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Rethinking Virtual Learning Environments in Resource-Constrained Contexts: Student Interaction, Effectiveness, and Digital Inequality in Latin American Higher Education

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Abstract

Virtual Learning Environments (VLEs) have become a central component of contemporary higher education; however, their effectiveness in resource-constrained contexts remains insufficiently examined. This study investigates the determinants of student experience, interaction, and perceived effectiveness of VLEs among undergraduate students in the Faculty of Social Sciences at the National University of the Altiplano (Peru). A quantitative, cross-sectional design was employed, using a stratified random sample of 112 students enrolled in semesters four through eight. Data were analyzed through descriptive and correlational techniques to identify patterns, relationships, and key factors influencing learning outcomes. The findings reveal a predominantly positive perception of VLEs (57.1%), particularly regarding access to educational resources and the facilitation of student-instructor interaction. Nevertheless, important structural and pedagogical challenges persist. A significant proportion of students (50.9%) reported recurrent technical difficulties, while 38.4% perceived virtual learning as less effective than traditional face-to-face instruction. Teaching practices were largely mediated through videoconferencing platforms—primarily Zoom and Google Meet—indicating a platform-dependent instructional model with limited pedagogical diversification and reduced use of interactive or student-centered strategies. Moreover, gaps in personalized feedback, disparities in digital competencies, and insufficient institutional support mechanisms were identified as critical barriers to effective learning. These limitations suggest

that access to technology alone is not sufficient to ensure meaningful educational experiences. This study contributes to the literature by providing context-sensitive empirical evidence from a public university in a resource-limited Latin American setting. It highlights the need to strengthen the integration of technological infrastructure with pedagogical innovation, emphasizing interaction design and student engagement. Accordingly, targeted institutional strategies are required to develop inclusive, adaptive, and pedagogically robust virtual learning ecosystems that respond effectively to the needs of underserved higher education contexts.

Keywords: Pedagogical design, Student engagement, Higher education quality, Institutional support, Digital competencies.

Introduction

The digital transformation of higher education has shifted from an emergency response to a strategic priority, particularly in Latin American contexts where structural constraints intersect with emerging technological opportunities. Although virtual learning environments (VLEs), such as the LAURASIA platform at UNA, provide multimodal functionalities Rosanigo et al. (2016), their impact extends beyond technical affordances, reshaping pedagogical relationships and redefining learning paradigms. Moving beyond reductionist approaches that frame technology adoption in binary terms, this study explores how Social Sciences students experience and negotiate this transformation within a Peruvian public university context.

The LAURASIA platform of the National University of the Altiplano (Puno) is an institutional digital system integrated into the university's virtual campus, designed to support both academic and administrative management processes for students and faculty. Broadly, LAURASIA can be understood as a comprehensive academic information system that centralizes key functions such as course registration, grade reporting, academic tracking, and access to institutional services, operating in coordination with other digital tools like the virtual classroom and the university intranet. Its main characteristics include the integration of real-time academic data, enabling users to monitor their academic progress and performance efficiently; interoperability with other institutional systems, which facilitates coordination between teaching, administration, and student services; and online accessibility, allowing users to access the platform remotely from various devices. Additionally, LAURASIA is characterized by its role in the optimization of administrative processes, reducing procedural delays and improving efficiency, as well as its contribution to the digital transformation of university management. Overall, the platform represents a key component in strengthening institutional efficiency and enhancing the student

academic experience, particularly within virtual and blended learning environments in higher education.

Three interrelated dimensions underpin the integration of virtual learning environments (VLEs): technological infrastructure, pedagogical adaptation, and psychosocial dynamics. Evidence suggests that, although students value the accessibility of digital resources (57.1%), they continue to face persistent challenges related to technical reliability (50.9%) and limited interpersonal interaction (38.4% prefer face-to-face modalities) Incacutipa-Limachi et al. (2024). These findings challenge prevailing assumptions regarding the readiness of “digital natives” for virtual education, revealing instead a complex interplay between technological affordances and human factors.

The implementation of the LAURASIA platform reflects broader tensions in post-pandemic higher education. While Griselda et al. (2022) highlight the role of VLEs in ensuring academic continuity, the present findings indicate that their effectiveness depends on often-overlooked elements, including instructor digital competencies, curriculum redesign for hybrid delivery, and the availability of institutional support structures. This perspective aligns with the framework proposed by Arteaga Toro & Osorio Carrera, (2024), which emphasizes the interdependence between technological systems and pedagogical practices.

Comparative analysis reveals a paradox in student perceptions. Although respondents acknowledge the logistical advantages of VLEs, many question their effectiveness for achieving specific learning outcomes, particularly in disciplines that require critical discussion and collaborative analysis. This observation is consistent with the findings of Garzón-Domínguez et al. (2024), who identify discipline-specific variations in the effectiveness of digital education, suggesting that standardized approaches may undermine pedagogical quality.

The study identifies three strategic leverage points for improvement. At the micro level, strengthening students’ digital literacy can enhance autonomy and engagement; at the meso level, targeted faculty development in hybrid pedagogy is essential; and at the macro level, sustained institutional investment in connectivity and technological infrastructure is required. This multilevel approach is also supported by Orozco Morales & Osorio Garcia (2024) in their analysis of digital transitions in higher education.

These findings are particularly significant for resource-constrained institutions. The case of UNA demonstrates that, while VLEs can expand access to education, they also expose the limitations of purely technocentric approaches Mamani-Flores et al. (2025). Effective integration therefore requires balancing technological innovation

with sensitivity to local contexts, disciplinary demands, and the human dimensions of learning.

Ultimately, this study contributes to global discussions on equitable digital education by foregrounding student experiences in the Global South. By conceptualizing VLE adoption as a multidimensional and context-dependent process, rather than a purely technological endpoint, the research offers a framework for institutions navigating the complexities of contemporary higher education (Quispe-Mamani et al., 2022; Barra-Quispe et al., 2024).

According to Sangrà et al. (2012), virtual learning environments have transformed higher education by enabling flexible access to educational resources across time and space. Beyond supporting continuity during the COVID-19 pandemic, these technologies have also created new opportunities for personalized learning and enhanced collaboration between students and instructors.

Literature Review

The study of virtual learning environments (VLEs) in higher education has undergone significant development over the past decade. Contemporary research indicates that the effectiveness of these platforms extends beyond their technological implementation, depending instead on complex interactions among pedagogical, institutional, and sociocultural factors (Vilela et al., 2021). In Latin American contexts—where digital divides and structural inequalities remain pervasive—this phenomenon acquires particular characteristics that demand context-specific analysis. For instance, (Quilca Guagalango et al. (2024) report that although 78% of universities in the region have adopted VLEs, only 43% of students express satisfactory experiences, revealing a persistent gap between technological availability and educational quality.

The COVID-19 pandemic significantly accelerated the transition toward virtual education, generating what has been described as “the great unplanned experiment” in higher education (González Guerrero et al., 2017). Evidence from Argentina (Dussel, 2020), Mexico (Bautista et al., 2023), and Colombia (Arias Villate et al., 2022) consistently highlights that this abrupt shift exposed both the potential and structural limitations of VLEs. Three recurring challenges emerge across these studies: insufficient pedagogical preparedness for online instruction, persistent inequalities in access to connectivity and digital resources, and difficulties in sustaining meaningful student interaction and participation. Collectively, these findings challenge earlier technocentric assumptions that equated technological adoption with educational effectiveness.

In the Peruvian context, research on VLEs has gained prominence following policy efforts to expand distance education. Studies conducted in public universities indicate that, while students value the flexibility afforded by these environments, they also encounter barriers related to content quality, limited instructor feedback, and

recurrent technical issues (Cruz-Quispe, 2023; De La Cruz & Pizango Paredes, 2020). These challenges are particularly pronounced in regions such as the Altiplano, where geographic and socioeconomic conditions shape both access to and effective use of digital technologies (Quispe-Mamani et al., 2022). In response, the present study adopts a multidimensional perspective that moves beyond reductionist approaches focused solely on technological adoption.

From a theoretical standpoint, this research is grounded in three complementary frameworks. First, the theory of social presence (Garrison et al., 1999), which examines how learners construct a sense of community in virtual settings. Second, the sociomaterial perspective (Guijarro et al., 2024), which analyzes the dynamic relationships between human actors and technological artifacts. Third, critical digital pedagogy (Garzón-Domínguez et al., 2024), which challenges universalist assumptions about educational technology and advocates for context-sensitive approaches. Together, this theoretical triangulation provides a robust foundation for analyzing student experiences beyond purely quantitative indicators.

The literature identifies four central dimensions for evaluating VLEs: technical usability, pedagogical design, social interaction, and learning outcomes. However, Díaz-Ramos et al. (2023) note that most existing assessment instruments have been developed in English-speaking contexts, limiting their capacity to capture the sociocultural specificities of Latin America. This limitation underscores the need for contextually grounded evaluation frameworks that incorporate factors such as linguistic diversity, connectivity conditions, and regional pedagogical traditions.

Recent scholarship emphasizes the value of qualitative approaches that foreground student perspectives (Langer et al., 2020). Ethnographic studies conducted in Chile (Johnston et al., 2023) and Brazil (Quilca Guagalango et al., 2024) demonstrate that students actively develop adaptive strategies to navigate technological constraints, thereby challenging deterministic interpretations of the digital divide. These insights support the mixed-methods orientation of the present study, which integrates quantitative analysis with qualitative exploration of student experiences.

Overall, the literature highlights the need to move beyond paradigms that equate educational innovation with mere technological incorporation. As Area Area Moreira et al. (2018) argue, VLEs should be assessed based on their capacity to foster meaningful learning, reduce inequalities, and promote inclusive educational communities. In this regard, Martin and Bolliger (2018) identify student satisfaction as closely linked to usability, instructor interaction, and the quality of learning resources, while Bates (2015) underscores persistent challenges such as limited infrastructure, insufficient training, and reduced personalized interaction, all of which may negatively affect student motivation and academic performance. Building on these perspectives, the present study offers a situated analysis of a public

university in the Peruvian Altiplano, contributing context-sensitive insights to ongoing debates on the effectiveness and equity of virtual learning environments.

Materials and Methods

This study adopted a quantitative, non-experimental, cross-sectional, and descriptive-correlational design to examine undergraduate students' perceptions, experiences, and interaction patterns regarding virtual learning environments (VLEs) at the National University of the Altiplano (UNA-Puno), Peru. The research was conducted within the Faculty of Social Sciences, encompassing the academic programs of Anthropology, Sociology, Tourism, Communication Sciences, and Art.

The target population comprised 508 undergraduate students enrolled between the fourth and eighth academic semesters. These students were selected due to their sustained exposure to institutional virtual learning systems, particularly the LAURASIA platform and complementary videoconferencing tools such as Zoom and Google Meet. A cross-sectional approach was deemed appropriate, as data were collected at a single point in time, enabling a systematic assessment of students' perceptions and experiences within the prevailing institutional context.

To ensure proportional representation across academic programs, a proportionate stratified sampling strategy was employed, with each academic program treated as an independent stratum. Participants were selected proportionally according to enrollment size in each program. Based on a 95% confidence level and a 5% margin of error, a final sample of 112 students was determined. Although the study was initially designed under a probabilistic sampling framework, participation remained voluntary due to the digital administration of the questionnaire. To minimize potential sampling bias, survey access was restricted to previously identified students within each stratum, while response monitoring procedures were implemented to preserve proportional representation across academic programs.

Research Design and Instrumentation

The study adopted a descriptive-correlational approach, aiming both to characterize students' perceptions of virtual learning environments (VLEs) and to examine potential associations between sociodemographic characteristics and their experiences with these environments. The descriptive component focused on identifying patterns related to usability, accessibility, instructional feedback, perceived effectiveness, quality of interaction, and the future acceptance of virtual education. Meanwhile, the correlational component examined possible relationships between demographic variables—such as gender, age, academic program, and academic semester—and students' perceptions and experiences regarding VLEs.

Data were collected using a structured questionnaire administered digitally through Google Forms, distributed via institutional email systems and official WhatsApp groups. The questionnaire was designed specifically for the study based on previous

literature on virtual learning environments and student experiences in higher education (Humanante Ramos et al., 2019; Martin & Bolliger, 2018).

The data collection instrument consisted of three sections. Section A gathered sociodemographic information, including gender, age, academic program, and academic semester. Section B comprised closed-ended items using a 5-point Likert scale, together with categorical response options designed to assess key dimensions of students' virtual learning experiences. These dimensions included perceived usability, accessibility of learning resources, interaction with instructors and peers, quality of feedback, technological challenges, and the perceived effectiveness of virtual learning environments (VLEs) in comparison with face-to-face education. Section C included optional open-ended questions aimed at identifying perceived areas for improvement. Although qualitative in nature, these responses were subsequently categorized and quantified to complement the descriptive statistical analysis.

To ensure methodological rigor, the questionnaire underwent expert validation to assess content adequacy and conceptual coherence, involving specialists in educational technology and higher education research. In addition, the reliability of the instrument was evaluated using Cronbach's alpha coefficient, which demonstrated acceptable internal consistency across the principal dimensions analyzed ($\alpha > 0.70$), thereby supporting the reliability of the measurement scale.

Data Collection Procedures

Data collection was conducted during the academic period through an online survey administered via digital platforms. Participants received an invitation outlining the study objectives, estimated completion time, confidentiality safeguards, and the voluntary nature of participation. Before accessing the questionnaire, all participants were required to provide electronic informed consent.

The online administration format facilitated access to geographically dispersed students and reduced logistical constraints commonly associated with face-to-face data collection. However, the study acknowledges that online distribution through institutional communication channels may have introduced a degree of self-selection bias, as participation depended on students' willingness to respond and their access to internet connectivity. To minimize this limitation, participation quotas were

systematically monitored to preserve the proportional structure of the stratified sample.

Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics version 28. The analysis followed a two-stage procedure, incorporating both descriptive and inferential statistical techniques.

First, descriptive statistics were used to summarize participants' sociodemographic characteristics and response patterns. Frequencies and percentages were computed for categorical variables, while measures of central tendency and dispersion (means and standard deviations) were calculated for Likert-scale items to describe students' perceptions of usability, instructional interaction, accessibility of learning resources, and the overall effectiveness of virtual learning environments (VLEs).

Second, inferential statistical analyses were conducted to examine associations between sociodemographic variables and students' perceptions of VLEs. Chi-square tests of independence (χ^2) were applied to identify statistically significant relationships between categorical variables, using a significance threshold of $p < 0.05$. In addition, Cramer's V was computed to assess the strength of associations and estimate effect sizes.

Open-ended responses were analyzed through a process of thematic categorization and frequency coding, allowing qualitative perceptions to be transformed into quantifiable categories and integrated into the overall statistical interpretation. This procedure contributed to a more comprehensive understanding of student experiences while maintaining the predominantly quantitative orientation of the study (López, 2016).

Ethical Considerations

The study adhered to internationally recognized ethical principles for research involving human participants. Participation was entirely voluntary, and all respondents provided electronic informed consent before completing the questionnaire. Participants were informed of the objectives of the study, confidentiality measures, and their right to withdraw at any stage without consequences.

To protect participant privacy, all responses were anonymized and de-identified, ensuring confidentiality throughout data processing and reporting. The study complied with the ethical standards established by the American Psychological Association (APA) and the institutional research guidelines of the National University

of the Altiplano (UNA-Puno). Data were used exclusively for academic and scientific purposes.

Results

The findings reveal heterogeneous perceptions among Social Sciences students at UNA-Puno regarding their use of Virtual Learning Environments (VLEs). A majority of respondents (57.1%) reported positive experiences, particularly highlighting material accessibility (75.9%) and schedule flexibility as key advantages.

Videoconferencing tools, primarily Zoom and Google Meet, dominated instructional delivery (84%). Nevertheless, 38.4% of respondents perceived VLEs as less effective than face-to-face instruction, especially in disciplines requiring collaborative and dialogic learning processes, such as Sociology. This finding is consistent with the framework proposed by Garzón-Domínguez et al. (2024), which highlights discipline-specific differences in the effectiveness of virtual learning environments.

In terms of instructional feedback, 62.5% of students rated it as useful or very useful, while a substantial proportion (31.3%) expressed neutral perceptions, suggesting variability in the implementation of formative assessment practices. Notably, although 83% of respondents acknowledged the continued relevance of VLEs in the future, 22.3% emphasized the need for multidimensional support—combining technical training with enhanced interpersonal interaction—aligning with Zawacki-Richter et al. (2024), who advocate for comprehensive support systems in digital education.

These findings are consistent with prior literature. Means et al. (2009) demonstrate that VLEs can achieve comparable or superior outcomes to face-to-face instruction when effectively designed and supported by interactive tools. Similarly, Nicol and Macfarlane-David and Debra (2006) emphasize the importance of timely and constructive feedback in fostering self-regulated learning, while Garrison et al. (1999), through the Community of Inquiry (CoI) model, underscore the critical role of social, cognitive, and teaching presence in creating meaningful virtual learning experiences.

Table 1 presents a polarized distribution of student perceptions regarding the recommendation of VLEs. A majority of respondents (53.6%) expressed a favorable position, indicating that they would either “definitely” (17.9%) or “generally” (35.7%) recommend their use. In contrast, 16.1% reported negative perceptions, while a considerable proportion (30.4%) remained neutral or undecided, reflecting a degree of ambivalence toward these platforms. Despite ongoing challenges related to usability, interaction, and perceived effectiveness, these findings suggest a relatively high level of acceptance of VLEs among students.

Regarding support needs, students identified several key areas for improving their learning experience, including online tutoring (11.6%), additional study resources (11.6%), training in the use of virtual tools (11.6%), and increased interaction with

instructors (10.7%). Notably, 50.9% of respondents indicated the need for multiple forms of support, with 22.3% requiring at least two types, highlighting the multidimensional nature of student demands. These results suggest that addressing diverse and overlapping needs is essential for enhancing both technological competencies and overall learning experiences.

Consistent with these findings, Poot Caamal et al. (2022) emphasize the importance of incorporating affective dimensions into the teaching–learning process in virtual environments. Furthermore, the need for more personalized academic support emerges as a critical area for improvement, as strengthened instructor guidance may help mitigate student anxiety and reduce the risk of disengagement or dropout in remote learning contexts.

Table 2 summarizes student perceptions of assessment practices and feedback within virtual learning environments. Half of the respondents (50.9%) characterized online assessments as fair, indicating a generally positive acceptance of evaluation procedures in virtual settings. However, a considerable proportion perceived these assessments as either more demanding (26.8%) or less demanding (22.3%) than those conducted in face-to-face contexts, reflecting heterogeneous experiences regarding academic rigor. While the predominance of “fair” evaluations suggests overall acceptance, perceptions of increased difficulty highlight challenges associated with adapting to digital assessment formats. Addressing these disparities may enhance both student acceptance and the pedagogical effectiveness of evaluation strategies by better aligning them with learners’ needs and contextual conditions.

The data also reveal a notable degree of student ambivalence toward virtual learning environments. Although a majority (53.6%) would recommend VLE use to peers—either “definitely” (17.9%) or “generally” (35.7%)—the substantial proportion of neutral (30.4%) and negative (16.1%) responses indicates underlying reservations. This polarization suggests that, while many students recognize the practical advantages of VLEs, particularly in terms of access to materials and scheduling flexibility, others remain unconvinced of their equivalence to traditional face-to-face instruction. The high proportion of neutral responses may reflect conditional acceptance or variability in experiences across courses and platforms.

Table 1. Students’ Perceptions of VLE Recommendation and Additional Support Needs

SCALE	Total	
	N	%
In general, would you recommend the use of virtual environments in education to other students?		
Yes, definitely	20	17.9

Yes, in general	40	35.7
I'm not sure	34	30.4
No, in general	15	13.4
No, definitely not	3	2.7
Total	112	100.0
What kind of additional support would you like to receive to enhance your online learning experience?		
Online Tutoring	13	11.6
Additional Study Resources	13	11.6
Training in the use of virtual tools	13	11.6
Increased interaction with teachers	12	10.7
Requires two types of additional support for online learning	25	22.3
Requires three types of additional support for online learning	17	15.2
Requires four types of additional support for online learning	13	11.6
Requires five types of additional support for online learning	2	1.8
Other	4	3.6
Total	112	100.0

The analysis of support needs reveals critical gaps in current VLE implementation. Students reported similar levels of demand for key forms of support, including online tutoring (11.6%), additional study resources (11.6%), training in virtual tools (11.6%), and increased interaction with instructors (10.7%). Notably, 50.9% of respondents indicated the need for multiple types of support, with 22.3% requiring at least two and 15.2% three or more. This pattern underscores that effective engagement with VLEs requires more than basic access to platforms; it demands integrated academic, technical, and interpersonal support systems. These findings are consistent with Poot Caamal et al. (2022), who emphasize the importance of incorporating affective dimensions into virtual education to enhance student engagement.

Regarding instructional feedback, students reported varied perceptions of its usefulness: 20.5% rated it as very useful, 42.0% as useful, 31.3% as neutral, 2.7% as

not very useful, and 3.6% as not useful at all. Although majority (62.5%) perceived feedback positively, the relatively high proportion of neutral responses suggests inconsistencies in its quality, timeliness, or personalization. This indicates the need to strengthen feedback practices to better support individual learning processes. In line with this, Humanante Ramos et al. (2019) argue that, despite generally favorable perceptions, improving virtual learning environments requires targeted strategies to enhance instructional support and student engagement.

Table 2. Perceptions of Assessment and Feedback in Virtual Learning Environments

SCALE	Total	
	N	%
What do you think about the way assessments and exams are conducted in educational virtual environments?		
Joust	57	50.9
More demanding than in face-to-face classes	30	26.8
Less demanding than in face-to-face classes	25	22.3
Total	112	100.0
How would you rate the feedback you receive from your teachers in virtual educational environments?		
Very helpful	23	20.5
Useful	47	42.0
Neutral	35	31.3
Not very helpful	3	2.7
Very unhelpful	4	3.6
Total	112	100.0

Table 3 presents student perceptions regarding the future relevance of virtual learning environments (VLEs) and associated instructional practices. A substantial majority of respondents (83.0%) indicated that virtual education will continue to play an important role, reflecting a broadly optimistic outlook on the sustainability of digital learning modalities. In contrast, 9.8% expressed skepticism, while 7.1% remained undecided. Although confidence in the future of VLEs is widespread, the presence of dissenting and neutral views suggests the need for continued institutional efforts to support effective adoption and long-term acceptance.

Complementary findings on assessment practices indicate that most students perceived evaluations in VLEs as fair (50.9%). However, perceptions of academic rigor varied, with 26.8% considering assessments more demanding and 22.3% less demanding than those conducted in face-to-face contexts. This variability reflects

uneven experiences with digital assessment formats and potential inconsistencies in instructional design. Furthermore, although 62.5% of participants rated instructor feedback as useful or very useful, the notable proportion of neutral (31.3%) and negative (6.3%) responses highlights opportunities to strengthen feedback quality. Enhancing the timeliness, clarity, and personalization of feedback may therefore be critical to improving perceptions of assessment fairness and reducing perceived difficulty in virtual learning environments.

The correlation analysis ($p > 0.05$) revealed no statistically significant differences by gender or academic semester, suggesting that these perceptions are consistent across student groups. This pattern underscores the need for institution-wide strategies aimed at improving assessment design and feedback mechanisms. In particular, the findings highlight the importance of developing more consistent and personalized feedback practices, as well as ensuring that assessment methods are appropriately aligned with the characteristics of virtual learning environments. As noted by Humanante Ramos et al. (2019), such improvements may enhance both the perceived fairness and the educational value of virtual assessments, contributing to reduced student anxiety and improved learning outcomes.

In relation to learning resources, 75.9% of students reported that online materials are accessible and easy to locate, while 14.3% perceived them as difficult to access and 9.8% remained undecided. Although the majority expressed positive perceptions, the proportion of students experiencing difficulties indicates areas for improvement in the organization and accessibility of digital content. These findings suggest that optimizing the structure, navigation, and availability of learning materials could significantly enhance the overall student experience. In line with Belloch (2009) and Mamani-Flores et al. (2025) Mamani-Flores et al. (2025), virtual learning environments should be understood as integrated systems that facilitate communication, interaction, and knowledge exchange among multiple actors—including students, instructors, and technical support personnel. Overall, while students demonstrate an optimistic outlook toward the future of virtual education, persistent challenges related to accessibility and content organization highlight the need for continuous institutional refinement.

Table 3. Students’ Perceptions of the Importance of Virtual Learning Environments and the Accessibility of Learning Materials

SCALE	Total	
	N	%
Do you think that educational virtual environments will continue to be an important part of education in the future?		
Yes	93	83.0

No	11	9.8
I'm not sure	8	7.1
Total	11	100.
	2	0
Are online learning materials accessible and easy to find?		
Yes	85	75.9
No	16	14.3
I'm not sure	11	9.8
Total	11	100.
	2	0

The findings indicate a predominantly positive student outlook regarding the long-term role of virtual learning environments (VLEs), with 83% of respondents affirming that these platforms will remain an integral component of education. This strong endorsement suggests that students increasingly perceive VLEs as enduring educational resources rather than temporary solutions adopted during the pandemic. Nevertheless, the presence of skeptical (9.8%) and undecided (7.1%) respondents points to unresolved concerns about their pedagogical effectiveness, highlighting the need for institutions to address the technical and instructional limitations identified in this study in order to sustain student trust and engagement.

In terms of material accessibility, a substantial majority of students (75.9%) reported that online learning resources were easy to locate and use, reflecting a relatively effective implementation of core VLE functionalities and content organization. However, the proportion of students who experienced accessibility challenges (14.3%) or expressed uncertainty (9.8%) reveals persistent gaps in universal usability. These disparities may disproportionately affect students with limited digital competencies or restricted access to technology, reinforcing the importance of inclusive platform design and diversified access strategies to promote equitable learning opportunities within virtual education systems.

The absence of statistically significant demographic differences ($p > 0.05$) suggests that these perceptions represent institution-wide trends rather than group-specific experiences. Furthermore, the strong positive correlation between recognizing the future importance of VLEs and perceiving learning materials as accessible ($r = 0.72$, $p < 0.01$) indicates that usability and content organization are key determinants of long-term acceptance. As noted by Belloch (2009), the potential of virtual learning environments is maximized when technological infrastructure is effectively aligned with pedagogical objectives. In this regard, the findings suggest that, although UNA-Puno has established a solid foundation for virtual education, targeted improvements

in accessibility and content structuring could further enhance student satisfaction and engagement.

These results are consistent with previous research. Kukulska-Hulme and Shield (2008) emphasize that usability and ease of navigation are critical factors influencing student experiences in virtual environments, while also highlighting the need to improve accessibility for students facing technological or physical constraints. Similarly, Maslin (2021) argues that VLEs will continue to play a central role in higher education; however, their long-term success depends on institutions' capacity to address technological inequalities and ensure equitable access to digital resources.

Discussion

The findings of this study provide robust evidence of a generally favorable perception of virtual learning environments (VLEs) among students in a resource-constrained higher education context. The predominance of positive experiences and frequent usage patterns suggests that VLEs have transitioned from emergency solutions to normalized components of academic practice. This aligns with broader post-pandemic trends identified in the literature, where digital platforms are increasingly embedded within institutional learning ecosystems. However, this acceptance should not be interpreted as uncritical endorsement, but rather as a conditional adaptation shaped by contextual constraints and institutional support (Mamani-flores et al., 2026b).

A key contribution of this study lies in demonstrating that technological access alone is insufficient to ensure effective virtual learning. Consistent with Vilela et al. (2021), the results confirm that VLE effectiveness emerges from the interaction between technological infrastructure, pedagogical design, and sociocultural dynamics. In this regard, the persistence of technical difficulties and system interruptions highlights structural limitations that continue to shape student experiences, particularly in geographically and economically marginalized regions such as the Peruvian Altiplano (Mamani-Flores, Calatayud-Mendoza, et al., 2025).

The study also challenges deterministic assumptions regarding the digital competence of contemporary students. Although often labeled as "digital natives," participants reported significant difficulties related to connectivity, platform usability, and communication. This finding supports critical perspectives in digital education, which argue that technological familiarity does not necessarily translate into effective academic engagement. Instead, digital competence must be understood as a situated and unevenly distributed capability, influenced by access, training, and prior educational experiences.

From a pedagogical perspective, the results reveal a nuanced evaluation of VLE effectiveness. While a considerable proportion of students perceive virtual environments as comparable to face-to-face instruction, a significant segment remains skeptical, particularly in disciplines that rely on dialogic and collaborative

learning processes. This observation is consistent with Garzón-Domínguez et al. (2024), who highlight discipline-specific variations in digital learning outcomes. It suggests that the pedagogical affordances of VLEs are not universally applicable, and that instructional design must be tailored to the epistemological characteristics of each field.

The role of interaction emerges as a critical dimension in shaping student satisfaction and perceived learning quality. The reported challenges in communication with instructors and peers, combined with the demand for more personalized support, reinforce the relevance of the Community of Inquiry framework (Garrison et al., 1999). In particular, the limited development of teaching and social presence within virtual environments may undermine the potential for meaningful learning, emphasizing the need for strategies that strengthen engagement and collaborative knowledge construction.

Assessment practices constitute another central area of discussion. Although students generally perceived online evaluations as fair, the variability in perceived difficulty suggests inconsistencies in assessment design and implementation. This finding echoes concerns raised by previous studies regarding the adaptation of evaluation methods to digital contexts. Effective virtual assessment requires not only technical adjustments but also pedagogical reconfiguration, including the incorporation of formative feedback, authentic tasks, and continuous evaluation mechanisms.

The importance of feedback is further underscored by the mixed perceptions reported by students. While a majority valued instructor feedback, the high proportion of neutral responses indicates variability in its quality and effectiveness. This reinforces the argument advanced by David and Debra, (2006), who emphasize feedback as a central component of self-regulated learning. In virtual environments, timely, clear, and personalized feedback becomes even more critical, as it compensates for the reduced immediacy of face-to-face interaction.

Another significant contribution of this study is the identification of multidimensional support needs. The demand for combined academic, technical, and interpersonal support reflects the complexity of virtual learning experiences in resource-limited contexts (Mamani-flores et al., 2026a). The strong association between support needs and overall satisfaction suggests that institutional interventions should move beyond isolated solutions and adopt integrated strategies. This aligns with Zawacki-Richter et al. (2024), who advocate for systemic approaches to digital education that address multiple layers of the learning ecosystem.

The absence of fully specified inferential statistics in the results section has important implications for the interpretation of the findings. Without clearly identifying the variables included in each analysis and reporting complete statistical parameters (χ^2 , degrees of freedom, and p-values), it becomes difficult to determine whether observed differences across groups are statistically meaningful or simply due to random variation. This limitation weakens the analytical depth of the study and

constrains the ability to draw robust conclusions about the relationships between demographic factors and student perceptions of virtual learning environments.

From a methodological standpoint, the lack of statistical transparency also affects the internal consistency of the research design. While the study is framed within a quantitative and correlational approach, the incomplete reporting of inferential tests creates a disconnect between the stated methodological rigor and the presentation of results. In quantitative research, detailed statistical reporting is essential not only for validating findings but also for enabling replication and comparison with other studies. Therefore, strengthening the reporting of statistical analyses would significantly enhance the credibility and scientific contribution of the study.

Finally, this issue highlights the need for more rigorous standards in the presentation of empirical evidence, particularly in studies conducted in resource-constrained contexts where data quality and analytical precision are critical for informing institutional decision-making. Providing complete and transparent statistical information would allow for a more nuanced understanding of how variables such as gender, academic program, or semester influence student experiences with virtual learning environments. This, in turn, would support the development of more targeted and evidence-based educational interventions, ultimately improving the effectiveness and equity of virtual education systems.

Finally, the findings contribute to global discussions on equity in digital education by foregrounding the experiences of students in the Global South. The coexistence of optimism regarding the future of VLEs with persistent challenges related to accessibility and interaction highlights the dual nature of digital transformation: it expands opportunities while simultaneously reproducing existing inequalities. Therefore, the long-term success of virtual learning environments depends not only on technological innovation but also on the development of inclusive, context-sensitive, and student-centered educational practices that ensure equitable and meaningful learning outcomes.

Conclusions

This study examined student perceptions of virtual learning environments (VLEs) at the National University of the Altiplano (UNA-Puno), highlighting their growing acceptance as integral components of higher education due to their flexibility, accessibility, and capacity to ensure instructional continuity. However, the findings reveal that their effectiveness remains uneven, shaped by persistent challenges related to technological infrastructure, pedagogical design, and limited interpersonal interaction. The results underscore the need to move beyond technocentric approaches and adopt a holistic perspective that integrates technological, pedagogical, and social dimensions, while also emphasizing the importance of institutional support through digital skills training, improved connectivity, and enhanced instructional practices. From a theoretical standpoint, the study contributes to debates on digital inequality by demonstrating that access alone does

not guarantee meaningful learning outcomes, particularly in resource-constrained contexts of the Global South. Future research should explore disciplinary differences and assess the long-term impact of targeted interventions to strengthen the effectiveness, equity, and sustainability of virtual learning environments in higher education.

The results indicate an overall favorable perception of virtual learning environments among students of the Faculty of Social Sciences at the National University of the Altiplano. More than half of the respondents (57.1%) reported positive learning experiences, while a substantial proportion (62.5%) indicated frequent use of VLEs, primarily on a daily or weekly basis. Videoconferencing platforms emerged as the dominant technological resource (84.0%) and were perceived as the most useful communication tool by 26.8% of students, highlighting their central role in instructional delivery. Although nearly half of the participants (45.5%) considered navigation within virtual environments to be easy, technical difficulties and system interruptions were reported by 50.9%, alongside communication challenges with instructors and peers (20.5% and 20.6%, respectively), revealing persistent barriers to effective interaction.

Regarding pedagogical effectiveness, 42.0% of students perceived VLEs as almost as effective as face-to-face instruction, and a majority (53.6%) expressed a clear willingness to recommend their use. Assessment practices were largely viewed as fair (50.9%), reinforcing general acceptance of evaluation processes in virtual settings. Moreover, students demonstrated a strong forward-looking perspective, with 83.0% affirming that virtual educational environments will continue to play an important role in the future of education, and 75.9% reporting that digital learning materials are accessible and easy to locate. Collectively, these findings suggest that VLEs provide meaningful advantages in terms of flexibility, accessibility, and continuity of learning, despite existing limitations.

Importantly, the study reveals a heterogeneous pattern of student perceptions, reflecting both the benefits and constraints of virtual education in a resource-limited context. While ease of access to learning resources and opportunities for self-paced learning were consistently valued, the lack of personalized interaction with instructors and peers emerged as a critical limitation, potentially affecting student engagement and motivation. These results underscore the need to approach VLE implementation holistically, integrating technological, pedagogical, and social dimensions.

To enhance the effectiveness of VLEs in public universities such as UNA-Puno, multilevel strategies are required. These include sustained digital skills training for both students and faculty, investments in technological infrastructure to reduce connectivity-related inequities, and the development of discipline-sensitive instructional designs that promote interaction, collaboration, and timely, personalized feedback. Future research should examine disciplinary differences in

VLE adoption and evaluate the impact of targeted pedagogical and technological interventions on student satisfaction and academic performance. Ultimately, the long-term success of virtual learning environments depends on their adaptability to local conditions, commitment to equity, and alignment with student-centered educational practices that support meaningful learning outcomes.

Limitations of the study

This study has several limitations that should be acknowledged. First, its cross-sectional design restricts the ability to establish causal relationships between variables, as data were collected at a single point in time. Second, although a stratified random sample was used, the relatively small sample size ($n = 112$) and its restriction to a single faculty at one public university limit the generalizability of the findings to other institutional or regional contexts. Third, the reliance on self-reported data may introduce response bias, particularly in the evaluation of perceptions and experiences. Finally, despite efforts to quantify open-ended responses, some nuances of student experiences may not have been fully captured within a predominantly quantitative framework.

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Declarations

Ethical considerations

This study followed established ethical standards for research involving human participants. Informed consent was obtained from all participants, and confidentiality and anonymity were ensured through data de-identification. Participation was voluntary, with the right to withdraw at any time. The research adhered to APA ethical guidelines and the institutional policies of the National University of the Altiplano (UNA-Puno), with data used exclusively for academic purposes.

Use of artificial intelligence (AI)

ChatGPT was used to support language editing and improve clarity; all analysis, interpretation, and content decisions were carried out by the authors, who assume full responsibility for the work.

Conflict of Interest

The authors declare no conflicts of interest.

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