Impact of the Covid-19 pandemic on perceptions and behaviors of university students in Tunisia

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Abstract
This research investigates student’s perceptions around their online learning experience during the sanitary confinement period. It tests the impact of social presence on the performance of learners through an integrator model that includes direct, mediating and moderating relationships. This research uses the method of structural equations (AMOS 21) and the macro Spss for the test of mediating and moderating effects. The model is tested on a sample of 234 students interviewed through a self-administered questionnaire. The results of this study showed that social presence influences positively collaborative learning, learner satisfaction and engagement. Satisfaction and engagement play a mediating role between collaborative learning and academic performance. Finally, the results proved the moderating role of self-efficacy on the relationship between satisfaction-performance and engagement-performance has been invalidated. From where, it is recommended that teachers design their learning modules based on collaborative activities and using interactive social media tools to enhance the e-learning experience.

Keywords
Academic performance, Collaborative learning, COVID-19, Engagement, Satisfaction, Social media, Social presence
Introduction

With increasing technological development and the acknowledged prominence of the Internet and social media, online learning is on the rise, particularly through social networking sites. Indeed, the use of online technology has steadily increased over the past two decades (Allen and Seaman, 2013). This is done through the use of interactive applications and platforms, as well as the synchronous and asynchronous features on social media sites. This growth reflects the importance given to this type of teaching, as a very flexible form of learning, especially in a context of crisis such as that caused by COVID-19. Indeed, since its inception in early 2020, this pandemic has been considered a “Black Swan Event” (He and Harris, 2020; Taleb, 2008), a shocking event that has changed the world (Grech and Grech, 2020; Stefano et al., 2020). Indeed, COVID-19 has caused profound changes in all aspects of human life and has led us to believe that the world will not be the same after its demise. Nevertheless, while the consequent effects of this pandemic appear to have a significant impact on the attitudes and behaviours of individuals and organizations (Bejaoui et al., 2021), it is clear that not all of these effects are adverse. Indeed, many individuals and entities have experienced new experiences in the era of this pandemic by implementing many of their remote activities.

Around the education system, these measures have led to reconsider the place given to e-Learning, compared to traditional learning (Maqableh and Alia, 2021). Teachers and tutors are now forced to rethink their teaching methods as well as the learning tools used and to appeal to online learning to resolve the problem linked to the conjunction of physical distancing and educational continuity during the period of sanitary confinement (Yekefallah et al., 2021).

Nevertheless, since the first experiences of distance learning, this type of teaching has been linked to certain failures felt by users, in particular around a lack of humanisation and interpersonal connection, which has always been a barrier to its use (Simuth and Sarmany-Schuller, 2012). And yet, the advocates of distance education have not stopped looking for ways of interactivity in order to create the perception of a social presence. This presence is not only comforting to the user but also linked successfully to important online learning outcome variables (Richardson et al., 2016) such as satisfaction (Maqableh and Alia, 2021; Gunawardena and Zittle, 1997) engagement (Gallini and Moely, 2003) and learner performance (Al-Rahmi and Zeki, 2017). Thus, it is recommended that socio-emotional aspects be taken into account in e-Learning with a view to making it a positive and desired experience for the learners.

On the other hand, according to Vygotsky’s socioconstructivist theory, social presence is important in the learning process for not only psychological but also pedagogic reasons (Russo and Benson, 2005; Picciano, 2002). Indeed, according to this theory, developing knowledge necessarily involves a phase of social interaction with others (Vygotsky, 1986). This interaction is likely to facilitate the acquisition of knowledge and skills (Vygotsky, 1986). Thus, the collaborative approach of learning is likely to have a positive effect on the attitudes and behaviors of learners and contribute to the success of learning’s activity (Johnson and Johnson, 1990). In this perspective, this research aims to study the following problem: what extent does perceived social presence should be influence the performance of learners during the COVID-19 pandemic?

Literature review

Social media. Kaplan and Haenlein (2010) define social media as “a group of Internet based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content”. So, referring to this definition and that of Peters et al. (2013), we define social media as Internet-based communication systems that support
the creation and exchange of content between virtual links. The rise of social media as collaborative communication channels has created disruptions in the habits of Internet users in a bid to overcome COVID-19 induced restrictions (Khan et al., 2021).

These have evolved from passive consumers to content creators, which are also prosumers or post-consumers (Cova and Cova, 2009). The term User Generated Content (UGC) (Rachna and Khajuria, 2017) testifies to this phenomenon by designating the rise of content produced on the Web by Internet users themselves, which has led to a new version of the Internet that is intended to be participatory, creative, and playful. On the other hand, the physical distance required by the pandemic has stimulated the increasing use of mediation technologies to maintain social connectivity (Kirk and Rifkin, 2020). According to Mnkandla and Minnaar (2017), the adoption of social media platforms in e-Learning has clearly led to a reconsideration of distance learning. They facilitate learning and promote the development of knowledge in higher education institutions (Khan et al., 2021). In this case, the learner uses digital social networks to play a proactive role in the development of the course: he shares content, videos and photos related to the teaching module, discusses in real time via the Forums, Messenger, Skype or Google Talk but also publishes and reviews information on blogs and social networks (Abi-Rafeh and Azzi, 2020; Khan, 2020).

**Social presence.** In a mediated environment, social presence refers to the degree to which users perceive one or more other people to be present via the mediated interface (Lim et al., 2015). This definition is an interpretation of the definition of Short et al. (1976) which were the first to introduce the concept of social presence in the field of social psychology and communication. Short et al. (1976) define social presence as “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (p. 65). In this conceptualization, social presence has emerged as a social and communicational factor that affects the perception of online learners of psychological distance with their instructors on the one hand and learners on the other (Gunawardena and McIsaac, 2004).

Other interpretations of this definition, such as that of Gunawardena (1995), have led to the view of social presence as the degree to which a person is perceived as a “real person” in a mediated communication. Social presence is therefore a psychological state in which a technology user experiences virtual presence with other social actors when receiving a certain social or communication signal (Lee, 2004). This perception and awareness of the presence of others would encourage interaction as claimed by Kim and Biocca (1997). The sense of social presence is therefore essential in order to understand the psychological and emotional relationship that develops between learners despite the distance (Kim, 2011). This notion is useful for detecting the effects of such a perception on the behavior of users of a mediated interface, in particular their propensity to interact (Tu and McIsaac, 2002) or to engage more in e-Learning activities (Molinillo et al., 2018).

**Collaborative learning.** According to Panitz (1996), collaboration is defined as the cooperation and interaction between members of a group who work together to achieve a set of common goals. In pedagogy, collaborative learning is the set of teaching strategies that foster the collaboration of learners to optimize their own and others’ learning (Maharani et al., 2020; Johnson and Johnson, 1999). In this type of learning, learners do more than listen passively to the lesson; they are encouraged to participate in knowledge generation by speaking, writing, reading, reflecting and interacting (Laal et al., 2013). Collaborative learning therefore occurs when students work together in small groups and tend to achieve a common goal (Manickam et al., 2020). It is also developed when students learn to collaborate, solve problems and develop various tasks, particularly through the exploration and sharing of ideas in-group work (Dewi and Muhid, 2021). This way of learning
creates a positive interdependence between learners (Panitz, 1996) and visibly develops their ability to create meaning and think critically (Angeli et al., 2003) notably through exploratory dialogues (Nambi, 2019). Thus, learners are all the more able to explore topics they do not know and to improve their skills on more than one level (Prince, 2004).

**Learner satisfaction.** The success of e-Learning is based on several factors, including user satisfaction. Indeed, the degree of satisfaction of learners with e-learning plays an important role in whether or not this type of learning is adopted. In the context of e-learning, Sun et al. (2008) define learner satisfaction with e-learning (Lee et al., 2009; Szymanski and Hise, 2000) as the total perception of the experience of learners consuming the e-Learning service while Tough (1982) defines it by characterizing the emotional state of the user. According to this author, online satisfaction refers to students’ joyful feelings or positive attitudes toward learning activities (Tough, 1982).

In the context of collaborative learning, satisfaction has a particular impact on the attitudes of learners towards group work and the learning atmosphere in general (Guuawardena et al., 2001). From this perspective, Dewiyanti et al. (2007) defined learner satisfaction with collaborative learning as the degree to which a learner feels positively associated with their own collaborative learning experiences.

**Student engagement.** It is widely accepted that the concept of engagement is essential for the success of learning activities. Nevertheless, there is no consensus on the definition of this important concept. Multiple definitions of engagement were provided by the research. These definitions are based on various and often overlapping concepts such as effort, interest, persistence, motivation or involvement (Bouvier et al., 2014b; Molinari et al., 2016). In this case, we focus our research on the emotional dimension of engagement by adopting the definition of Rueda et al. (2017) that learner engagement refers to the degree and intensity of a student’s emotional involvement, his motivation to collaborate, participate and contribute during the course activities (Brodie et al., 2013).

**Academic performance.** According to Salgado (2013), performance is, in practice, a vague and multidimensional notion that makes sense only in the context in which it is used. In the context of e-learning, Zhang et al. (2010) see effectiveness and efficiency as important criteria for the performance of e-learning. Effectiveness refers to the achievement of the objectives of the educational experience, while efficiency reflects the maximization of the benefits of e-learning (Zhang et al., 2010). Applied to individuals, learning performance refers to the extent to which learners achieve the course’s learning objectives in terms of acquiring knowledge, understanding key concepts and developing skills. (Alavi et al., 1997). This is also consistent with the definition advanced by Narad and Abdullah (2016) that academic performance refers to the knowledge acquired and assessed by a teacher’s grades in response to the educational objectives set by students and teachers over a specific period of time.

**Self-efficacy.** The self-efficacy, is a notion derived from Bandura’s sociocognitive theory (Bandura, 1986) according to which individual behaviour, cognitive factors and the environment influence each other in a dynamic and reciprocal way (Bandura, 2002; Gist and Mitchell, 1992). In terms of learning, self-efficacy refers to the learner’s belief in his or her ability to successfully organize and perform a task in an e-Learning context (Zimmerman, 2000). This definition emphasizes the importance of an individual’s confidence in their skills and the impact of that confidence on their achievements. Indeed, the feeling of effectiveness is likely to affect the motivation and behaviour of the individual and intervenes so that he implements his skills in order to achieve a goal. In this
regard, it is important to point out that the self-efficacy is likely to influence the human experience in all its phases. It acts on the setting of the objectives for which people invest themselves, on the amount of energy spent to achieve these objectives and on the probability of achieving specific levels of behavioural performance. In addition, self-efficacy is particularly important as it incorporates the person’s judgment on what he or she might do in the future. It also incorporates its judgments on its ability to apply its skills to broader tasks and in various situations (Compeau and Higgins, 1995). In the context of the use of technology, Compeau and Higgins (1995) consider that individuals would use computers if they perceived that there would be gains associated with their use.

Based on this review of the literature, this research seeks to answer the following questions:

- Would the perception of a social presence on social networks influence collaborative learning, satisfaction and learners’ engagement?
- Is the relationship between collaborative learning and learners’ performance mediated by their satisfaction and engagement?
- Does learners’ self-efficacy moderate the satisfaction-performance and engagement-performance relationships in the context of e-Learning?

**Conceptual model and development of hypotheses**

The model addressed in this research is theoretically based on findings related to social cognitive theory (Bandura, 1986), the active learning paradigm (Bonwel and Eison, 1991) and the socio-constructivist approach (Vygotsky, 1986). In this perspective, the model below (Figure 1) looks at the impact of social presence and collaborative atmosphere on learner satisfaction, engagement and academic performance. To do this, it tests a set of direct, mediating and moderating effects that make up all of our research hypotheses as follows:

![Figure 1. Conceptual model of research.](image-url)
Effect of social presence on collaborative learning. According to Cho et al. (2015), the stronger the social presence in the group, the greater the importance of collaborative learning. Thus, in the event of a strong social presence, employees may be able to interact more easily to define a problem, explore relevant information, integrate ideas, discuss alternatives and test possible solutions (Garrison et al., 2010). Thus, we make the following hypothesis:

**H1.** Social presence has a positive influence on collaborative learning

Effect of social presence on learner’s satisfaction. In the literature, several studies have already shown that perceived social presence positively affects learner satisfaction in an online course (Kang et al., 2014). Indeed, Gunawardena and Zittle (1997) examined social presence as a powerful predictor of student satisfaction in a computer conferencing environment. Thus, we make the following hypothesis:

**H2.** Social presence influences positively the satisfaction of online learners.

Effect of social presence on student engagement. According to Fu et al. (2009), the social presence of a learner in an online collaborative working group affects the learner’s predisposition to learn and to make a greater individual effort. Indeed, social presence allows the development of a sense of community that influences the motivation of learners towards the development of collaborative learning with their peers (Smith and Flaherty, 2013). Thus, we make the following hypothesis:

**H3.** Social presence influences positively student engagement

Effect of collaborative online learning on learner’s engagement. In learning environment, collaboration is likely to foster learner engagement in the learning activity. Indeed, by collaborating, learners are further encouraged to invest energy and actively participate in the learning activity (Zheng et al., 2015). Thus, we make the following hypothesis:

**H4.** Collaborative learning influences positively learners’ engagement

Effect of collaborative learning on learners’ satisfaction. Interactions between instructors and learners (Dietrich et al., 2015) on the one hand, and between learners on the other, are recognized as success factors in collaborative learning (Vuopala et al., 2015). Through such interactions, teachers can encourage their students to adopt active collaborative learning (Chapman and Van Aukun, 2001) that gives them satisfaction. Indeed, if students have the opportunity to ask questions, express their ideas, discuss and interact with their teachers as well as with their peers, they will feel more comfortable and therefore more satisfied with this mode of learning (Abrantes et al., 2007). Thus, we make the following hypothesis:

**H5.** Collaborative learning has a positive influence on learners’ satisfaction.

Effect of learners’ engagement on academic performance. Several studies have attempted to demonstrate that there is a direct and significant relationship between learner engagement and achievement of a high level of learning performance. One explanation for this relationship is that engaged learners typically exhibit high levels of energy and dedication when performing a task. They also experience a state of total immersion in activity (Gonzalez et al., 2020) and tend to collaborate more and better (Rueda et al., 2017). Thus, we make the following hypothesis:
H6. Learners’ engagement has a positive influence on academic performance

**Effect of learners’ satisfaction on academic performance.** In the context of collaborative online learning, So and Brush (2008) have shown that there is a positive effect between perceived satisfaction and learner performance. In the same vein, Al-Rahmi et al. (2018) have shown that the use of social networks positively influences the link between learner satisfaction and performance. Hence, we make the hypothesis:

H7. Satisfaction influences positively learners’ performance.

**Mediating effect of satisfaction and engagement.** This study looks also at the mediating effect of satisfaction and engagement on the relationship between collaborative learning and the performance of learners. The interest expressed here stems from the fact that no previous study has examined the existence of such mediation, despite the separate approval of any direct effects which constitute it. Apart from the previously developed relationships around collaborative learning-satisfaction, collaborative learning-engagement, satisfaction-performance and engagement-performance, research has also shown that there is a direct relationship, positive and meaningful between collaborative learning and learner performance (Al-Rahmi and Zeki, 2017; Al-Rahmi et al., 2018). Thus, the assumption that the relationship between collaborative learning and academic performance is mediated by satisfaction and engagement is a hypothesis based on sound theoretical foundations. However, we propose to test it empirically in order to (1) affirm or deny the existence of a mediation relationship beyond the separate partial effects and (2) specify whether it is a total or partial mediation and this, placing yourself in the context of using social media in learning. Thus, we make the following hypothesis:

H8. Satisfaction and engagement mediate the relationship between collaborative learning and academic performance.

**Moderating effect of self-efficacy.** Satisfaction with the type of learning seems to be one of the factors in improving the ability of learners to assimilate new knowledge and acquire new skills (Norzaïdi and Salwani, 2009). That said, from the time it comes to using a new learning tool, it is legitimate to think that the relationship of satisfaction-performance could be moderated by the self-efficacy, that is, the learner’s belief in his or her ability to use this new tool to capture the course and succeed. This means that learners with a strong self-efficacy are likely to convert their satisfaction with the learning tool into a completed performance. Thus, we make the following hypothesis:

H9. Self-efficacy moderates positively the relationship between satisfaction and academic performance.

**Moderating effect of self-efficacy on relationship between learners’ engagement and academic performance.** Past studies have shown that learners’ engagement is likely to positively influence their academic performance (Mayer et al., 2009). Nevertheless, this relationship may be moderated by the self-efficacy. Indeed, if engaged students are more likely to succeed, their engagement could be all the more influential on their performance if they believe in their ability to achieve their learning goals. Thus, we pose the hypothesis
H10. Self-efficacy moderates positively the relationship between learners’ engagement and academic performance

Methodology

Data collection procedure

A convenience sample was collected with 234 Tunisian undergraduate, graduate and postgraduate students belonging to different public universities located on Tunisian territory. We interviewed students who had an online teaching experience during the containment period of the first wave of COVID-19, without limiting ourselves to a given discipline, a given institution or a given geographical area. The sample includes 65% women and 35% men. Students are between 19 and 36 years old. 66% of them are between 19 and 25 years old and 34% of them are between 26 and 36 years old. These students took e-learning courses using synchronous and asynchronous tools. Facebook groups were created to plan synchronous sessions and meetings on interactive platforms (Microsoft teams, Google meet, Hangout, etc.) and to allow students to interact with their teachers and peers. These interactive groups and platforms were used to provide distance learning during the drop-off period of the face-to-face courses. For each variable included in the model, we borrowed from the literature a measurement scale that is conceptually consistent with the context of the study (see Table 1). The data collection was carried out in the form of a self-administered questionnaire by the students, via a link to a form launched on Google Drive and posted on the teaching groups in question. Participation in the study is voluntary. No compensation was awarded to participants in return for their participation.

Results

An exploratory and then confirmatory analysis were carried out in order to verify the psychometric quality of the measurement scales borrowed from the literature. We also checked the reliability as well as the convergent and discriminant validity of these variables. Then, we used the SEM in order to test the direct links relating to our model. However, in order to study the mediating roles and the moderation effects, we have chosen to use the Hayes process, with reference respectively to Preacher and Hayes (2008) and Hayes (2018).

The results show that all variables in our model are reliable with Jöreskog Rhô indices exceeding 0.7. Convergent validity is also ensured as AVE values exceed the empirical threshold of 0.5 (Fornell and Larcker, 1981).

The discriminant validity (Table 2) is also checked since the convergent validity ($\rho_{VC}$) of each constructor is greater than the square of the correlations it shares with the other constructs ($VD = \rho_{VC} > \text{Correlations}^2$).

Hypothesis testing

The results reported in Table 3 reveal that social presence has a positive and significant effect on collaborative learning. Thus, H1 is supported. We find that social presence has a positive and significant effect on both satisfaction and learner engagement. Thus, H2 and H3 are, therefore, supported. The results also show that collaborative learning has a positive and significant effect on engagement and satisfaction. Thus, H4 and H5 are supported. H6 and H7 therefore, supported, so
### Table 1. Measurement items, standardized factor loading, Rho de Jöreskog, and AVE.

| Constructs and items | Standardized factor loading | Rho de Jöreskog | AVE |
|----------------------|-----------------------------|-----------------|-----|
| Social presence (Lim et al., 2015) | 0.772 | 0.531 |
| SP1                  | 0.697 | |
| SP2                  | 0.68  | |
| SP3                  | 0.803 | |
| Collaborative learning (So and Brush, 2008) | 0.9 | 0.531 |
| CL1                  | 0.729 | |
| CL2                  | 0.72  | |
| CL3                  | 0.727 | |
| CL4                  | 0.762 | |
| CL5                  | 0.74  | |
| CL6                  | 0.803 | |
| CL7                  | 0.647 | |
| CL8                  | 0.689 | |
| Satisfaction (Chiu et al., 2005) | 0.883 | 0.653 |
| SAT1                 | 0.819 | |
| SAT2                 | 0.759 | |
| SAT3                 | 0.820 | |
| Engagement (Rueda et al., 2017) | 0.843 | 0.641 |
| ENG1                 | 0.822 | |
| ENG2                 | 0.753 | |
| ENG3                 | 0.825 | |
| Academic performance (Hsiao et al., 2016) | 0.841 | 0.572 |
| API                  | 0.877 | |
| AP2                  | 0.659 | |
| AP3                  | 0.762 | |
| AP4                  | 0.71  | |
| Self-Efficacy (Choi et al., 2007) | 0.843 | 0.642 |
| SE1                  | 0.825 | |
| SE2                  | 0.736 | |
| SE3                  | 0.838 | |

Note(s): All measures are five-point scales with anchors 1 = strongly disagree and 5 = strongly agree.

### Table 2. Discriminant validity test.

| CL  | SAT | AP  | PS  | ENG | SE  |
|-----|-----|-----|-----|-----|-----|
| CL  | 0.531 |     |     |     |     |
| SAT | 0.4032 | 0.653 |     |     |     |
| AP  | 0.2981 | 0.4134 | 0.572 |     |     |
| PS  | 0.2332 | 0.2756 | 0.2265 | 0.531 |     |
| ENG | 0.2851 | 0.5112 | 0.4382 | 0.2284 | 0.641 |
| SE  | 0.2992 | 0.4422 | 0.4303 | 0.2410 | 0.5169 | 0.642 |
academic performance of learners is directly and positively influenced by both online satisfaction and learner engagement.

**Mediating effect.** The results in the Table 4 indicate a significant partial mediated effect of satisfaction and engagement, respectively, between the collaborative learning atmosphere and academic performance. So, the H8 is confirmed.

**Moderation effects**

The analysis showed a non-significant negative effect of self efficacy on the satisfaction-performance relationship as well as on the engagement-performance relationship; This means that the two hypotheses H9 and H10 have not been validated. The two moderation effects are mapped through the graphics below (Figure 2).

These graphs schematize respectively the effect of satisfaction on performance and engagement on performance at −1 SD, 0 SD and +1 SD of the moderator (self-efficacy). These effects are plotted and compared visually. They can be interpreted by observing the slope of the regression lines. So, based on these charts, we see that high levels of satisfaction and engagement are associated with a higher level of performance, which can be seen on all three lines of each chart. It is also visible that the three groups visible on the graphs differ in their level of performance. However, we can conclude that the respective relationship between satisfaction and performance as well as between engagement and performance is essential for each group. However, what is not significant is the interaction effect for moderation. Thus, hypotheses H9 and H10 are invalidated.

**Discussions and implications**

The objective of this study is to test the impact of perceived social presence on the performance of learners in the context of an integrative model that includes direct links, mediators and moderators. The results strongly and significantly confirmed the direct relationships of the model. Social presence has been shown to have a positive effect on the development of a collaborative learning atmosphere (H1). By placing themselves in a learning environment that encourages interaction, learners are even more encouraged to work collaboratively. This result is consistent with past work (Molinillo et al., 2018). According to Smith and Flaherty (2013), social presence enables the

| Hypothesis | Path   | CR    | Standardized coefficient | SE    | Results   |
|------------|--------|-------|--------------------------|-------|-----------|
| H1         | SP→L   | 5.849 | 0.489***                  | 0.091 | Supported |
| H2         | SP→SAT | 4.242 | 0.329***                  | 0.09  | Supported |
| H3         | SP→ENG | 4.023 | 0.34***                   | 0.098 | Supported |
| H4         | CL→ENG | 4.992 | 0.404***                  | 0.087 | Supported |
| H5         | CL→SAT | 6.376 | 0.496***                  | 0.083 | Supported |
| H6         | ENG→AP | 5.906 | 0.441***                  | 0.07  | Supported |
| H7         | SAT→AP | 5.340 | 0.385***                  | 0.068 | Supported |

Note(s): SP = Social Presence; CL = Collaboratif Learning, SAT = Satisfaction. ENG = Engagement, AP = Academic Performance, ***<0.001.
development of a sense of community that motivates learners to develop their own learning in collaboration with their peers. Similarly, Molinillo et al. (2018) explained that social presence facilitates interpersonal communication through the creation of a warm learning environment, user-friendly and interactive which encourages learners to use technology to interact with others and to strengthen cooperation among group members.

This research has shown also that social presence has a positive and significant effect on satisfaction (H2) and learner engagement (H3). This result is in perfect harmony with past work. Indeed, according to Gunawardena and McIsaac (2003), social presence improves the learning experience, motivates learners and strengthens their sense of belonging to the active community, which also promotes their satisfaction (Zhan and Mei, 2013) and their engagement (Hall and Herrington, 2010). More recently, Zhan and Mei (2013) have shown that social presence is a very good predictor of student satisfaction with the online course. In this regard, it is important to note that social media plays an important role in building this positive relationship, as it provides a more user-friendly and less nervous learning environment (Zhan et al., 2011).

On the other hand, this research has shown that collaborative learning has a positive impact on engagement (H4) and learner satisfaction (H5). This finding is consistent with previous studies (Wu

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### Table 4. Mediation effects.

| Total effect of CL on AP | B    | SE   | T    | P  | LLCI | ULCI |
|-------------------------|------|------|------|----|------|------|
|                         | 0.462| 0.062| 7.406| 0.000| 0.339| 0.584|

| Direct effect of CL on AP | B    | SE   | T    | P  | LLCI | ULCI |
|--------------------------|------|------|------|----|------|------|
|                          | 0.177| 0.067| 2.64 | 0.009| 0.045| 0.309|

| Indirect effects of CL on AP | Total | B    | Boot SE | Boot LLCI | Boot ULCI |
|------------------------------|-------|------|---------|-----------|-----------|
| SAT                          | 0.285 | 0.136| 0.047   | 0.048     | 0.233     |
| ENG                          | 0.149 | 0.041| 0.073   | 0.235     |           |

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### Figure 2. Moderation effects.
et al., 2010). According to Johnson et al. (2008), creating and maintaining a collaborative learning space within an e-learning environment is important to improve learner satisfaction. Indeed, creating satisfaction is intimately linked to the method of teaching chosen and to the way in which the course and the space of the course are established (Lee et al., 2011). In this regard, Chang and Wang (2008) recommend that online courses be provided through interactive tools to achieve a higher level of interaction and therefore better satisfaction and engagement. Such educational materials can respond to the quest for interaction between stakeholders and proliferate their engagement to learning activity.

Moreover, this research has shown that learners’ satisfaction positively influences their academic performance (H7). This result is consistent with the work of Al-Rahmi and Zeki (2017). According to Chiu et al. (2007), for example, the more satisfied the learner is with the instructor/tutor, the course design and/or the choice of teaching method, the more this affects the learner’s academic performance. Learner engagement has also been shown to improve learner performance (H6). This outcome is similar to those of Rueda et al. (2017) which confirmed that online learners with a high level of engagement have a high probability of achieving their academic goals.

Around mediating effects, this research has shown that the relationship between collaborative learning and academic performance is mediated both by the satisfaction of learners and by their engagement (H8). The indirect effect of these two variables is much greater than the direct effect of collaborative learning on learner performance. This includes choosing social media in which interaction and collaboration generate the highest level of satisfaction and engagement to hope for a better impact on learner performance.

In addition, it should be noted that the satisfaction and engagement of learners in a collaborative learning atmosphere is linked to the construction of new knowledge through social interaction (Janssen et al., 2009). We relate this assertion to the principles of localized and distributed cognitive theory Hollan et al. (2000) which gives a major importance to the environment in which learning is built and to the interaction that occurs between learners in the course of this learning. In this regard, Dillenbourg et al. (2003) highlighted the role of virtual communities in the development of knowledge in an open and informal setting. The authors used concrete examples to demonstrate that such communities are an environment conducive to the transmission of knowledge and experience, this allows other members of the community to seize new knowledge and develop varied approaches to solving problems raised within the community. Thus, through the online social environment, learners become more able to communicate with their peers, solve problems or organize social events in a collaborative manner (Anderson, 2007).

Furthermore, the results of this study have not shown that self-efficacy plays a moderating role in the relationship satisfaction-performance or engagement-performance. These two moderations were not significant (H9 and H10). Indeed, in times of health crisis, learners have been confronted with emotional states characterized in particular by the effect of stress, boredom, fatigue, fear, anger or even anxiety. They were perplexed by the evolution of the pandemic state in Tunisia, in particular because of the worsening pandemic situation in several other countries. This has led to the removal of the expected positive effect of their self-efficacy. In addition, learners build their sense of self-efficacy through the vicarious experiences that result from learning by observing what others do. In this respect, students were particularly influenced by the difficulties their peers were facing when switching to online teaching. Many students were unable to take distance learning courses because they did not have the means to do so.

However, the results of this study emphasized the importance of reducing the levels of anxiety, depression and stress experienced by learners, thanks to the communication and socialization tools offered by social media platforms. This requires a highly immersive, motivating and effective
learning scenario to build collaborative pedagogical situations and implement a training engineering that promotes the use of interactive materials to foster the perception by learners of a comforting social presence. Social media interaction methods should also be used to provide coaching sessions to support students in difficulty. These actions are likely to highlight the relational side alongside the cognitive and technical aspects strongly attached to the teaching profession.

The results of this study also raise awareness among those responsible for improving the predisposition of universities to adapt to such situations. Indeed, because of the pandemic, several academic institutions around the world have decided to move entirely to online education in order to overcome the constraints imposed by this type of disaster, this again highlights the importance attached to this type of teaching.

In terms of practical managerial implications, this study recommends that teachers in educational institutions develop their own pages and groups on the different social networks and invite students to join these groups and pages to help them interact with their tutors and peers, and to proliferate their satisfaction, commitment and academic performance. The social presence of these students on user-friendly interactive platforms such as social networks is a key lever that can help learners overcome educational problems of all kinds. These groups and pages will provide a very convenient communication and interaction environment that can improve the success of online education, particularly in times of crisis. The pages or groups created by the teachers may be published on the official page of the institution to which they are affiliated in order to reduce the research effort of these pages by the students and to further simplify the interaction with the teachers as well as with the peers. It is also recommended to publish on these groups and pages innovative teaching tools such as personalized videos, short conferences, forums and discussion rooms around digital readings related to the teaching undertaken. These learning tools could be supported by collaborative projects and review exercises. In this way, the courses will be delivered in such a way as to bring online teaching closer to face-to-face teaching and to respond to the problems encountered by the learners in a visual and better adapted way. They could then access content that is 100% dedicated to them.

Limitations and further research

Despite its important contributions, this research has its limitations. First, it is important to point out that investigations into e-Learning during crises constitute a recent field of research. It is also multidisciplinary, which makes any attempt to conceptualize it more difficult.

In addition, limits are associated with the small size of the sample as well as the convenience method adopted in this first study on the impact of COVID-19 on the perceptions and behaviors of Tunisian students towards the online learning. These choices related to the limited resources of the investigators as well as the specific conditions under which the study was conducted. The response rate was relatively low compared to the number of students targeted. We therefore recommend that researchers, in the context of future research on this issue, try to adopt a larger and more representative sample.

In addition, we propose other possible avenues of research. Indeed, it would be interesting to include the relationships tested as part of a comparative study that confront different social media, in particular to capture the media that generate the most collaboration, satisfaction and engagement in a learning context.

Another avenue of research that seems promising to us is that of designing a pedagogical engineering that adapts to the way in which the learner prefers to learn in times of crisis, i.e. to emergency pedagogy. It would also be interesting to study the effect of teachers’ use of coaching
techniques, for students with difficulties in a crisis, on the performance of these learners as well as their self-efficacy. Finally, it would also be interesting to study the impact of other variables in this research context such as optimal experience, learning and tutoring styles, etc.

**Conclusion**

History has shown that periods of crisis often lead to major transformations in society (Kirk and Rifkin, 2020) and highlight the importance of socio-emotional aspects in managing these crises. In this case, the present study highlighted the importance of developing a learner’s perception of the social presence of peers and tutors in order to address the barriers associated with the adoption of e-learning as well as to promote the performance of learners.

Nevertheless, the development of the perception of a social presence in an online environment remains delicate because it requires the conscious and deliberate efforts of several actors: designers, professors and students. The same applies to the performance of these learners and yet, this paper has provided the with useful recommendations around the design and scripting of an online learning module in order to promote collaborative learning, increase the satisfaction and engagement of online learners and achieve the pedagogical objective in terms of performance.

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**References**

Abi-Rafeh J and Azzi AJ (2020) Emerging role of online virtual teaching resources for medical student education in plastic surgery: covid-19 pandemic and beyond. *Journal of Plastic, Reconstructive & Aesthetic Surgery* 73(8): 1575–1592.

Abrantes JL, Seabra C and Lage LF (2007) Pedagogical affect, student interest, and learning performance. *Journal of Business Research* 60(9): 960–964.

Allen IE and Seaman J (2013) Changing Course: Ten Years of Tracking Online Education in the United States. Babson Survey Research Group and Quahog Research Group, LLC, pp. 1–47. Retrieved 20 March 2015 Available at: [www.onlinelearningsurvey.com/reports/changingcourse.pdf](http://www.onlinelearningsurvey.com/reports/changingcourse.pdf)

Al-Rahmi WM, Alias N, Othman MS, et al. (2018) A model of factors affecting learning performance through the use of social media in Malaysian higher education. *Computers & Education* 121: 59–72.

Al-Rahmi WM and Zeki AM (2017) A model of using social media for collaborative learning to enhance learners’ performance on learning. *Journal of King Saud University - Computer and Information Sciences* 29(4): 526–535.

Alavi M, Yoo Y and Vogel D (1997) Using Information Technology to add value to management education. *Academy of Management Journal* 40(6): 1310–1333.
Anderson P (2007) *What Is Web 2.0? Ideas, Technologies and Implications for Education*. JISC. [Online]. Available at: www.jisc.ac.uk/media/documents/techwatch/ts0701b.pdf (accessed on 10 June 2010).

Angeli C, Valanides N and Bonk CJ (2003) Communication in a web-based conferencing system: the quality of computer-mediated interactions. *British Journal of Educational Technology* 34(1): 31–43.

Bandura A (1986) The assessment and predictive generality of self-percepts of efficacy. *Journal of Behavior Therapy and Experimental Psychiatry* 13(3): 195–199.

Bandura A (2002) Social Cognitive Theory in Cultural Context. *Applied Psychology: An International Review* 51(2): 269–290.

Béjaoui A, Mgadmi N, Moussa W, et al. (2021) A short-and long-term analysis of the nexus between Bitcoin, social media and Covid-19 outbreak. *Heliyon* 7(7): e07539.

Bonwel CC and Eison JA (1991) Active Learning: Creating Excitement in the Classroom. In: *ASHEERIC Higher Education Report No. 1*. Washington, DC: The George Washington University, School of Education and Human Development.

Bouvier P, Sehaba K and Lavoué E (2014b) A trace-based approach to identifying users’ engagement and qualifying their engaged-behaviours in interactive systems: Application to a social game. *User Modeling and User-Adapted Interaction* 24(5): 413–451.

Brodie RJ, Ilic A, Juric B, et al. (2013) Consumer engagement in a virtual brand community: An exploratory analysis. *Journal of Business Research* 66(1): 105–114.

Chang HH and Wang IC (2008) An investigation of user communication behavior in computer mediated environment. *Computers in Human Behavior* 24(5): 2336–2356.

Chapman K and Van Auken S (2001) Creating Positive Group Project Experiences: An Examination of the Role of the Instructor on Students’ Perceptions of Group Projects. *Journal of Marketing Education* 23(2): 117–127.

Chiu CM, Chiu CS and Chang H C (2007) Examining the integrated influence of fairness and quality on learners’ satisfaction and Web-based learning continuance intention. *Information Systems Journal* 17(3): 271–287.

Chiu CM, Hsu M-H, Sun S-Y, et al. (2005) Usability, quality, value and e-learning continuance decisions. *Computers & Education* 45(4): 399–416.

Cho YH, Yim SY and Paik S (2015) Physical and social presence in 3D virtual role-play for pre-service teachers. *Internet Higher Education* 25: 70–77.

Choi DH, Kim J and Kim SH (2007) ERP training with a web-based electronic learning system: The flow theory perspective. *International Journal of Human-Computer Studies* 65(3): 223–243.

Compeau DR and Higgins CA (1995) Application of Social Cognitive Theory to Training for Computer Skills. *Information Systems Research* 6(2): 118–143.

Cova B and Cova V (2009) Faces of the new consumer: A genesis of consumer governmentality. *Recherche et Applications en Marketing (English Edition)* 24(3): 81–99.

Dewi P and Muhid A (2021) Students’ Attitudes towards Collaborative Learning through E-Learning during Covid-19: A Male and Female Students. *Journal of English Literature, Linguistics, and Education* 9(1): 29–33.

Dewiyanti S, Brand-Gruwel S, Jochems W, et al. (2007) Students experiences with collaborative learning in asynchronous Computer-Supported Collaborative Learning environments. *Computers in Human Behavior* 23(1): 496–514.

Dietrich J, Dicke AL, Kracke B, et al. (2015) Teacher support and its influence on students’ intrinsic value and effort: Dimensional comparison effects across subjects. *Learning and Instruction* 39: 45–54.

Dillenbourg P, Poirier C and Carles L (2003) Communautés virtuelles d’apprentissage : e-jargon ou nouveau paradigme ? In: *A. Taurisson et A. Sentini. Pédagogies.Net. L’essor des communautés virtuelles d’apprentissage*. Montréal: Presses, pp. 9–47.
Fornell C and Larcker DF (1981) Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research* 18(1): 39–50.

Fu FL, Wu YL and Ho HC (2009) An investigation of coopetitive pedagogic design for knowledge creation in Web-based learning. *Computers & Education* 53(3): 550–562.

Gallini SM and Moely BE (2003) Service-Learning and Engagement, Academic Challenge, and Retention. *Michigan Journal of Community Service Learning* 10(1): 5–14.

Garrison R, Cleveland-Innes M and Fung T (2010) Exploring causal relationships among teaching, cognitive and social presence: student perceptions of the Community of Inquiry framework. *The Internet and Higher Education* 13(1–2): 31–36.

Gist ME and Mitchell TR (1992) Self-Efficacy: A Theoretical Analysis of Its Determinants and Malleability. *The Academy of Management Review* 17(2): 183–211.

González-Rodríguez MR, Díaz-Fernández C and Pino-Mejías MÁ (2020) The impact of virtual reality technology on tourists’ experience: a textual data analysis. *Soft Computing* 24(3): 13879–13892.

Grech P and Grech R (2020) COVID-19 in Malta: The mental health impact. *Psychological Trauma: Theory, Research, Practice, and Policy* 12(5): 534–535.

Gunawardena CN (1995) Social presence theory and implications for interaction collaborative learning in computer conferences. *International Journal of Educational Telecommunications* 1(2): 147–166.

Gunawardena CN and Zittle FJ (1997) Social presence as a predictor of satisfaction with a computer-mediated conferencing environment. *American Journal of Distance Education* 11(3): 8–26.

Gunawardena CN and McIsaac MS (2004) Distance education. In: Jonassen D (ed), *Handbook for Research on Educational Communications and Technology*. Mahwah, NJ: Erlbaum, pp. 355–396.

Guuawardena NC, Nola AC, Wilson APL, et al. (2001) A cross-cultural study of group process and development in online conferences. *Distance Education* 22(1): 85–112.

Hall AJ and Herrington J (2010) The development of social presence in online Arabic learning community. *Australasian Journal of Educational Technology* 26(7): 1012–1027.

Hayes AF (2018) *Introduction to Mediation, Moderation, and Conditional Process Analysis*. 2nd Ed. New York: The Guilford Press.

He H and Harris L (2020) The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. *Journal of Business Research* 116: 176–182.

Hollan J, Hutchins E and Kirsh D (2000) Distributed Cognition: Toward a New Foundation for Human-Computer Interaction Research. *ACM Transactions on Computer-Human Interaction* 7(2): 174–196.

Hsiao KL, Shu Y and Huang TC (2016) Exploring the effect of compulsive social app usage on technostress and academic performance: perspectives from personality traits. *Telematics and Informatics* 34(2): 679–690.

Janssen J, Erkens G, Kirschner PA, et al. (2009) Influence of group member familiarity on online collaborative learning. *Computers in Human Behavior* 25(1): 161–170.

Johnson DW and Johnson RT (1999) *Learning Together and Alone: Cooperative, Competitive and Individualistic Learning*. 5th ed. Boston, MA: Allyn & Bacon.

Johnson RD, Hornik S and Salas E (2008) An empirical examination of factors contributing to the creation of successful e-learning environments. *International Journal of Human-Computer Studies* 66(5): 356–369.

Johnson DW and Johnson RT (1990) Cooperative learning and achievement. In: Sharan S (ed), *Cooperative Learning: Theory and Research*. New York: Praeger, pp. 23–37.

Kang M, Liew BYT, Kim J, et al. (2014) Learning Presence as a Predictor of Achievement and Satisfaction in Online Learning Environments. *International Journal on E-Learning* 13(2): 1537–2456.

Kaplan AM and Haenlein M (2010) Users of the world, unite! The challenges and opportunities of social media. *Business Horizons* 53(1): 59–68.
Khan MN, Ashraf MA, Seinen D, et al. (2021) Social Media for Knowledge Acquisition and Dissemination: The Impact of the COVID-19 Pandemic on Collaborative Learning Driven Social Media Adoption. *Frontiers in Psychology* 12: 648253.

Khan TM (2020) Use of social media and WhatsApp to conduct teaching activities during the COVID-19 lockdown in Pakistan. *International Journal Pharmacy Practice* 29(1): 90.

Kim J (2011) Developing an instrument to measure social presence in distance higher education. *British Journal of Educational Technology* 42(5): 763–777.

Kim T and Biocca F (1997) Telepresence via television: two dimensions of telepresence may have different connections to memory and persuasion. *Journal of Computer-Mediated Communication* 3(2): JCMC325.

Kirk CP and Rifkin LS (2020) I’ll Trade You Diamonds for Toilet Paper: Consumer Reacting, Coping and Adapting Behaviors in the COVID-19 Pandemic. *Journal of Business Research* 117: 124–131.

Laal M, Naseri AS, Laal M, et al. (2013) What do we achieve from learning in collaboration? *Procedia - Social and Behavioral Sciences* 93(21): 1427–1432.

Lee KM (2004) Presence, explicated. *Communication Theory* 14(1): 27–50.

Lee SJ, Srinivasan S, Trail-Constant T, et al. (2011) Examining the relationship among student perception of support, course satisfaction, and learning outcomes in online learning. *The Internet and Higher Education* 14(3): 158–163.

Lee BC, Yoon JO and Lee I (2009) Learners’ acceptance of e-learning in South Korea: Theories and results. *Computers & Education* 53(14): 1320–1329.

Lim JS, Hwang YC, Kim S, et al. (2015) How social media engagement leads to sports channel loyalty: Mediating roles of social presence and channel engagement. *Computers in Human Behavior* 46: 158–167.

Maharani R, Marsigit M and Wijaya A (2020) Collaborative learning with scientific approach and multiple intelligence: Its impact toward math learning achievement. *Journal of Educational Research* 113(4): 303–316.

Manickam Y, Selvam SD and Ahrumugam P (2020) A Study on the Impact of Collaborative Learning on Academic Performance Using Facebook in Higher Education. *International Journal of Advanced Research in Education and Society* 2(1): 15–23.

Maqableh M and Alia M (2021) Evaluation online learning of undergraduate students under lockdown amidst COVID-19 Pandemic: The online learning experience and students’ satisfaction. *Children and Youth Services Review* 128: 106160.

Mayer RE, Stull A, DeLeeuw K, et al. (2009) Clickers in college classrooms: Fostering learning with questioning methods in large lecture classes. *Contemporary Educational Psychology* 34(1): 51–57.

Mnkandla E and Minnaar A (2017) The Use of Social Media in E-Learning: A Meta synthesis. *The International Review of Research in Open and Distributed Learning* 18(5): 227–248.

Molinari G, Poellhuber B, Heutte J, et al. (2016) Engagement and Persistence in Distance Learning Settings: Multiple Perspectives. *Distance and Mediation of Knowledge* 13.

Molinillo S, Aguilar-Illescas R, Anaya-Sánchez R, et al. (2018) Exploring the impacts of interactions, social presence and emotional engagement on active collaborative learning in a social web-based environment. *Computers & Education* 123: 41–52.

Nambi R (2019) Secondary School Students’ Experiences with Reading Aloud in Uganda: A Case Study. *Journal of Language Teaching and Research* 10(2): 224–231.

Narad A and Abdullah B (2016) Academic performance of senior secondary school students: Influence of parental encouragement and school environment. *Rupkatha Journal on Interdisciplinary Studies in Humanities* 8(2): 12–19.

Norzaidi MD and Salwani MI (2009) Evaluating technology resistance and technology satisfaction on students’ performance. *Campus-Wide Information Systems* 26(4): 298–312.
Panitz T (1996) A Definition of Collaborative vs Cooperative Learning. Available at: http://colccti.colfinder.org/sites/default/files/a_definition_of_collaborative_vs_cooperative_learning.pdf (accessed on 3 February 2020).

Picciano AB (2002) student perceptions: issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks* 6(1): 21–40.

Peters K, Chen Y, Kaplan AM, et al. (2013) Social Media Metrics — A Framework and Guidelines for Managing Social Media. *Journal of Interactive Marketing* 27(4): 281–298.

Preacher KJ and Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 40(3): 879–891.

Prince M (2004) Does active learning work? A review of the research. *Journal of Engineering Education* 93(3): 223–231.

Rachna D and Khajuria I (2017) A Study of User-Generated Content on Social Networking Sites and its Impact on Consumer-Based Brand Equity Constructs. *Global Journal of Management and Business Research: E Marketing* 17(1).

Richardson J, Swan K, Lowenthal P, et al. (2016) Social Presence in Online Learning: Past, Present, and Future. In: Proceedings of Global Learn-Global Conference on Learning and Technology Limerick, Ireland: Ireland Publisher: Association for the Advancement of Computing in Education (AACE), pp. 477–483. 28-29 April.

Rueda L, Benitez J and Braojos J (2017) From traditional education technologies to student satisfaction in Management education: A theory of the role of social media applications. *Information & Management* 54(8): 1059–1071.

Russo T and Benson S (2005) Learning with invisible others: Perceptions of online presence and their relationship to cognitive and affective learning. *Educational Technology & Society* 8(1): 54–62.

Salgado M (2013) Performance: A Fundamental Dimension for the Evaluation of Companies and Organizations. Available at: https://halshs.archives-ouvertes.fr/hal-00842219/document

Short J, Williams E and Christie B (1976) *The Social Psychology of Telecommunications*. London: Wiley.

Smith R and Flaherty J (2013) The importance of social presence in an online MBA program- A preliminary investigation. *Teaching & Learning Innovation* 16.

Simuth J and Sarmany-Schuller I (2012) Principles for e-pedagogy. *Procedia-Social and Behavioral Sciences* 46: 4454–4456.

So HJ and Brush TA (2008) Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education* 51(1): 318–336.

Stefano M, Giuseppe T and Nicolinom A (2020) The COVID-19 outbreak: From “black swan” to global challenges and opportunities. *Pulmonology* 26(3): 117–118.

Sun CH, Tsai RJ, Finger G, et al. (2008) What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education* 50(4): 1183–1202.

Szymanski DM and Hise RT (2000) E-Satisfaction: An initial examination. *Journal of Retailing* 76(3): 309–322.

Taleb N (2008) *The Black Swan: The Impact of the Highly Improbable*. London: Penguin.

Tough A (1982) *Some Major Reasons for Learning*. ERIC Document Reproduction Service. No. ED033251.

Tu CH and McIsaac M (2002) The relationship of social presence and interaction in online classes. *The American Journal of Distance Education* 16(3): 131–150.

Vuopala E, Hyvonen P and Järvelä S (2015) Interaction forms in successful collaborative learning in virtual learning environments. *Active Learning in Higher Education* 17(1): 1–14. DOI: 10.1177/1469787415616730

Vygotsky LS (1986) *Thought and Language*. MA: MIT.
Wu JH, Tennyson RD and Hsia TL (2010) A study of student satisfaction in a blended e-learning system environment. *Computers & Education* 55(1): 155–164.

Yekefallah L, Namdar P, Panahi R, et al. (2021) Factors related to students’ satisfaction with holding e-learning during the Covid-19 pandemic based on the dimensions of e-learning. *Heliyon* 7(7): e07628.

Zhan Z and Mei H (2013) Academic self-concept and social presence in face-to-face and online learning: Perceptions and effects on students’ learning achievement and satisfaction across environments. *Computers & Education* 69: 131–138.

Zhan Z, Xu F and Ye H (2011) Effects of an online learning community on active and reflective learners’ learning performance and attitudes in a face-to-face undergraduate course. *Computers & Education* 56(4): 961–968.

Zhang BH, Looi CK, Seow P, et al. (2010) Deconstructing and reconstructing: transforming primary science learning via a mobilized curriculum. *Computers & Education* 55(4): 1504–1523.

Zheng X, Cheung CMK, Lee MKO, et al. (2015) Building brand loyalty through user engagement in online brand communities in social networking sites. *Information Technology & People* 28(1): 90–106.

Zimmerman BJ (2000) Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology* 25: 82–91.