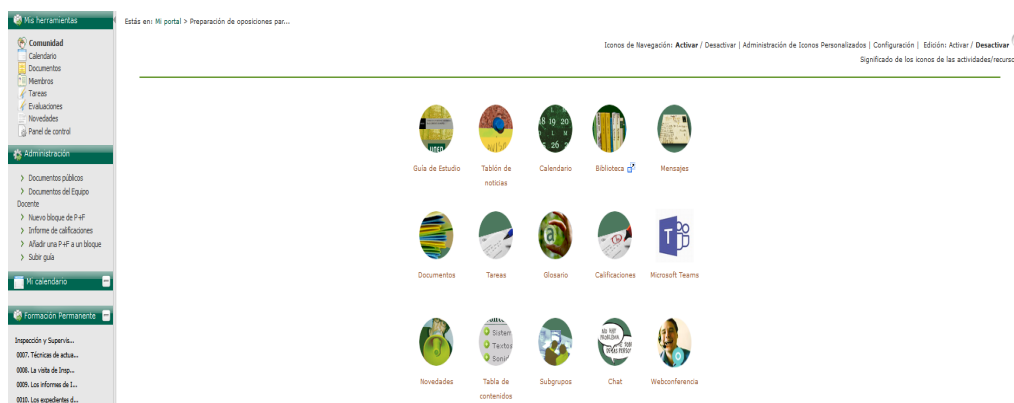
cognitive processes related to knowledge acquisition, the use of this social network can have a negative effect or yield poor results (Kirschner & Karpinski, 2010), with memory capacity and levels of concentration especially affected (Chiroma et al., 2016; Kaya & Bicen, 2016). These drawbacks have led some authors to produce guides on how to design well-structured activity plans that help differentiate Facebook use for social and educational purposes (Barrot, 2016; Junco 2015; Niu, 2019), and hence avoid the distractions associated with the former.

Research Context

Spain's National Distance Education University is the country's biggest university with 265,000 students; tuition is by way of a blended learning model delivered by the UNED learning management system known as aLF, as well as other resources. The LMS platform enables students to receive and send information, manage and share documents, create and participate in communities for specific courses, and develop projects online. aLF's main functions are to (a) manage work groups on demand, (b) share storage space, (c) organize content, (d) plan activities, (e) provide assessment and self-assessment, (f) offer an automatic notification service, (g) support questionnaire design, (h) publish news, and (i) provide a user-configured personal and public portal. In addition, aLF includes tools for communication and interaction to encourage collaboration and sharing of content between teachers and students by way of e-mail, internal messaging, forums, chat, a calendar, video-conferencing using Microsoft Teams, as well as notices and advice for students.

Figure 1

UNED's aLF: LMS Digital Environment



Note. Internal image of the aLF-Platform (UNED). (Source: Prof. Esteban Vázquez-Cano).

At the same time, UNED students have created Facebook groups to organize themselves and communicate with each other without teacher oversight. For example, at time of writing, the UNED pedagogy graduates Facebook group, the focus of this research, had around 5,000 members. In the 2019/2020 academic year, there were 2,973 students enrolled in the UNED degree course in pedagogy.

Figure 2

Facebook Group: UNED Pedagogy



Note. This is the Facebook group associated to the UNED University Degree in Pedagogy. (<https://www.Facebook.com/groups/126570557394056>)

This research was motivated by a concern expressed by various groups of UNED teachers regarding the decline in participation in the discussion forums established around official UNED courses. For example, student participation and interaction in the non-compulsory forums for three subjects in the pedagogy degree course and two in the official master courses has fallen by an average of 60% in the last five academic years.

This research was designed around three main objectives. First, are there significant differences in the end-of-course scores in the subjects taken by students who use Facebook groups and by those who do not? Second, do the students who use Facebook groups interact more with each other than those who use the LMS-aLF? Finally, we wished to design and assess a theoretical model using structural equations modelling.

Method

The research method applied in this study differed from the norm in two fundamental aspects. First, we adopted a methodological model formed of elements from three other models: the information success systems model (ISS), the technology acceptance model (TAM), and the unified theory of acceptance and use of technology (UTAUT). Second, the data for this work were gathered from a university that relies on distance learning, with models of interaction and collaboration mediated mainly by digital tools. We used EQS 6.4, structural equation modeling statistical software, to reveal the latent variables that can influence student satisfaction with Facebook study groups as a complement to the distance teaching-learning process.

The research hypotheses are illustrated in Figure 3.

Figure 3

Research Hypotheses

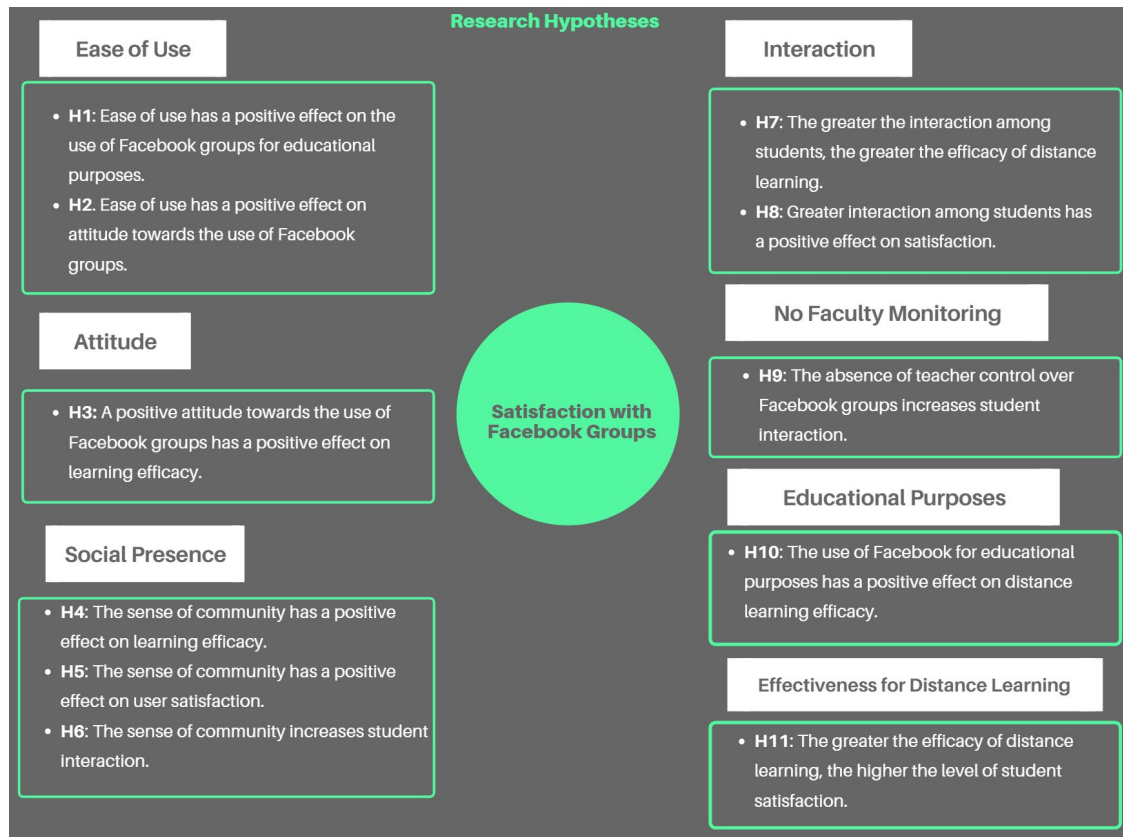
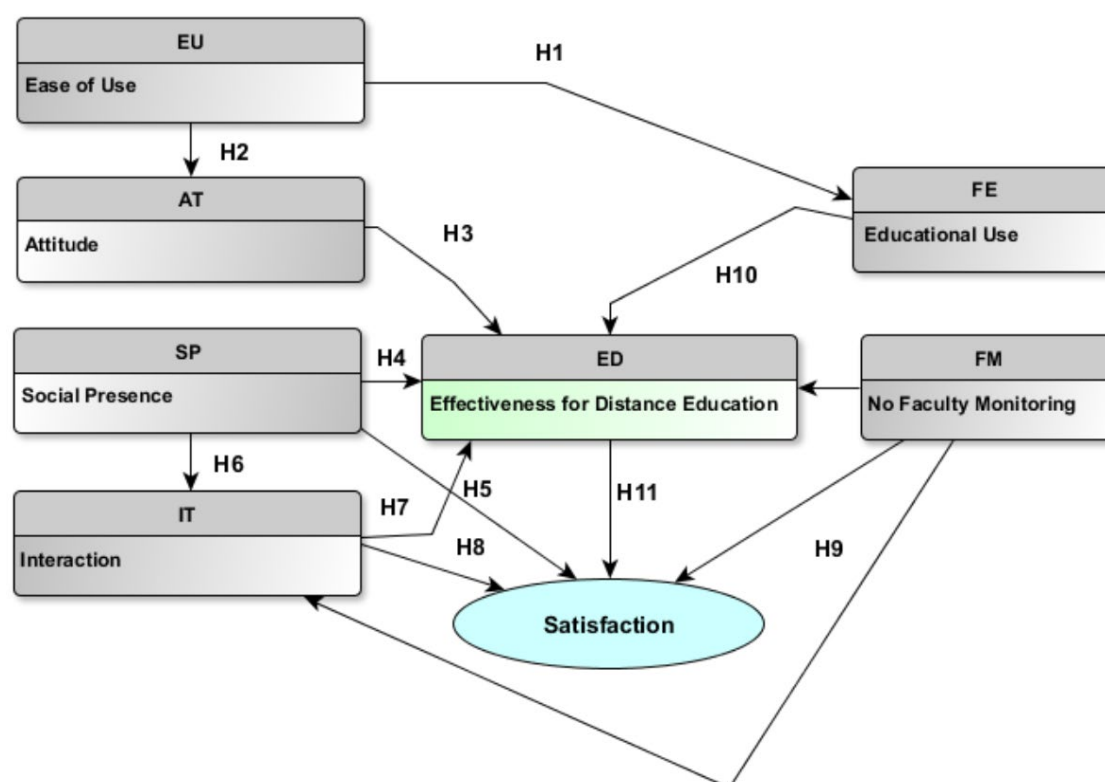


Figure 4 shows the proposed model that encompassed the relationships among the study's different variables and initial hypotheses.

Figure 4

Research Model and Hypothesized Relationships



Sample

The participant sample was obtained by cluster sampling students who use Facebook groups; the sample was formed of 418 students in UNED's pedagogy degree course, the Master in Innovation and Investigation, and the Master in Teacher Training. This constituted a representative sample (confidence level 0.95; z-score 1.96). The mean age of those interviewed was 32 (mean = 32.30; $SD = 2.40$).

Instrument and Variables

The study data were gathered between March 1, 2020 and December 20, 2020 using a validated questionnaire authorized by UNED's bioethics committee. Participants completed the questionnaire online once they provided their consent. The students who participated in the study voluntarily agreed that the researchers could check their final results on the academic platform (aLF) once the subject was finished. The questionnaire was distributed via UNED's virtual platform on aLF, and the participants were encouraged to pass it on to other Facebook study group members. The questionnaire contained 28 items among eight latent variables. The students responded to each item using a 1 to 5 scale, in which 1 corresponded to *totally disagree* and 5 to *totally agree*.

Figure 5 reflects the latent variables and items of the questionnaire. The first part of the questionnaire included sociodemographic items: age, sex, enrolled studies and subjects, and participation in UNED Facebook groups. The main constructs of the instruments were established according to seven latent variables, grouped among three macro-variables: (a) user's attitude (attitude and ease of use); (b) social perspective (social presence and interaction); and (c) educational impact (educational use, no faculty

monitoring, and effectiveness for distance education). As illustrated in Figure 5, these three macro-variables have been previously identified and analysed in the scientific literature.

Table 1

Questionnaire: Latent Variables and Items

Variable	Items	Authors
Ease of Use	EU1: The ease of use of Facebook groups enables me to share resources and information on course subjects at UNED. EU2: The ease of use of Facebook groups enables me to access a range of resources that I need to study the subjects of my course at UNED. EU3: The ubiquitous and multiplatform access offered by Facebook enables me to be permanently connected.	^a Abdalla (2007); DeLone & McLean (2003); Moorthy et al. (2019); Moghavvemi et al. (2017); Tarhini et al. (2017); Venkatesh & Bala (2008).
Attitude	AT1: I like to use Facebook groups to study. AT2: Facebook study groups provide me with considerable support in my course work. AT3: My opinion on the use of Facebook groups is positive.	^a Henderson et al. (2016) Kirschner & Karpinski (2010); Wang et al. (2013).
Social presence	SP1: Facebook study groups enable me to interact with my course colleagues. SP2: With Facebook groups, I feel in close contact with my course colleagues. SP3: With Facebook groups, I feel that I am part of a learning community. SP4: With Facebook groups, I feel less alone.	^b Aaen & Dalsgaard (2016); Akcaoglu & Lee (2018); Al-Rahmi et al. (2015); Aydin (2012); DeLone & McLean (2003); Ozkan & Koseler (2009). Wang et al. (2013).
Educational Use	FE1: Using Facebook groups enables me to share schemes, summaries, themes, and exams related to the courses I study at UNED. FE2: Using Facebook groups enables me to be informed of dates and organizational information related to my course work at UNED. FE3: Using Facebook groups is quicker and less complex than UNED's aLF platform. FE4: Using Facebook groups keeps me updated on issues related to my course work at UNED. FE5: The range of tools and options available to Facebook groups are useful to distance learning. FE6: I trust the academic information that appears in the Facebook groups.	^c Arteaga et al. (2014); Aydin (2012); Cheung et al. (2010); Davidovitch & Belichenko (2018); Manca & Ranieri (2016); Mazman & Usluel (2010); Moghavvemi et al. (2017); Niu (2019); Tarhini et al. (2017).
Interaction	IT1: When I use the Facebook groups of my courses, I interact more in forums and chats than I do on the UNED aLF platform. IT2: Recognition and feedback by "likes" has increased my participation in Facebook groups. IT3: Facebook group resources (Messenger and Wall) make me interact more with other course colleagues than the resources available on aLF (forums and chat).	^b Aydin (2012); Butler (2010); Chugh & Ruhi (2018); Davidovitch & Belichenko (2018); Dalsgaard (2016); Eom et al. (2006); Fiock (2020); Liaw (2008); Moghavvemi et al. (2017); Sheeran & Cummings (2018).
No faculty monitoring	FM1: The absence of teacher oversight in the Facebook groups means that I participate more. FM2: On the aLF platform, I do not post certain types of message because they can be seen by the teachers.	^c Giannikas (2020); Hew (2011); Selim, (2007); Lambić (2016).

	FM3: I feel freer and less inhibited in Facebook groups than on UNED's aLF platform.	
Effectiveness for Distance Education	ED1: I believe that involvement in Facebook groups increases my learning efficacy. ED2: I believe that I am more productive when involved with Facebook groups. ED3: Participation in Facebook groups increases my motivation towards learning.	Abdalla (2007); Barrot (2016); Bhuasiri et al. (2012); Callaghan & Fribbance (2016); Chen (2018); Chiroma et al. (2016); Chugh & Ruhi (2017); Kalelioğlu (2017); Kaya & Bicen (2016); Liaw (2008); Niu (2019); Sheeran & Cummings (2018).
Satisfaction	SA1: I am satisfied with the use of Facebook groups for educational purposes in the subjects I study at UNED. SA2: Facebook groups cover important aspects of learning in my course that are lacking in the aLF platform. SA3: Facebook groups satisfy my learning needs.	DeLone & McLean (2003); Lee (2010); Lee et al. (2009); Selim (2007).

Note: a) user's attitude b) social presence and interaction c) educational impact

Results

The results of this transversal study showed that the students who combined use of Facebook groups and LMS-aLF ($n = 418$) scored higher in their final course results (mean = 82.1/ $SE = 4.90$) than those students who used only LMS-aLF ($n = 217$; mean = 78.8/ $SE = 3.30$) with preliminary assessment of sample normality (Kolmogorov-Smirnov/GF sig. 234/aLF sig. 156) and compliance with the equality of variances criterion (Levene Test/sig. 567). Group comparison by the student's t test for independent samples was significant (sig. .000/ $t(45) = 12.45$, $p < .05$). The effect magnitude was calculated, with a result that showed a medium-to-high influence of Facebook on LMS-aLF, with a value of $r = .54$.

Figure 5

Central and Non-Central Distribution and Effect Size d

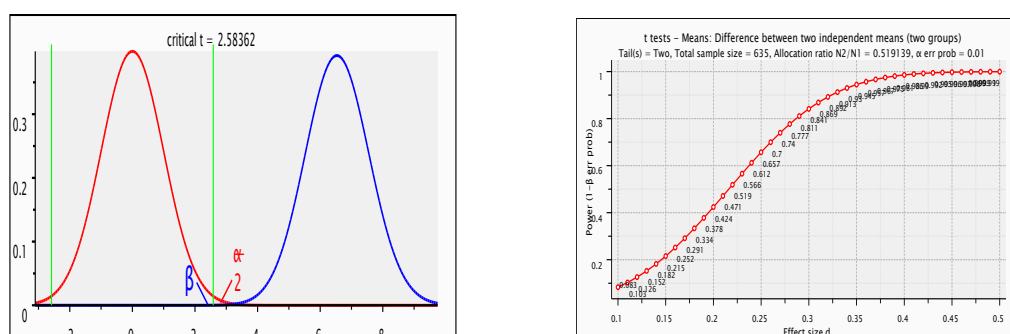


Table 2

Effect Size

Analysis	Post hoc: Compute achieved power	Results
Input	Tail(s)	Two
	Effect size d	0.5474088
	α err. prob.	0.01
	Sample size: Facebook group	418
	Sample size: LMS-aLF group	217
Output	Noncentrality parameter δ	6.5424878
	Critical t	2.5836185
	Df	633
Power (1 - β err. prob.)	0.9999608	

The 87% ($n = 363$) of students who used Facebook stated that they accessed Facebook groups more often and interacted there more frequently than they did LMS-aLF. A mean of 7.45 actions of access ($S = 0.948$ $\sigma = 0.974$) and 3.56 interactions (i.e., likes and messages) occurred per week in the Facebook groups ($S = 0.831$ $\sigma = 0.690$). Students who used LMS-aLF only, accessed it 3.12 times ($S = 0.912$ $\sigma = 0.831$) and 0.43 interactions (i.e., messaging in the forum, sending e-mails) per week ($S = 0.898$ $\sigma = 0.806$). Later, we analyzed and validated the scale used to measure the level of satisfaction of students who combined use of Facebook and LMS-aLF to develop their learning activity.

Analyzing the Validity and Reliability of the Scale

To begin, we performed a confirmatory factor analysis (CFA) to measure the model, using the robust maximum likelihood method (Bentler, 1995), with the EQS 6.4 statistical software. For a good fit, the loads average on each factor must be higher than 0.7 (Hair et al., 2006). The goodness-of-fit indices for the respecified measurement model are shown in Table 3.

Table 3

Standardized Estimations for Observable Indicators

Factor	λ	t Statistic	Chronbach's α	CRI	AVE
Ease of use			0.879	0.84	0.70
EU1	0.701	12.911			
EU2	0.698	11.193			
EU3	0.857	18.778			
Attitude			0.917	0.92	0.81
US1	0.903	18.765			
US2	0.963	19.001			
US3	0.831	18.323			
Social presence			0.901	0.90	0.71
SP1	0.815	18.045			
SP2	0.829	16.112			

SP3	0.850	17.143			
SP4	0.787	15.497			
Interaction			0.903	0.89	0.70
IT1	0.777	16.053			
IT2	0.885	17.567			
IT3	0.855	18.001			
No faculty monitoring			0.928	0.91	0.79
FM1	0.911	20.043			
FM2	0.932	21.112			
FM3	0.819	24.501			
Educational use			0.799	0.89	0.72
FE1	0.821	21.245			
FE2	0.802	22.322			
FE3	0.789	25.101			
FE4	0.811	19.108			
FE5	0.898	22.482			
FE6	0.815	23.432			
Effectiveness for distance education			0.952	0.94	0.84
ED1	0.895	22.098			
ED2	0.906	24.001			
ED3	0.948	25.019			
Satisfaction			0.879	0.91	0.83
SA1	0.803	19.987			
SA2	0.867	21.118			
SA3	0.851	20.231			

We calculated a number of goodness-of-fit indices: normed fit (NFI), non-normed fit (NNFI), comparative fit (CFI), and root mean square error of approximation (RMSEA). We obtained the following results: χ^2 (105 df) = 3.445; NFI = 0.918; NNFI = 0.921; CFI = 0.927; RMSEA = 0.781. The model fit well for all the values. The internal consistency of the constructs was also good; all the Cronbach's α coefficient values exceeded 0.7 (Nunnally & Bernstein, 1994), and the composite reliability index (CRI) that represents the variance shared between the set of observed variables that measure a construct was above 0.6 in all cases (Bagozzi & Yi, 1988). The average variance extracted (AVE) that measures the relation to the total variance due to the factor's measurement error was calculated for the construct, and yielded AVE values that exceeded the minimum recommended 0.5 level (Fornell & Larcker, 1981). The estimated standard error of the coefficients was used to calculate the t statistic for the null hypothesis that the coefficients equal zero in the population; the t scores for the coefficients ranged from 11.193 and 25.101, thus the items were significantly related ($p < 0.01$) to their factors, which confirmed convergent validity and indicated that the various items were strongly correlated.

Discriminant validity was also calculated. First, according to confidence interval test criteria, none of the confidence intervals at 95% of the individual elements of the latent factors contained 1 (Anderson & Gerbing, 1988). Second, the AVE statistic for each pair of factors was greater than the squared correlation (Fornell & Larcker, 1981). Thus, both the convergent and discriminant validity of the questionnaire were confirmed (Table 4).

Table 4

Discriminant Validity of Measures

Variable	1	2	3	4	5	6	7	8
1. Use	0.70	[0.271; 0.556]	[0.120; 0.356]	[0.419; 0.616]	[0.460; 0.650]	[0.379; 0.678]	[0.478; 0.676]	[0.143; 0.341]
2. Attitude	0.129	0.75	[0.285; 0.491]	[0.501; 0.715]	[0.565; 0.710]	[0.442; 0.701]	[0.171; 0.303]	[0.234; 0.529]
3. Social	0.057	0.125	0.73	[0.231; 0.515]	[0.228; 0.502]	[0.574; 0.432]	[0.405; 0.757]	[0.395; 0.686]
4. Interaction	0.341	0.258	0.112	0.81	[0.767; 0.898]	[0.131; 0.276]	[0.481; 0.613]	[0.452; 0.701]
5. Monitoring	0.113	0.301	0.131	0.339	0.78	[0.298; 0.407]	[0.365; 0.690]	[0.529; 0.737]
6. Educational	0.211	0.254	0.221	0.139	0.154	0.69	0.587	[0.464; 0.612]
7. Effectiveness	0.055	0.211	0.331	0.311	0.312	0.135	0.77	[0.223; 0.510]
8. Satisfaction	0.151	0.173	0.241	0.371	0.201	0.181	0.119	0.82

Note. Diagonal of the matrix: extracted variance (in bold). Below the diagonal: estimated correlation of the squared factors. Above the diagonal: 95% confidence interval for the estimated correlation of the factors.

With the measurement model revised (confirmatory factor analysis), we analyzed the structural equations model with the theoretical causal relationships between the latent variables. The nomological validity of the theoretical model can be checked by the chi-square difference test, which compares the theoretical model to the revised measurement model. The theoretical model will have nomological validity if there are no significant differences between the fit of the measurement and theoretical models, given that the scales will have established predictive relationships of other variables which are so substantial that, being less, they equal the goodness-of-fit of the model (Anderson & Gerbing, 1988). Therefore, the chi-square of the revised measurement model is subtracted from the chi-square of the theoretical model to produce the difference in value: $3,445.05 - 3,469.23 = 24.18$ (see Tables 3 and 4). The degrees of freedom for the test equal the difference between the degrees of freedom of both models, in this case $105 - 112 = 7$. The chi-square critical value with seven degrees of freedom was 24.3213 ($p < 0.001$). Thus, since $24.18 < 24.3213$, we confirmed that the scales had nomological validity.

Analyzing the Structural Model

Table 5 presents the results of the hypotheses contrasted in the structural part of the model, namely the standardized coefficients and robust t statistics, to evaluate their significance.

Table 5

Hypotheses Contrasted

Hypotheses	Structural relationship	Std. coefficient	t Statistic
H1	Ease of use → Educational use	0.675	7.832**
H2	Ease of use → Attitude	0.612	6.978**
H3	Attitude → Effectiveness	0.698	7.110**
H4	Social presence → Effectiveness	0.121	1.106 ns
H5	Social presence → Satisfaction	0.775	12.003***
H6	Social presence → Interaction	0.801	11.786***
H7	Interaction → Effectiveness	0.712	11.112***
H8	Interaction → Satisfaction	0.675	7.456***
H9	Monitoring → Effectiveness	0.819	10.276***
H10	Educational use → Effectiveness	0.878	11.567***
H11	Effectiveness → Satisfaction	0.845	11.341***

To a greater extent, this model explains the variables of effectiveness ($R^2 = 0.7792$), social presence ($R^2 = 0.610$), interaction ($R^2 = 0.823$), monitoring ($R^2 = 0.876$), ease of use ($R^2 = 0.561$), attitude ($R^2 = 0.370$) and educational use ($R^2 = 0.891$). Based on the previous discussion, the model that was initially proposed is that which appears in Figure 6.

Figure 6

Structural Model

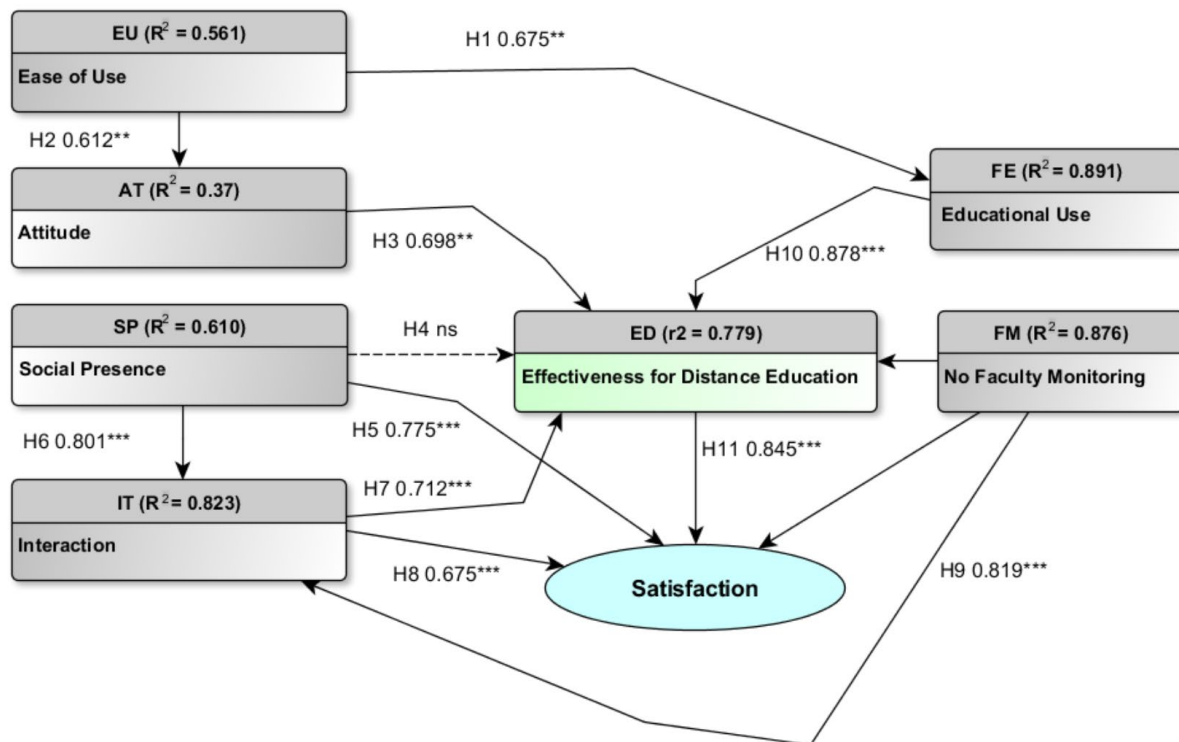


Table 6 presents the values of the structural model's fit indices. All the measurements fall within the limits established to confirm the data's goodness-of-fit.

Table 6

Fit Indices for the Structural Equations Model

Fit index	Recommended value	Actual
χ^2/df	<3 preferable <5	3.469
Goodness-of-fit index (GFI)	>0.80	0.815
Adjusted goodness-of-fit-index (AGFI)	>0.80	0.901
Comparative fit index (CFI)	>0.90	0.911
Root mean square error of approximation (RMSEA)	<0.08	0.902
Normed fit index (NFI)	>0.90	0.921
Non-normed fit index (NNFI)	>0.90	0.932
Parsimony normed fit index (PNFI)	>0.60	0.756

The results showed that ease of use had a positive influence on the use of Facebook groups for educational purposes ($\beta = 0.675$; $p < 0.01$) thus confirming hypothesis 1. The model also confirmed hypothesis 2 ($\beta = 0.612$; $p < 0.01$), which implied that the ease of use of Facebook groups bolstered students' attitudes towards using them. Positive attitudes towards use of Facebook groups had a positive effect on learning efficacy, thereby confirming hypothesis 3 ($\beta = 0.698$; $p < 0.01$). The hypotheses related to sense of community (H4; $\beta = 0.775$; $p < 0.01$) and social presence (H6; $\beta = 0.801$; $p < 0.01$) are confirmed, but not hypothesis 5 ($\beta = 0.121$; $p < 0.01$). Sense of community had a positive effect on user satisfaction and boosted interaction among students, which is one aspect of current didactics that the LMS does not seem to be achieving. On the other hand, the role of student interaction was confirmed in hypothesis 7 ($\beta = 0.712$; $p < 0.01$), so the greater the interaction among students, the greater the efficacy of distance learning, and hypothesis 8 ($\beta = 0.675$; $p < 0.01$), the greater the interaction among students, the more positive the effect on user satisfaction. Interaction was one of the main predictors of the efficacy of use of Facebook groups for distance learning, and interaction increases in Facebook groups when there is no teacher oversight (H9; $\beta = 0.819$; $p < 0.01$). The model confirmed hypothesis 10 ($\beta = 0.878$; $p < 0.01$) and demonstrated that use of Facebook groups for educational purposes increased perceived efficacy in distance education. Finally, hypothesis 11 showed that a higher level of distance learning efficacy increased student satisfaction at UNED ($\beta = 0.845$; $p < 0.01$). Satisfaction was confirmed mainly by the sense of community and the efficacy of distance learning achieved by membership in Facebook groups, which were more attractive due to their potential for interaction and lack of teacher control.

Discussion

The results showed that students viewed use of the Facebook groups in the distance learning university environment as an effective tool for learning; the learning efficacy achievable in online settings had a positive effect on user satisfaction, particularly in terms of productivity and motivation. According to the UNED students surveyed, the Facebook tool satisfied their learning needs and enabled them to access more relevant aspects of their courses than the official university platform (aLF) provided. The benefits of Facebook group use described here are in line with the findings of other studies (Akcaoglu & Lee, 2018; Arteaga et al., 2014; Davidovitch & Belichenko, 2018; Moghaviemi et al., 2017; Niu, 2019).

Effectiveness, therefore, was the most relevant variable in relation to satisfaction. This matched the conclusions of Davidovitch and Belichenko (2018) and Wang et al. (2013), who found that the feeling

of satisfaction was the result of good academic performance incentivized by the positive effects on learning that emerged from use of this tool. According to the data, another relevant factor related to satisfaction was the sense of belonging to a community, which positively influenced the number of interactions. Besides enabling fluid interactions among course colleagues, Facebook group membership created a sense of closeness to others and offset the feelings of solitude associated with distance learning contexts. Forming educational communities was one of Facebook's pedagogical functions identified by Mazman and Usluel (2010), and in distance education settings, this created a sense of belonging and identity that allowed the student to feel accompanied during the learning process (Callaghan & Fribbance, 2016; Sheeran & Cummings, 2018).

Interaction was another component related to student satisfaction, with a correlation between levels of interaction and greater distance learning efficacy. Students used Facebook groups and its communication resources (Messenger and Wall) more frequently than they used the forums and chats on institutional platforms. Resources such as recognition and feedback represented by Facebook likes helped to boost participation (Wang et al., 2013). Interactivity defines Facebook as a tool of communication and, according to Chugh and Ruhi (2018), and Sheeran and Cummings (2018), it facilitated connectivity between student working groups and staff teams; even when interactions were passive, they still contributed to higher levels of course commitment.

The values of the total effects included educational use, which is perceived as the most important predictor of distance learning efficacy, followed by other indicators such as attitude and interaction. According to the students' responses, the Facebook study group enabled them to remain updated on course information and important dates in the academic calendar better than the UNED platform, even though there was no difference in the quality of information provided by both. This indicated that the information posted on Facebook was reliable. Facebook also helped students share course information such as schemes, summaries, and exams; this supported connectivist theory that knowledge is acquired through the constant input of new information in virtual spaces (Siemens, 2004). The dynamics already mentioned helped explain the purely educational use of Facebook, and according to the results, they were strongly linked to its efficacy in generating good academic results. The perception of the tool's use as a study support to achieve better educational outcomes, together with intentionality or attitude towards its use, matched the findings of a range of authors who have pointed to these indicators to justify the decision by students to use Facebook groups (Goh et al., 2019; Kalelioğlu, 2017; Kitsantas et al., 2016; Lambić, 2016; Sharma et al., 2016).

Ease of use was also perceived as a predictor of attitude towards use of Facebook groups, as well as the main predictor for perceived usefulness. Our results showed that this medium provided students with a ubiquitous and easily accessible environment. Facebook's multiplatform characteristics enabled students to share and obtain course resources and information, and always be connected. These findings coincided with those of various studies (Giannikas, 2020; Moorthy et al., 2019; Moghavvemi et al., 2017), that showed how students' familiarity with this tool derives from automated use, hence they found no technical barriers.

We also noted that absence of teacher control was the most important predictor of interaction, although sense of belonging to a community was also influential. The students stated that the number of interventions rose when there was no teacher oversight, alluding to a sense of freedom that allowed them to interact more frequently, which would not occur if an authority figure was present to engender feelings of inhibition. The fact that the number of interactions in groups was higher when a teacher did

not intervene was detected in studies by Giannikas (2020) and Lambic (2016), who showed that lack of teacher oversight enabled the development of student scenarios that felt closer and less intimidating and led to a higher number of interventions. Lambic (2016) also indicated that interventions were motivated by the sense of community generated by the students, which was also noted by Aaen and Dalsgaard (2016). These researchers proposed a third space for communication represented by the absence of teachers, in which the student sets aside the role of student and individual to express themselves as a valuable member of a community.

The results allowed us to deduce that the use of Facebook in educational contexts was promoted by the affective and social factors that social presence represents, and, therefore, was not strictly linked to the cognitive processes of learning, but fostered them, instead. In the present study, motivation and productivity were connected with learning efficacy, supporting the application of social cognitive and social constructivism theories, respectively, to social media. The former has stated that motivation is one of the cognitive factors developed in this context (Deaton, 2015), and the latter has explained how learning is acquired by taking an active role in the knowledge-creation process thus increasing students' productivity (Churcher, 2014). According to the results of this study, university students preferred a like-for-like presence where their input was valued by a person with the same status, regardless of the personal or academic focus of the communication. Therefore, a most significant social presence for students has direct impact on learning outcomes. Research has not established a clear relationship between better learning outcomes and social presence, as most of the studies focus is on perceived learning (Oztok & Brett, 2011). This study, then, constitutes a significant step forward for research into social media-enhanced learning environments due to its confirmation of greater learning results through the use of non-controlled Facebook groups at the university level.

Conclusion

Facebook study groups that are not controlled by teachers can be an efficient, complementary educational tool to develop the teaching-learning process in distance learning. Students feel greater satisfaction when group involvement generates a sense of accompaniment that minimizes feelings of solitude, and a sense of participation in a learning community. Interaction was higher in Facebook groups than on the official LMS platform due to the former's ease of use and social penetration, as well as the sense of greater freedom these groups provide by not being controlled by teachers.

The main implication for practice is the need to rethink LMS design to enable learning communities to boost students' social presence and interaction, which in turn can activate methodologies for collaborative and cooperative work, among others. This is essential for developing university students' generic and specific competences in virtual environments. The current LMS design directs students to interact in spaces created for that purpose (e.g., forums, chats, Web conferencing). Many teachers use social networks in the methodological development of their subjects, but teacher control is always evident. For this reason, the LMS needs to provide spaces that are unregulated by teachers to encourage anonymous, informal interaction among students. Such spaces should enable students to create their own course communities using PLEs, MOOCs, and social networks (e.g., Facebook, Twitter, LinkedIn), which they can design and control themselves.

With on-site learning, students organize themselves around libraries, cafeterias, and the virtual and physical workspaces they already occupy. This leads to setting up Facebook and WhatsApp groups for

organizing and sharing knowledge and information, disseminating study material, as well as for their downtime activities. This close interaction is absent in distance learning, where students can feel isolated and lack a sense of belonging to a learning community. Social networks such as Facebook are a response to this need for students to interact in anonymous, informal settings for a variety of academic and social activities. In distance learning, informal spaces can help students feel part of a community of classmates, diminishing their sense of isolation, binding them more closely to their coursework and companions, and stimulating informal work dynamics. These objectives can be achieved on social networks, though they can also take place within the interactive spaces provided by a higher education institution's own LMS, thereby democratizing knowledge and access to these informal learning spaces associated with formal education.

Finally, we conclude that students perceive Facebook groups with no teacher oversight as satisfactory for distance learning. Even so, integrating with the LMS or designing the LMS with an architecture and functionalities similar to Facebook groups will be conditioned by the main motivation of each student, namely learning versus getting good marks.

Acknowledgments

The study was funded by Universidad Nacional de Educación a Distancia (Vice-Rector's Office for Digitization and Innovation with the support of the University Institute of Distance Education [IUED]), Governing Council of July 2, 2019 / BICI 37/08/07/2019.

References

- Aaen, J., & Dalsgaard, C. (2016). Student Facebook groups as a third space: Between social life and schoolwork. *Learning, Media and Technology*, 41(1), 160–186.
<https://doi.org/10.1080/17439884.2015.1111241>
- Abdalla, I. (2007). Evaluating effectiveness of e-blackboard system using TAM framework: A structural analysis approach. *AACE Journal*, 15(3), 279–287
- Akcaoglu, M., & Lee, E. (2018). Using Facebook groups to support social presence in online learning. *Distance Education*, 39(3), 334–352. <https://doi.org/10.1080/01587919.2018.1476842>
- Al-Rahmi, W., Othman, M. S., & Yusuf, L. M. (2015). The role of social media for collaborative learning to improve academic performance of students and researchers in Malaysian higher education. *The International Review of Research in Open and Distributed Learning*, 16(4).
<https://doi.org/10.19173/irrodl.v16i4.2326>
- Anderson, E., & Gerbing, D. W. (1988). Structural equation modelling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103, 411–423.
<https://doi.org/10.1037/0033-2909.103.3.411>
- Arteaga, R., Cortijo, V., & Javed, U. (2014). Students' perceptions of Facebook for academic purposes. *Computers & Education*, 70, 138–149. <https://doi.org/10.1016/j.compedu.2013.08.012>
- Aydin, S. (2012). A review of research on Facebook as an educational environment. *Educational Technology Research and Development*, 60(6), 1093–1106. <https://doi.org/10.1007/s11423-012-9260-7>
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16, 74–94. <https://doi.org/10.1007/BF02723327>
- Bahati, B. (2015). Extending students' discussions beyond lecture room walls via Facebook. *Journal of Education and Practice*, 6, 160–171. <https://files.eric.ed.gov/fulltext/EJ1079985.pdf>
- Bandura, A. (1999). Social cognitive theory: An agentic perspective. *Asian Journal of Social Psychology*, 2(1), 21–41. <https://doi.org/10.1111/1467-839X.00024>
- Barrot, J. S. (2016). Using Facebook-based e-portfolio in ESL writing classrooms: Impact and challenges. *Language, Culture and Curriculum*, 29(3), 286–301.
<https://doi.org/10.1080/07908318.2016.1143481>
- Bentler, P. M. (1995). *EQS structural equations program manual*.
<http://www.econ.upf.edu/~satorra/CourseSEMVVienna2010/EQSManual.pdf>
- Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J., & Ciganek, A. P. (2012). Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers & Education*, 58, 843–855.
<https://doi.org/10.1016/j.compedu.2011.10.010>

- Butler, P. (2010). *Visualizing Facebook friends*. <https://paulbutler.org/2010/visualizing-facebook-friends/>
- Callaghan, G., & Fribbance, I. (2016). The use of Facebook to build a community for distance learning students: A case study from the Open University. *Open Learning: The Journal of Open, Distance and e-Learning*, 31(3), 260–272. <https://doi.org/10.1080/02680513.2016.1229176>
- Chen, M. (2018). Students' perceptions of the educational usage of a Facebook group. *Journal of Teaching in Travel & Tourism*, 18(4), 332–348. <https://doi.org/10.1080/15313220.2018.1434448>
- Cheung, C. M. K., Chiu, P.-Y., & Lee, M. K. O. (2011). Online social networks: Why do students use Facebook? *Computers in Human Behavior*, 27(4), 1337–1343. <https://doi.org/10.1016/j.chb.2010.07.028>
- Chiroma, H., Shuib, N., Abubakar, A., Zeki, A. M., Gital, A., Herawan, T., & Abawajy, J. (2016). Advances in teaching and learning on Facebook in higher institutions. *IEEE Access*, 5, 480–500. <https://doi.org/10.1016/j.chb.2010.07.028>
- Chugh, R., & Ruhi, U. (2018). Social media in higher education: A literature review of Facebook. *Education and Information Technologies*, 23(2), 605–616. <https://doi.org/10.1007/s10639-017-9621-2>
- Churcher, K. (2014). “Friending” Vygotsky: A social constructivist pedagogy of knowledge building through classroom social media use. *Journal of Effective Teaching*, 14(1), 33–50. <https://eric.ed.gov/?id=EJ1060440>
- Dalsgaard, C. (2016). Students' educational use of Facebook groups. *Educational Media International*, 53(4), 261–273. <https://doi.org/10.1080/09523987.2016.1254879>
- Datu, J., Yang, W., Valdez, J., & Chu, S. (2018). Is Facebook involvement associated with academic engagement among Filipino university students? A cross-sectional study. *Computers & Education*, 125, 246–253. <https://doi.org/10.1016/j.compedu.2018.06.010>
- Davidovitch, N., & Belichenko, M. (2018). Facebook tools and digital learning achievements in higher education. *Journal of Education and e-Learning Research*, 5(1), 8–14. <https://doi.org/10.20448/journal.509.2018.51.8.14>
- Deaton, S. (2015). Social learning theory in the age of social media: Implications for educational practitioners. *Journal of Educational Technology*, 12(1), 1–6. <https://doi.org/10.26634/JET.12.1.3430>
- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30. <https://doi.org/10.1080/07421222.2003.11045748>
- Downes, S. (2007, February 3). What connectivism is. Half an hour. <https://halfanhour.blogspot.com/2007/02/what-connectivism-is.html>

- Eom, S. B., Ashill, N., & Wen, H. J. (2006). The determinants of students' perceived learning outcomes and satisfaction in university online education: An empirical investigation. *Decision Sciences Journal of Innovative Education*, 4(2), 215–235. <https://doi.org/10.1111/j.1540-4609.2006.00114.x>
- Feng, B., Li, S., & Li, N. (2016). Is a profile worth a thousand words? How online support-seeker's profile features may influence the quality of received support messages. *Communication Research*, 43(2), 253–276. <https://doi.org/10.1177/0093650213510942>
- Fiock, H. (2020). Designing a community of inquiry in online courses. *The International Review of Research in Open and Distributed Learning*, 21(1), 135–153. <https://doi.org/10.19173/irrodl.v20i5.3985>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equations models with unobservable variables and measurement error. *Journal of Marketing Research*, 18, 39–50. <https://doi.org/10.2307/3151312>
- Giannikas, C. (2020). Facebook in tertiary education: The impact of social media in e-learning. *Journal of University Teaching and Learning Practice*, 17(1), 3. <https://eric.ed.gov/?id=EJ1247596>
- Goh, C., Rasli, A., Tan, O., & Choi, S. (2019). Determinants and academic achievement effect of Facebook use in educational communication among university students. *Aslib Journal of Information Management*, 71(1), 105–123. <https://doi.org/10.1108/AJIM-05-2018-0116>
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. Prentice-Hall.
- Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education*, 42(8), 1567–1579. <https://doi.org/10.1080/03075079.2015.1007946>
- Hew, K. F. (2011). Students' and teachers' use of Facebook. *Computers in Human Behavior*, 27(2), 662–676. <https://doi.org/10.1016/j.chb.2010.11.020>
- Junco, R. (2015). Student class standing, Facebook use, and academic performance. *Journal of Applied Developmental Psychology*, 36, 18–29. <https://doi.org/10.1016/j.appdev.2014.11.001>
- Kalelioğlu, F. (2017). Using Facebook as a learning management system: Experiences of pre-service teachers. *Informatics in Education*, 16(1), 83–101. <https://doi.org/10.15388/infedu.2017.05>
- Kaya, T., & Bicen, H. (2016). The effects of social media on students' behaviors: Facebook as a case study. *Computers in Human Behavior*, 59, 374–379. <https://doi.org/10.1016/j.chb.2016.02.036>
- Kirschner, P., & Karpinski, A. (2010). Facebook® and academic performance. *Computers in Human Behavior*, 26(6), 1237–1245. <https://doi.org/10.1016/j.chb.2010.03.024>

- Kitsantas, A., Dabbagh, N., Chirinos, D. S., & Fake, H. (2016). College students' perceptions of positive and negative effects of social networking. In T. Issa, P. Isaias & P. Kommers (Eds.), *Social networking and education* (pp. 225–238). Springer. https://doi.org/10.1007/978-3-319-17716-8_14
- Lambić, D. (2016). Correlation between Facebook use for educational purposes and academic performance of students. *Computers in Human Behavior*, 61, 313–320. <https://doi.org/10.1016/j.chb.2016.03.052>
- Lee, J. (2010). Online support service quality, online learning acceptance, and student satisfaction. *The Internet and Higher Education*, 13(4), 277–283. <https://doi.org/10.1016/j.iheduc.2010.08.002>
- Lee, H., Choi, S., & Kang, Y. (2009). Formation of e-satisfaction and repurchase intention: Moderating roles of computer self-efficacy and computer anxiety. *Expert Systems with Applications*, 36(4), 7848–7859. <https://doi.org/10.1016/j.eswa.2008.11.005>
- Liaw, S.-S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. *Computers & Education*, 51(2), 864–873. <https://doi.org/10.1016/j.compedu.2007.09.005>
- Manca, S., & Grion, V. (2017). Engaging students in school participatory practice through Facebook: The story of a failure. *British Journal of Educational Technology*, 48(5), 1153–1163. <https://doi.org/10.1111/bjet.12527>
- Manca, S., & Ranieri, M. (2013). Is it a tool suitable for learning? A critical review of the literature on Facebook as a technology-enhanced learning environment. *Journal of Computer Assisted Learning*, 29(6), 487–504. <https://doi.org/10.1111/jcal.12007>
- Mazman, S. G., & Usluel, Y. K. (2010). Modeling educational usage of Facebook. *Computers & Education*, 55(2), 444–453. <https://doi.org/10.1016/j.compedu.2010.02.008>
- Moghavvemi, S., Paramanathan, T., Rahin, N., & Sharabati, M. (2017). Student's perceptions towards using e-learning via Facebook. *Behaviour & Information Technology*, 36(10), 1081–1100. <https://doi.org/10.1080/0144929X.2017.1347201>
- Moorthy, K., T'ing, L. C., Wei, K. M., Mei, P. T. Z., Yee, C. Y., Wern, K. L. J., & Xin, Y. M. (2019). Is Facebook useful for learning? A study in private universities in Malaysia. *Computers & Education*, 130, 94–104. <https://doi.org/10.1016/j.compedu.2018.12.002>
- Niu, L. (2019). Using Facebook for academic purposes: Current literature and directions for future research. *Journal of Educational Computing Research*, 56(8), 1384–1406. <https://doi.org/10.1177/0735633117745161>
- Nunnally, J., & Bernstein, I. H. (1994). *Psychometric theory*. McGraw-Hill.

- Ozkan, S., & Koseler, R. (2009). Multi-dimensional students' evaluation of e-learning systems in the higher education context: An empirical investigation. *Computers & Education*, 53(4), 1285–1296. <https://doi.org/10.1016/j.compedu.2009.06.011>
- Oztok, M., & Brett, C. (2011). Social presence and online learning: A review of the research. *The Journal of Distance Education*, 25(3), 1–10. <http://hdl.handle.net/1807/32440>
- Rice, R. E. (1993). Media appropriateness: Using social presence theory to compare traditional and new organizational media. *Human Communication Research*, 19(4), 451–484. <https://doi.org/10.1111/j.1468-2958.1993.tb00309.x>
- Selwyn, N. (2009). Faceworking: Exploring students' education-related use of Facebook. *Learning, Media and Technology*, 34(2), 157–174. <https://doi.org/10.1016/j.compedu.2005.09.004>
- Sharma, S. K., Joshi, A., & Sharma, H. (2016). A multi-analytical approach to predict the Facebook usage in higher education. *Computers in Human Behavior*, 55, 340–353. <https://doi.org/10.1016/j.chb.2015.09.020>
- Sheeran, N., & Cummings, D. (2018). An examination of the relationship between Facebook groups attached to university courses and student engagement. *Higher Education*, 76(6), 937–955. <https://doi.org/10.1007/s10734-018-0253-2>
- Siemens, G. (2004). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2. <https://www.semanticscholar.org/paper/Connectivism%3A-A-Learning-Theory-for-the-Digital-Age-Siemens/f87c61b964e32786e06c969fd24f5a7d9426f3b4>
- Siemens, G. (2005, January). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning*, 1. http://www.itdl.org/Journal/Jan_05/article01.htm
- Stacey, E. (2001). Social presence online: Networking learners at a distance. In D. Watson & J. Andersen (Eds.), *IFIP World Conference on Computers in Education* (pp. 39–48). Springer. https://doi.org/10.1007/978-0-387-35596-2_4
- Statista. (2021). *Number of monthly active Facebook users worldwide as of 1st quarter 2021 (in millions)*. <https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/>
- Sung, E., & Mayer, R. E. (2012). Five facets of social presence in online distance education. *Computers in Human Behavior*, 28(5), 1738–1747. <https://doi.org/10.1016/j.chb.2012.04.014>
- Tarhini, A., Masa'deh, R., Al-Busaidi, K.A., Mohammed, A.B., & Maqableh, M. (2017). Factors influencing students' adoption of e-learning: a structural equation modeling approach. *Journal of International Education in Business*, 10(2), 164–182. <https://doi.org/10.1108/JIEB-09-2016-0032>

- Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, 39(2), 273–315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- von der Pütten, A. M., Krämer, N. C., Gratch, J., & Kang, S.-H. (2010). “It doesn’t matter what you are!” Explaining social effects of agents and avatars. *Computers in Human Behavior*, 26(6), 1641–1650. <https://doi.org/10.1016/j.chb.2010.06.012>
- Wang, J., Lin, C., Yu, W., & Wu, E. (2013). Meaningful engagement in Facebook learning environments: Merging social and academic lives. *Turkish Online Journal of Distance Education*, 14(1), 302–322. <https://eric.ed.gov/?id=EJ1006268>

