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The role of online vs face-to-face learning environments in academic engagement profiles: a comparative study during and post lockdown

El rol del contexto educativo digital vs presencial en perfiles de engagement académico: estudio comparativo durante y post confinamiento

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Abstract

The aim of this paper was to contrast Engagement profiles in Colombian university students in two differential educational contexts, the online education originated by confinement, and the face-to-face classroom environment, in order to understand possible differences between the groups. To this end, 742 university students were evaluated in two differential educational contexts, the online education imposed during COVID-19 confinement, and the face-to-face classroom environment post-confinement. The sample consisted of Colombian university students between 18 and 25 years of age, from middle and low socio-economic backgrounds. The methodological approach was in two steps, the first a pre- and post-test comparison, the second a cluster analysis from which four profiles were defined according to the participants' scores on the UWES-S scale (Student Academic Engagement Scale). In the results, multiple comparisons indicated significant differences in the levels of vigour, absorption and between the four engagement profiles: high,

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medium, in process and low. The results showed that the group of students with high levels of engagement was composed of both online and face-to-face students. However, the groups composed of students with low-scoring profiles were made up of more students in the online mode of study, indicating a pattern where virtual schooling imposed during confinement was associated with lower motivation to learn. In the analyses by gender, females had higher levels than males in both learning contexts.

Keywords: Academic engagement; confinement; face-to-face; virtual education; cluster analysis; higher education.

Resumen

El presente trabajo tuvo como objetivo contrastar perfiles de Engagement en estudiantes universitarios colombianos en dos contextos educativos diferenciales, la educación en línea originada por el confinamiento, y el entorno de aula de manera presencial, con el fin de comprender posibles diferencias entre los grupos. Para ello se evaluaron 742 estudiantes universitario, en dos contextos de enseñanza diferenciales, la educación en línea impuesta durante el confinamiento por COVID-19, y el entorno de aula presencial post confinamiento. La muestra estuvo conformada por estudiantes universitarios colombianos entre 18 y 25 años, de nivel socioeconómico medio y bajo. La aproximación metodológica fue en dos pasos, la primera una comparación pre y post test, la segunda a partir de un análisis de clústeres desde la cual se definieron cuatro perfiles clasificados de acuerdo con las puntuaciones de los y las participantes en la escala UWES–S (Student Academic Engagement Scale). En los resultados, las comparaciones múltiples señalaron diferencias significativas en los niveles de vigor, absorción y entre los cuatro perfiles de Engagement: alto, medio, en proceso y bajo. Los resultados evidenciaron que el grupo de estudiantes con alto nivel estuvo integrado tanto por estudiantes en modalidad virtual como presencial. No obstante, los grupos compuestos por estudiantes con perfiles de bajos puntajes se conformaron por más estudiantes en la modalidad de estudios en línea, señalando un patrón donde la escolaridad virtual impuesta durante el confinamiento se asoció con menor motivación para aprender. En los análisis por sexo, las mujeres presentaron mayores niveles que los hombres en ambos contextos de enseñanza

Palabras clave: Engagement académico; confinamiento; presencialidad; educación virtual; análisis de clústeres; educación superior.

Introduction

In the context of the health emergency caused by the spread of the COVID-19 virus, nations around the world were forced to transform their dynamics of social interaction, including the way in which the right to education was provided and received. In Colombia, as of 17 March 2020, the Ministry of National Education legislated the suspension of face-to-face classes, and decreed remote work for teachers and students, without any modification of the academic calendar (Colombian Ministry of Education, 2020). Without space for pedagogical accompaniment, students and faculty had to leave the campuses and move their work, daily life, communication and other activities associated with the

teaching-learning processes to entirely digital environments (Gourlay, 2021). These measures remained in force until 20 January 2022, when Circular No. 021 decreed the return to face-to-face attendance in university campuses (Colombian Ministry of Education, 2022).

For four academic semesters, specialised learning in higher education was entirely mediated by the use of computer technologies, electronic devices and wireless broadband. The forced transition to virtuality represented a break in the traditional face-to-face teaching framework, mainly in two aspects: the impossibility of physical interaction between teacher/student dyads and between students, and the asynchrony in the development of educational content (Aristovnik et al., 2020; McKee and Ntokos, 2022).

There is consensus in the literature related to how in the face-to-face environment, the teacher can exercise greater control over the learning process of their students, assess in real time the level of understanding of the topics, limit environmental distracters, model collaborative work among peers, and provide varied and multimodal activities to address the educational needs of the great diversity of learners present in a classroom (De Anda et al., 2021). In particular, peer interactions and socially constructed meanings constitute an important affective dimension for learning, a source of positive emotional experiences that have been found to be related to the strengthening of study skills, greater retention of content, and even protective against cognitive exhaustion or academic burnout, and student dropout (Marenco-Escuderos et al., 2021; Suárez-Colorado and Restrepo Cervantes, 2019).

Unlike face-to-face education, in the online schooling environment, or e-learning, the greatest weight of the learning process falls on the learner. It is the student who manages his/her own time, space and pace of work at his/her own discretion, which requires a type of learner who is particularly autonomous, involved and active in his/her learning (Gómez, et al., 2017; Choez and Alcívar, 2022). In the last five years, research on e-learning has recorded exponential growth in enrolments in entirely digital courses, which reveals the interest of the new generations of learners in the distance learning modality over the physical classroom. Especially during the COVID-19 confinement, such findings identified high rates of improvement in academic performance and study satisfaction among university students enrolled in online courses compared to those who took traditional face-to-face courses prior to confinement (Aristovnik et al., 2020; Bond et al., 2020; Nortvig and Georgsen, 2022).

Although this is a field under exploration, a number of advantages of digital learning environments over face-to-face environments have begun to be identified. For example, the asynchrony of processes gives students more time to elaborate answers related to the work content, to document themselves in order to better argue shared assertions, and to actively participate in discussions with teachers and peers. In addition, the technological components of video and audio provide greater possibilities to review the content developed by the teacher as many times as necessary and thus achieve greater clarity in the mastery of the topics, all of which is possible if students have the necessary technological tools to successfully fulfil their academic commitments (Aristovnik et al., 2020; Forero-Arango et al, 2023).

The influence of the mode of study, whether face-to-face or virtual, on meaningful learning has given rise to numerous scientific debates. Some positions argue that the material context (virtual or face-to-face) is simply a scenario, and insist that in both modalities, in one way or another, the necessary dynamics of content transmission, human relations, autonomous work and personal motivation, which are fundamental for learning, are transversal. These same positions point out how the link with one method or another is due to personal preferences (Molina et al., 2021).

In Colombia, some studies have documented how initially during the first semester of confinement the move to virtual education generated stress and emotional discomfort among university students, with a prevalence of emotions of frustration, anguish and despair in the face of the new teaching methodologies that caused up to 17% of students nationwide to drop out of their studies (Colombian Ministry of Education, 2021; Moreno-Correa, 2020). However, for the same period one year later, even during the confinement, the university coverage rate increased by 53.94 % representing an exponential growth in reinstatement and coverage levels not evidenced since 2018 before the COVID-19 epidemic (Colombian Ministry of Education, 2021). These figures show a panorama of the rapid adaptability of university students to the new online study modalities, as well as their desire for self-improvement and personal development despite the health emergency conditions.

In the specific case of what happened during confinement, beyond the context of instruction, whether virtual or face-to-face, the effectiveness in academic competences responded mainly to the individual psychological characteristics of motivation and attitudinal disposition towards academic work. In the educational literature, "academic engagement" refers to the set of specific attitudes and behaviours that are positive for the fulfilment of school duties, such as the number of hours dedicated to studies, meeting deadlines for deliveries, class attendance, or proactivity in seeking support to solve problems (Alrashidi, et al., 2016; Martínez et al, 2022).

Research around the world has found academic engagement correlated with high levels of performance, satisfaction with learning, resilience to difficulties experienced during university semesters, and increased retention in both face-to-face and online education (Álvarez-Pérez et al., 2021; Badoiu et al., 2021; González-García et al., 2018; Guillen et al., 2022; Tortosa et al., 2020).

An important criticism of research on academic engagement is that studies have been framed in a single teaching-learning context (virtual or face-to-face) as independent phenomena, leaving gaps with respect to empirical data that can objectively contrast the differences or similarities in academic performance and engagement of university students simultaneously in both educational environments. Only in this way can the role of the mode of study on motivation and engagement in learning be discerned (González and García-Hernández, 2020; Moral Pajares et al, 2022).

In response to the aforementioned scientific concerns, this research focused on the identification of Engagement in Colombian university students in two differential

educational contexts, online education originated by confinement, and the classroom environment in order to generate a comparison between two differential educational contexts that define the learning process. A two-step methodological approach was used: first, pre- and post-test comparisons indicated significant differences in Engagement among students, and then a cluster analysis allowed us to extract academic Engagement profiles and again contrast them according to characteristics such as study modality and gender, aspects that would show current results on the new adaptations in the learning process that were built around and after the pandemic.

Method

Population and Sample

Through a quantitative, simple cross-sectional associative study, the relationship between the study variables was examined without their manipulation and intervention (Ato, et al., 2013). The sample consisted of 742 students, of which 742 students were prosocially distributed by mode of study (50-50 distribution) in public and private institutions. The representation of female participants in the face-to-face modality was N=221 (59.6 %), and male N=150 (40.4 %); in the virtual modality women N=266 (71.7 %); and men N= 105 (28.3 %). Participants ranged in age from 18 to 25 years (M= 21.3; *SD*= 6.07). Data collection was carried out digitally by an online survey at two different Times (T). The first time (T1) between February and March 2021, during the second peak of the Covid-19 Confinement in Colombia (N= 371), and the second time (T2) in March and April 2022.

Instrument

Academic Engagement: the UWES-S scale (Student Academic Engagement Scale) created by Schaufeli *and* Bakker (2003) was used, which has a theoretical model with adequate fit indicators (CFI=.90; GFI=.91; RMSEA=.09) and satisfactory levels of reliability (α between .75 and .84); the scale has been previously adapted and validated with a Colombian population (Caballero, et al., 2015). With 17 items, the scale assesses three dimensions of academic engagement: vigour (6 items), dedication (5 items) and absorption (6 items). The Vigour dimension refers to the energy levels and efforts a student makes in a class period, e.g., *My tasks as a student make me feel full of energy*. For the present research the dedication scale obtained a moderate reliability α=.72; b) dedication: measuring the levels of enthusiasm, pride and motivation to take on academic challenges, e.g. *I am proud to do this degree*. For the present research the dedication scale obtained a strong reliability (α=.79; c) Absorption: Comprises 6 items where the degree of satisfaction of the students with their studies is evaluated (α=.7), e.g.: *I am happy when I am doing tasks related to my studies*. Students responded to each item on a Likert scale of 7 options, from 0 "never" to 6 "always".

Data collection and analysis procedure

This study was part of an inter-institutional collaborative project of the faculties of psychology and undergraduate studies whose objective was to document the effect of confinement on the psychological adjustment and academic performance of university students in the Colombian Caribbean. Subsequent to its institutional endorsement through the rectoral resolution No. 018 of November 16, 2018, we proceeded to collect the information with an online questionnaire created with the Google forms® tool, it was sent by teachers to students on Microsoft Teams® learning platforms, and also distributed by WhatsApp groups with the collaboration of psychology and undergraduate students.

The ethical guidelines of contact, informed consent, anonymity and free withdrawal for research in psychology recommended by the World Medical Association, in the Declaration of Helsinki revised in Taipei in 2016, were followed. All students surveyed declared virtually their free and voluntary participation, without any remuneration and with knowledge of the objectives and scope of the project. The estimated time to complete the test was approximately 17 minutes.

Exploratory and confirmatory factor analyses allowed us to test the psychometric fit of the UWES-S to the Colombian Caribbean population. Hypothesis testing was approached using Analysis of Variance [ANOVA] to identify differences in Engagement as a function of study mode and gender. Subsequently, a two-step cluster analysis, first by Ward's hierarchical grouping method, and a second grouping by a non-hierarchical method (Tkaczynski, 2017) allowed participants to be classified according to their similarities in the Engagement indicators. To establish significant differences between groups, multiple comparisons were performed using Tukey, HSD and Games-Howell post-hoc tests (Pardo and Ruiz, 2002). Finally, cross-tabulations allowed us to evaluate the distribution of participants according to gender and study modality. Descriptive and inferential statistical analyses were performed in Jamovi (2021, version 1.8). Cluster analyses were performed with the Machine Learning module in JASP (2022, version 0.16.2). Both programs are interfaces for statistical data analysis, which work with the R programming language (R Core Team, 2021).

Results

The cluster analysis was performed in two steps, first a hierarchical analysis by Ward's extraction method, in order to statistically extract the optimal number of response profiles from an unsupervised algorithm (Mlodak, 2021). This analysis showed 4 profiles or clusters of Engagement scores among the total sample of 742 participants. In a second step a new clustering of participants was defined by the "K-means" extraction algorithm, which has shown better clustering ability according to the parameterisation of means as centres. The resulting 4-cluster model proved to be a robust model with sufficient

predictive ability for the Engagement variables among university students (R^2 = .72).

The composition of the clusters was as follows: a first cluster grouped 215 students with the highest Engagement scores, for which it was dubbed "*Engagement-high*". This group accounted for 18.6 % of the heterogeneity of the total cluster data, and obtained an adequate silhouette score of b = .42. A second cluster comprised 280 participants whose scores on the Engagement dimensions were within the upper and lower bounds of the average, thus they were dubbed "*Engagement-medium*" (n=280), which explained 34.4 % of total data, and a moderate silhouette score of b = .23. The third cluster grouped 179 students with average and low scores on the Engagement dimensions, for which they were dubbed "*Engagement-in-progress*". This cluster accounted for 28.9 % of heterogeneity within the cluster, and obtained an adequate silhouette score of b = .25.

Finally, the fourth group was dubbed "*Engagement-low*" since it consisted of 68 subjects with the lowest Engagement scores. This group accounted for 18.7% of the data within the cluster and obtained an adequate silhouette score of b = .33. It should be noted that the means or centres of each cluster are standardised, and can be seen in Table 1, and the graphical representation of the profiles found are presented in Figure 1.

Table 1

Cluster Distribution

Conglomerate	**High engagement**	**Average engagement**	**Engagement in process**	**Low engagement**
Size	215	280	179	68
Heterogeneity within the cluster	.186	.344	.283	.187
Sum of squares Inside	118.439	219.114	180.330	119.217
Vigor Centre	1.033	0.134	-0.822	-1.656
Centre Dedication	0.679	0.289	-0.388	-2.315
Absorption Centre	1.054	0.074	-0.747	-1.670

To find out in greater detail the statistical differences between the indicators of absorption, vigour and dedication of the four extracted groups. Levene's homoscedasticity test indicated differences between the variances of the groups for each dimension ($p < .05$), these results allowed us to continue with the Games-Howell post-hoc tests (Pardo and Ruiz, 2002). Table 2 presents the one-to-one comparisons of the extracted Engagement profiles in the university population.

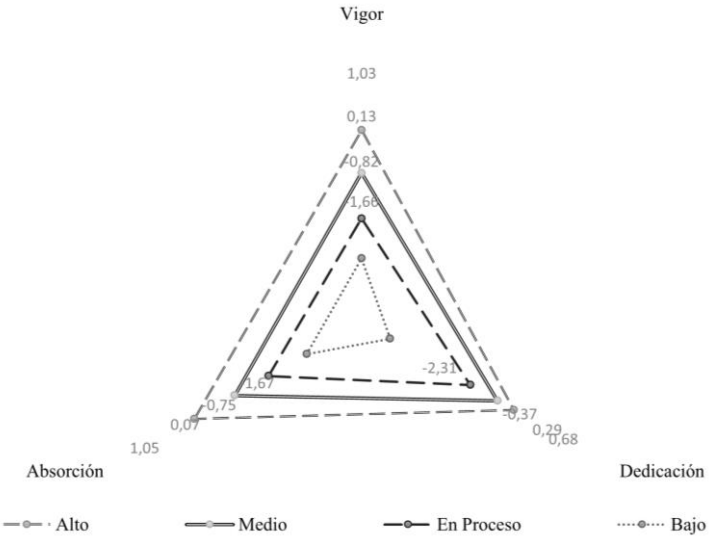

Figure 1. Clustering of Engagement styles in Colombian university students**.**

Firstly, in the dedication dimension it was found that the "*Engagement-high*" group is statistically different from the rest of the groups, in fact, they have the highest levels of dedication in relation to the "*Engagement-medium*", "*Engagement-in-progress*" and "*Engagement-low"* profile (p <.001). Additionally, it was found that the "*Engagement-medium*" group has dedication scores that are statistically higher than the "*Engagement-in-progress*" and "*Engagement-low"* groups (p < .001). On the other hand, it was found that the "*Engagement-in-progress*" group maintain significantly higher scores than the "*Engagement-low*" university students (p <.001), who have the lowest levels of dedication.

Secondly, the post-hoc test also showed significant differences between all groups on the Absorption dimension. It was found that the "*Engagement-high*" group is statistically different than the rest of the groups (p <.001), as well as the "*Engagement-medium*" group is statistically different in the absorption dimension from those belonging to the "*Engagement-in-progress*" and "*Engagement-low*" groups (p <.001), specifically, those students belonging to the "*Engagement-medium*" group showed higher mean scores in absorption compared to the "*Engagement-in-progress*" and "*Low*" groups. Finally, the "*Engagement-in-progress*" group presented scores that are statistically higher than the "*Engagement-low*" group (p < .001).

Table 2

Games-Howell Post Hoc for Differences in Engagement within Clusters

Comparison	$\Delta\bar{x}$ Vigour	ET. Vigour	$\Delta\bar{x}$ Dedication	ET. Dedication	$\Delta\bar{x}$ Absorption	ET. Absorption	*p*
High-Middle	6.02	.29	1.84	.19	6.12	.28	< .001*
High-In process	12.38	.35	5.04	.26	11.24	.31	< .001*
High-Low	17.94	.61	14.1	.48	16.99	.62	< .001*
Medium-In process	6.37	.34	3.20	.27	5.12	.31	< .001*
Medium-Low	11.94	.60	12.29	.49	10.87	.62	< .001*
In progress-Low	5.56	.63	9.10	.52	5.75	.64	< .001*

Note. 1= High; 2= Medium; 3= In process; 4= Low; $\Delta\bar{x}$: Mean Difference; E. T= Standard Error

Distribution of Engagement styles by study mode

Cross-tabulations allowed a comparison of the membership of each cluster by mode of study of its members. Data were interpreted based on the Chi-square statistic and corrected residuals, where a score ≥1.96 is indicative of statistical differences, highlighting the category with the highest value of positive corrected residuals (Haberman, 1973).

The analysis showed that there are differences in the clusters in relation to the mode of study ($x^2_{(3)} = 16.415; p < .000$). The cross-tabulation showed no statistical differences in the cluster with high Engagement in relation to the mode of study. However, there was a difference in the proportion in the rest of the clusters. Firstly, there were differences in the proportions in the "*medium-engagement*" group (corrected residual 3.2), with a higher proportion of students studying face-to-face (58%). Secondly, differences were found in the proportions in the "*In progress*" Engagement group (corrected residual 2.0), where 56% of the group was made up of students who were taking classes virtually. Finally, the group with "*Low*" Engagement is mostly distributed with students in the virtual modality (66 %, corrected residual = 2.8), as shown in table 3.

Table 3

Cluster membership by mode of study

Conglomerate		Study Mode		Total (N=472)
		On-site (N=371)	Online (N=371)	
High	Count	109	106	215
	% within the group	51	49	
	Corrected waste	.2	-.22	

Medium	Count	161	119	
	% within the group	58	42	280
	Corrected waste	3.2*	-3.2	
In	Count	78	101	
progress	% within the group	44	56	179
	Corrected waste	-2.0	2.0*	
Under	Count	23	45	
	% within the group	34	66	68
	Corrected waste	-2.8	2.8*	

Note. *Statistically significant differences, residual ≥ 1.9

Gender differences in the composition of Engagement profiles

The Student's t-test indicated gender differences in each of the dimensions of academic engagement: vigour ($t_{(740)} = -3.38$ p<.000), dedication ($t_{(740)} = -4.88$ p<.000), and absorption ($t_{(740)} = -3.09$, p<.01). The differences in scores between males and females on the three dimensions of Engagement are presented in the table. As shown in the table, the scores are significantly higher among women compared to men in all dimensions of engagement. In table 4 we can see how dedication is most important, followed by absorption and finally vigour.

Table 4

Differences in Academic Engagement according to Gender

	Group	M	DE	T	p
Vigour	Man	22	7.09	-3.38	< .001
	Woman	23.8	6.41		
Dedication	Man	24.3	5.33	-4.88	< .001
	Woman	26.1	4.31		
Absorption	Man	23.1	6.41	-3.09	.002
	Woman	24.6	6.11		

On the other hand, taking into account that significant differences were found according to gender, the same comparison was made, but separating the participants according to their mode of study, the data showed that in the face-to-face mode of study there are no gender differences in the dimensions of vigour and absorption of Engagement, however, women obtained significantly higher scores in the dimension of dedication (p=.000).

In the virtual study mode, statistical differences were found between men and women in the three dimensions of Engagement: women obtained significantly higher scores in vigour, dedication and absorption (p<.001 in all the dimensions indicated). Table 5 shows

the complete results of the comparison of the groups by mode in relation to the manifestations of Engagement.

Table 5

Differences in Academic Engagement according to Gender and Mode of Study

Modality	Engagement Dimension	Group	M	DE	F	*p*
On-site	Vigour	Man	23.42	6.18	3.737	.054
		Woman	24.66	5.93		
	Dedication	Man	24.68	5.15	16.117	.000*
		Woman	26.51	3.641		
	Absorption	Man	24.17	5.81	1.704	.193
		Woman	24.97	5.75		
Virtual	Vigour	Man	19.75	7.91	15.418	.000*
		Woman	23.15	6.70		
	Dedication	Man	23.68	5.60	11.785	.001*
		Woman	25.79	4.77		
	Absorption	Man	21.21	6.94	14.509	.000*
		Woman	24.28	6.38		

Discussion and Conclusions

Face-to-face university education and the new online mode of study represent two learning contexts that differ mainly in the physical-material channels in which instruction is transmitted (the physical classroom or digital technological channels). In both modes of study, students' academic performance is determined by a complex interplay of the learner's own personal motivational factors, the type of academic activities, and the characteristics of the contexts in which instruction occurs.

Due to the COVID-19 pandemic, for four academic semesters, between 2020 and 2021, by Colombian health regulations, university instruction was offered exclusively in the virtual modality by all educational institutions in the country. For students enrolled in face-to-face academic programmes, this change in the teaching context imposed great challenges, but also opportunities to adjust their attitudes and study habits to the new multimodal, fully online environments.

The scientific literature in education has been clear in showing that both digital and face-to-face environments are favourable contexts for learning, locating the differences in performance in students' academic engagement. Engagement then stands out as that

motivational dimension that informs commitment to one's own training and is positioned as the necessary condition for adaptation to any specialised university learning context (Badoiu et al., 2021).

The aim of this paper was to contrast different academic engagement profiles of Colombian university students enrolled in different educational contexts (virtual and face-to-face study modalities), in order to understand possible differences between the groups. A subject-centred analytical approach was chosen: by means of a cluster analysis, 721 students were classified according to their scores in the dimensions of vigour, dedication and absorption of Engagement. The results indicated four profiles, the first called "*Engagement-high*" because its participants had the highest scores on vigour, absorption and dedication to studies; a second profile of "Engagement-medium", with average scores on the three dimensions assessed; a third profile called "*Engagement-in-progress*" with slightly below average scores; and a final, also the least numerous group made up of participants who scored significantly lower on the three dimensions of the construct.

A cross-tabulation analysis revealed the proportion of participants enrolled in virtual and face-to-face study modes in each group. It was found that the Engagement-high profile is exhibited by equal proportions of virtual and face-to-face students. This finding supports those theses that have suggested academic engagement and motivation to learn as independent of the material context in which learning occurs (De Juan, 2019). Rather, it is the psychological resources related to motivation, vigour, absorption in studies, as well as positive behaviours and habits towards schoolwork that account for personal investments in learning (Badoiu et al., 2021). The results of effectiveness and efficiency in academic adherence operate through the autonomy of the student and the commitment he or she exercises, even in spite of the different vicissitudes that certain circumstances may offer (Marenco-Escuderos et al., 2021).

It is important to discuss that the results also evidenced notable differences in the Engagement of students in virtual and face-to-face study modes. Specifically, it was found that the profiles with the lowest scores in vigour, dedication and absorption (profile "*in process*" and "*Engagement-low*") were exhibited by the student enrolled in the virtual modality. Taking into consideration the health emergency conditions associated with the population in virtual mode, it is possible that the lower scores in Engagement among students in virtual mode are due to physical and/or emotional health affectations, perhaps due to negative situations and personal difficulties that could interfere with the achievement and complete dedication to academic duties during confinement (Valero et al., 2021).

Other possible theories that could explain the low engagement profiles among online students are related to the relational elements that support the willingness to carry out academic activities, or the drastic change in study habits and the lack of habituation of some students towards autonomous learning (Palacios-Garay et al., 2020). From these

explanations, low engagement profiles represent students with learning dynamics that do not favour virtual contexts, but on the contrary affect their academic performance. On this point, previous research has shown that, although for some students technology increases the perception of personal control and direction in the learning process, it has also been observed that for many students virtual environments are impersonal and difficult to operate (Aristovnik et al., 2020; McKee and Ntokos, 2022; Molina et al., 2021). It could be concluded that, in the particular case of the present study, the virtuality forced by confinement negatively affected the willingness to learn among many university students, perhaps because they required more social interaction and affective support from a tangible educational community, which is typical of a face-to-face context.

Finally, with respect to gender differences, different research has considered gender as a determinant of the level of student engagement within a normative face-to-face setting, with women consistently showing higher engagement over time (Díaz et al., 2020; Moreta et al., 2018; Sánchez-Cañizares et al., 2007). However, research in e-learning environments rarely points to gender differences in academic performance or engagement (Seppälä et al., 2009; Liébana-Presa et al., 2018). Gender undoubtedly remains a phenomenon of interest in educational research, its relationships, effects, and variations across virtual and face-to-face study contexts (Guillen et al., 2021). In the present research, gender differences in Engagement were found in both study contexts. Females consistently scored higher than males in both virtual and face-to-face study settings.

Little research on learning in virtual contexts points to gender differences in the engagement of university students. The present study shows the existence of important gender differences in the vigour, dedication and absorption to studies. Colombian female university students show greater commitment to learning, and are willing to adopt healthy habits towards studies (spending more time exploring academic subjects, completing assignments and handing them in on time, looking for complementary sources to deepen their knowledge of the contents, among other positive attitudes and behaviours towards learning).

The current results contribute to scientific evidence of a statistical trend in favour of the female gender, supported by other data such as the higher enrolment of women in university studies in the country (SNIES, 2021), as well as empirical results that feed the discussion on the study modalities and adjustments that university students were able to make due to an unplanned situation, but whose results will accompany the learning process of the next generations.

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