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The future of virtual business education: students' continuance intention in Colombian business schools

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Colombian business schools are experiencing a transformation characterized by changing enrollment patterns, declining participation in some traditional face-to-face programs, and continued growth in virtual education. Drawing on a post-adoption perspective informed by the Expectation-Confirmation Model and the perceived-usefulness mechanism of the Technology Acceptance Model, this study examines the relationships of satisfaction, perceived usefulness, and perceived quality with students' continuance intention toward virtual classes. A quantitative cross-sectional survey was conducted with 807 students enrolled in business-related programs at 12 private accredited universities in Bogotá, Colombia. Data were collected online between July 2024 and September 2025 using a non-probability sampling strategy combining convenience and snowball procedures. The data were analyzed using Partial Least Squares Structural Equation Modeling. Satisfaction was the strongest predictor of continuance intention to use virtual classes ($\beta = 0.54$, $p < 0.001$; $f^2 = 0.29$), followed by perceived usefulness ($\beta = 0.23$, $p < 0.001$; $f^2 = 0.08$). Perceived quality also had a statistically significant relationship with continuance intention ($\beta = 0.09$, $p = 0.004$), although its incremental practical contribution was marginal ($f^2 = 0.02$). The model explained 56% of the variance in continuance intention and showed predictive relevance ($Q^2 = 0.38$). The main empirical contribution lies in identifying a differentiated hierarchy among the predictors: students' overall satisfaction has substantially greater practical relevance than perceived usefulness and the focused perceived-quality attributes measured in the study. The findings provide context-bounded implications for private accredited business schools seeking to strengthen students' post-use evaluations of virtual learning.

KEYWORDS
business schools, Colombia, continuance intention, perceived quality, perceived usefulness, post-adoption, student satisfaction, virtual classes

1 Introduction

Higher education institutions are experiencing important changes in student enrollment patterns, learning preferences, and the use of digital technologies. In Colombia, these changes are particularly relevant for business-related programs, which have traditionally represented one of the largest fields of higher education enrollment (MEN-SNIES, 2024). At the same time, virtual education has grown substantially, especially after the COVID-19 pandemic, making it necessary to understand which factors influence students' intention to continue using virtual classes. Continuance intention is a relevant construct for explaining whether users are willing to keep using a system after an initial experience with it (Bhattacherjee, 2001). In this study, continuance intention is examined in the context of virtual classes because the expansion of online education raises not only questions of access, but also questions about whether students perceive this modality as satisfactory, useful, and of sufficient quality to continue using it.

1.1 Business schools and virtual education in Latin America

Business schools in Latin America have historically contributed to the professionalization of management education and to the development of managerial capabilities in the region (Alvarado et al., 2018). In recent years, one of the most relevant transformations affecting these institutions has been the expansion of online learning as a delivery modality in higher education. The COVID-19 pandemic accelerated the adoption of virtual education across the region, transforming online classes from an emergency response into a more stable component of academic provision. However, this transition has been uneven because students' experiences with online learning depend on access to technology, institutional support, pedagogical adaptation, and engagement conditions (Salas-Pilco et al., 2022). Recent regional evidence also indicates that digital transformation in higher education requires institutions to move beyond emergency remote teaching toward more structured digital learning strategies, especially in relation to infrastructure, pedagogical capacity, and quality assurance (UNESCO IESALC, 2024). Therefore, business schools require empirical evidence on the factors associated with students' intention to continue using virtual classes, particularly satisfaction, perceived usefulness, and perceived quality.

1.2 Enrollment patterns in Colombian business education and virtual learning

Colombia provides a relevant setting for this study because business-related programs continue to represent one of the largest areas of higher education enrollment in the country. Official data show that enrollment in economy, administration, accounting, and related fields increased from 602,662 students in 2012 to a peak of 801,289 students in 2017. After that year, enrollment declined to 794,990 in 2018, 764,889 in 2019, and 750,676 in 2020. Although a partial recovery was observed in 2021, with 768,369 students, enrollment fell again to 726,844 students in 2022 and to 656,438 students in 2023. In 2024, enrollment in this field increased to 709,859 students, but it remained below both the 2017 peak and the 2022 level. This trajectory shows that business-related programs remain highly relevant in Colombian higher education, while also evidencing a decline after the 2017 peak and only a partial recovery in 2024 (MEN-SNIES, 2024).

At the same time, Colombian higher education has experienced a significant change in enrollment by delivery modality. Face-to-face enrollment reached 1,994,043 students in 2017 and then followed a downward trend, decreasing to 1,823,558 students in 2022, 1,775,957 students in 2023, and 1,773,335 students in 2024. In contrast, virtual education expanded substantially during the same period, increasing from 16,046 students in 2012 to 446,063 students in 2022, 518,068 students in 2023, and 582,721 students in 2024. This means that virtual enrollment increased by 136,658 students between 2022 and 2024, confirming the continuation of online learning growth after the pandemic period.

These enrollment patterns justify the focus of the present study. The decline observed in business-related enrollment after 2017 and the simultaneous expansion of virtual education suggest that institutions should not only examine access to online education, but also the factors associated with students' willingness to continue using virtual classes. In this sense, satisfaction, perceived usefulness, and perceived quality are relevant constructs for understanding whether virtual learning is perceived as a viable academic modality by students enrolled in accredited private business schools.

Table 1 integrates official enrollment data by field of study and delivery modality in Colombian higher education between 2012 and 2024. The table focuses on the field of economy, administration, accounting, and related fields because it corresponds directly to the empirical context of this study: business-related higher education. It also includes face-to-face and virtual enrollment in order to present the comparison between offline and online education requested by the reviewer.

The expansion of virtual education may also be linked to practical advantages for both institutions and students. Compared with face-to-face education, online learning may reduce dependence on physical classroom space, while increasing the relevance of digital infrastructure, platform performance, instructional design, and academic support. From the student perspective, virtual education can offer geographical flexibility, reduced commuting time, greater control over learning pace, and better work-study balance. These contextual factors are not directly tested in the present empirical model, but they help justify why students' continuance intention toward virtual classes should be examined in Colombian business education (Forero-Henao et al., 2024).

1.3 Purpose and structure of the study

The present study focuses on students' perceptions of virtual learning in accredited private business schools in Bogotá, Colombia. Specifically, it examines whether satisfaction,

TABLE 1 Enrollment trends in Colombian higher education, business-related fields, and delivery modality, 2012–2024.

Year	Total higher education enrollment	Economy, administration, accounting and related fields	Face-to-face enrollment	Virtual enrollment
2012	1,929,586	602,662	1,652,726	16,046
2013	2,092,891	668,635	1,793,906	26,852
2014	2,220,652	721,100	1,896,653	51,010
2015	2,293,550	745,067	1,960,949	63,569
2016	2,394,434	781,102	1,989,216	126,423
2017	2,446,314	801,289	1,994,043	169,231
2018	2,440,367	794,990	1,970,681	200,170
2019	2,396,250	764,889	1,934,202	221,625
2020	2,355,603	750,676	1,879,985	251,383
2021	2,448,271	768,369	1,836,550	375,086
2022	2,466,228	726,844	1,823,558	446,063
2023	2,475,833	656,438	1,775,957	518,068
2024	2,553,560	709,859	1,773,335	582,721

The business-related field corresponds to "Economy, administration, accounting and related fields." Face-to-face and virtual enrollment correspond to delivery methodology. Consolidated official data for 2025 and 2026 were not available in the official sources consulted at the time of revision; therefore, unsupported estimations were not included.
Source: Authors' own compilation based on MEN-SNIES official enrollment statistics.

perceived usefulness, and perceived quality are associated with students' continuance intention to use virtual classes. This focus is relevant because the expansion of online education in Colombian higher education requires not only analyzing enrollment growth, but also understanding whether students are willing to continue using virtual classes after having experienced this modality.

Accordingly, the study addresses the following research question: How are student satisfaction, perceived usefulness, and perceived quality of virtual learning associated with students' continuance intention to use online classes in accredited private business schools in Bogotá, Colombia?

The theoretical logic of the present study is primarily post-adoption rather than initial technology acceptance. Continuance intention concerns students' willingness to keep using virtual classes after having experienced them, whereas the original Technology Acceptance Model was primarily developed to explain technology acceptance and behavioral intention. Accordingly, the study draws on the Expectation-Confirmation Model to frame satisfaction and perceived usefulness as post-use evaluations associated with continuance intention, while retaining the Technology Acceptance Model as a complementary foundation for the specific role of perceived usefulness (Bhattacherjee, 2001; Davis, 1989).

The study does not test the complete Expectation-Confirmation Model because confirmation of expectations was not measured. It also does not test the complete Technology Acceptance Model because perceived ease of use was not included in the available instrument. Therefore, the empirical model should be understood as a focused post-adoption model informed by continuance and technology-acceptance literature, rather than as a complete application or theoretical extension of either framework. Satisfaction and perceived quality are not proposed as substitutes for perceived ease of use.

The contribution of the study is not based exclusively on examining a previously underrepresented national context. Its main empirical contribution lies in comparing the relative explanatory importance of three conceptually different post-use evaluations. The findings distinguish the dominant role of satisfaction from the smaller contribution of perceived usefulness and the marginal direct contribution of perceived quality. This differentiated pattern provides a more precise basis for interpreting and prioritizing the antecedents of continuance intention than an assessment based solely on the statistical significance of the three relationships. The Colombian setting remains relevant because it provides evidence from a specific urban, private, and accredited segment of higher education, but the study does not claim that contextual novelty alone constitutes a theoretical contribution.

The empirical scope of the study is limited to students enrolled in accredited private business schools in Bogotá, Colombia. Therefore, the findings should be interpreted as context-specific evidence rather than as generalizable conclusions for all Colombian or Latin American business schools. The study also does not compare students from virtual, hybrid, and face-to-face modalities; consequently, its findings refer only to the continuance intention of students who participated in the online survey.

The study is structured as follows. After this introduction, the literature review presents the four key constructs examined in the study: student satisfaction, perceived usefulness, perceived quality, and continuance intention to use virtual classes. The following section describes the methodology, including the sample, measurement scales, and PLS-SEM analytical procedure. The results section reports the measurement model and structural model findings. Finally, the discussion and conclusion present the main empirical implications, limitations, and future research directions directly derived from the constructs analyzed in the empirical model.

2 Literature review

2.1 Satisfaction in virtual classes

Student satisfaction with their academic program and institution is a key short-term attitudinal outcome shaped by the overall educational experience. High levels of satisfaction contribute directly to student retention and to the attraction of new applicants (Athiyaman, 1997; Elliott, 2002).

Within virtual learning environments, student satisfaction is influenced by multiple factors, including content quality, teaching methodology, technical preparedness, and pedagogical design. With regard to teaching methodology, satisfaction in virtual classes depends not only on the quality of course content but, even more importantly, on the instructional approach employed by professors. Effective instruction is characterized by dynamism, enthusiasm, and careful organization, all of which facilitate continuous interaction and student engagement. Prior research shows that student satisfaction is strongly shaped by how a professor delivers the course (Marsh and Roche, 1997). This effect becomes even more critical in virtual settings, where students tend to prefer synchronous sessions that foster active participation over fully asynchronous formats (Bangert, 2006; Gray and DiLoreto, 2016).

Synchronous interactions through online platforms have been shown to significantly enhance overall course satisfaction. Students perceive real-time interactions as more effective in enriching the educational experience than purely asynchronous methods, emphasizing that instructor guidance and opportunities for active participation are fundamental (Cao et al., 2009). During the COVID-19 pandemic, students from more than 90 countries reported that synchronous sessions, particularly those incorporating active learning strategies, substantially increased their motivation, enjoyment, and overall satisfaction. These strategies also helped reduce feelings of isolation by fostering a more social and participatory environment that enriched the learning experience (Nguyen et al., 2021).

Student satisfaction in virtual learning also depends on the technical preparedness of both instructors and students. A study conducted in India found that technical readiness, self-efficacy, and student autonomy combined with instructors' digital competence and course structure directly influenced student engagement and satisfaction in synchronous online classes during the pandemic (Maini et al., 2021). Similarly, research in Canada showed that the level of instructor participation and the quality of their interventions were key determinants of students' behavioral, emotional, and intellectual engagement in synchronous online environments (Shi et al., 2010).

Another critical determinant of student satisfaction is the implementation of student-centered pedagogical design. Evidence from a virtual physical education course in Malaysia showed that a participation-based approach yielded satisfaction rates exceeding 95% in dimensions such as clarity of objectives, course organization, and workload management. These findings underscore that engagement extending beyond the virtual classroom plays a vital role in promoting deep and lasting learning (Eswaramoorthi et al., 2022).

Studies conducted prior to the COVID-19 pandemic, such as Kenney and Khanfar (2009), demonstrate that students who perceive virtual classes as high quality are more likely to continue with this learning modality. These results are consistent with the principles of experiential learning and highlight the importance of affective and interactive dimensions in management education. In online learning environments, student satisfaction emerges as a critical factor for business programs seeking to implement high-impact educational practices and foster deeper student engagement (Arbaugh, 2010; Kolb, 2014). This is particularly evident in private universities and business schools, where students show a clear willingness to invest in online education.

In the specific context of virtual classes, previous studies have shown that satisfaction is strongly associated with students' willingness to continue using online learning environments. For example, Machuca et al. (2021) found that satisfaction, together with perceived usefulness, enjoyment, and trust, influenced engineering students' continuance intention toward virtual classes in Peruvian private universities. Similarly, Cheng (2020) showed that satisfaction played a mediating role between course quality factors and continuance intention in cloud-based e-learning systems.

Based on these insights, the following hypothesis is proposed:

Hypothesis 1 (H1) : Satisfaction in virtual classes is positively associated with students' continuance intention to use virtual classes.

2.2 Perceived usefulness in virtual classes

Perceived usefulness refers to an individual's subjective assessment of the extent to which a specific information system or technology enhances efficiency and productivity by simplifying tasks (Davis, 1989). According to Luo (2023) and Garcia-Buitrago et al. (2024), perceived usefulness reflects the degree to which technology reduces effort, increases speed, and improves comfort when performing specific activities. In educational settings, technology can facilitate learning by streamlining academic processes and making them more efficient (Bolodeoku et al., 2022).

In e-learning, perceived usefulness is a critical determinant of both the acceptance and the success of virtual learning environments (Alsabawy et al., 2016). Van Raaij and Schepers (2008) found that perceived usefulness had a direct effect on the actual use of virtual platforms among MBA students in China. They also showed that perceived ease of use influenced system use indirectly through perceived usefulness, suggesting that the more useful a technology is perceived to be, the more likely students are to adopt and use it frequently. Similarly, a study involving more than 270 university students revealed that perceived usefulness, together with social influence and self-efficacy, was among the most significant factors shaping students' intention to use e-learning platforms. In the same vein, research conducted in Ecuadorian universities indicated that perceived usefulness not only directly affected the intention to

use e-learning platforms but was also influenced by perceived enjoyment and social influence. These findings underscore the importance of considering both technical and motivational aspects when designing and implementing effective e-learning systems (Ramírez Anormaliza et al., 2016), and they reinforce the relevance of the Technology Acceptance Model (TAM) for explaining students' behavior toward emerging educational technologies (Kurdi et al., 2020).

From a complementary perspective, evidence from Slovenia shows that higher education students perceived e-learning courses as more useful when instructors demonstrated high levels of engagement, course design was well structured, and teaching performance was positively evaluated. These results highlight the importance of the human component beyond the technological infrastructure itself in shaping students' perceptions of the usefulness of virtual learning systems (Keržič et al., 2019).

Moreover, prior research has shown that ease of use is a key driver of technology adoption in education (Garcia-Buitrago et al., 2024). In the e-learning context, Luo (2023), and Price-Howard and Lewis (2023) emphasize that intuitive interfaces and user-friendly platforms facilitate the seamless adoption of digital tools, thereby enhancing student engagement and learning efficiency.

Although perceived ease of use is a central construct in the original TAM (Davis, 1989), it was not included in the present empirical model because the available survey instrument focused on students' functional and experiential evaluations of virtual classes rather than on platform usability. This omission is acknowledged as a limitation of the study and is not presented as a theoretical replacement of perceived ease of use.

Perceived usefulness has also been associated with continuance intention in Latin American virtual education contexts. Rosales (2022) for instance, reported that students' intention to continue online learning was influenced by their perception that virtual education helped them achieve academic goals more efficiently.

In line with this literature and with the measurement items used in this study, perceived usefulness in virtual classes is defined as students' perception that virtual learning platforms improve their academic performance, facilitate faster access to academic information, improve the effectiveness of information search, facilitate access to course materials and academic resources, and increase academic productivity. On this basis, the following hypothesis is proposed:

Hypothesis 2 (H2) : Perceived usefulness in virtual classes is positively associated with students' continuance intention to use virtual classes.

2.3 Perceived quality in virtual classes

Quality in virtual education is a multidimensional concept that may include academic, technical, informational, service, pedagogical, and interactional dimensions. Sultan and Wong (2019) conceptualize academic quality as students' evaluation of the academic, administrative, and service dimensions of an institution. Similarly, Peltier et al. (2007) identify several relevant dimensions in online education, including student interaction, student–teacher interaction, instructor engagement, course content, and course organization. Research on fully online programs has also emphasized instructor–student interaction, peer interaction, instructional strategies, content design, user interface, and social presence as relevant components of the online learning experience (Templeton et al., 2015). In addition, Sharif Nia et al. (2023) found that content quality and online interaction are important antecedents of student engagement, satisfaction, and academic effectiveness.

However, the present study does not empirically measure the entire multidimensional domain of virtual educational quality. The available scale, adapted from Udo et al. (2011), focuses primarily on students' perceptions of whether the platform and learning resources are up to date, whether the platform works properly, whether instructions are clear, and whether the overall quality of the education received through virtual classes is perceived positively.

This operationalization is therefore narrower than the broad conceptualizations of virtual-learning quality described in previous research. Information-systems literature distinguishes system quality, information quality, and service quality as related but conceptually separate dimensions (DeLone and McLean, 2003). Accordingly, the perceived-quality construct examined in the present study captures a focused combination of platform functionality, resource updating, instructional clarity, and an overall perceived-quality evaluation. It does not directly measure instructor engagement, peer interaction, feedback quality, social presence, pedagogical strategies, or learning outcomes.

Previous research has shown that different quality-related dimensions may be associated with satisfaction and continued use of e-learning systems. System quality, information quality, course quality, content quality, and service quality have been identified as relevant factors in students' evaluations and continuance decisions (Al-Maroof et al., 2021; Cheng, 2020; Lin, 2011; Lin et al., 2011; Roca et al., 2006; Udo et al., 2011). Nevertheless, because these studies operationalize quality through different dimensions, the findings of the present study must be interpreted according to the specific indicators included in its measurement instrument.

Based on this focused operational definition, the following hypothesis is proposed:

Hypothesis 3 (H3) : Perceived quality in virtual classes is positively associated with students' continuance intention to use virtual classes.

2.4 Continuance intention to use virtual classes

Continuance intention refers to users' willingness to keep using a system after an initial experience with it. In information systems research, this construct is commonly examined from a post-adoption perspective, which differs from initial acceptance

because it focuses on users' decision to continue using a technology after they have already interacted with it. Bhattacherjee's expectation-confirmation model explains continuance intention as a post-use judgment shaped by users' previous experience, satisfaction, and perceived usefulness of the system (Bhattacherjee, 2001).

Therefore, continuance intention is especially relevant in contexts where the issue is not only whether a technology is adopted for the first time, but whether users are willing to keep using it over time.

In virtual education, continuance intention captures students' stated willingness to continue using online classes, virtual learning platforms, or digital learning environments as part of their academic experience. This distinction is important because emergency or mandatory use of online education, such as during the COVID-19 pandemic, does not necessarily imply long-term acceptance or voluntary continuation. Students may attend virtual classes because institutional conditions require them to do so, but their intention to continue depends on how they evaluate the experience after use. Prior research on e-learning continuance has shown that students' continued use of online learning systems is influenced by post-use evaluations such as satisfaction, confirmation of expectations, perceived usefulness, quality of the system, and perceived learning value (Cheng, 2020; Rajeh et al., 2021; Roca et al., 2006).

Continuance intention also differs from actual retention or persistence. While retention refers to students' real continuation in a program or institution, continuance intention measures a behavioral intention: the student's expressed willingness to use virtual classes again in the future. This distinction is important for the present study because the empirical model does not measure actual dropout, academic persistence, graduation, or institutional retention. Instead, it measures students' intention to continue using virtual classes based on their perceptions of the online learning experience.

From the perspective of technology acceptance, perceived usefulness remains a central antecedent of behavioral intention because users are more likely to continue using a system when they believe it helps them perform relevant tasks more effectively (Davis, 1989). In e-learning contexts, this means that students may be more willing to continue using virtual classes when they perceive that online learning supports their academic performance, improves access to information, facilitates learning activities, or increases academic productivity. Previous studies on e-learning continuance have similarly found that perceived usefulness is associated with learners' intention to keep using online learning technologies (Rajeh et al., 2021; Roca et al., 2006; Sørebø et al., 2009).

Satisfaction is another central component of continuance intention because it reflects students' affective and evaluative response to their prior experience with virtual learning. When students perceive that online classes meet or exceed their expectations, they are more likely to report satisfaction and, consequently, a stronger intention to continue using the modality. In this sense, satisfaction functions as a post-use evaluation that links previous experience with future behavioral intention (Bhattacherjee, 2001; Cheng, 2020). This is particularly relevant in virtual education because students' perceptions may be shaped not only by the platform itself, but also by instructor interaction, course organization, feedback, content quality, and the overall learning experience.

Perceived quality is also relevant for understanding continuance intention in virtual classes. In the present study, however, this construct has a focused operational scope. It primarily captures students' evaluations of platform functionality, updated learning resources, clarity of instructions, and overall perceived quality. Therefore, the observed relationship between perceived quality and continuance intention should not be generalized to pedagogical, interactional, or service-quality dimensions that were not directly measured.

Based on this literature, the present study conceptualizes continuance intention as the endogenous construct explained by satisfaction, perceived usefulness, and perceived quality. This means that the study examines whether students who evaluate virtual classes more positively are also more willing to continue using them. However, the construct should be interpreted carefully. Continuance intention in this study refers to students' stated willingness to keep using virtual classes; it should not be interpreted as direct evidence of actual retention, dropout reduction, curriculum redesign, pedagogical innovation, or institutional transformation.

2.5 Post-adoption framework: expectation-confirmation logic and TAM-informed perceived usefulness

The present study examines continuance intention as a post-adoption outcome. This distinction is theoretically important because initial technology acceptance and continued use represent related but different stages of user behavior. The Technology Acceptance Model explains behavioral intention primarily through perceived usefulness and perceived ease of use (Davis, 1989). By contrast, the Expectation-Confirmation Model was developed to explain users' intention to continue using an information system after an initial period of experience, emphasizing satisfaction, perceived usefulness, and confirmation of previous expectations (Bhattacherjee, 2001).

The Expectation-Confirmation Model therefore provides the principal post-adoption logic for the relationship between satisfaction and continuance intention examined in this study. Satisfaction represents students' affective and evaluative response to their previous experience with virtual classes, while continuance intention reflects their stated willingness to keep using this modality. Perceived usefulness also remains relevant during the post-adoption stage because users may continue using a system when they believe that it improves the performance of activities that are important to them. Previous e-learning research has similarly associated satisfaction and perceived usefulness with continued use of online learning systems (Cheng, 2020; Roca et al., 2006; Sørebø et al., 2009).

TAM is retained as a complementary theoretical reference for the relationship between perceived usefulness and behavioral intention. The study does not apply the complete original TAM because perceived ease of use was not included in the available questionnaire. Perceived ease of use is not treated as irrelevant, nor are satisfaction and perceived quality proposed as



FIGURE 1
Empirical model and hypotheses.

substitutes for it. Its absence represents a limitation of the empirical instrument.

Perceived quality is included as an additional post-use evaluation of the virtual learning environment. It is not presented as an original TAM construct or as a core component of the Expectation-Confirmation Model. Instead, it represents a context-specific antecedent whose direct relationship with continuance intention is assessed alongside satisfaction and perceived usefulness. Consequently, the proposed model should be interpreted as a focused post-adoption model informed by the Expectation-Confirmation Model and the perceived-usefulness mechanism of TAM, rather than as a complete test or extension of either theory. The proposed empirical model and hypotheses are presented in Figure 1.

3 Materials and methods

3.1 Data

The final analytical sample consisted of 807 valid questionnaires completed by students enrolled in business-related programs at 12 private universities with High-Quality Accreditation in Bogotá, Colombia. Data were collected through an online questionnaire between July 2024 and September 2025. All participants were over 18 years of age. To be eligible, respondents had to be actively enrolled in a Business Administration or related business program at a private institution holding High-Quality Accreditation granted by the Colombian Ministry of Education.

A non-probability sampling design combining convenience and snowball procedures was used. The online questionnaire was initially shared with professors and students associated with business-related programs at the participating institutions. Professors supported the dissemination of the questionnaire among potentially eligible students, while students could also share the survey link with peers who met the same inclusion criteria. This chain-referral procedure facilitated access to the target population, although it did not provide every eligible student with a known and equal probability of selection (Goodman, 1961).

Professors participated only in the dissemination of the survey invitation and were not included as respondents in the study. All 807 valid questionnaires included in the analytical sample were completed by eligible university students. The use of convenience and snowball sampling may have introduced self-selection and network-related bias because students who were more accessible, more connected to professors or participating peers, or more willing to complete an online survey may have been more likely to participate. Consequently, the sample should not be interpreted as statistically representative of all students enrolled in Colombian business schools.

Because the questionnaire was disseminated through professors and subsequently circulated among students through a chain-referral procedure, the total number of eligible students who ultimately received the survey invitation was not recorded. Consequently, a conventional response rate could not be calculated. The final analytical database contained 807 valid questionnaires. The absence of a response-rate denominator limits the assessment of potential nonresponse bias.

The study was geographically restricted to Bogotá because the city concentrates a substantial proportion of Colombia's higher education enrollment and hosts several private accredited universities offering business-related programs. Therefore, Bogotá provides a relevant context for examining virtual business education, although this geographic concentration limits the generalizability of the findings to other Colombian regions (MEN-SNIES, 2024).

Private accredited universities were selected because the study focuses on institutions operating in a tuition-based and quality-assured segment of Colombian higher education, where students' satisfaction, perceived usefulness, and perceived quality are particularly relevant for understanding continuance intention toward virtual classes. However, this selection criterion limits the applicability of the findings to public institutions, non-accredited institutions, and institutions located outside Bogotá.

Because the questionnaire was administered online, the sample may overrepresent students with regular access to digital technologies and prior familiarity with virtual learning environments. This potential mode-of-administration bias, together with the self-selection and network-related limitations of the sampling procedure, should be considered when interpreting the results. At the same time, online administration is consistent with the empirical focus of the study, since the research examines students' continuance intention toward virtual classes.

Table 2 presents the demographic profile of the respondents according to the variables available in the dataset: gender and age range. The sample included 335 men and 472 women. Regarding age, 479 participants were between 18 and 25 years old, 217 were between 26 and 35 years old, and 111 were between 36 and 45 years old.

3.2 Measurement

Table 3 presents the measurement sources, number of items, and response scale used for the four constructs examined in this study. These instruments were previously validated in the literature, translated into Spanish, and adapted to align with the research objectives while preserving the original semantic integrity of each item. The adaptation process focused on preserving the meaning of the original items while adjusting their wording to the context of virtual classes. Since the available survey instrument was designed to evaluate students' satisfaction, perceived usefulness, perceived quality, and continuance intention, perceived ease of use and extrinsic motivations were not available as independent constructs. Responses were recorded on a 7-point Likert scale, where 1 indicated "totally disagree" and 7 indicated "totally agree". Continuance intention to use virtual classes was measured using adapted items from previous e-learning and service quality studies. The construct captures students' post-use orientation toward continuing, recommending, and extending their use of virtual learning. Although one item refers to perceived value for the fee paid, it was retained because it reflects students' evaluative judgment after experiencing online distance learning. Therefore, the construct should be interpreted as a broad post-use continuance orientation toward virtual classes rather than as actual institutional retention.

TABLE 2 Demographic profile of respondents.

Variable	Category	*n*	%
Gender	Men	335	41.5
Gender	Women	472	58.5
Age	18–25	479	59.4
Age	26–35	217	26.9
Age	36–45	111	13.8

Source: Authors' own compilation.

3.3 Common method bias assessment

Because satisfaction, perceived usefulness, perceived quality, and continuance intention were measured from the same respondents through a single self-report questionnaire administered during one data-collection period, the design may be susceptible to common method bias (Podsakoff et al., 2003). To assess this potential threat, the full collinearity VIF approach proposed by Kock (2015) was selected. Under this procedure, each latent construct is treated as an endogenous variable and regressed on all the other constructs. The resulting full collinearity VIF values are evaluated against the conservative threshold of 3.3. These values are conceptually and computationally different from the inner VIF values used to evaluate predictor collinearity in the hypothesized structural model.

4 Results

The data from this quantitative study were initially processed using SPSS and subsequently analyzed with SmartPLS, given the predictive orientation of the research and the widespread use of PLS in social science studies (Barroso et al., 2009). The validation procedure first examined the reliability and validity of the measurement instrument and then estimated the structural model to assess both the significance and strength of the relationships among the proposed variables.

4.1 Preliminary assessment of the data and PLS-SEM suitability

Before estimating the measurement and structural models, the suitability of the data for PLS-SEM was assessed. The final sample of 807 respondents exceeds the minimum requirements for a model with three predictors pointing to one endogenous construct. PLS-SEM was considered appropriate because the study has a predictive orientation and seeks to explain variance in continuance intention rather than to test a covariance-based theoretical model. In addition, collinearity diagnostics, reliability indicators, convergent validity, discriminant validity, and predictive relevance were examined following established reporting recommendations for PLS-SEM (Hair et al., 2019).

4.2 Common method bias diagnostic

Because satisfaction, perceived usefulness, perceived quality, and continuance intention were measured from the same respondents through a single cross-sectional self-report

TABLE 3 Sources of measured items.

Study variable	Author(s)	Number of items	Items	Response scale
Satisfaction in virtual classes	Udo et al. (2011)	4	1. I am satisfied with my decision to enroll in the online classes 2. My choice to enroll in online classes was a wise one 3. I think I did the right thing when I paid for online learning service 4. I feel that my experience with online learning has been enjoyable	7-point Likert scale: 1 = totally disagree; 7 = totally agree
Perceived usefulness in virtual classes	Gefen and Straub (2000)	5	1. Virtual learning platforms improve my academic performance. 2. Virtual learning platforms allow me to get academic information faster 3. Virtual learning platforms improve my effectiveness in searching for academic information 4. Virtual learning platforms make it easier to access course materials and academic resources 5. Virtual learning platforms increase my academic productivity	7-point Likert scale: 1 = totally disagree; 7 = totally agree
Perceived quality in virtual classes	Udo et al. (2011)	4	1. Platform and learning resources seem to be up to date 2. The virtual class platform works well 3. The virtual class platform for virtual classes has clear instructions 4. The perception of the overall quality of the education you get through virtual classes is excellent	7-point Likert scale: 1 = totally disagree; 7 = totally agree
Continuance intention to use virtual classes	Chang et al. (2020); Udo et al. (2011)	5	1. If there is a need to learn in the future. I will use virtual classes to learn. 2. Besides using the university website to learn. I will also use other virtual classes tools more frequently and actively. 3. I will suggest others to use virtual classes to learn. 4. I know I get a good service for the fee I paid for online distance learning 5. I would likely do another degree program online	7-point Likert scale: 1 = totally disagree; 7 = totally agree

Source: Authors' own compilation.

questionnaire, the study may be susceptible to common method bias. Therefore, common method bias was assessed using the full collinearity VIF procedure proposed by Kock (2015). Under this approach, each latent construct was treated as an endogenous variable and regressed on all the other constructs included in the model.

The resulting full collinearity VIF values were 2.33 for satisfaction, 1.82 for perceived usefulness, 1.58 for perceived quality, and 2.18 for continuance intention. All values were below the conservative threshold of 3.3, suggesting that common method bias was unlikely to constitute a major threat to the estimated relationships. These full collinearity VIF values should not be confused with the inner VIF values reported in the structural model, which were used to assess collinearity among the predictors of continuance intention. Nevertheless, this diagnostic does not completely eliminate the limitations associated with collecting all constructs from the same respondents through a cross-sectional self-report questionnaire.

4.3 Supplementary checks by gender and age

To address potential demographic variation in the sample, supplementary analyses were conducted by gender and age group. Since the constructs were measured using 7-point Likert-type scales, Mann–Whitney *U*-tests were used to compare gender groups, and Kruskal–Wallis tests were used to compare age groups. Gender was compared between men ($n = 335$) and women ($n = 472$), while age was compared across three groups: 18–25 years ($n = 479$), 26–35 years ($n = 217$), and 36–45 years ($n = 111$). These analyses were conducted as supplementary robustness checks and were not part of the hypothesized structural model.

The supplementary analyses showed no statistically significant gender or age-group differences in satisfaction, perceived usefulness, perceived quality, or continuance intention at the 0.05 level (see Table 4). These tests should not be interpreted as

TABLE 4 Supplementary group comparison tests by gender and age.

Construct	Gender comparison	Mann–Whitney *U*	*p*-value, two-tailed	Age-group comparison	Kruskal–Wallis H	*p*-value
Satisfaction	Men ($n = 335$) vs. Women ($n = 472$)	76,245.00	0.388	18–25, 26–35, 36–45	3.214	0.201
Perceived usefulness	Men ($n = 335$) vs. Women ($n = 472$)	77,104.50	0.549	18–25, 26–35, 36–45	4.012	0.135
Perceived quality	Men ($n = 335$) vs. Women ($n = 472$)	75,882.00	0.33	18–25, 26–35, 36–45	2.756	0.252
Continuance intention to use virtual classes	Men ($n = 335$) vs. Women ($n = 472$)	74,930.50	0.206	18–25, 26–35, 36–45	5.108	0.078

Mann–Whitney *U*-tests were reported using two-tailed *p*-values because no directional hypothesis was proposed for gender differences. Kruskal–Wallis tests were used to compare the three age groups. These tests were conducted as supplementary robustness checks and were not part of the hypothesized structural model.
Source: Authors' own compilation.

a formal analysis of moderation in the structural relationships. However, because no theory-driven hypotheses of demographic moderation had been formulated and the supplementary comparisons did not identify statistically significant distributional differences, gender and age were not introduced *post hoc* as control variables or moderators in the hypothesized PLS-SEM model. They were retained as descriptive and supplementary variables, and the structural model was estimated using the complete sample of 807 respondents. Future research may test demographic moderation directly when supported by explicit theoretical hypotheses and appropriate measurement-invariance procedures.

4.4 Measurement model assessment

To validate the reflective measurement model, an assessment of indicator reliability, internal consistency, convergent validity, and discriminant validity was conducted. This process involved evaluating individual item reliability and internal consistency using Cronbach's α and Composite Reliability (CR). In line with Hair et al. (2019), values above 0.70 were obtained, confirming the internal consistency of the instrument. Convergent validity was assessed through the Average Variance Extracted (AVE), and, following the criteria established by Fornell and Larcker (1981), all AVE values exceeded the recommended threshold of 0.50, thereby supporting the adequacy of the measurement model.

The measurement model assessment (Table 5) demonstrated robust reliability and convergent validity. All constructs exhibited Cronbach's alpha and composite reliability (CR) values well above the 0.70 threshold (Hair et al., 2019), with continuance intention to use virtual classes showing particularly high internal consistency ($\alpha = 0.91$; CR = 0.925). Furthermore, the average variance extracted (AVE) for all constructs exceeded the 0.50 criterion, confirming adequate convergent validity.

For discriminant validity, we first confirmed that the square root of the AVE for each construct was greater than its correlations with the other constructs in the model, in accordance with Fornell and Larcker's (1981) recommendations. In addition, we assessed discriminant validity using the heterotrait–monotrait ratio of correlations (HTMT). HTMT was used to assess discriminant validity, as recommended in variance-based SEM. Values below conservative thresholds are commonly interpreted as evidence of discriminant validity (Henseler et al., 2015).

The standardized root mean square residual was inspected solely as a complementary diagnostic of possible model misspecification. The SRMR value was 0.061, below the commonly referenced value of 0.08, suggesting no major discrepancy between the observed and model-implied correlations. However, SRMR was not treated as evidence of overall model fit. Consistent with the predictive and explanatory orientation of PLS-SEM, evaluation of the structural model relied primarily on R^2, Q^2, path-coefficient significance, f^2 effect sizes, and collinearity diagnostics.

All constructs exhibit adequate reliability, with Cronbach's alpha values ranging from 0.84 to 0.91, composite reliability coefficients between 0.86 and 0.93, and AVE values between 0.61 and 0.71, all above the 0.50 threshold suggested by Fornell and Larcker (1981). Overall, students report moderately high levels of satisfaction, perceive virtual classes as useful and of good quality, and express strong intentions to continue using this learning modality. Nonetheless, specific areas such as academic productivity, clarity of instructions, access to course materials and academic resources, and platform performance still require improvement. These descriptive and measurement-model results indicate that students report moderately favorable evaluations of virtual classes in terms of satisfaction, perceived usefulness, perceived quality, and continuance intention. The predictive relationships among these constructs are examined in the structural model presented below.

Although the constructs showed adequate reliability and convergent validity, several items presented relatively high standard deviations (see Table 5). This suggests heterogeneity in students' perceptions of virtual classes rather than a lack of measurement reliability. In practical terms, students did not evaluate virtual learning uniformly: some reported favorable experiences, while others expressed more moderate or critical evaluations. This dispersion is consistent with the post-pandemic context, in which students' experiences with online learning may differ according to access to technology, course design, instructor interaction, and prior experience with virtual education.

TABLE 5 Measurement model evaluation results.

Variables/Items	Mean	St. Dev	Loadings factor
F1. Satisfaction in virtual classes (α = 0.840; CR = 0.861; AVE = 0.609)			
I am satisfied with my decision to enroll in the online classes	5.18	1.89	0.718*
My choice to enroll in online classes was a wise one	4.88	1.47	0.790*
I think I did the right thing when I paid for online learning service	4.12	1.72	0.837*
I feel that my experience with online learning has been enjoyable	5.22	1.79	0.771*
F2. Perceived usefulness in virtual classes (α = 0.890; CR = 0.915; AVE = 0.682)			
Virtual learning platforms improve my academic performance.	4.78	1.90	0.870*
Virtual learning platforms allow me to get academic information faster	4.82	1.74	0.786*
Virtual learning platforms improve my effectiveness in searching for academic information	4.70	1.73	0.869*
Virtual learning platforms make it easier to access course materials and academic resources	4.35	1.95	0.807*
Virtual learning platforms increase my academic productivity	4.27	1.78	0.794*
F3. Perceived quality in virtual classes(α = 0.870; CR = 0.871; AVE = 0.628)			
Platform and learning resources seem to be up to date	4.34	1.80	0.837*
The virtual class platform works well	4.29	1.78	0.787*
The virtual class platform for virtual classes has clear instructions	4.19	1.67	0.764*
The perception of the overall quality of the education you get through virtual classes is excellent	4.27	1.64	0.781*
F4. Continuance intention to use virtual classes (α = 0.910; CR = 0.925; AVE = 0.714)			
If there is a need to learn in the future. I will use virtual classes to learn.	4.50	1.77	0.810*
Besides using the university website to learn. I will also use other virtual classes tools more frequently and actively.	4.90	1.89	0.962*
I will suggest others to use virtual classes to learn.	5.47	1.91	0.773*
I know I get a good service for the fee I paid for online distance learning	5.06	1.64	0.710*
I would likely do another degree program online	5.89	1.84	0.943*

α = Cronbach's alpha; CR = composite reliability; AVE, average variance extracted. Factor loadings marked with * were statistically significant at $p < 0.001$ based on bootstrapping. Source: Authors' own compilation.

Discriminant validity was assessed using both the Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT). As shown in Table 6, the square root of the AVE for each construct, reported on the diagonal, exceeds the corresponding inter-construct correlations, thereby satisfying the Fornell–Larcker criterion. This indicates that each construct shares more variance with its own indicators than with the other constructs in the model.

In addition, Table 7 reports the HTMT ratios. All values are below the conservative threshold of 0.85, providing further evidence of discriminant validity among the constructs. These results confirm that satisfaction, perceived usefulness, perceived quality, and continuance intention represent empirically distinct dimensions within the proposed model.

Overall, the measurement model demonstrates satisfactory discriminant validity, supporting the adequacy of the subsequent structural model estimation.

4.5 Structural model assessment

Following the validation process, the structural model was estimated using PLS with 5,000 bootstrap subsamples (Henseler, 2017). The results indicate that the path coefficients were significant for all hypothesized relationships and were consistent with their expected theoretical direction. This supports the explanatory power of the structural model, as evidenced by R^2 and Q^2 values greater than zero. As shown in Table 8, all relationships between the variables were positive and statistically significant, providing empirical support for the three hypotheses proposed in this study.

To rule out collinearity issues in the structural model, we inspected the variance inflation factor (VIF) values for all predictor constructs. All inner VIF values ranged from 1.56 to 1.78, which is well below the conservative threshold of 3.3, suggesting that multicollinearity is not a concern in the proposed model (Hair et al., 2019). Finally, we computed f^2 effect sizes to evaluate the relative impact of each predictor on continuance intention. The effect-size results reveal substantial differences in practical relevance among the three predictors. Satisfaction produced the largest contribution to continuance intention ($f^2 = 0.29$), perceived usefulness produced a smaller but meaningful contribution ($f^2 = 0.08$), and perceived quality produced only a marginal incremental contribution ($f^2 = 0.02$). Therefore, the statistical significance of all three paths should

not be interpreted as evidence that the predictors are equally important in practical terms.

The structural model explains 56% of the variance in continuance intention to use virtual classes ($R^2 = 0.56$), which can be interpreted as a moderate explanatory power according to Hair et al. (2019). In addition, the Stone–Geisser's Q^2 value for continuance intention is 0.38, which is clearly above zero, indicating that the model has satisfactory predictive relevance for this endogenous construct.

The findings reveal a direct and significant relationship between satisfaction and students' intention to continue with online classes, confirming Hypothesis H1 ($\beta = 0.54$, $p < 0.001$). These results are consistent with previous studies by Kenney and Khanfar (2009) and Areiza-Padilla and Galindo-Becerra (2022). Similarly, perceived usefulness had a positive and statistically significant relationship with continuance intention, supporting Hypothesis H2 ($\beta = 0.23$, $p < 0.001$), in line with evidence from Luo (2023), Price-Howard and Lewis (2023), and Garcia-Buitrago et al. (2024). Finally, perceived quality had a positive and statistically significant relationship with continuance intention ($\beta = 0.09$, $p = 0.004$), supporting H3. However, its effect size was only $f^2 = 0.02$, indicating a marginal incremental contribution compared with satisfaction and perceived usefulness. Given the sample size of 807 respondents, statistical significance should not be interpreted as evidence of substantial practical importance (see Table 8).

TABLE 6 Fornell–Larcker criterion for discriminant validity.

Construct	SAT	PU	QUA	CI
Satisfaction in virtual classes (SAT)	**0.780**	0.600	0.550	0.719
Perceived usefulness in virtual classes (PU)	0.600	**0.826**	0.520	0.592
Perceived quality in virtual classes (QUA)	0.550	0.520	**0.792**	0.498
Continuance intention to use virtual classes (CI)	0.719	0.592	0.498	**0.845**

Diagonal elements in bold represent the square root of the AVE. Off-diagonal values represent inter-construct correlations. SAT, satisfaction in virtual classes; PU, perceived usefulness in virtual classes; QUA, perceived quality in virtual classes; CI, continuance intention to use virtual classes.
Source: Authors' own compilation.

TABLE 7 Heterotrait–Monotrait ratio (HTMT).

Construct	SAT	PU	QUA	CI
Satisfaction in virtual classes (SAT)	–	0.724	0.671	0.812
Perceived usefulness in virtual classes (PU)	0.724	–	0.635	0.731
Perceived quality in virtual classes (QUA)	0.671	0.635	–	0.603
Continuance intention to use virtual classes (CI)	0.812	0.731	0.603	–

All HTMT values are below the conservative threshold of 0.85. SAT, satisfaction in virtual classes; PU, perceived usefulness in virtual classes; QUA, perceived quality in virtual classes; CI, continuance intention to use virtual classes.
Source: Authors' own compilation.

5 Discussion

This study contributes to the literature on virtual-learning continuance by providing comparative evidence on the relative importance of three post-use evaluations. Rather than treating all statistically significant antecedents as equally relevant, the findings reveal a differentiated pattern: satisfaction is the dominant predictor, perceived usefulness makes a smaller but meaningful contribution, and perceived quality makes only a marginal direct contribution. The main empirical contribution therefore lies in clarifying the hierarchy of these predictors within the analyzed model, rather than solely in applying an existing framework to a Colombian sample.

Satisfaction showed the strongest relationship with continuance intention ($\beta = 0.54$; $f^2 = 0.29$). This finding is consistent with the post-adoption logic of the Expectation-Confirmation Model, according to which satisfaction derived from previous system use is a central antecedent of continuance intention (Bhattacherjee, 2001). In the context of virtual classes, this result indicates that students' overall evaluation of their previous online-learning experience is more strongly associated with their willingness to continue than the other evaluations included in the model.

Perceived usefulness also had a positive and statistically significant relationship with continuance intention ($\beta = 0.23$; $f^2 = 0.08$). This finding supports the continued relevance of functional evaluations during the post-adoption stage. Students appear more willing to continue using virtual classes when they perceive that these environments improve academic performance, facilitate access to information and learning resources, and support academic productivity. Nevertheless, its contribution was substantially smaller than that of satisfaction.

Perceived quality showed a positive but practically marginal direct relationship with continuance intention ($\beta = 0.09$; $f^2 = 0.02$). This finding should not be interpreted as evidence that all dimensions of educational quality have limited importance. The construct used in this study primarily captures platform functionality, updated resources, clarity of instructions, and an overall quality evaluation. Therefore, the result indicates

TABLE 8 Results of the structural model.

Hypothesis	Path	β	t	p	95% CI	f^2	VIF	Decision
H1	SAT → CI	0.54	13.10	<0.001	[0.46, 0.62]	0.29	1.78	Accepted
H2	PU → CI	0.23	5.96	<0.001	[0.15, 0.31]	0.08	1.70	Accepted
H3	QUA → CI	0.09	2.85	0.004	[0.03, 0.15]	0.02	1.56	Accepted

β = standardized path coefficient; CI, confidence interval obtained through bootstrapping; f^2, effect size; VIF, variance inflation factor; SAT, satisfaction in virtual classes; PU, perceived usefulness in virtual classes; QUA, perceived quality in virtual classes; CI Continuance intention to use virtual classes. R^2 for CI = 0.56; Q^2 for CI = 0.38.

that this focused perceived-quality evaluation contributes little additional explanatory power once satisfaction and perceived usefulness are included in the model. Instructor engagement, feedback quality, peer interaction, pedagogical design, social presence, and learning outcomes were not directly measured and cannot be inferred from this coefficient.

The findings provide context-bounded empirical evidence rather than a new general theory of virtual education. They do not constitute a complete validation of the Expectation-Confirmation Model because confirmation of expectations was not measured, nor do they constitute a complete validation of TAM because perceived ease of use was absent. The contribution consists of showing how the included antecedents differ in explanatory and practical relevance within a specific urban, private, and accredited segment of Colombian higher education.

These results should also be interpreted as associations derived from a cross-sectional design. The study did not evaluate actual continued use, institutional retention, dropout, academic performance, curriculum redesign, or specific pedagogical interventions. Consequently, the findings support interpretations about students' stated continuance intention, but not causal conclusions regarding actual educational outcomes.

5.1 Practical implications

The practical implications should be prioritized according to the different magnitudes of the observed relationships. Satisfaction deserves the greatest institutional attention because it showed the strongest association and the largest effect size. Accredited private business schools should therefore systematically monitor students' overall evaluations of their virtual-learning experience. The present model does not identify the specific causes of satisfaction, but the literature suggests that course organization, instructor interaction, feedback, and perceived value may constitute relevant areas for subsequent institutional assessment.

Perceived usefulness represents a secondary but meaningful area for intervention. Institutions should ensure that virtual classes clearly support students' academic objectives, facilitate access to information and learning materials, and contribute to academic performance and productivity. These recommendations are directly connected to the usefulness indicators included in the study.

Perceived quality should be interpreted more cautiously. Its direct effect was statistically significant but practically marginal. Therefore, platform functionality, updated resources, and clear instructions should not be presented as equally influential as satisfaction or perceived usefulness. These elements remain appropriate areas for monitoring because they correspond directly to the measurement items, but the findings do not support assigning them the same explanatory priority as satisfaction.

Institutions should also avoid assuming that the results demonstrate the effectiveness of particular pedagogical strategies. Future intervention studies should test whether changes in instructor presence, synchronous interaction, feedback systems, multimedia resources, or applied learning activities produce measurable improvements in satisfaction, perceived usefulness, broader dimensions of quality, and actual continuance behavior.

5.2 Limitations and future research

Several limitations should be considered when interpreting the findings. First, the empirical evidence is restricted to 807 students enrolled in business-related programs at 12 private accredited universities in Bogotá, Colombia. The study used a non-probability sampling design combining convenience and snowball procedures. Consequently, students did not have a known and equal probability of selection, and the findings cannot be statistically generalized to all Colombian business students or to the heterogeneous landscape of Latin American higher education.

Second, convenience and snowball sampling may have introduced self-selection and network-related bias. Participation was voluntary, and students who were more accessible, more strongly connected to the referral networks, or more interested in virtual education may have been more likely to participate. The sample may therefore underrepresent eligible students who were less connected to the recruitment networks or less willing to complete an online questionnaire.

Because the questionnaire was redistributed through the snowball procedure, the total number of students who ultimately received the invitation was not recorded. A conventional response rate could therefore not be calculated. This limitation prevents a direct assessment of potential nonresponse bias.

Third, all substantive constructs were measured from the same respondents through a single self-report questionnaire. This design creates a potential risk of common method bias. The full collinearity assessment produced VIF values below the conservative threshold of 3.3, suggesting that common method bias was unlikely to constitute a major threat to the estimated relationships. Nevertheless, statistical diagnostics cannot completely eliminate the limitations associated with a single-source self-report design. Future studies should consider temporal separation, multiple data sources, marker variables, or behavioral measures of actual platform use.

Fourth, the cross-sectional design does not establish temporal or causal relationships. Although the structural model estimates theoretically directed associations, it cannot demonstrate that satisfaction, perceived usefulness, or perceived quality causes subsequent continued use. Longitudinal studies should measure students' evaluations at different points and examine whether continuance intention predicts actual future use, persistence, or enrollment behavior.

Fifth, the perceived-quality construct has a narrower operational scope than the broader concept of virtual educational quality. Its indicators primarily capture platform functionality, updated resources, clarity of instructions, and an overall perceived-quality evaluation. Therefore, the observed coefficient should not be generalized to instructor quality, feedback, peer interaction, pedagogical design, social presence, service quality, or actual learning outcomes. Future studies should measure these dimensions separately and examine their direct and indirect relationships with satisfaction and continuance intention.

Sixth, the theoretical model is partial. Confirmation of expectations, a central variable in the Expectation-Confirmation Model, was not measured. Perceived ease of use, a central variable in the original Technology Acceptance Model, was also unavailable in the questionnaire. Therefore, the findings support only the relationships included in the empirical model and should not be interpreted as a complete validation of either theoretical framework.

Seventh, the dataset contained gender and age but did not include other potentially relevant characteristics such as socioeconomic status, academic level, employment status, prior experience with virtual learning, or study modality. Supplementary Mann–Whitney and Kruskal–Wallis tests did not identify statistically significant differences by gender or age, but these comparisons do not constitute formal structural moderation tests.

Finally, future research should include public universities, non-accredited institutions, other Colombian regions, and students from face-to-face, hybrid, and fully virtual programs. Additional studies should incorporate perceived ease of use, confirmation of expectations, engagement, instructor feedback, peer interaction, cost reduction, geographical flexibility, commuting avoidance, control over learning pace, and work-study balance. Longitudinal and cross-country designs would provide stronger evidence regarding how students' post-adoption evaluations and actual virtual-learning behavior evolve over time.

6 Conclusion

This study examined the relationships of satisfaction, perceived usefulness, and perceived quality with students' continuance intention toward virtual classes in accredited private business schools in Bogotá, Colombia. Data were collected online between July 2024 and September 2025 from 807 students using a non-probability sampling strategy combining convenience and snowball procedures.

Satisfaction was the strongest predictor of continuance intention ($\beta = 0.54$; $f^2 = 0.29$), followed by perceived usefulness ($\beta = 0.23$; $f^2 = 0.08$). Perceived quality was statistically significant ($\beta = 0.09$, $p = 0.004$), but its incremental practical contribution was marginal ($f^2 = 0.02$). The model explained 56% of the variance in continuance intention and showed predictive relevance with $Q^2 = 0.38$.

The principal empirical contribution lies in identifying a differentiated hierarchy among the predictors rather than merely documenting statistically significant relationships in a Colombian setting. Students' overall satisfaction with their previous virtual-learning experience was more strongly associated with continuance intention than perceived usefulness or the focused quality attributes measured in the study. The quality result refers primarily to platform functionality, updated resources, clarity of instructions, and an overall quality evaluation; it should not be generalized to all dimensions of educational quality.

These conclusions are bounded by the non-probability convenience and snowball sample, the specific context of private accredited universities in Bogotá, the cross-sectional self-report design, the focused operationalization of perceived quality, and the absence of confirmation of expectations, perceived ease of use, extrinsic motivations, and comparison groups from face-to-face or hybrid modalities. Future research should examine the complete post-adoption process, incorporate broader and differentiated measures of virtual-learning quality, and compare students across institutions, regions, countries, and educational modalities.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Javeriana University with code FCEA-DF-00922021. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MC-O: Investigation, Writing – review & editing, Conceptualization, Software, Writing – original draft, Project administration, Visualization, Methodology, Data curation, Supervision, Validation, Formal analysis. KB-P: Visualization, Formal analysis, Writing – original draft, Project administration, Data curation, Conceptualization, Investigation, Supervision, Writing – review & editing, Validation, Methodology, Software. DN: Project administration, Formal analysis, Writing – original draft, Visualization, Methodology, Data curation, Supervision, Investigation, Software, Validation, Conceptualization, Writing – review & editing. JA-P: Software, Formal analysis, Visualization, Data curation, Writing – original draft, Project administration, Conceptualization, Validation, Methodology, Investigation, Supervision, Writing – review & editing. IV-G: Writing – original draft, Formal analysis, Software, Data curation, Visualization, Conceptualization, Supervision, Project administration, Investigation, Writing – review & editing, Methodology, Validation. JI-C: Visualization, Project administration, Formal analysis, Validation, Data curation, Supervision, Software, Conceptualization, Writing – review & editing, Writing – original draft, Methodology, Investigation.

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