

**The Emotional Side of the E-learning Among Nursing Students: the role of the Affective  
Correlates on the E-Learning Satisfaction\***

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\* On the 26th December prof. Adalgisa Battistelli passed away. She was unable to see this article published. This loss lets us dismay and shattered. Prof. Battistelli shaped not only this work, but also an entire generation of researchers and practitioners of psychological science. Prof. Battistelli spent her life to address the learning and development challenges of diverse professional groups, such as nursing, from a psychological perspective. At an academic level, this work attests to her great and generous commitment to train and develop her doctoral students, as in the particular case of Dr. Letizia Dal Santo and Dr. Marco Peña Jimenez. Accuracy, carefulness, innovation, intellectual honesty and passion are the precious legacy she left us. Thank you very much Prof.ssa Adalgisa, you will always be a source of professional and personal inspiration for all of us. Thank you because the time we spent together made us feel “on the shoulders of a giant”. We’ll not forget your wisdom and we’ll do our best to honor your memory.

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### **Abstract**

Emotions are a core component of the learning process, which impact not only academic performance, but also the way we perceive our training, including the full remote training. The present study aims to investigate the mediating role played by positive and negative emotions in the relationship between the cognitive and the social presence of the e-learning environment and satisfaction with e-learning. Based on the Community of Inquiry (CoI) framework and on a cross-sectional study, our theoretical model was assessed (by using structural equation modelling) in a sample of 353 undergraduate nursing students at an Italian university. The results showed that the students' e-learning experience is related to both positive and negative emotions in different ways, which in turn impacts the satisfaction with e-learning. Thus, findings highlight the interplay between e-learning perceptions, affective correlates and satisfaction with remote training. Theoretical and practical implications related to the development of educational interventions are further discussed.

*Keywords:* E-learning environment, emotions, satisfaction with E-learning, Community of Inquiry (CoI)

## **The Emotional Side of the E-learning Among Nursing Students: The Role of the Affective Correlates on E-Learning Satisfaction**

### **Introduction**

Education has been experiencing multiple changes (e.g., new learning contents, methods, applications) because of the adoption of the new digital technologies, thus transforming the way learning takes place and how people (e.g., students, teachers) interact with each other (for a review see Rodrigues et al., 2019). As a result, this new form of learning, that uses emerging technologies (e.g., learning platforms, mobile and wearable devices) for educational purposes, also known as e-learning or online learning, has expanded significantly in recent times (for a review see Valverde-Berrocso et al., 2020). The recent social distancing measures to prevent the spread of COVID-19 pandemic all over the world, have accelerated and intensified these educational changes, thus placing e-learning as an alternative (if not the unique) option to ensure training in higher education, including nursing education. Thus, it becomes important to evaluate not only the online courses' features, but also how students experience the e-learning environment (Woolliscroft, 2020).

In that regard, many scholars (e.g., Mayer, 2020; Loderer et al., 2020) have called for further research to explore the emotional side of e-learning considering that human learning involves much more than cognitive processes and outcomes. Learning environments, and more specifically e-learning environment, might trigger positive (e.g., curiosity, surprise, pride) and negative (e.g., failure, anxiety, frustration) emotions, which in turn could potentially interfere with other cognitive processes and outcomes (e.g., Reizenzein et al., 2019). For instance, regarding emotional outcomes, satisfaction with a course is considered a relevant learning outcome shaping the decision to continue or withdraw from a course (Paechter et al., 2010).

Studying the emotional states in the e-learning experience of students seems to be even more relevant to respond to the unplanned educational changes (e.g., synchronous virtual classrooms, online discussion forums, virtual meetings) imposed by the COVID-19 pandemic (Carolan et al., 2020). For example, these unforeseen changes may, themselves, trigger an emotional response, which, in turn, may impact the way students experience online learning (Cleveland-Innes and Campbell, 2012). In the nursing context, empirical evidence on how students experience distance e-learning (i.e., from face-to-face to e-learning training) during the pandemic is still scarce (e.g., García-González et al., 2021; Kim and Park, 2021). To bridge this gap, the present study aims to examine the emotional side of e-learning during the COVID-19 pandemic context by investigating the role of emotions in the relationship between perceived experiences of e-learning environment and satisfaction with e-learning. More specifically, this study addresses the following research questions (RQ):

RQ1. How are nursing students' perceptions of e-learning experience (e.g., cognitive, social) related to positive and negative emotions?

RQ2. How are (positive and negative) emotions of nursing students related to overall satisfaction with e-learning training?

RQ3. Do nursing students' negative and positive emotions act as mediating mechanisms on the relationship between e-learning experience (e.g., cognitive, social) and satisfaction with e-learning training?

By addressing these research questions, we seek to contribute to research on emotions in technology-based learning contexts (and more specifically in e-learning nurse education) in two ways (Loderer et al., 2020; Carolan et al., 2020). First, considering that the complete e-learning training imposed by the COVID-19 pandemic was a new experience for study participants, we

provide evidence on how the undergraduate nursing students' evaluations of two essential aspects of educational experience (i.e., social and cognitive) are related to overall satisfaction with a fully online course. Second, we lend evidence on the mediating role of positive and negative emotions between perceived e-learning experiences and satisfaction, thus demonstrating the potential that affective mechanisms have for shaping satisfaction, but also opening up new avenues of research to study other educational outcomes.

### **The E-learning Educational Experience**

E-learning refers to a learning system based on digital and online technologies, whose main goal is to offer learners an interactive, learner-centered and open learning environment, which can support and improve the learning processes (Rapanta et al., 2020; Rodrigues et al., 2019). E-learning has been seen for a long time as an alternative form of learning for those learners who could not have had learning opportunities otherwise (Rhim and Han, 2020). However, it is more and more frequent to find higher-education institutions offering “online education” courses or even entire academic programs (Rivera-Vargas et al., 2021).

Over the last years, considerable efforts have been made to explore the constant changes in the e-learning environment (Loderer et al., 2020; Rodrigues et al., 2019). While many frameworks (e.g., Mayer, 2020; Paechter et al., 2010) propose to explore several functional facets of the learning environment (e.g., course design, student-instructor exchange, student-student exchange), others propose to study learning by focusing on the perception of the individuals' educational experience (Fiock, 2020; Garrison et al., 2010). In this regard, we propose here to focus on the core aspects of the learning experience or “presence” within an e-learning environment, based on the Community of Inquiry (CoI) theoretical framework (Fiock, 2020; Garrison et al., 2010).

Drawing from the CoI framework (Fiock, 2020; Garrison et al., 2010), the present study evaluates the e-learning educational experience by focusing on the cognitive and the social presences as two core elements of the e-learning environment. Cognitive presence is defined as the learners' ability to develop meaning through a reflective process or sustained reflection (i.e., problem identification, exploration, ideas integration, problem resolution) (Garrison et al., 2010). Social presence refers to the students' ability to present themselves as "real people" by using existing online communicating tools, which is determined by several social presence indicators (i.e., emotional expression, open communication, group cohesion) (Garrison et al., 2010).

Empirical evidence suggests that learning experience involves cognitive and social presences to develop meaningful learning and shows that they are related to useful learning outcomes (e.g., overall satisfaction, perceived learning, sense of community) (Castellano-Reyes, 2020). For example, Garrison and Arbaugh (2007) found that social and cognitive presences was positively associated with valuable learning outcomes such as learners' satisfaction, sense of community and perceived learning. More recently, Lim and Richardson (2021) indicated that the student's perception of cognitive and social presence were positively related to student satisfaction. In line with this perspective, the present study's general focus is to examine how nursing students perceive cognitive and social presences, as two representative factors of a meaningful and constructive learning environment (Fiock, 2020; Garrison et al., 2010).

### **Emotions and Satisfaction With E-learning**

Cognition and social interactions are considered the core elements of meaningful learning environments, including in online settings, which in turn might trigger affective and emotional processes (Ashwin and Guddeti, 2020). Within the e-learning educational setting, emotions refer to both positive (e.g., enjoyment, curiosity) and negative (e.g., anger, sadness, anxiety) affective

states, experienced by learners as parts of their e-learning experience (D'Mello, 2013; Mayer, 2020).

Emotions research within educational environments has demonstrated that emotions are linked to learning outcomes such as academic achievement (Artino, 2012), students' performance (D'Mello et al., 2014) and satisfaction with the training (Paechter et al., 2010). Among all these different learning outcomes, we explored how emotions are related to overall satisfaction with e-learning for several reasons. First, satisfaction with a course is a variable, which involves a self-perceived range of fulfillment linked to the individual's wish to learn and is an indicator of a positive evaluation of a learning experience (Arbaugh, 2000). Second, satisfaction is also an affective outcome, which influences learners' decision to remain or leave a course (Paechter et al., 2010). Last, satisfaction can be considered an alternative, but relevant indicator of educational quality (Hakim, 2014). On the other hand, psychological research has also provided substantive meta-analytical evidence about the antecedents (e.g., prior knowledge, learning environment) and outcomes (e.g., engagement, achievement) of emotions within the technology-based learning context such as the e-learning training (e.g., D'Mello, 2013; Loderer et al., 2020). In fact, emotions are representative variables of affective states which, regulate not only the way we perceive our environment, but also how we react to a given context (e.g., Ashwin and Guddeti, 2020; Reisenzein et al., 2019).

Building on these observations, emotions can be considered as central affective mechanisms, which mediate the relationship between the student's evaluation of the e-learning environment and the overall satisfaction with the e-learning experience.

### **Aim and hypotheses**

In line with the previous observations, this study aims to contribute to better understand the perception of the e-learning environment, characterized by cognitive (strategic planning) and social (interaction) factors, and the mediating role played by emotions on students' satisfaction with the e-learning training. Thus, we formulated the following hypotheses (see Figure 1):

*Hypothesis 1.* The cognitive dimension of the e-learning environment will be positively related to positive emotions and negatively related to negative emotions.

*Hypothesis 2.* The social dimension of the e-learning environment will be positively related to positive emotions and negatively related to negative emotions.

*Hypothesis 3a.* Positive emotions will be positively related to satisfaction with e-learning.

*Hypothesis 3b.* Negative emotions will be negatively related to satisfaction with e-learning.

*Hypothesis 4a.* Positive emotions will mediate the relationship between the cognitive and the social dimension of the e-learning environment and satisfaction with e-learning.

*Hypothesis 4b.* Negative emotions will mediate the relationship between the cognitive and the social dimension of the e-learning environment and satisfaction with e-learning.

---- Insert Figure 1 about here ----

## **Method**

### **Study Design**

Through a cross-sectional design, the current study explored the affective correlates of the e-learning environment, as they were experienced by nursing students during the lockdown due to the COVID-19 pandemic. To do so, an online questionnaire was used for data collection in a Graduated Nursing Program in Italy. The questionnaire was administered in September 2020, 6 months after the implementation of the fully e-learning training program (March-August 2020).



## Sample

The sample was composed of 353 undergraduate nursing students enrolled in a public Italian university who agreed to voluntarily participate in the current study. Within this sample, the majority of the participants were female (81.9%), and students had an average mean of 22.8 years old ( $SD = 3.99$ ). Students' sociodemographic and e-learning characteristics are detailed in Table 1.

---- Insert Table 1 about here ----

## Procedure

As part of our research protocol, we contacted the Nursing Studies Department and, after approval of the study protocol, an institutional e-mail having the online survey was sent to the target population. The criteria used to extend the invitation to take part in our study to the target population was the following: (1) students enrolled in the Nursing Studies Department, (2) second- and third-year students (bachelor's degree), and (3) students who had a fully remote training by using an online-connected learning platform (i.e., Moodle) and digital communication technologies (i.e., Zoom, Skype). Then, the target study population received an invitation from the university, where they were informed about the purpose and the characteristics of the research, as well as that their participation in the study was voluntary. The survey was administered via an online survey platform, where authors explicitly informed the above-mentioned aspects and assuring the anonymity of respondents.

## Measures

**Satisfaction with E-learning.** Satisfaction with e-learning was assessed by using an adapted version of the short form of the Minnesota Satisfaction Questionnaire (MSQ; Weiss et al., 1967). Three items measure the overall degree of satisfaction with the E-learning activities ( $\alpha$

= .87). Items comprising this variable (e.g., “I am satisfied with the preparation I have achieved by using the distance teaching method”) were rated on a 5-point Likert scale from 1 (“not at all”) to 5 (“extremely”).

**Positive and Negative Emotions.** Affective states were assessed through nine different emotional descriptors felt during the E-learning activities (Wortha et al., 2019). *Positive emotions* (sample emotional descriptors were “pleasure”, “hope”, and “pride”) and *Negative emotions* (illustrative emotional descriptors were “sadness”, “frustration”, and “anxiety”) were rated on a 5-point type-Likert scale from 1 (“not at all”) to 5 (“extremely”).

**E-Learning Environment Perception.** E-learning environment perception was assessed by using a 12-item scale derived from the John Hopkins Learning Environment Scale (JHLES; Shochetet al., 2015) and adapted for the purposes of this study. This measure assesses four dimensions of the e-learning environment perception (c.f., autonomy, programming, collaboration, communication), which capture two core aspects: (1) strategic planning (an e-learning environment which develops a cognitive activation for an autonomous planning) as a cognitive presence dimension, and (2) interaction (an e-learning environment allowing relationship and communication with other students) as a social presence dimension. The goodness of the two-factor learning experiences provided adequate support for the two-factor solution ( $\chi^2(26) = 97.35, p < .05$ ; CFI = 0.93; TLI = 0.91; RMSEA = 0.08, SRMR = 0.04) compared to the 1-factor solution ( $\chi^2(27) = 283.41, p < .05$ ; CFI = 0.77; TLI = 0.70; RMSEA = 0.16, SRMR = 0.09). Both “strategic planning” (sample item: “The distance learning experience allowed me to organize my study times and anticipate the preparation of some exams”) and “interaction” (sample item: “The distance learning experience allowed me to stay in touch with

my fellow students and share teaching materials”) were rated through a type-Likert scale ranging from 1 (“not at all”) to 5 (“extremely”).

### **Ethical Considerations**

In accordance with the ethical principles of the Declaration of Helsinki (World Medical Association, 2013) and the ethical guidelines (Section 8) of the American Psychological Association (2020), the current research was examined and approved by the Institutional Research Board of the Nursing Studies Department before data collection.

### **Data Analysis**

Statistical Package for Social Sciences software version 25.0 was used to analyze descriptive data and to carry out bivariate analysis. Reliability analysis was performed by using JASP software version 0.14.1 (McNeish, 2018). To assess our measurement model and test our hypotheses, structural equation modelling was performed by using Mplus 8. Regarding the analytical approach, considering that our measures used 5-point response options, we adopted a maximum likelihood approach (with a Robust Maximum Likelihood estimator, MLR in Mplus), which is considered an advisable option for 5 or more response options (Rhemtulla et al., 2012). The goodness of fit of our research model was evaluated through different statistical indexes such as the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Maximum-Likelihood Chi-Square ( $\chi^2$ ) and the degrees of freedom ( $df$ ), by following the traditional assessment criteria (Keith, 2019).

## **Results**

### **Measurement Model**

Confirmatory Factorial Analysis (CFA) was carried out to assess the measurement model. The results obtained indicate that all underlying latent factors of the corresponding items are consistent with the 5 constructs of our research model ( $\chi^2(179) = 407.38, p < 0.05$ ; CFI = 0.94; TLI = 0.93; RMSEA = 0.05, SRMR = 0.06). As can be seen in Table 2, the hypothesized 5-factor model was compared to model 2 (4-factor model: both e-learning environment factors were combined), model 3 (4-factor model: both emotions factors were combined), model 4 (3-factor model :both emotions factors were combined, and both e-learning environment factors), model 5 (2-factor model: e-learning environment factors, emotion factors, and satisfaction were grouped), and model 6 (1-factor model). The results indicate that the 5-factor solution yielded an adequate fit to the data compared to other competing nested models, where two or more factors were combined to examine the discriminant validity of the theorized five-factor model.

---- Insert Table 2 about here ----

To provide further evidence of the convergent validity of the study variables, Table 3 presents the average variance extracted (AVE) and composite reliability (CR) of the five latent variables of our theorized model. Based on AVEs, reasonably good evidence of convergent validity is demonstrated. All AVE's values were satisfactory ( $> 0.50$ ) or excellent ( $> 0.70$ ), except for the e-learning environment fostering strategic planning, where value is acceptable (Bagozzi and Yi, 1988). In terms of internal consistency, all CR values are above 0.7, which indicates good levels of scale reliability (Hair et al., 2010). It is also reported coefficient omega, which is consistent with Cronbach's alpha reported in the measures section, thus providing evidence of the satisfactory levels for reliability/internal consistency.

Means, standard deviations and correlations of the study variables are presented in Table 3. Bivariate analysis showed that the perception of the e-learning environment, fostering strategic

planning and interaction, is positively correlated to positive emotions and negatively associated with negative emotions felt in the remote training, and these in turn have a significantly positive and negative relationship with satisfaction with remote training, respectively.

---- Insert Table 3 about here ----

### **Structural Model**

By using Structural Equation Modelling (SEM), the relationship between the latent variables of our theorized framework was examined and the underlying model demonstrated an adequate fit ( $\chi^2(181) = 428.34, p < 0.05$ ; CFI = 0.93; TLI = 0.92; RMSEA = 0.06, SRMR = 0.06). Standardized path coefficients of the tested model are presented in Figure 2. All factors loadings and the path coefficients were significant ( $p < 0.01$ ), except for the relationship between the perception of the e-learning environment fostering interaction and negative emotions. Overall, the current findings show that the perception of the e-learning environment fostering strategic planning is significantly positively associated with positive emotions ( $\beta = 0.46, p < 0.01$ ) and significantly negatively associated with negative emotions ( $\beta = -0.45, p < 0.01$ ), thus lending support to hypotheses 1a and 1b, respectively. The perception of the e-learning environment fostering interaction is significantly positively related to positive emotions ( $\beta = 0.37, p < 0.01$ ) and no significant relationship was founded with negative emotions ( $\beta = -0.09, p = 0.29$ ). Therefore, hypothesis 2a is supported and hypothesis 2 is rejected. Positive emotions are significantly positively associated with satisfaction with e-learning ( $\beta = 0.43, p < 0.01$ ), while negative emotions is significantly negatively related with the latter ( $\beta = -0.31, p < 0.01$ ). Hypothesis 3a and 3b are thus supported.

Two additional pathways were added to test the mediation hypotheses 4a and 4b, that is, the perception of the e-learning environment fostering strategic planning and interaction to

satisfaction with e-learning. While the relationship between e-learning environment fostering interaction and satisfaction was not significant ( $\beta = 0.01, p = 0.83$ ), the relationship between e-learning environment fostering strategic planning and satisfaction was significant ( $\beta = 0.36, p < 0.01$ ), and improved the model fit ( $\Delta\chi^2[\Delta df = 1] = 1.00, p < 0.01$ ). Consequently, such path was considered in the final structural model.

Moreover, in order to analyze the mediation effect, a bootstrapping technique was used by following the guidelines of Shrout and Bolger (2002). Table 4 reports the direct effects and indirect effects of the model. As can be seen, findings showed that positive emotions about remote training partially mediate the relationship between e-learning environment fostering strategic planning and satisfaction with e-learning (direct effect  $\beta = 0.36, p < 0.01$ ; indirect effect  $\beta = 0.20, p < 0.01$ ), and totally mediate the relationship between e-learning environment fostering interaction and satisfaction with e-learning (direct effect  $\beta = 0.01, p = 0.83$ ; indirect effect  $\beta = 0.16, p < 0.01$ ). Hypothesis 4a is thus partially supported. Moreover, negative emotions about remote training partially mediate the relationship between e-learning environment fostering strategic planning and satisfaction with e-learning (direct effect  $\beta = 0.36, p < 0.01$ ; indirect effect  $\beta = 0.14, p < 0.01$ ), and did not mediate the relationship between e-learning environment fostering interaction and satisfaction with e-learning (direct effect  $\beta = 0.01, p = 0.83$ ; indirect effect  $\beta = 0.02, p = 0.31$ ). Therefore, hypotheses 4b is partially supported.

---- Insert Figure 2 about here ----

---- Insert Table 4 about here ----

## Discussion

The current study aimed to better understand the emotional side of the fully remote e-learning training during the COVID-19 pandemic context, as experienced by nursing students.

More specifically, we aim to explore the mediating role of emotions in the relationship between the perception of the e-learning environment, characterized by cognitive (i.e., strategic planning) and social (i.e., interaction) factors, and satisfaction with the e-learning. Based on the CoI theoretical framework, which claims that social and cognitive presences represent two core elements of the e-learning experience, we explore the affective correlates of the nursing students' learning experience within an e-learning environment.

Our results showed a positive relationship between cognitive (i.e., strategic planning) and social (i.e., interaction) presences and positive emotions. In other words, the cognitive effort involved in constructing knowledge and the interaction with others might trigger positive emotions such as curiosity, pride and hope. Likewise, a positive relationship between cognitive presence (i.e., strategic planning) and satisfaction with e-learning was found. These results are consistent with the CoI framework, which highlights the importance of cognitive (e.g., solving problems, connecting ideas, planning activities) and social (e.g., opportunities to exchange, collaboration) presences for developing meaningful (e.g., satisfaction with e-learning training) learning experiences within the e-learning environment (e.g., Rhim and Han, 2020).

Our findings also indicated that cognitive (i.e., strategic planning) and social (i.e., interaction) presences are related to negative emotions in different ways. While the cognitive dimension of the learning experience showed a negative association with emotions such as frustration, anxiety and sadness, the social presence showed no relationship with these negative emotions. Previous studies have revealed that cognitive presence, and more specifically, the autonomy and the cognitive control involved in the strategic planning decreases the negative emotional activation (e.g., Westerlund et al., 2021), but also that cognition and social interaction play different roles in the emotional states, which is consistent with emotional and affective

states literature (e.g., Izard et al., 1984). Nevertheless, further research is strongly recommended to determine whether the lack of relationship between these learning experiences and negative emotions is similar in different educational environments and ways of learning.

Our research showed the partial mediating role played by positive emotions in the cognitive presence (i.e., strategic planning) and satisfaction with e-learning relationship. Put another way, the cognitive presence would activate students' satisfaction either directly and indirectly, through the intervention of positive emotions (Garrison et al., 2010). Likewise, the social dimension (i.e., interaction with peers) does not directly affect students' satisfaction with e-learning training directly, but rather positive emotions play the role of a fully mediating mechanism between learning experiences and learning outcomes (i.e., satisfaction with e-learning training). Accordingly, our findings suggest that cognitive (e.g., planning, connecting ideas) and social (e.g., collaboration among students) presences elicit positive emotions, which in turn move students to feel fulfilled with the e-learning environment (Hambacher et al., 2018).

Last, the current findings showed that negative emotions play a mediating role between cognitive presence (i.e., strategic planning) and satisfaction with e-learning, however, negative emotions would not play a mediating role in the relationship between social presence (e.g., interaction with other students) and satisfaction with e-learning (Garrison et al., 2010). In other words, negative emotions have the potential of regulating the cognitive side of the learning experience; however, this affective mechanism would act in a different way in the case of social presence (i.e., interaction). This observation suggests that other psychological processes or learning contexts might trigger negative emotions by shaping affective learning outcomes such as satisfaction with e-learning.

### **Theoretical Implications**



Our study has some theoretical implications, which are worth mentioning. On the one hand, our results extend the knowledge about core facets of the learning experience, that is, the students' perceptions of the e-learning environment as a Community of Inquiry (Yilmaz, 2020). In particular, we focus on the cognitive and the social presence as two core components of the online learning settings (Giannous and Kioumourtzoglou, 2016; Lim and Richardson, 2021). This is in line with previous research (Mehall, 2021), which offered evidence that positive social interaction is associated with satisfaction in e-learning. In addition, strategic planning showed a positive link to students' satisfaction; this is consistent with a recent study by Lim and Richardson (2021) who claimed that: "cognitive presence showed the most powerful predictive effects on students 'perceived learning outcomes and satisfaction'" (p.1).

On the other hand, this study sheds light on how emotions shape e-learning processes (e.g., learning experience, learning outcomes). This has a theoretical implication, which suggests considering positive and negative emotions as mediators/moderators elements of social and cognitive presences and other learning outcomes (Majeski et al., 2018). Future studies are strongly recommended to better understand the complex interplay among different kinds of presence such as emotional, cognitive, social and teaching and their links with different outcomes. Our results are consistent with previous findings claiming that emotions shape learning, including in e-learning communities (Cleveland-Innes and Campbell, 2012; Marchand and Gutierrez, 2011). Indeed, the consideration of the intervening role of emotions is "... use the specific meaning of these terms to make the point that sometimes, when we are not studying emotion *per se*, it is the consideration of emotion that reveals the nature of the relationship between our constructs of interest..." (Zerbe and Haertel, 2000, p. 156-157). Accordingly,

further research on emotional presence within an online community is strongly recommended to better understand their role and influence on the online environment's experience.

### **Practical Implications**

Our study has some practical implications on nursing education, to develop meaningful learning experiences. Our results underline the importance of considering strategic planning and social interaction as essential aspects of e-learning. This consideration implies that educators must develop online courses, which can foster students' perception of the e-learning environment as a Community of Inquiry (Mehall, 2021; Yilmaz, 2020).

In particular, our study underlines that interaction promotes positive emotions, which in turn activate students' satisfaction. That implies that educators should foster e-learning experiences where students have the opportunities to share their thoughts and their feeling in order to find solutions together. The promotion of high quality interpersonal interactions is demonstrated to lead to better student outcomes and generally increases students' satisfaction with the online learning setting (Mehall, 2021). It is therefore very important to facilitate communication by creating a climate of trust (e.g., through social interactions), which in turn will provide the environment for purposeful interactions (Lim and Richardson, 2021).

Our results also show the important role of strategic planning in e-learning environments. In this regard, educators should promote interventions, which can shape the quality of cognitive development and the optimal functioning of a community of inquiry. In the digital age, the balancing of different online educational settings or resources means educators need to be aware that the perception of the e-learning setting can be improved by the construction of a learning community (Yuan and Kim, 2014). This implies that educators, in the online environment, play a

fundamental role: a facilitator role. They are called to facilitate students to active engage, plan their learning activities and promote interaction among peers.

### **Limitations of the study**

The current research offers some insights about the emotional correlates within an e-learning environment; however, some limitations have to be pointed out. First, from a theoretical standpoint, while we focused on two central (i.e., cognition, interaction) dimensions fostered within an e-learning environment, as presented in the CoI framework. Further research is needed to explore how other presences, such as teacher presence, are involved in the learning experience of a remote training context and which is the overlapping among these different components. Second, from a methodological viewpoint, our study used a cross-sectional design, which allowed us to evaluate specific affective states, further research is therefore needed to assess the dynamic of affective states and possible changes within the e-learning environment through longitudinal studies. Moreover, even though the measures used in the current study assess core aspects of the learning experience and affective correlates, further research is needed to make an in-depth evaluation of different facets of the learning experience and the spectrum of emotions. Likewise, by considering the type of sampling (i.e., convenience) of the present work, future research might include participants of different educational levels and experiences with the use of e-learning devices for evaluating the potential moderating role of such educational characteristics. Last, from an educational practice view, the current study was carried out in the midst of accelerated and unexpected implementation of an e-learning training program (due to the COVID-19 pandemic), thus providing new opportunities in the future to take into account other personal and contextual variables (e.g., prior e-learning experiences) impacting the learning process.

## **Conclusion**

The digital age, and more recently the COVID-19 pandemic, have accelerated the transformation of learning settings in higher education, by offering new opportunities to better understand and seize the opportunities of e-learning environments. Based on the CoI theoretical framework, we propose to examine the affective correlates of the fully remote e-learning as experienced by a sample of nursing students, and more specifically, how (positive, negative) emotions mediate the relationship between the learning experience (i.e., cognitive, social) and learning outcomes (i.e., satisfaction with e-learning). Our findings suggest that both cognitive (i.e., strategic planning) and social (i.e., interaction) presences impact students' emotions differently, which in turn might affect the satisfaction with e-learning training. Thus, our model sheds light on the complex interplay among cognitive, emotional and relational components, which is consistent with previous studies (e.g., Cleveland-Innes and Campbell, 2012).

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**Table 1***Students' Sociodemographic and E-learning Characteristics*

Variable	<i>n</i>	%
<b>Gender</b>		
Female	289	81.9
Male	60	17.0
Did not reply	4	1.1
<b>Age <sup>a</sup></b>		
19 - 20 years old	73	20.7
21 - 22 years old	162	45.9
23 - 24 years old	58	16.4
More than 25 years old	55	15.6
Did not reply	5	1.4
<b>Number of students using e-learning technologies before the pandemic</b>		
Videoconferencing software (e.g., Zoom, Skype) for educational courses	71	20.1
Videoconferencing software(e.g., Zoom, Skype) for meeting other students	103	29.1
Instant messaging software (e.g., WhatsApp, Facebook messenger)	306	86.4
E-mail	290	81.9
University learning platform (i.e., Moodle)	221	62.4
<b>Number of students using e-learning technologies during the pandemic (Mar-Sept 2020)</b>		
Videoconferencing software (e.g., Zoom, Skype) for educational courses	353	100.0
Videoconferencing software(e.g., Zoom, Skype) for meeting other students	282	79.7
Instant messaging software (e.g., WhatsApp, Facebook messenger)	323	91.5
E-mail	311	88.9

University learning platform (i.e., Moodle)	327	92.4
Self-perceived IT and digital skills proficiency <sup>b</sup>		
Low level	17	4.8
Basic level	97	27.5
Good Level	180	51.0
Advanced Level	59	16.7

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*Note.*  $N = 353$ .

<sup>a</sup> Participants were on average 22.8 years old ( $SD = 3.9$ ).

<sup>b</sup> Students reported their IT and digital skills proficiency at the end of the academic semester (September 2020).

**Table 2***Fit Indices for Confirmatory Factor Analysis Models*

Model	$\chi^2$	<i>df</i>	RMSEA	RMSEA 90% CI	CFI	TLI	SRMR	Model comparison (Satorra- Bentler)
1. Hypothesized 5-factor model	407.38*	179	0.06	0.052 – 0.068	0.94	0.93	0.05	–
2. Model A	664.64*	183	0.09	0.079 – 0.093	0.86	0.84	0.08	2 vs. 1 = 202.35, <i>df</i> = 4, <i>p</i> < 0.01
3. Model B	749.68*	183	0.09	0.087 – 0.101	0.84	0.82	0.08	3 vs. 1 = 267.82, <i>df</i> = 4, <i>p</i> < 0.01
4. Model C	1005.34*	186	0.11	0.105 – 0.119	0.77	0.74	0.10	4 vs. 1 = 472.36, <i>df</i> = 7, <i>p</i> < 0.01
5. Model D	1055.40*	188	0.11	0.108 – 0.121	0.76	0.73	0.10	5 vs. 1 = 475.55, <i>df</i> = 9, <i>p</i> < 0.01
6. Model E	1312.60*	189	0.13	0.123 – 0.136	0.68	0.65	0.10	6 vs. 1 = 627.49, <i>df</i> = 10, <i>p</i> < 0.01

*Note.* *N* = 353; \* *p* < .01; CFI: Comparative fit index; CI: Confidence interval; RMSEA: Root-mean-square error of approximation;

SRMR: Standardized root mean square residual; TLI: Tucker–Lewis index.

Model A: 4-factors model (LESP and LEIN combine); Model B: 4-factors model (PEEL and NEEL combine); Model C: 3-factors model (LESP and LEIN combine, and PEEL and NEEL combine); Model D: 2-factors model, (LESP and LEIN combine, and PEEL, NEEL and OSEL combine); Model E: 1-factor model.

LESP: Learning Environment fostering Strategic Planning; LEIN: Learning Environment fostering Interaction; PEEL: Positive Emotions about E-Learning; NEEL: Negative Emotions about E-Learning; OSEL: Overall Satisfaction with E-Learning.

**Table 3***Descriptive Statistics, Reliability and Correlations of Study Variables*

Variable	<i>M</i>	<i>SD</i>	<i>AVE</i>	<i>CR</i>	1	2	3	4	5
1. LESP	3.02	0.87	0.47	0.77	(.82)				
2. LEIN	2.54	0.84	0.59	0.88	.52**	(.88)			
3. PEEL	2.73	0.85	0.59	0.85	.56**	.57**	(.85)		
4. NEEL	2.85	0.98	0.56	0.87	-.40**	-.29**	-.46**	(.87)	
5. OSEL	2.90	0.97	0.70	0.87	.67**	.55**	.71**	-.60**	(.87)

Note.  $N = 353$ ; \*\*  $p < .01$

*M* = mean; *SD* = standard deviation; *AVE* = Average variance extracted; *CR* = Composite reliability; Values in brackets are internal consistency coefficients (McDonald's omega).

LESP: Learning Environment fostering Strategic Planning; LEIN: Learning Environment fostering Interaction; PEEL: Positive Emotions about E-Learning; NEEL: Negative Emotions about E-Learning; OSEL: Overall Satisfaction with E-Learning.

**Table 4***Mediation Analysis*

Effect	$\beta$	SE	95% CI		p
			LL	UL	
Direct effects					
LESP → PEEL	0.46	0.08	0.31	0.61	< 0.01
LESP → NEEL	-0.45	0.09	-0.61	-0.27	< 0.01
LEIN → PEEL	0.37	0.07	0.22	0.51	< 0.01
LEIN → NEEL	-0.09	0.08	-0.25	0.07	0.29
LESP → OSEL	0.36	0.07	0.22	0.50	< 0.01
LEIN → OSEL	0.01	0.06	-0.11	0.12	0.83
PEEL → OSEL	0.43	0.08	0.27	0.59	< 0.01
NEEL → OSEL	-0.31	0.05	-0.41	-0.21	< 0.01
Indirect effects					
LESP → PEEL → OSEL	0.20	0.05	0.11	0.31	< 0.01
LEIN → PEEL → OSEL	0.16	0.05	0.08	0.26	< 0.01
LESP → NEEL → OSEL	0.14	0.03	0.08	0.21	< 0.01
LEIN → NEEL → OSEL	0.02	0.03	-0.02	0.09	0.31

Note.  $N = 353$ ; Bootstrapping sample = 10000; Standardized coefficients are reported. 95% CI:

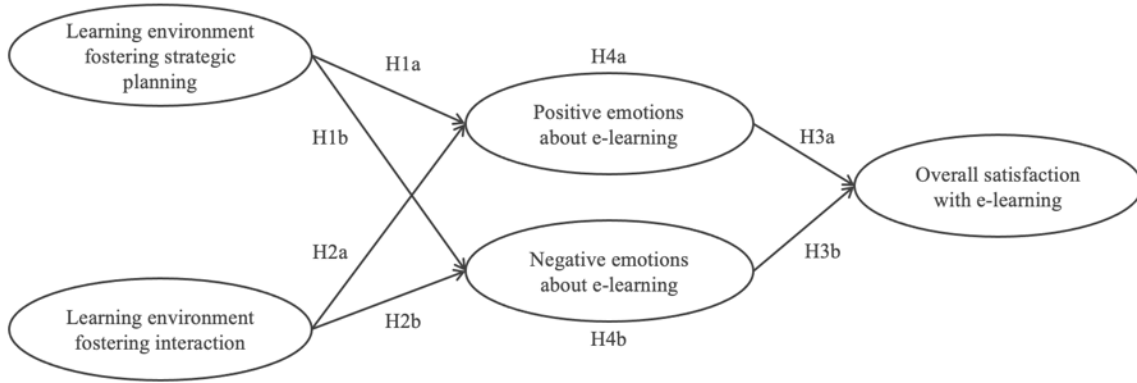
95% confidence interval for  $\beta$ ; LL = lower limit; UL = upper limit.

LESP: Learning Environment fostering Strategic Planning; LEIN: Learning Environment fostering Interaction; PEEL: Positive Emotions about E-Learning; NEEL: Negative Emotions about E-Learning; OSEL: Overall Satisfaction with E-Learning.



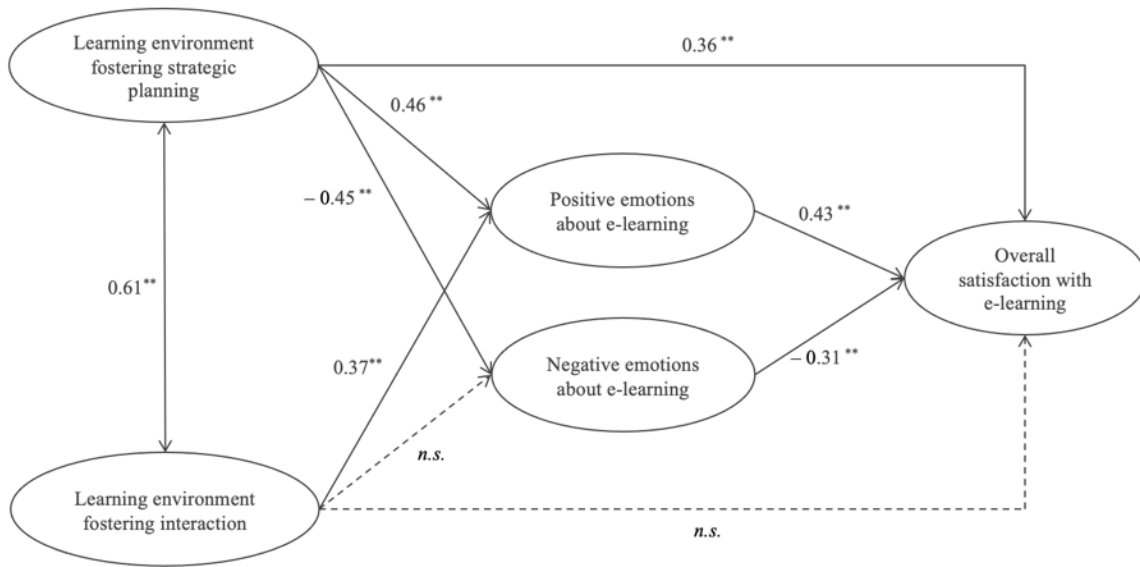
**Figure 1**

*Theoretical Framework*



**Figure 2**

*Structural Model of Associations Between Learning Experiences and Affective-Related Constructs*



*Note.*  $N = 353$ ; Coefficients presented are standardized path coefficients associated with the final model.

$** p < 0.01$ .