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Evaluation of a solidary academic-pedagogical project in virtual graduate programs

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The consolidation of virtual education as a strategic modality in postgraduate training requires rigorous evaluations of its relevance from the student perspective. For this reason, this research aimed to compare the perceptions of students in two virtual master's programs at the National Open and Distance University, developed under the Solidarity Pedagogical Academic Project model focused on collaboration, equity, and social commitment to strengthen learning in virtual environments. These aspects were analyzed, taking into account five key areas of this approach, namely educational resources, teaching support, assistance and guidance, pedagogical mediation, and humanistic training. The study adopted a quantitative, non-experimental, comparative cross-sectional approach. Structured surveys were applied according to the Likert scale with 25 items distributed across the areas mentioned above. To validate the statistical assumptions, tests of normality (Shapiro–Wilk), homoscedasticity (Breusch–Pagan), and independence (chi-square) were performed, determining the absence of normality, the presence of homogeneous variances, and independence between data. Based on these results, Yuen's robust test was used to compare the medians between the groups. The results revealed that there are no statistically significant differences between the perceptions of the two groups and demonstrated the robustness and consistency of virtual learning environments, highlighting their ability to offer equitable, student-centered learning experiences aligned with high-quality standards. The effectiveness of the supportive instructional model in diverse virtual contexts is reaffirmed.

KEYWORDS

virtual education, higher education, student satisfaction, humanistic education, masters programs

1 Introduction

In the Colombian context, although significant progress has been made in the provision of virtual postgraduate programs, structural tensions persist that hinder the consolidation of virtual education focused on the needs and experiences of students. Deficiencies remain in key areas such as the quality and relevance of educational resources, teacher support, academic guidance, pedagogical mediation, and the incorporation of a humanistic perspective into education. Concerning digital resources, many of the current proposals lack a coherent pedagogical design, which limits their ability to foster autonomy, critical thinking, and meaningful appropriation of knowledge (Van Dorresteijn et al., 2025). This problem is exacerbated at the postgraduate level, where the complex and specialized nature of the content requires rigorous, contextualized, and diversified teaching materials.

Pedagogical mediation is a fundamental element in virtual education. However, in many cases, teaching practices in online settings are reduced to the unidirectional delivery of content, with little to no dialogic engagement, thus impeding the collaborative construction of knowledge. For pedagogical mediation to be effective, it must involve active strategies that encourage critical thinking, dialogue, and contextualized learning, while leveraging digital tools in purposeful and meaningful ways (Arancibia et al., 2020; Cabero-Almenara and Palacios-Rodríguez, 2021). When these dynamics are absent, the potential of virtual environments to foster authentic, situated, and transferable learning is significantly diminished. Additionally, the lack of structured, face-to-face interaction within virtual programs has been shown to affect students' ability to self-regulate, maintain discipline, and stay engaged, thereby compromising their academic performance (Alastor et al., 2023).

Finally, the dehumanization of the educational process has emerged as a growing concern. When intensive virtualization is not accompanied by a pedagogical approach centered on the learner, it can result in depersonalized practices where technical aspects overshadow human relationships. The absence of meaningful human interaction in digital environments may lead to emotional isolation, a weakened sense of belonging, and a diminished overall learning experience (Castro-Inostroza et al., 2020; García-Naranjo, 2021; Herrera-Herrera, 2019; Koon, 2023; Robles-Cardoso and Muñoz-Díaz, 2020). Simultaneously, the persistence of the digital divide disproportionately affects students in rural and low-income communities, restricting equitable access to virtual learning opportunities and further entrenching long-standing structural inequalities (Ezcurra, 2011; Marginson, 2016).

UNAD's PAPS is the backbone of its institutional educational model and is projected as a Latin American benchmark for the development of virtual education with a deep social commitment. Its design organically integrates three interdependent levels: philosophical foundations, which guide the institutional vision and mission; axiological foundations, which define the values and guiding principles of educational practice; and practical-operational foundations, which articulate these principles with concrete implementation in academic, pedagogical, and community processes (Universidad Nacional Abierta y a Distancia UNAD de Colombia, 2025).

The axiological underpinning of the model is articulated through foundational principles including solidarity, equity, social justice, autonomy, inclusion, and ethical commitment. These principles transcend mere institutional discourse, functioning as operative criteria that guide praxis. Solidarity is operationalized through proactive support mechanisms and the cultivation of learning communities; equity and inclusion are enacted via strategic interventions aimed at guaranteeing access and retention for students hailing from diverse sociocultural milieus; autonomy is fostered through pedagogical methodologies designed to enhance self-directed learning and critical thinking capacities; and social justice is concretized in the institution's commitment to community empowerment and territorial transformation. These postulates are consonant with Nussbaum's (2010) capabilities approach, which posits the expansion of substantive freedoms as a core objective of education.

Key components of the model include contextualized curriculum design, featuring programs relevant to the sociocultural and productive realities of the regions (Henao-Álvarez et al., 2022);

innovative pedagogical mediation that incorporates active, collaborative, and problem-based methodologies supported by interactive digital resources (Sangrá et al., 2022); comprehensive support addressing academic, psychosocial, vocational, and socio-emotional aspects (Martínez, 2020); formative and ethical assessment grounded in continuous feedback, academic integrity, and the development of self-regulation (Sepúlveda-Parrini et al., 2024); and social and community outreach initiatives that link education with projects impacting local communities and strengthen the university-community relationship (Cohen, 2020).

From an academic perspective, this research is justified by its contribution to the critical study of pedagogical proposals that, like the Solidarity Academic Pedagogical Project (PAPS), articulate humanistic principles with the use of emerging educational technologies. In a scenario characterized by a proliferation of models focused exclusively on technical efficiency or the achievement of operational competencies, the solidarity approach represents an alternative that seeks to balance academic excellence (Araya-Muñoz and Majano-Benavides, 2022; Bobadilla et al., 2020; Martín-Lucas, 2021; Ros, 2011). Assessing its implementation within virtual master's programs facilitates the generation of empirical evidence that informs the development of more robust and contextually relevant models for digital learning environments, while also promoting the continuous enhancement of pedagogical practices in higher education.

From a social standpoint, this research addresses the imperative to ensure that virtual education does not become a source of exclusion or educational dehumanization. In Colombia, virtual learning has served as a vital access point for populations traditionally marginalized from face-to-face education, including rural residents, individuals with work or family obligations, and communities facing mobility challenges (Gobierno Nacional de Colombia, 2023). However, expanding access alone does not guarantee equity or academic success (Segovia-García et al., 2022). There is an urgent need to develop educational models that acknowledge student diversity, foster meaning-making, critical thinking, and citizenship education, and provide comprehensive support, guidance, and quality throughout the educational process. With its focus on solidarity, inclusion, and social transformation, the Solidarity Academic Pedagogical Project (PAPS) emerges as a promising model warranting thorough analysis (Álvarez Romero and Guevara Rodríguez, 2022).

From an institutional viewpoint, the study is relevant for strategic decision-making on strengthening pedagogical processes in virtual postgraduate programs. In particular, for UNAD, which has been a pioneer in the implementation of PAPS, having empirical evidence on student perceptions of the model's effectiveness is key to guiding innovation, quality assurance, and continuous improvement processes (Leal-Afanador, 2021). Likewise, the results can offer valuable insights for other institutions interested in adopting or adapting pedagogical models with a humanistic and solidarity-based approach, especially in contexts where accelerated virtualization has left gaps in pedagogy and ethics.

In recent years, research on the quality and relevance of virtual education in postgraduate programs has shown significant progress, as well as pending challenges. In Colombia, Molina-Vásquez (2022) proposed an evaluation model that integrates key variables such as curricular coherence, student attention, and digital content generation in Colombian public universities, constituting a relevant framework for the institutional evaluation of virtual modalities. However, this

model has not been validated in the specific context of the Solidarity Academic Pedagogical Project (PAPS), which leaves open the question of its applicability in this pedagogical proposal.

In a similar vein, [García-Naranjo \(2021\)](#) found that the most effective pedagogical practices in virtual environments are those that integrate individual, social, and cultural dimensions, promoting active and meaningful learning. This finding converges with the PAPS in its interest in comprehensive training and ethical mediation, although its approach does not delve into the community and solidarity nature of this model. For his part, [Moreno-Salamanca \(2021\)](#) demonstrated that cooperative strategies enhance interaction and collaborative learning, based on Vygotsky's theory, which coincides with the participatory philosophy of the PAPS, although his study focused more on academic performance than on the ethical and social implications of learning.

At the regional level, [Araya-Muñoz and Majano-Benavides \(2022\)](#) in Costa Rica pointed out that, despite having solid technological infrastructure, limited pedagogical mediation persists, with a predominance of lectures, which contrasts with the PAPS, which prioritizes active and horizontal methodologies. In the European context, [Alastor et al. \(2023\)](#) analyzed the virtual university experience in Spain, identifying advances in autonomy and digital skills, but also shortcomings in innovation and pedagogical communication, aspects that PAPS seeks to address through its emphasis on meaningful interaction and constant support. Similarly, [Díaz-Guillen et al. \(2021\)](#) emphasized the importance of pedagogical methodologies that foster learner autonomy and promote digital inclusion, core elements also embedded in the solidarity-based approach of the PAPS. Complementing this perspective, [Pereira-Hernández \(2024\)](#), in a study conducted in Mexico, underscored the significance of sustained teacher support and the personalization of digital learning resources. These aspects resonate with the PAPS's emphasis on relational proximity and the humanization of the virtual educational experience.

The purpose of this study is to compare student perceptions across two UNAD online master's programs, Pedagogical Mediation and Education, both implemented under the Solidarity Academic Pedagogical Project model. Specifically, the study evaluates the five foundational pillars of the model: educational resources, teaching support, guidance and counseling, pedagogical mediation, and humanistic training. This evaluation aims to validate the relevance and effectiveness of the PAPS pedagogical approach in virtual postgraduate education.

Are there significant differences in students' perceptions of the quality of the five pillars of the solidarity-based pedagogical model (educational resources, teacher support, guidance and counseling, pedagogical mediation, and humanistic training) between the master's programs in Pedagogical Mediation and Education at UNAD?

Null hypothesis (H_0): There are no statistically significant differences in students' perceptions of the five pillars of the solidarity-based pedagogical model between the master's programs in Pedagogical Mediation and Education at UNAD.

2 Methodology

This study adopted a quantitative, non-experimental, cross-sectional comparative design, which was selected for its suitability in

capturing and analyzing variations in perceptions among distinct participant groups within a defined period. This approach allows for identifying statistically significant differences between cohorts without the need for experimental manipulation, aligning with the study's objective of evaluating perceptions of the Solidarity Academic Pedagogical Project (PAPS) across different programs. Comparative cross-sectional designs have been widely recommended in educational research when the aim is to analyze current conditions and relationships among variables in natural settings ([Creswell and Creswell, 2018](#)).

2.1 Sample size justification

The study population included students from two master's programs who were actively enrolled during the 2025 period in which the instrument was applied, and a small group of graduates from both programs. Although both the control and experimental groups were enrolled in master's programs implemented under the Solidarity Academic Pedagogical Project (PAPS), their academic focus led to differentiated emphasis on the foundational pillars of the model: educational resources, teacher support, guidance and counseling, pedagogical mediation, and humanistic training.

The experimental group, composed of students from the Master's in Pedagogical Mediation, demonstrated a stronger alignment with the pedagogical mediation pillar. This group engaged in a curriculum designed to transform teaching practices through interactive, collaborative, and problem-based methodologies. Pedagogical mediation in this context was not limited to instructional delivery but was conceptualized as an active, student-centered approach aimed at fostering autonomy, critical thinking, and reflective practice, core elements emphasized by the PAPS.

In contrast, the control group, comprised of students from the Master's in Education, placed greater emphasis on the humanistic training and teacher support pillars. This program's broader pedagogical perspective emphasized education as a vehicle for ethical formation and social transformation, consistent with PAPS values such as equity, solidarity, and justice. The role of teacher support was also more prominent in this group, with a focus on mentorship, academic accompaniment, and pedagogical leadership as key components of their training.

This differentiation in emphasis reflects the unique academic trajectories and intended professional roles associated with each program, even as both operate under the shared philosophical and axiological foundations of the PAPS model.

A non-probabilistic convenience sampling approach was employed, based on participants' accessibility and voluntary consent to participate ([Cohen, 2020](#)). The final sample comprised $n = 44$ individuals who completed the survey anonymously. Of these, 59.1% were enrolled in the Master's in Pedagogical Mediation and 40.9% in the Master's in Education. Gender distribution was balanced, with a slight predominance of women (52.3%). In terms of age, the largest proportion fell within the 31–40 range (45.7%), followed by those aged 20–30 (41.3%), and a smaller segment aged 41–50 (8.7%).

While the sample size may be considered modest, it is appropriate for exploratory and descriptive research in virtual postgraduate education, where enrollment numbers and voluntary participation frequently limit access to respondents.

Methodological literature indicates that samples of this magnitude are adequate for detecting medium effect sizes with acceptable statistical power in comparative analyses, particularly when the purpose is to produce preliminary evidence and identify trends to guide future, larger-scale investigations (Onwuegbuzie and Collins, 2017).

2.2 Instrument reliability

The instrument employed in this research underwent a reliability analysis using Cronbach's alpha, yielding a coefficient of 0.89, which indicates high internal consistency according to conventional thresholds (George and Mallery, 2019). This result confirms that the set of items effectively measures the intended constructs of digital educational resources, teacher accompaniment, mediation, and humanistic focus, ensuring robustness in data interpretation.

The data collection instrument consisted of a structured survey composed of 25 items, distributed across the five axes of the solidarity-based pedagogical model: educational resources, teacher support,

guidance and counseling, pedagogical mediation, and humanistic training. Each item was rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree), which allowed for the quantification of student perceptions regarding each dimension of the model. The axes served as variables for analysis. Table 1 describes the questions asked for each variable.

Data analysis included both descriptive and inferential statistical techniques. The descriptive analysis involved creating tables to compare results between control and experimental groups. Box-and-whisker plots were also employed to visually assess data distribution and detect outliers. For the inferential analysis, assumptions of normality, homoscedasticity, and independence were tested. Normality was assessed using the Shapiro–Wilk test, homoscedasticity with the Breusch–Pagan test, and independence via the chi-square test. Results indicated a lack of normality but confirmed homogeneity of variances and independence among data. Based on these findings, the robust Yuen test was applied, which is appropriate for comparing medians in nonparametric samples with outliers. Statistical analyses were performed using the free software RStudio (Wilcox, 2020).

TABLE 1 Model axes and analysis questions.

Variable	Subcategory	Question number	Question
Digital educational resources	Clarity of materials	Q1	Are the educational materials provided clear and easy to understand?
	Multimedia resources	Q2	Do the multimedia resources (videos, presentations, simulations) enhance my learning?
	Virtual platform	Q3	Does the virtual platform contain all the necessary materials to follow the course?
	Content updating	Q4	Are the contents updated and relevant to the topics covered?
	Device accessibility	Q5	Can I easily access the resources from any device?
Teacher support	Response time	Q6	Does the teacher respond to my questions in a reasonable amount of time?
	Feedback	Q7	Do I receive useful feedback on my activities and assessments?
	Dialogue encouragement	Q8	Does the teacher encourage participation and dialogue in virtual classes?
	Respectful environment	Q9	Is a respectful and supportive environment promoted in the virtual classroom?
	Pedagogical strategies	Q10	Does the teacher use appropriate pedagogical strategies for the virtual setting?
Support and guidance	Technical support	Q11	Do I know who to turn to in case of technical or academic difficulties?
	Communication channels	Q12	Does the institution provide effective communication channels for resolving issues?
	Platform orientation	Q13	Have I received clear guidance on how to use the virtual platform?
	Academic support	Q14	Do I feel supported in my learning process throughout the course?
	Supplementary resources	Q15	Are supplementary resources provided to reinforce the content covered?
Pedagogical mediation	Teacher as guide	Q16	Does the teacher act more as a guide than a transmitter of information?
	Personal development	Q17	Are personal skills promoted in addition to academic knowledge?
	Learning organization	Q18	Are my learning pace and style respected in the virtual environment?
	Autonomy and critical thinking	Q19	Does the course foster autonomy and critical thinking?
	Individual appreciation	Q20	Do I feel valued as a person within the educational process?
Humanistic education	Personal reflection	Q21	Do course activities promote personal reflection and self-awareness?
	Teacher empathy	Q22	Does the teacher show empathy and understanding toward students' personal situations?
	Meaningful learning	Q23	Is meaningful learning connected to real life and students' interests encouraged?
	Inclusion and diversity	Q24	Is student diversity in experiences, contexts, and knowledge taken into account?
	Student participation	Q25	Do I feel that my opinions and participation are valued during the course?

2.3 Data analysis

In the analysis of responses to variables related to perceptions of digital educational resources, teacher support, guidance, pedagogical mediation, and humanistic training, an asymmetrical pattern was observed in the distribution of data. Both the tables and graphs showed that the responses “agree” and “strongly agree” emerged as the most representative, while responses of dissatisfaction and neutrality appeared, for the most part, as outliers. Figure 1 shows the boxplots for the control group’s responses.

In the experimental group, there was a decrease in atypical data compared to the control group, leading to the conclusion that there was greater homogeneity of data in the experimental group. Figure 2 shows the boxplots for the responses of the experimental group.

2.3.1 Digital educational resources variable

This is studied in consideration of five subcategories in which educational materials, multimedia resources, virtual platforms, content updates, and ease of access to resources are evaluated. When asked whether the educational materials provided were easy to understand, 88.5% of respondents gave a favorable opinion. In the experimental group, the percentage of favorability was 88.9%. As additional data, it was observed that there were no dissenting responses in the experimental group. When evaluating whether multimedia resources (videos, presentations, simulations) enrich learning, 83.8% of respondents in the control group expressed satisfaction, and 88.9% did so in the experimental group.

When asked whether the virtual platform contains all the necessary material to follow the course, the data showed that 88.4% of the subjects in the control group expressed satisfaction with the platform used, a figure that increased to 94.4% in the experimental group. It should be noted that no one in the experimental group had an unfavorable opinion on this question, compared to 7.7% of those in the control group. Regarding the updating and relevance of the content, 11.1% of the people in the experimental group disagreed with

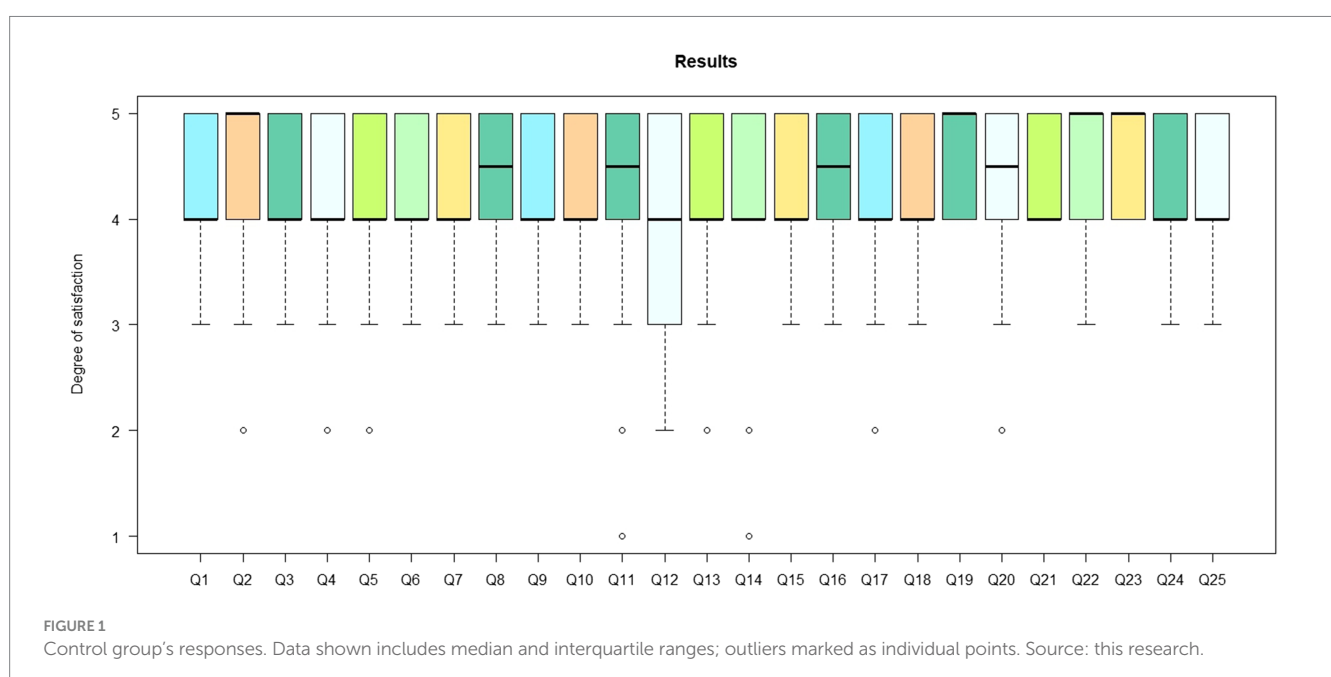
this item, while 11.5% of those in the control group did so. 84.6% of the subjects in the control group and 83.3% of those in the experimental group were satisfied with the content provided. It is worth noting here that there was a higher percentage of people who were dissatisfied with the updating and relevance of the content.

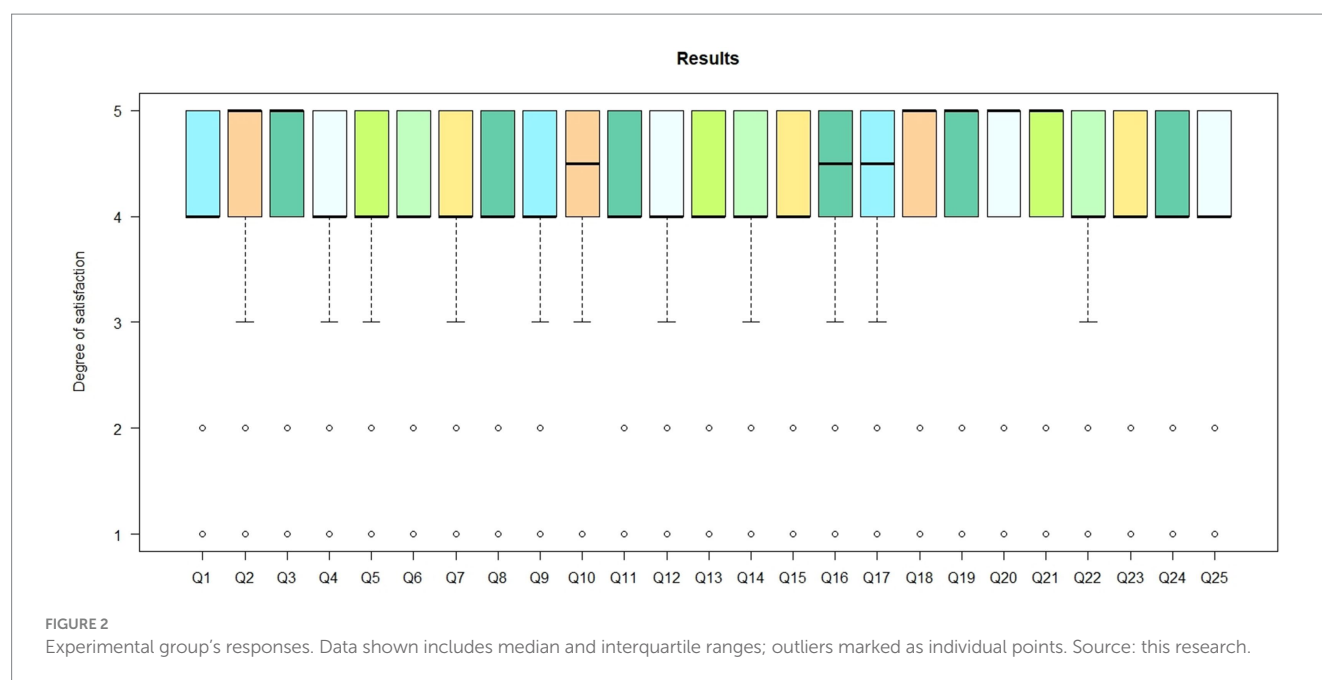
Finally, for this variable, regarding the ease of access to resources from any device. This study reveals that 11.5% of the control group objected, a similar finding to that observed in the experimental group (11.1%). 3.8% of the control group were neither for nor against, compared to 11.1% of the experimental group. 84.7% of the subjects in the control group found points in favor of access to educational resources, while in the experimental group, the percentage of acceptance was only 77.7% of those surveyed. Table 2 summarizes the above ideas.

2.3.2 Teacher support variable

When inspecting the reasonable time taken to answer questions. This research demonstrates that, in the control group, there were no people who agreed or disagreed, 15.4% gave a negative response, and 84.7% gave a favorable response to this event. In the experimental group, there were no dissatisfied responses, and 88.9% said they were satisfied with the time given by the teacher to answer questions. When examining feedback on activities and assessments, 80.8% of the control group gave a favorable opinion, while 11.5% gave a negative rating. In the experimental group, there were no negative responses, and 88.9% of individuals said they were satisfied with the feedback provided, while 11.1% did not give an opinion.

In the analysis of whether the teacher encourages participation and dialogue in virtual classes, this research points to 88.5% of the subjects in the control group agreed or strongly agreed, while in the experimental group, the favorability rating rose to 88.9%. As additional data, the analysis highlights that there were no disagree responses in the experimental group. Regarding promoting an atmosphere of respect and support in the virtual classroom, in the control group, 46.2% strongly agreed and 34.6% agreed. In the experimental group,





38.9% strongly agreed and 44.4% agreed, highlighting that in the control group there was more favorability for choosing the strongly agree option.

On the other hand, when examining whether the teacher uses appropriate teaching strategies for the virtual environment, this study uncovers that 50% of the control group strongly agreed and 30.8% agreed. In the experimental group, 38.9% strongly agreed and 44.4% agreed, there were no disagreements, and 16.7% did not express an opinion on the matter. [Table 3](#) summarizes the above ideas.

2.3.3 Support and guidance variable

84.6% of the control group subjects responded that they knew whom to turn to in case of technical difficulties, in contrast to 15.4% who gave an unfavorable rating of the experiment. In the experimental group, the percentage of favorable responses decreased to 77.8, 11.2% gave an unsatisfactory rating, and 11.1% did not express an opinion. 34.6% of the subjects in the control group strongly agreed with the communication channels proposed for solving problems, while 42.3% agreed. In the experimental group, 33.3% strongly agreed and 38.9% agreed. It is noteworthy that in the experimental group, 16.7% disagreed, exceeding the 15.4% recorded as unsatisfactory responses in the control group.

For the item, clear guidance on the use of the virtual platform, 84.7% of the control group expressed satisfaction, while 15.4% expressed dissatisfaction. In the experimental group, the satisfaction rate dropped to 83.3%, and there was an increase in the number of people who preferred to express neither agreement nor disagreement. 84.6% of the control group said they felt supported in the learning process throughout the course, 11.5% gave an unsatisfactory response, and 3.8% said they neither agreed nor disagreed. In the experimental group, 83.3% were satisfied with the learning support, and 16.7% were dissatisfied. Regarding complementary resources to reinforce the content covered, 88.5% of the control group was satisfied with what was provided, compared to 11.5% who were not. In the experimental group, the satisfaction rate rose to 88.9%, with no one expressing

dissatisfaction, but 11.1% neither agreed nor disagreed. [Table 4](#) summarizes the above ideas.

2.3.4 Pedagogical mediation variable

Half of the respondents in both the control and experimental groups expressed strong agreement in rating the teacher as a guide in the learning process. Additionally, 30.8% of the control group agreed, compared to 44.4% of the experimental group. When evaluating the development of personal skills alongside academic knowledge, half of the control group strongly agreed, whereas only 27.8% of the experimental group did so. The “agree” option was selected by 34.6% of the control group and 55.6% of the experimental group. The percentage of dissatisfaction was higher in the control group (11.5%) compared to the experimental group (5.6%). 84.6% of the control group expressed satisfaction with the timing and learning styles within the virtual environment, while 15.4% disagreed. In the experimental group, the favorability percentage was 88.9, 11.1% were neutral, and no dissatisfaction was reported. Regarding autonomy and critical thinking, 88.5% of the control group agreed or strongly agreed that these skills are fostered in class, while 11.5% disagreed. No negative responses were found in the experimental group; 55.6% strongly agreed and 44.4% agreed.

When assessing whether students feel valued as individuals within the educational process, 65.4% of the control group strongly agreed and 19.2% agreed. In the experimental group, half of the respondents strongly agreed, 33.3% agreed, and 5.6% expressed dissatisfaction. [Table 5](#) summarizes the above findings.

2.3.5 Humanistic education variable

When examining whether the course activities promote personal reflection and self-awareness, 65.4% of the control group strongly agreed, compared to 44.4% of the experimental group. Additionally, 23.1% of the control group agreed, while 55.6% of the experimental group agreed. It was observed that 11.5% of the control group expressed dissatisfaction with these aspects, whereas no unfavorable

TABLE 2 Descriptive analysis—variable: digital educational resources.

Question	SD (%)		D (%)		N (%)		A (%)		SA (%)	
	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental
Q1	7.7	0	3.8	0	0	11.1	50	55.6	38.5	33.3
Q2	7.7	0	3.8	5.6	3.8	5.6	30.8	33.3	53.8	55.6
Q3	7.7	0	3.8	0	0	5.6	34.6	50	53.8	44.4
Q4	7.7	0	3.8	11.1	3.8	5.6	42.3	44.4	42.3	38.9
Q5	7.7	0	3.8	11.1	3.8	11.1	46.2	33.3	38.5	44.4

Percentages rounded to one decimal place; SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.
Source: This research.

TABLE 3 Descriptive analysis—variable: teacher support.

Question	SD (%)		D (%)		N (%)		A (%)		SA (%)	
	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental
Q6	7.7	0	7.7	0	0	11.1	46.2	50	38.5	38.9
Q7	7.7	0	3.8	0	7.7	11.1	46.2	50	34.6	38.9
Q8	7.7	0	3.8	0	0	11.1	42.3	38.9	46.2	50
Q9	7.7	0	7.7	0	3.8	16.7	34.6	44.4	46.2	38.9
Q10	7.7	0	0	0	11.5	16.7	30.8	44.4	50	38.9

Percentages rounded to one decimal place; SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.
Source: This research.

TABLE 4 Descriptive analysis—variable: support and guidance.

Question	SD (%)		D (%)		N (%)		A (%)		SA (%)	
	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental
Q11	7.7	5.6	7.7	5.6	0	11.1	50	27.8	34.6	50
Q12	7.7	0	7.7	16.7	7.7	11.1	42.3	38.9	34.6	33.3
Q13	7.7	0	7.7	5.6	0	11.1	46.2	44.4	38.5	38.9
Q14	7.7	5.6	3.8	11.1	3.8	0	50	50	34.6	33.3
Q15	7.7	0	3.8	0	0	11.1	50	50	38.5	38.9

Percentages rounded to one decimal place; SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.
Source: This research.

TABLE 5 Descriptive analysis—variable: pedagogical mediation.

Question	SA (%)		D (%)		N (%)		A (%)		SA (%)	
	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental
Q16	7.7	0	3.8	0	7.7	5.6	30.8	44.4	50	50
Q17	7.7	0	3.8	5.6	3.8	11.1	34.6	55.6	50	27.8
Q18	7.7	0	7.7	0	0	11.1	30.8	50	53.8	38.9
Q19	7.7	0	3.8	0	0	0	30.8	44.4	57.7	55.6
Q20	7.7	0	7.7	5.6	0	11.1	19.2	33.3	65.4	50

Percentages rounded to one decimal place; SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.
Source: This research.

responses were found in the experimental group. Eighty-four-point 7% (84.7%) of the control group indicated that the teacher shows empathy and understanding toward students' situations, while 11.5% disagreed. In the experimental group, the favorability percentage was 88.9%, with no unfavorable responses, and 11.1% were neutral.

Furthermore, 84.7% of the control group stated that meaningful learning connected to real life and student interests is encouraged, while 15.4% expressed dissatisfaction. No negative responses were reported in the experimental group, where 44.4% agreed and 55.6% strongly agreed. Regarding the consideration of diversity in students' experiences, contexts, and knowledge, 84.6% of the control group expressed satisfaction, while 15.4% were dissatisfied. In the experimental group, satisfaction rose to 94.5%, with no dissatisfied responses, and only 5.6% remained neutral.

Finally, when asked whether students' opinions and participation were taken into account during the course, 84.7% of the control group expressed satisfaction. This percentage increased to 88.9% in the experimental group, where no unfavorable responses were recorded. Table 6 summarizes these results.

In the inferential analysis, the means of the subcategories of each variable within the control group were compared to determine whether significant differences existed between them. Subsequently, a comparison was made between the subcategories of the corresponding variables from the experimental and control groups, to identify significant differences between the two groups.

The comparison of means was performed using analysis of variance (ANOVA), with the decision criterion based on the p -value at a 5% significance level. The hypotheses to be tested for comparing the means of each subcategory within the control and experimental groups were:

Null hypothesis: The means among the subcategories of each variable are equal for both the control and experimental group. **Alternative hypothesis:** At least one pair of means differ

Table 7 displays the p -values obtained from the analysis, which indicate that there is insufficient evidence to reject the null hypothesis. The table also reports the effect size coefficients, which were analyzed based on the classification proposed by Joaquín Amat (2016) who argues that a value of 0.01 is considered a small effect, 0.06 a medium effect, and 0.14 a large effect.

Overall, the computational output revealed mostly small effect sizes, suggesting a limited influence of the independent variable on the dependent variable. Only two coefficients (0.06 and 0.04) approached or reached the threshold for a medium effect, indicating slightly more substantial, though still moderate, effects in those specific comparisons. In this case, the effect size was calculated using the ratio appropriate for ANOVA designs, offering a complementary measure of practical significance beyond statistical significance.

$$n^2 = \frac{\text{Sum of Squares Between Groups}}{\text{Total Sum of Squares}}$$

Using the Shapiro–Wilk test at a 5% significance level, it was determined that the data from both the control and experimental groups did not follow a normal distribution and that the residuals did not have a zero mean. However, homogeneity of variances was

confirmed through the Breusch–Pagan test, and independence of residuals was verified using the Chi-square test.

Subsequently, an inferential analysis was conducted to examine the presence of statistically significant differences between the results obtained for the control and experimental groups, following the methodology outlined by Mella-Gómez (n.d.) and Monge (n.d.).

Given the violation of parametric assumptions, the robust Yuen's test was employed. This test compares trimmed means and is particularly useful when the assumption of normality is not satisfied. Moreover, Yuen's test is resistant to the influence of outliers.

The hypotheses tested were as follows:

$$\begin{cases} \text{Null hypothesis: The means are equal} \\ \text{Alternative hypothesis: The means are not equal} \end{cases}$$

At the 5% significance level, it was determined that there were no statistically significant differences between the control and experimental groups (Table 8).

3 Results

The results are organized by thematic categories directly aligned with the research objectives. Student perceptions were analyzed around five key variables of the virtual learning environment, distinguishing between the experimental and control groups. The analysis integrates both descriptive and inferential techniques, in accordance with the adopted methodological approach, and includes a critical interpretation supported by theoretical frameworks and recent literature.

3.1 Digital educational resources

Subcategories: clarity of materials, multimedia resources, virtual platform, content updating, device accessibility.

The descriptive results reflect high overall satisfaction in both cohorts, with rates exceeding 80%, especially in the experimental group, which recorded no disagreement in key items such as clarity, multimedia, and platform completeness. However, content updating showed 11% disagreement in both groups, indicating a persistent area for improvement. Accessibility from devices showed lower satisfaction in the experimental group (77.7%) compared to the control group (84.7%).

These findings underscore the growing importance of interactive and accessible digital resources, aligning with evidence that digital tools enhance student motivation particularly through gamified elements, immediate feedback, and adaptability to individual pace (Li et al., 2024). In a broader context, the integration of emerging technologies focused on personalization and interaction, such as interactive books and learning analytics systems significantly boosts student satisfaction and engagement (Reyes-Parra et al., 2024).

3.2 Teacher support

Subcategories: response time, feedback, dialogue facilitation, respectful environment, pedagogical strategies.

TABLE 6 Descriptive analysis—variable: humanistic education.

Question	SA (%)		D (%)		N (%)		A (%)		SA (%)	
	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental	Control	Experimental
Q21	7.7	0	3.8	0	0	0	23.1	55.6	65.4	44.4
Q22	7.7	0	3.8	0	3.8	11.1	38.5	33.3	46.2	55.6
Q23	7.7	0	7.7	0	0	0	38.5	44.4	46.2	55.6
Q24	7.7	0	7.7	0	0	5.6	42.3	55.6	42.3	38.9
Q25	7.7	0	7.7	0	0	11.1	38.5	55.6	46.2	33.3

Percentages rounded to one decimal place; SD, strongly disagree; D, disagree; N, neutral; A, agree; SA, strongly agree.
Source: This research.

The experimental group reported a notably more favorable perception, with no negative responses across any item, while the control group registered up to 15.4% dissatisfaction in feedback. Pedagogical strategies received high ratings in both groups, though the experimental group tended more toward “agree” rather than “strongly agree.”

These results highlight the relevance of active teacher presence in virtual environments as a key factor in fostering meaningful learning and a student-centered experience. This is consistent with [Garrison and Vaughan \(2019\)](#) Community of Inquiry framework and supported by research emphasizing the need for ongoing teacher training in digital contexts ([Arancibia et al., 2020](#); [Ordaz-Villegas and Durán-Fonseca, 2023](#)).

3.3 Support and guidance

Subcategories: technical support, communication channels, platform orientation, academic support, supplementary resources.

Overall, both groups expressed satisfaction; however, the experimental group showed greater neutrality in items such as platform orientation. This suggests that while technical support was adequate, institutional support design in digital environments could be further strengthened. The data reflect that the availability of multimodal communication channels and a student-centered approach with continuous feedback and personalized support reinforce satisfaction in virtual learning ([López-Martínez and Gómez-Torres, 2024](#)).

3.4 Pedagogical mediation

Subcategories: teacher’s role as guide, personal development, learning organization, autonomy and critical thinking, individual appreciation.

Perceptions were highly positive across both groups. Particularly notable were high levels of agreement regarding the teacher’s role as a guide and the promotion of autonomy and critical thinking, with no negative responses in the experimental group.

These findings are aligned with the principles of sociocultural constructivism, which position the teacher as a facilitator of cognitive development and autonomous learning ([Gunawan et al., 2024](#)). Moreover, active learning has shown superior effectiveness compared to traditional methods, improving performance and reducing dropout rates ([Zhou et al., 2024](#)).

3.5 Humanistic education

Subcategories: personal reflection, teacher empathy, meaningful learning, inclusion and diversity, student participation.

Overall, the experimental group showed higher levels of satisfaction, particularly in inclusion, meaningful learning, and student participation. However, personal reflection was more strongly valued in the control group (65.4% strongly agreed vs. 44.4% in the experimental group).

Integrating humanistic components enhances a more inclusive, student-centered education, as suggested by contemporary value-based teaching approaches ([Tébar-Belmonte, 2017](#)). The slight variation in personal reflection indicates the need to emphasize

TABLE 7 Values and effect sizes for each variable.

Variable	Control group		Experimental group	
	<i>p</i> -value	Effect size	<i>p</i> -value	Effect size
Digital educational resources	0.97	0.004	0.73	0.02
Teacher support	0.97	0.004	0.95	0.007
Guidance and orientation	0.98	0.002	0.77	0.02
Pedagogical mediation	0.99	0.002	0.28	0.06
Humanistic education	0.90	0.008	0.52	0.04

p-Values correspond to one-way ANOVA results assessing differences between the control and experimental groups for each variable. Effect sizes were calculated using eta squared (η^2) and interpreted as small = 0.01, medium = 0.06, and large = 0.14.

TABLE 8 Presents the obtained *p*-values, confidence intervals, and effect sizes calculated using Cohen's *d*.

Question number	<i>p</i> -value	Confidence Interval (95%)	Effect size (Cohen's <i>d</i>)
Q1	0.94	(−1, 1)	0.15
Q2	0.99	(−1, 1)	0.18
Q3	0.61	(−1, 1)	0.16
Q4	0.98	(−1, 1)	0.03
Q5	0.75	(−1, 1)	0.07
Q6	0.92	(−1, 1)	0.27
Q7	0.82	(−1, 1)	0.32
Q8	0.81	(−1, 1)	0.24
Q9	0.83	(−1, 1)	0.17
Q10	0.63	(−1, 1)	0.07
Q11	0.47	(−1, 0.5)	0.13
Q12	0.98	(−1, 1)	0.004
Q13	0.92	(−1, 1)	0.16
Q14	0.99	(−1, 1)	0.05
Q15	0.93	(−1, 1)	0.21
Q16	0.99	(−1, 1)	0.32
Q17	0.43	(0, 1)	0.09
Q18	0.43	(−1, 1)	0.12
Q19	0.84	(−1, 1)	0.30
Q20	0.45	(−0.5, 1)	0.007
Q21	0.30	(−0.5, 1)	0.10
Q22	0.60	(−1, 1)	0.32
Q23	0.59	(−1, 1)	0.48
Q24	0.94	(−1, 1)	0.29
Q25	0.69	(−1, 1)	0.14

According to Bobbitt (2022), Cohen's *d* is interpreted as follows: 0.2 indicates a small effect, 0.5 a medium effect, and 0.8 a large effect. The computational output reveals predominantly small effect sizes, except for item Q23, which exhibits a medium effect size. The table presents the *p*-values, 95% confidence intervals, and effect sizes (Cohen's *d*) for each questionnaire item. Effect sizes are interpreted according to Cohen (1988) criteria, where 0.2 indicates a small effect, 0.5 a medium effect, and 0.8 a large effect.

strategies that promote introspection within the digital pedagogical framework (Joo et al., 2022).

3.5.1 Inferential analysis

Shapiro–Wilk, Breusch–Pagan, and Chi-square tests confirmed a non-parametric distribution, homogeneity of variances, and independence of residuals. One-way ANOVA was applied within the control group, and the robust Yuen's test was used to compare between groups. The latter, appropriate for non-normal distributions and the presence of outliers, revealed no statistically significant differences at the 5% significance level. Despite more favorable perceptions in the experimental group, inferential contrasts suggest that there are no statistically conclusive changes in terms of overall student perception.

4 Limitations

While this study provides valuable insights into student perceptions of the Solidarity Academic Pedagogical Project (PAPS), several limitations must be acknowledged to appropriately contextualize its findings and guide future inquiry. First, the sample size, although suitable for exploratory analysis, is relatively small and drawn from a specific institutional and disciplinary context. This limits the generalizability of the results to broader populations. Future research involving larger and more diverse cohorts across different academic programs and institutions would strengthen the external validity and applicability of the findings. Second, the study's cross-sectional design captures perceptions at a single point in time. While useful for identifying trends and differences between groups, it does not allow for the observation of how these perceptions might evolve. Longitudinal studies would be valuable in assessing the sustained impact of the PAPS model and understanding how student experiences and outcomes develop across the course of their academic journey.

Third, the use of a quantitative methodology enabled objective comparisons across key dimensions of the model; however, it did not capture the contextual or experiential nuances underlying those responses. Incorporating mixed-methods approaches in future research, combining quantitative data with qualitative insights from interviews, focus groups, or case studies, could provide a deeper understanding of the lived experiences and meaning-making processes of students and educators within the PAPS framework. A critical methodological consideration also lies in the study's reliance on self-reported perceptions as the primary data source. While self-perceptions are valuable for assessing subjective experiences, they are susceptible to biases, such as social desirability or individual interpretation variability. To address this limitation, future studies should seek to triangulate data with objective indicators, such as academic performance metrics, retention rates, or learning analytics, to offer a more comprehensive and reliable evaluation of the pedagogical strategies and their outcomes.

5 Discussion

The findings of this study affirm the importance of a carefully structured instructional design in virtual learning environments, where the integration of interactive digital resources, active teacher

engagement, and humanist pedagogical strategies combine to enhance the student experience. Although inferential tests did not reveal statistically significant differences in general perception between the experimental and control groups, descriptive results indicate clear trends that warrant theoretical and practical consideration (Sangrá et al., 2022).

Firstly, the *Digital Educational Resources* dimension showed consistently high evaluations in both cohorts, with slight advantages for the experimental group. The absence of negative responses regarding clarity, multimedia quality, and full platform availability reinforces evidence that well-designed digital resources enhance student motivation and engagement, especially when they include gamified elements, immediate feedback, and adaptability to individual learning pace (Ahmed et al., 2023). Nonetheless, the persistent perception of outdated content in both groups highlights a critical area for improvement, aligning with studies indicating that the continuous updating of materials is a key determinant of perceived quality in virtual environments (Al Rawashdeh et al., 2021). The lower rating of device accessibility in the experimental group suggests that technological innovation must be accompanied by an inclusive, multiplatform design.

Regarding *Teacher Support*, perceptions were significantly more favorable in the experimental group, particularly in feedback and dialogue facilitation, where active teaching presence is essential for meaningful learning. Empirical evidence supports the crucial role of continuous digital competency training for educators in ensuring effective pedagogical interactions (Bag et al., 2023). This finding underscores that human mediation remains a fundamental pillar in the success of virtual education, even in highly digitized contexts.

The *Support and Guidance* dimension confirms that the availability of multimodal communication channels and efficient technical support is essential for student satisfaction. Although the experimental group exhibited greater neutrality in platform orientation, this trend may reflect confidence in the virtual environment while also suggesting the need to strengthen induction programs and digital literacy support (Beimel et al., 2024).

Concerning *Pedagogical Mediation*, the high valuation of the teacher's role as a guide and the encouragement of autonomy and critical thinking corroborates the relevance of the sociocultural constructivist paradigm (Rajabalee and Santally, 2021). These results align with recent studies showing that active learning is superior to traditional methods, not only in academic performance but also in reducing dropout rates, even in virtual contexts (Rakha, 2025). This pattern reinforces the need to incorporate active methodologies as a central element in digital pedagogical design.

Lastly, *Humanistic Education* emerged as a differentiating component, particularly in terms of inclusion, meaningful learning, and student participation. Although personal reflection was more strongly valued by the control group, this invites reconsideration of strategies that foster introspection in technology-mediated environments (Masalimova et al., 2022). In this sense, value-centered and person-centered education contribute to integral learning that transcends disciplinary content.

In summary, even though differences did not reach statistical significance in the applied robust tests, observed trends suggest that pairing innovative interactive digital resources, active teacher mediation, effective institutional support, and a humanist approach may enhance students' positive perceptions in virtual education. This has direct implications for instructional design in digital environments:

technological innovation must be complemented by solid pedagogical strategies and institutional commitment to continuous updating, accessibility, and teacher training (Hsin-Lan et al., 2022).

5.1 Original contribution

This study presents the first quantitative evaluation of the Solidarity Academic Pedagogical Project (PAPS) within Colombian virtual postgraduate education, integrating its five pillars into a comparative design. While previous research has explored humanistic or solidarity-based models in qualitative or theoretical terms, no prior studies have provided empirical evidence using robust statistical analysis to assess student perceptions of PAPS. This constitutes a novel contribution to the global literature on virtual education and pedagogical mediation.

5.2 International relevance

These findings engage in dialogue with recent global studies on inclusive and student-centered online education. Initiatives in Europe and Asia have reported comparable benefits of active mediation and humanistic approaches, yet our research uniquely situates these within the context of Latin American public higher education. This cross-regional resonance suggests that solidarity-based pedagogical models are adaptable to varied cultural and institutional environments.

5.3 Practical implications

The evidence gathered provides concrete guidance for educators, instructional designers, and policymakers. For faculty, results highlight the importance of ongoing training in digital pedagogy and the integration of empathy, diversity, and active learning into online teaching. For instructional designers, the data supports the creation of adaptable, device-accessible resources tailored to diverse learning styles. For institutional leaders and policymakers, findings underscore the need to invest in supportive structures, technical assistance, academic guidance, and systematic feedback to enhance retention and satisfaction in virtual postgraduate programs.

6 Conclusion

The findings of this study suggest that, within the specific context of two virtual master's programs at UNAD, students in the experimental group reported higher levels of satisfaction, particularly regarding the clarity of instructional materials, the multimedia quality of content, and the availability of the virtual platform. These results highlight the value of incorporating digital resources designed for clarity, accessibility, and adaptability, especially when these are aligned with the pedagogical aims of each program. However, it is important to interpret these outcomes with caution, as the study does not benchmark them against other pedagogical approaches, and the modest sample size limits the generalizability of conclusions.

The role of active teacher engagement also emerged as a central factor, especially when characterized by timely feedback, dialogic interaction, and a respectful pedagogical climate. These aspects

appear to support students' sense of connection, belonging, and motivation in virtual environments. This reinforces the importance of ongoing professional development in both digital and pedagogical competencies to ensure responsive, student-centered instructional support.

While students acknowledged the importance of technical support and multiple communication channels, findings also revealed a need for more effective orientation processes related to platform navigation and the use of digital tools. This indicates that institutional policies must continue evolving to address operational challenges and promote digital literacy through structured induction strategies.

In terms of pedagogical mediation, positive perceptions were associated with constructivist and active learning strategies. Although the study does not directly measure academic outcomes, participant responses are consistent with existing literature linking these pedagogies to improved engagement and reduced dropout in virtual contexts. This supports the continued integration of methodologies that promote autonomy, collaborative learning, and critical thinking.

With regard to humanistic training, participants valued the presence of reflection, empathy, and diversity as elements contributing to a more holistic and ethical educational experience. Nonetheless, the data suggest that greater emphasis is still needed on strategies that foster introspection, self-regulation, and active participation, particularly within digital learning environments.

A noteworthy finding shared by both groups was the persistent dissatisfaction with the updating of academic content. This issue, reported consistently, points to a concrete area for institutional improvement. The study would benefit from offering specific recommendations, such as implementing periodic content audits, involving faculty in continuous curricular revision, and incorporating student feedback mechanisms, to enhance the relevance and currency of learning materials. Addressing this weakness could significantly strengthen the perceived and actual quality of virtual postgraduate education.

In conclusion, although limited by its exploratory design and sample size, this study provides contextualized evidence on how the strategic integration of innovative digital tools, qualified pedagogical support, and humanistic principles, under the framework of the Solidarity Academic Pedagogical Project (PAPS), can contribute to the enhancement of virtual postgraduate education. These findings offer a basis for institutional reflection and serve as an invitation for future research, particularly in exploring the differentiated application of the PAPS model across diverse academic contexts and student populations.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repository and accession number(s) can be found in the article/supplementary material.

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Ethics statement

This research received formal approval from the UNAD's Ethics Committee, ensuring adherence to ethical standards. Although the study posed minimal risk to participants, ethical oversight was obtained to safeguard confidentiality and informed consent following national and institutional regulations.

Author contributions

KO-O: Conceptualization, Investigation, Validation, Writing – original draft, Writing – review & editing, Data curation. DB-G: Supervision, Conceptualization, Writing – review & editing, Funding acquisition. JS-M: Data curation, Formal analysis, Methodology, Writing – review & editing, Software.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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