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**INFLUÊNCIA DA EDUCAÇÃO VIRTUAL NA SATISFAÇÃO DOS ESTUDANTES UNIVERSITÁRIOS NOS PAÍSES EM DESENVOLVIMENTO: SCOPING REVIEW**

**INFLUENCE OF VIRTUAL EDUCATION ON THE SATISFACTION OF UNIVERSITY STUDENTS IN DEVELOPING COUNTRIES: SCOPING REVIEW**

**INFLUENCIA DE LA EDUCACIÓN VIRTUAL EN LA SATISFACCIÓN DE LOS ESTUDIANTES UNIVERSITARIOS EN LOS PAÍSES EN DESARROLLO: SCOPING REVIEW**

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## RESUMO

**Introdução:** A rápida transição para o ensino virtual durante a pandemia da COVID-19 criou desafios e oportunidades em todo o mundo. O que antes era uma opção complementar, o ensino online tornou-se essencial. A pandemia acelerou a sua adoção nos países em desenvolvimento, revelando grandes lacunas de infraestruturas, tais como o fornecimento instável de eletricidade e a escassez de professores qualificados na Ásia, na América Latina e em África.

**Objetivo:** Mapear os resultados empíricos recentes sobre os fatores que afetam a satisfação dos estudantes universitários com a educação virtual em países em desenvolvimento e identificar elementos-chave para melhorar as experiências de aprendizagem online em contextos de baixos recursos.

**Métodos:** Foi realizada uma scoping review seguindo o protocolo PRISMA. Um conjunto inicial de 51 estudos (2020-2024) foi recuperado das principais bases de dados académicas. Após a aplicação de critérios rigorosos de inclusão e exclusão, foram selecionados 12 estudos, predominantemente da América Latina e do Médio Oriente. A maioria utilizou desenhos quantitativos e transversais com questionários de satisfação dos estudantes.

**Resultados:** Os principais determinantes da satisfação incluíram a qualidade do ensino, o acesso à tecnologia, a motivação dos alunos, o stress académico e a adaptabilidade. Surgiram correlações positivas entre a satisfação e a qualidade do serviço, a flexibilidade e o bem-estar emocional.

**Conclusão:** A revisão destaca a necessidade de modelos de educação virtual sensíveis ao contexto e centrados no aluno. Contribui para o desenvolvimento de estratégias inclusivas para melhorar a aprendizagem online em contextos com recursos limitados e defende ferramentas padronizadas e abordagens longitudinais em pesquisas futuras.

**Palavras-chave:** educação virtual; satisfação dos alunos; qualidade da educação; acesso à educação; adaptação dos alunos

## ABSTRACT

**Introduction:** The rapid shift to virtual education during the COVID-19 pandemic created both challenges and opportunities worldwide. Once a supplementary option, online learning became essential. The pandemic accelerated adoption in developing nations, exposing major infrastructure gaps such as unstable electricity and limited qualified teachers across Asia, Latin America, and Africa.

**Objective:** To review recent empirical findings on the factors that influence university students' satisfaction with online education in developing countries and identify key elements for improving online learning experiences in low-resource settings.

**Methods:** A scoping review was conducted following the PRISMA protocol. An initial pool of 51 studies (2020–2024) was retrieved from major academic databases. After applying strict inclusion and exclusion criteria, 12 studies were selected, predominantly from Latin America and the Middle East. Most used quantitative, cross-sectional designs with student satisfaction questionnaires.

**Results:** Key determinants of satisfaction included teaching quality, technological access, student motivation, academic stress, and adaptability. Positive correlations emerged between satisfaction and service quality, flexibility, and emotional well-being.

**Conclusion:** The review highlights the necessity of context-sensitive, student-centered virtual education models. It contributes to the development of inclusive strategies for improving online learning in resource-constrained settings and advocates for standardized tools and longitudinal approaches in future research.

**Keywords:** virtual education; student satisfaction; quality of education; access to education; student adaptation

## RESUMEN

**Introducción:** La rápida transición a la enseñanza virtual durante la pandemia de COVID-19 ha planteado retos y oportunidades en todo el mundo. Lo que antes era una opción complementaria, la enseñanza en línea, se ha convertido en algo esencial. La pandemia ha acelerado su adopción en los países en desarrollo, poniendo de manifiesto importantes carencias en materia de infraestructuras, como el suministro eléctrico inestable y la escasez de profesores cualificados en Asia, América Latina y África.

**Objetivo:** Analizar los resultados empíricos recientes sobre los factores que influyen en la satisfacción de los estudiantes universitarios con la educación virtual en los países en desarrollo e identificar los elementos clave para mejorar las experiencias de aprendizaje en línea en contextos con escasos recursos.

**Métodos:** Se llevó a cabo una scoping review siguiendo el protocolo PRISMA. Se recuperó un conjunto inicial de 51 estudios (2020-2024) de las principales bases de datos académicas. Tras aplicar criterios estrictos de inclusión y exclusión, se seleccionaron 12 estudios, predominantemente de América Latina y Oriente Medio. La mayoría utilizó diseños cuantitativos y transversales con cuestionarios de satisfacción de los estudiantes.

**Resultados:** Entre los factores determinantes clave de la satisfacción se encontraban la calidad de la enseñanza, el acceso a la tecnología, la motivación de los estudiantes, el estrés académico y la adaptabilidad. Se observaron correlaciones positivas entre la satisfacción y la calidad del servicio, la flexibilidad y el bienestar emocional.

**Conclusión:** La revisión destaca la necesidad de modelos de educación virtual sensibles al contexto y centrados en el estudiante. Contribuye al desarrollo de estrategias inclusivas para mejorar el aprendizaje en línea en entornos con recursos limitados y aboga por herramientas estandarizadas y enfoques longitudinales en futuras investigaciones.

**Palabras clave:** educación virtual; satisfacción de los estudiantes; calidad de la educación; acceso a la educación; adaptación de los estudiantes

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## INTRODUCTION

The rapid shift to virtual education during the COVID-19 pandemic created both challenges and opportunities worldwide. Once a supplementary option, online learning became essential. Hussain (2023) notes that the pandemic accelerated adoption in developing nations, exposing major infrastructure gaps such as unstable electricity and limited qualified teachers across Asia, Latin America, and Africa. Many underdeveloped countries had to quickly adopt platforms like Google Classroom and Zoom, unlike more developed nations with prior experience. According to Li et al. (2023), student satisfaction strongly influences academic performance, motivation, and retention, yet is shaped by multiple interrelated factors.

Although the concept of satisfaction comes from the business world, its application in education is relevant, since virtual education shares characteristics with services, such as intangibility, the need for interaction, and the importance of user experience. Satisfaction is the customer's perception of service quality versus expectations (Husain et al., 2022). Service quality offers a competitive advantage. In virtual education, satisfaction reflects overall experience with online learning, involving emotional responses shaped by content quality, usability, and personalization. It captures all stages of the educational process, serving as a global measure (Erragcha & Babay, 2023).

The literature shows both benefits and drawbacks of virtual education. Lucenko et al. (2023) highlight time savings, access from any location, and self-paced learning. However, increased self-teaching, limited real-time instructor support, reduced concentration, poor adaptation, and lack of face-to-face interaction negatively affect students' learning process.

Other research articles have focused on those aspects that affected satisfaction during the pandemic. According to Sanchez-Ruiz and Larrea-Silva (2022), access to digital tools, the quality of teachers' teaching, teacher-student communication, educational level, infrastructure, and increased homework were factors that either positively and/or negatively impacted the students' experience. It is worth mentioning that this research piece did not mention theories to understand virtual education, such as connectivism, nor the quality of virtual education as a service.

This scoping review aims to organize and deepen our understanding of developing country university students' satisfaction with virtual education. Specifically, the contribution of this review lies in clarifying the key findings linked to students' satisfaction with virtual education, offering a theoretical framework that facilitates a better understanding of the virtual educational experience.

## 1. THEORETICAL FRAMEWORK

We were able to find key ideas pertaining to the subject of this article by analyzing the chosen literature. As a result, the primary subjects that offer a more comprehensive picture of the state of knowledge on the topic are presented in this part.

### 1.1 Virtual Education

Virtual education has become a key response to contemporary educational demands, particularly during crises such as the COVID-19 pandemic. Theories like connectivism emphasize integrating digital technologies and modern methodologies, prioritizing the connection and restructuring of information over memorization (Nasar, 2024). In this context, the teacher acts as a facilitator, and collaboration among students, instructors, and institutions is essential. Motivation, defined as an internal driver of action, plays a central role in promoting continuous, adaptive training for effective technological use in learning (Sarmiento-Pesántez et al., 2023). According to Grados Espinoza et al. (2022), virtual education involves digitally mediated instruction without physical co-presence, yet it is not suitable for all learners. Success depends on motivation, organization, technological access, and appropriate support. It may benefit students with special needs, though challenges include technological adaptation and error management. Rooeintan et al. (2022) add that virtual education is rooted in Western approaches valuing autonomy, independent learning, and active participation.

### 1.2 Access to Virtual Education

During the pandemic, Velarde Molina et al. (2024) point out that access to virtual education was facilitated with information and communication technologies (ICT) and virtual social networks (VN), which allowed academic programs to continue. Although there were limitations in interaction and a lot of time in front of the screen was required, there were advantages in terms of travel time and greater flexibility in schedules. Both teachers and students positively valued these tools, which improved the quality of the content and encouraged collaboration.

### 1.3 Reverse Classroom Process

Online training emphasizes how and what students learn, aiming to promote meaningful learning and critical thinking through student-centered tools and collaborative environments that integrate theoretical and practical components (Canova-Barrios et al., 2023). This aligns with a major shift in education during the information age: the move from teacher-centered to learner-centered paradigms (Moradi et al., 2023). Virtual education has facilitated this shift by enabling active methodologies in which students take a leading role, participating throughout the learning process while teachers act as mediators and guides (Sarmiento-Pesántez et al., 2023).

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A key innovation is the flipped classroom model, which transforms traditional classroom dynamics. Students study theoretical content outside the classroom through digital materials, reserving class time for practical tasks and interactive dialogue. As noted by Barrutia Barreto et al. (2021), drawing on Hernández-Silva and Tecpan Flores (2017), this approach restructures classroom activities to strengthen collaborative learning. It relies heavily on ICT to support information exchange and the development of essential digital skills.

According to Barrutia Barreto et al. (2021), the flipped classroom enhances cooperation, innovation, and focus. Students respond positively because it promotes collaboration, problem-solving, learning communities, and sustained dialogue, ultimately improving academic performance, motivation, engagement, and interaction.

### 1.4 Satisfaction with the Quality of Virtual Education

Understanding service quality satisfaction begins with Huapaya et al. (2023), who cite Cronin et al. (2000) in defining satisfaction as the customer’s perception of received value, where service quality relative to cost is central. Perceived quality is the main determinant of satisfaction, influencing value and reinforcing their interrelation. In virtual education, satisfaction with service quality is essential for assessing program success. According to Sarmiento-Pesántez et al. (2023), student satisfaction reflects the effectiveness of academic and administrative services, including learning units, interactions, and available facilities. Students’ perceptions, expectations, and needs guide improvements in academic program management. Moreover, satisfaction is vital for institutional sustainability, influencing academic success, retention, and positive word-of-mouth, shaped by curriculum, training, support services, and labor-market relevance.

### 1.5 Adaptation to Virtual Programs

Adapting pedagogical methods to the virtual environment requires flexibility and personalization, as students immersed in advanced technologies struggle with traditional models. This adaptation also influences students’ mental health. Aghaei Sabet et al. (2022) note that health-related behaviors can support or hinder academic performance: optimism, resilience, and goal orientation enhance it, while helplessness, lack of effort, and procrastination weaken it. Virtual education likewise affects psychological conditions, including depressive symptoms and performance, although more mature and socially skilled students tend to value it more. According to Thus et al. (2009), as cited in Moradi et al. (2023), the success of virtual education depends on implementing a model aligned with students’ needs and learning objectives, requiring a multidisciplinary approach. Connectivism supports this goal; as Sarmiento-Pesántez et al. (2023) explain, it emphasizes technology’s role in enabling digital natives to search, select, and meaningfully acquire information while developing skills in an evolving environment.

## 2. METHODS

To achieve the research objectives, a scoping review study was conducted following the PRISMA protocol, established by Page et al. (2021). Similarly, the evaluation criteria for scoping review articles developed by the Joanna Briggs Institute were used, with the purpose of guaranteeing standards of quality, transparency, and, where appropriate, generalization of the results (Lockwood et al., 2015).

### 2.1 Search Strategy

In the review conducted, the Scopus, EBSCO, and Web of Science databases were used. Only articles published in international scientific journals from 2020 to 2024 were included.

The research question guiding the review was: What does the current literature say about the satisfaction of university students from developing countries with virtual education?

To define the descriptors, the UNESCO Thesauri were used, according to the ISO 25964 standard, with terms such as “education”, “virtual education”, “electronic learning”, “satisfaction”, “comfort”, and “well-being”. With these descriptors, the search equation was formulated: “virtual education” AND satisfaction.

### 2.2 Inclusion and Exclusion Criteria

Table 1 – Criteria table

Inclusion criteria	Exclusion criteria
Empirical texts	Published prior to 2020.
Satisfaction studies in relation to virtual education	Studies or research on satisfaction associated with fields other than virtual education
Time period: Between 2020 and 2024	Studies and research without the availability of the full text
Studies written in English and Spanish	Documents that appear repeatedly in search engines
Studies focused on undergraduate and graduate university students	Studies were excluded if they failed to meet the critical appraisal criteria of the Joanna Briggs Institute, specifically those lacking clear inclusion criteria for participants or valid and reliable measurement instruments
Studies in developing countries	-

Note: Countries considered to be developing countries were classified according to the International Monetary Fund's (2023) classification.

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### 2.3 Document Selection Procedure

To write this review, a rigorous selection of primary articles was made and went through several stages of evaluation. In the first phase, 34 articles were obtained from the databases. In the second phase, the duplicate records were deleted, as were those without access to the full article, reducing the number to 19 articles that met these requirements. Finally, in the third stage, we verified that the articles were aligned with the subject matter of the review, selecting 12 articles that met the inclusion criteria and were chosen for this scoping review.

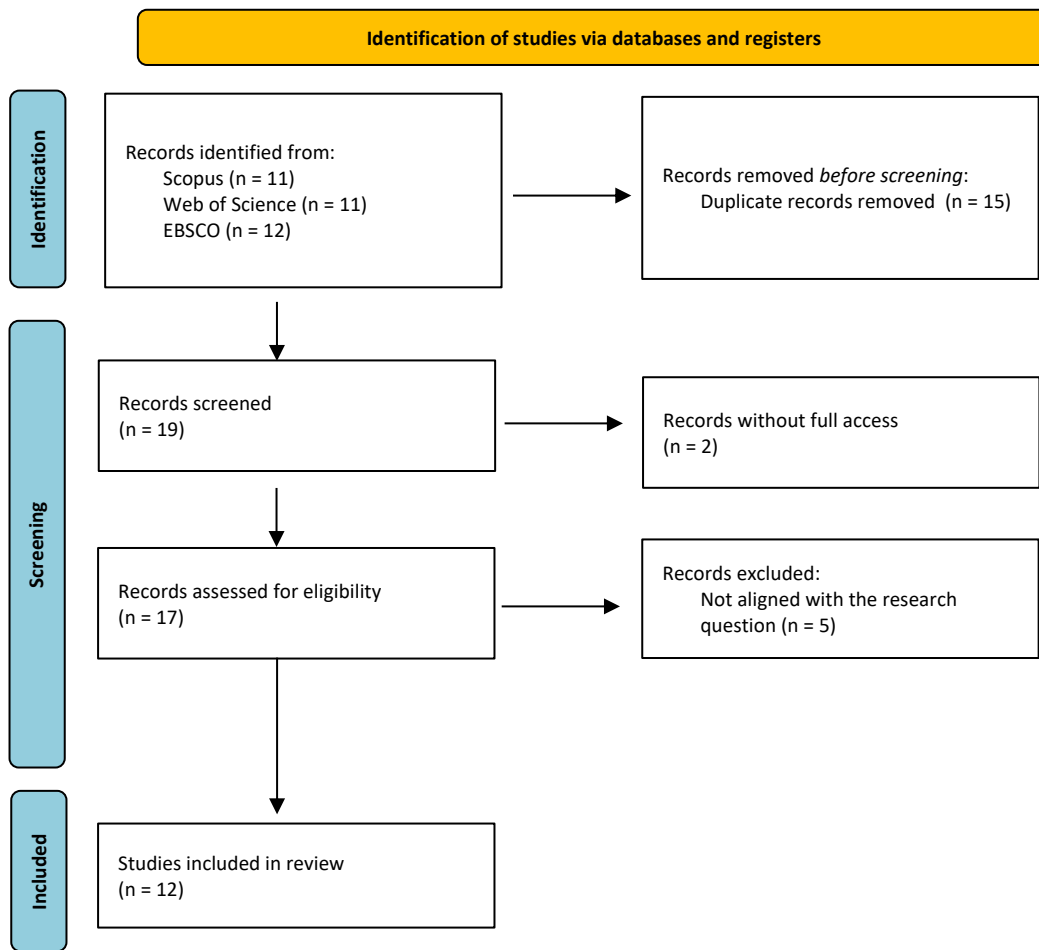


Figure 1 – Selection according to the PRISMA Protocol

### 2.4 Data Analysis

As this review required more detailed information, a comparative table was prepared to record the year of publication, the source of the research, the theoretical framework, the type of study, the instrument used, the perspective adopted, the population studied, as well as the objectives, the conclusions, and the language in which the texts reviewed were published.

## 3. RESULTS

After reviewing the data according to the established methodology, a sample of twelve articles was obtained. Then, a summary of these twelve articles was prepared, covering the following aspects: author, year, focus, location of the research, main finding, and sample size. Therefore:

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**Table 2 – Synthesis of Selected Articles**

N°	Author	Year	Method/Approach	Location	Main Finding	Sample Size (# of students)
01	Aghaei Sabet et al. (2022)	2022	Quantitative - descriptive - correlational	Iran	Student satisfaction was significantly predicted by health-oriented lifestyle components, explaining 37.4% of the variance ( $R^2 = .37$ ), with positive correlation to academic optimism ( $r = .54$ ) and negative correlation to learned helplessness ( $r = -.44$ ).	188
02	Babadi and Saberikia (2021)	2021	Quantitative - descriptive - cross-sectional	Iran	Students reported a relatively desirable level of satisfaction with virtual education (mean = $2.96 \pm 0.63$ ), and 75.2% expressed willingness to continue virtual classes.	209
03	Barrutia Barreto et al. (2021)	2021	Qualitative - descriptive	Lima - Peru	Students adapted progressively to virtual learning despite initial difficulties, with 60% reporting negative effects and perceiving virtual education as inferior to face-to-face instruction.	10
04	Canova-Barrios et al. (2023)	2023	Quantitative - cross-sectional	Buenos Aires - Argentina	Overall satisfaction with virtual learning was moderately high (mean = $6.9/10$ ) and showed significant associations with having children ( $p = .02$ ) and a low positive correlation with age ( $r = .20$ , $p = .02$ ).	121
05	Castillo Vento et al. (2022)	2022	Quantitative - descriptive - correlational	Peru	Student satisfaction with virtual education showed a significant positive relationship with academic performance (Spearman's $Rho = .41$ , $p = .00$ ).	118
06	Grados Espinoza et al. (2022)	2022	Quantitative - cross-sectional	Peru	Only 34.8% of students reported high satisfaction, and lower satisfaction was associated with being in the fifth year ( $PR = .92$ ), partial university adaptation ( $PR = .82$ ), and high stress levels ( $PR = .89$ ).	1878
07	Huapaya et al. (2023)	2023	Quantitative - non-experimental - descriptive	Peru	Service quality showed a moderate and significant relationship with satisfaction (Kendall's $Tau-b = .53$ , $p = .00$ ), and overall perception correlated strongly with satisfaction ( $r = .77$ ).	492
08	Moradi et al. (2023)	2023	Quantitative - descriptive - correlative	Iran	Students' attitudes toward virtual education were strongly and significantly associated with their satisfaction ( $r = .81$ , $p < .01$ ), with no differences between academic majors.	165
09	Osmani (2021)	2021	Quantitative - cross-sectional	Iran	Interactive learning activities showed the strongest association with overall satisfaction ( $r = .61$ , $p < .01$ ), while 42.2% of students reported moderate satisfaction levels.	320
10	Roeointan et al. (2022)	2022	Quantitative - cross-sectional - descriptive	Iran	Students' attitudes toward virtual education exhibited a strong, significant correlation with their satisfaction ( $r = .79$ , $p < .01$ ).	229
11	Sarmiento-Pesántez et al. (2023)	2023	Quantitative - exploratory - descriptive - correlational	Ecuador	High satisfaction was present in 77% of students, with significant links to teaching strategies such as clear guidance and interactive resources ( $p < .01$ ).	56
12	Velarde Molina et al. (2024)	2024	Quantitative - descriptive - correlational	Peru	A very strong and significant positive correlation was found between the virtual education model and graduate student satisfaction (Spearman's $Rho = .95$ , $p = .00$ ).	21

### 3.1 Description of the Publications Included

In terms of language, seven of the articles were published in English and five in Spanish.

Regarding the location of the research, the studies came from Peru (5), Iran (5), and Ecuador (1). One article was also found from Buenos Aires, Argentina. In terms of year of publication, the studies are distributed as follows: 2023 (4), 2022 (4), 2021 (3), and one article in 2024.

While reviewing the thirteen articles mentioned, some similarities were identified between them, which allowed for the objectives to be classified into the three categories described below:

- Those that identify factors influencing satisfaction with virtual education: Aghaei Sabet et al. (2022), Babadi and Saberikia (2021), Osmani (2021), Moradi et al. (2023), and Canova-Barrios et al. (2023) analyzes factors affecting virtual education satisfaction, including curriculum quality, health-oriented academic behaviors, and internships that enhance understanding.
- Those linking the quality and effectiveness of virtual education with satisfaction: Castillo Vento et al. (2022), Huapaya et al. (2023), Sarmiento-Pesántez et al. (2023), and Grados Espinoza et al. (2022) link virtual learning satisfaction to academic performance, emphasizing perceived educational quality and service satisfaction, while noting that high stress and poor adaptation significantly reduce students' satisfaction with virtual education.

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- c) Highlighting the challenges and adaptations in virtual education: Barrutia Barreto et al. (2021), Velarde Molina et al. (2024), and Rooeintan et al. (2022) note that adaptation to virtual education was gradual, with communication, technological access and mastery, teacher performance, positive attitudes, and easy technology access being essential factors for student satisfaction.

In terms of the methodological approach, twelve quantitative and one qualitative research studies were identified. Due to the nature of the subject under review and the context in which it was developed, satisfaction with virtual education has been analyzed mostly at a university educational level, both at the undergraduate and graduate levels.

Regarding the application of research instruments, it was observed that quantitative studies generally used surveys and virtual questionnaires. Even the single qualitative research article used a survey, but with open-ended questions. Although not specifically indicated in the article, this finding is inferred from the analysis. A summary table of these is shown below:

**Table 3 – Research Instruments**

N°	Author	Purpose	Instrument
01	Aghaei Sabet et al. (2022)	To investigate students' satisfaction with virtual education according to their health-focused lifestyle.	Virtual education satisfaction questionnaire - Questionnaire of academic lifestyle behaviors that promote and inhibit health education (Salehzadeh et al., 2017)
02	Babadi and Saberikia (2021)	Describing the quality of the curriculum in virtual modality and satisfaction during the pandemic.	Virtual education curriculum components quality questionnaire (Azizi et al., 2018) - Student satisfaction with online learning questionnaire (Nourian et al., 2012)
03	Barrutia Barreto et al. (2021)	To assess the level of satisfaction with the virtual education system by university students.	Ad-hoc virtual survey designed by the authors
04	Canova-Barrios et al. (2023)	To study the perception and satisfaction toward virtual education in nursing students.	Self-administered questionnaire (Spector et al., 2020).
05	Castillo Vento et al. (2022)	Linking satisfaction with the virtual modality and academic performance.	Ad-hoc Virtual Education Satisfaction Questionnaire - English II Course Report Card
06	Grados Espinoza et al. (2022)	To estimate the factors associated with the level of satisfaction with virtual education.	Student Dissatisfaction Questionnaire (Bautista et al., 2020) - COVID-19 Pandemic-Related Perceived Stress Scale (Campo-Arias et al., 2020)
07	Huapaya et al. (2023)	To determine the relationship of sociodemographic factors to the quality of education and satisfaction with virtual education.	Quality of Service in Distance Higher Education (Araya Castillo, 2017) - Satisfaction and Behavioral Intention in Distance Higher Education (Araya Castillo, 2017)
08	Moradi et al. (2023)	To inquire on the relationship between attitudes toward the use of virtual education and satisfaction	Two ad hoc questionnaires designed by the authors, one on 'Satisfaction with e-learning' and the other on 'Attitude towards e-learning'.
09	Osmani (2021)	To analyze the relationship between various factors related to satisfaction with virtual education.	Ad-hoc questionnaire designed by the author
10	Rooeintan et al. (2022)	To determine the attitude towards virtual education and its relationship with satisfaction.	Questionnaire validated by Nourian et al. (2012)
11	Sarmiento-Pesántez et al. (2023)	Assess the degree of use of strategies and methodologies in terms of student satisfaction in virtual education.	Questionnaire based on Valdez Betalleluz, modified for research purposes
12	Velarde Molina et al. (2024)	To understand the students' perception of the structure, contents, tools, teaching, knowledge, and use of technological tools used by teachers	Ad-hoc questionnaire designed by the authors

#### 4. DISCUSSION

The review of the literature on student satisfaction in virtual education environments reveals several crucial findings that provide a comprehensive view of this phenomenon. Our analysis of the available studies shows that flexibility and personalization of learning are significant contributors to student satisfaction. The ability to access educational materials at any time and adjust the pace of study according to individual needs aligns with the principles of virtual education and connectivism, which emphasize self-directed learning and the integration of digital technologies (Babadi & Saberikia, 2021; Sarmiento-Pesántez et al., 2023). This flexibility is fundamental to enhance the educational experience in virtual environments, allowing students to manage their own learning and actively participate in the educational process.

Despite the benefits of virtual education, such as reduced travel times and the ability to access educational resources at any time, there are significant problems such as increased stress and anxiety associated with online study (Moradi et al., 2023). For instance, lack of physical contact and social isolation can negatively affect the student experience, limiting the benefits of active and collaborative methodologies promoted in the flipped classroom based on interaction and active participation in learning (Barrutia

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Barreto et al., 2021). These problems underscore the need for effective strategies to manage students' emotional well-being and foster interaction and collaboration in the virtual environment.

The concept of service quality, as discussed in e-service theory, also emerges as a critical factor for student satisfaction. The quality of the virtual educational environment, including the user interface, access to resources, and technical support, directly influences students' perception of their educational experience (Huapaya et al., 2023). To ensure a satisfactory experience, it is essential that virtual education platforms provide a high-quality educational environment that meets the expectations and needs of students. Finally, this study presents several limitations that should be considered when interpreting its findings. First, the scoping review is based on articles available in specific databases, which could exclude relevant studies not indexed in these sources. Also, most of the included studies focus on educational contexts in developing countries, which limits the generalizability of the results to other settings. Another limitation is the variability in the methods of measuring student satisfaction, which makes direct comparison between studies difficult. Finally, the exclusion of studies without full-text availability may have introduced a selection bias, as potentially relevant data from abstracts or conference proceedings were not considered.

## CONCLUSION

In conclusion, current evidence shows that student satisfaction with virtual education environments is shaped by multiple factors, including flexibility and personalization of learning, service quality, and the management of emotional well-being. While virtual education offers advantages such as accessible and adaptable learning, it also presents challenges that must be addressed to improve students' experiences. Educational institutions should implement strategies to mitigate stress and anxiety associated with online study, foster interaction and collaboration, and guarantee high-quality services.

In practical terms, universities must prioritize investment in stable digital infrastructure and comprehensive teacher training in digital skills, rather than merely transferring face-to-face classes to videoconference platforms. Likewise, policymakers should address the digital divide to ensure equitable satisfaction levels across diverse student populations. The adoption of sustainable and adaptive pedagogical approaches, such as connectivism, can further optimize student satisfaction and enhance the overall effectiveness of virtual education.

Based on these conclusions, it is recommended that assessment methodologies be standardized to allow for more accurate comparisons across studies. Finally, future research should examine the long-term mental health effects of virtual education in the post-pandemic context, as well as how student and teacher satisfaction and adaptation evolve over time.

## AUTHORS' CONTRIBUTION

Conceptualization, O.V.S. and F.F.F.; data curation, F.M.R. and D.C.A.; funding acquisition, F.F.F.; investigation, O.V.S., F.F.F., F.M.R. and D.C.A.; methodology, O.V.S.; project administration, O.V.S.; resources, F.F.F.; software, F.F.F. and D.C.A.; supervision, O.V.S.; validation, O.V.S. and F.F.F.; visualization, D.C.A.; writing – original draft, O.V.S., F.F.F., F.M.R. and D.C.A.; writing – review and editing, O.V.S., F.F.F., F.M.R. and D.C.A.

## CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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