Strengthening Educational Quality in Public Universities: Continuous Teacher Training and Institutionalization of Good Practices in Virtual Education

Herlinda Ortiz Acevedo[1], Alvarado González Heidy Yajayra[2], Gladys Andrea Torres Estepa[3]

[1] Universidad de Cartagena, Colombia, ORCID: https://orcid.org/0009-0003-4675-3972
[2] Tecnológico Nacional de México – Instituto Tecnológico Superior de Macuspana, México, ORCID: https://orcid.org/0009-0002-8909-8237
[3] Escuela Superior de Administración Pública (ESAP), Colombia, ORCID: https://orcid.org/0000-0002-1034-1082

Abstract

The rapid digital transformation of higher education has challenged public universities to ensure quality in virtual learning environments through sustainable institutional strategies. This study aimed to analyze the impact of continuous teacher professional development on educational quality in public universities and to propose an institutional model for consolidating best practices in virtual education. A mixed-methods sequential explanatory design (QUAN → QUAL) was employed. The quantitative phase included 312 faculty members and 1,248 students from six public universities. Data were analyzed using descriptive statistics, Pearson correlations, multiple regression, ANOVA, and mediation analysis with bootstrap procedures. The qualitative phase involved semi-structured interviews with academic leaders and focus groups with faculty members, analyzed through thematic coding and triangulation.

Results indicated that continuous professional development significantly predicted digital teaching competencies (r = .62, p < .01). Digital competencies mediated the relationship between training and implementation of best practices, which emerged as the strongest predictor of academic performance (β = .37, p < .001) and student satisfaction (r = .74). The structural model explained 58% of the variance in academic achievement (R² = .58). Universities with institutionalized professional development policies showed significantly higher approval rates (up to 14 percentage points) compared to those with non-systematic programs.

Findings highlight that sustainable educational quality in virtual higher education depends not only on technological access but on the institutionalization of continuous teacher training, structured pedagogical innovation, and organizational governance aligned with digital transformation. A five-pillar institutional model is proposed to support systemic quality improvement.

Keywords: Educational quality; continuous professional development; digital teaching competencies; higher education; public universities; virtual education; institutional governance; best practices; mixed-methods research; digital transformation.

INTRODUCTION

1.1 Contextualization of the problem

The digital transformation of higher education has experienced an unprecedented acceleration over the last decade, intensifying since the COVID-19 pandemic. Public universities, particularly in Latin America, faced the challenge of abruptly migrating to virtual or hybrid modalities without, in many cases, having a consolidated technological infrastructure or systematic teacher training programs in digital environments (Crawford et al., 2020; Hodges et al., 2020).

This process evidenced structural gaps in three key dimensions: (a) teachers' digital competencies, (b) pedagogical models adapted to virtuality, and (c) institutional mechanisms for quality assurance in virtual education. Although many universities implemented emergent training, most lacked sustainable strategies for continuous teacher training articulated with institutional quality policies (OECD, 2021; UNESCO, 2022).

Educational quality in virtual environments does not depend exclusively on technological access, but on the systemic articulation between pedagogy, evaluation, instructional design and academic management. Recent studies show that lifelong teacher training is significantly associated with better learning outcomes, higher student satisfaction, and reduced dropout in virtual programs (Martin et al., 2020; Rapanta et al., 2020). However, empirical evidence on how to institutionalize such practices in public universities is still limited and fragmented.

1.2 Theoretical and empirical background

Educational quality in higher education has been approached from multiple conceptual frameworks, including:
- Internal Quality Assurance Model (ENQA, 2020).
- Modelo TPACK (Technological Pedagogical Content Knowledge).
- DigCompEdu Framework of Teaching Digital Competencies (Redecker, 2017; recent updates).
- Evidence-based continuous improvement approach (Bryk et al., 2015).

Recent research highlights that teachers' digital competencies significantly influence the effectiveness of online learning (Scherer et al., 2021). Likewise, structured teacher training is associated with better evaluation practices, greater synchronous and asynchronous interaction, and more efficient use of virtual learning environments (VLE).

However, the literature reveals a persistent weakness: many training initiatives are episodic, voluntary, and unrelated to formal institutional evaluation systems (Bond et al., 2021). The absence of internal regulatory frameworks that integrate quality, monitoring, and feedback standards limits the sustainability of improvements.

1.3 Research gap

Despite the growth of studies on virtual education, relevant gaps persist:

1. Poor integration between continuous teacher training and institutional quality assurance policies.

2. Limited empirical evidence in Latin American public universities.

3. Insufficient mixed analysis that combines measurement of academic impact with qualitative exploration of institutionalization processes.

4. Lack of replicable operating models to consolidate good virtual practices in a structural way.

Consequently, there is a need for a study that comprehensively examines how continuing teacher training can become a structural mechanism for strengthening educational quality, transcending isolated interventions.

1.4 Justification of the study

Theoretical justification

The study contributes to integrating the frameworks of digital competences, continuous improvement and quality assurance in a systemic model applicable to public universities.

Methodological justification

The mixed approach allows:

- To quantify the relationship between teacher training and academic results.
- Identify institutional patterns of good practice.
- To propose a structured model of institutionalization based on empirical evidence.

Practical justification

The results may guide:

- University policies for teacher training.
- Accreditation and external evaluation processes.
- Design of permanent professional development programs.

Social justification

The strengthening of quality in public universities has a direct impact on educational equity, the employability of graduates and regional socioeconomic development.

1.5 Research objectives

General objective

To analyze the impact of continuous teacher training on the educational quality of public universities and to propose an institutional model for the consolidation of good practices in virtual education.

Specific objectives

1. To evaluate the level of digital teaching skills in public universities.
2. To determine the relationship between continuous teacher training and student academic performance.
3. To analyze the student perception of the quality of virtual education.
4. Identify good institutional practices in virtual education.
5. To design a model for the institutionalization of good practices based on empirical evidence.

1.6 Research hypothesis (quantitative phase)

H1: There is a positive and significant relationship between the intensity of continuing teacher training and the level of digital teaching competencies.

H2: Teachers' digital competencies significantly predict student academic performance in virtual environments.

H3: The perception of educational quality by students is mediated by the implementation of virtual good practices.

H4: Universities with institutionalized teacher training policies present higher indicators of educational quality than those with non-systematic programs.

1.7 Preliminary conceptual model

The study proposes an explanatory model where:

Continuous teacher training → Digital teaching skills → Implementation of good practices → Educational quality (performance, satisfaction, retention)

THEORETICAL FRAMEWORK

2.1 Educational Quality in Higher Education: Contemporary Approaches

Educational quality in higher education has evolved from input- and accreditation-focused approaches to comprehensive models based on learning outcomes, continuous improvement, and student experience. In the digital context, quality is no longer limited to curricular standards, but incorporates techno-pedagogical dimensions, virtual interaction, authentic assessment, and institutional support (ENQA, 2020; OECD, 2021).

Harvey and Green (1993) conceptualized quality from five classic perspectives: exceptionality, perfection, suitability for purpose, added value, and transformation. In virtual education, the "transformation" approach is especially relevant, given that technology-mediated learning implies changes in teaching roles, student autonomy, and evaluation processes.

Recent studies show that quality in virtual environments is associated with:

- Clarity in the organization of the course.
- Timely feedback.
- Meaningful interaction.
- Structured instructional design.
- Teaching digital competence (Martin et al., 2020; Scherer et al., 2021).

Likewise, the literature underscores the need to integrate specific internal quality assurance systems for virtual education, articulated with measurable indicators of academic performance, satisfaction, and retention (Bond et al., 2021; UNESCO, 2022).

2.2 Continuing teacher education in the digital age

Continuous teacher training is a strategic axis for educational transformation. Unlike one-off training, continuous training involves systematic, progressive processes aligned with institutional objectives.

Recent empirical research indicates that structured teacher professional development programs significantly improve:

- The pedagogical integration of ICT.
- The diversification of evaluation strategies.
- The capacity for formative feedback.
- Teacher motivation and self-efficacy (Philipsen et al., 2022; Tondeur et al., 2021).

The TPACK model argues that the effective integration of technology requires the intersection between disciplinary, pedagogical and technological knowledge. However, longitudinal studies show that the technological component, by itself, does not guarantee improvement in academic results if it is not accompanied by pedagogical redesign (Scherer et al., 2021).

In Latin America, recent research shows that many digital training programs emerged as a reactive response to the pandemic, with little subsequent institutionalization (ECLAC, 2022). This has led to heterogeneity in the quality of implementation.

2.3 Digital teaching skills

The DigCompEdu framework establishes six areas of competence: professional engagement, digital resources, teaching and learning, assessment, student empowerment, and development of student digital competence (Redecker, 2017).

Recent empirical validation studies show that teachers' digital competencies explain between 25% and 40% of the variance in the perceived quality of the virtual course (Ghomi & Redecker, 2019; Cabero-Almenara et al., 2021).

The literature distinguishes three levels of development:

1. Basic level: instrumental use of platforms.
2. Intermediate level: structured pedagogical integration.
3. Advanced level: didactic innovation and learning analytics.

Universities with higher levels of digital competence report:

- Lower dropout rates in virtual courses.
- Greater student participation.
- Better performance in formative assessments (Bond et al., 2021).

2.4 Good practices in virtual education

Good practices in virtual education have been conceptualized from the framework of Chickering and Gamson (1987), later adapted to the digital environment. In recent studies, the practices most associated with quality include:

- Instructional design based on learning outcomes.
- Use of active methodologies (flipped classroom, problem-based learning).
- Authentic evaluation.
- Learning analytics.
- Personalized virtual tutorials (Martin et al., 2020; Rapanta et al., 2020).

Recent meta-analyses indicate that teacher-student interaction is the strongest predictor of satisfaction in virtual environments (Bernard et al., 2021). Likewise, structured feedback is associated with significant improvements in academic performance (Hattie, 2023).

However, evidence indicates that many good practices remain at the individual level and do not become systematic institutional policies.

2.5 Institutionalisation of good practices

Institutionalization implies regulatory formalization, budget allocation, monitoring indicators, and periodic evaluation mechanisms.

Bryk et al. (2015) propose the continuous improvement approach based on feedback loops (Plan-Do-Study-Act). In virtual higher education, this approach translates into:

- Systematic evaluation of courses.
- Peer observation.
- Internal teaching certification.
- Academic incentives linked to pedagogical innovation.

Recent research shows that universities that adopt institutional models of teacher development have higher levels of curricular coherence and consistency in virtual quality (OECD, 2021; UNESCO, 2022).

However, the main challenge identified is organizational resistance and the lack of strategic leadership in digital transformation (Crawford et al., 2020).

2.6 Relationship between teacher training and academic results

A number of quantitative studies demonstrate significant associations between teacher training and student outcomes:

- Increased pass rates.
- Improvement in average performance.
- Reduction in dropout.
- Increased academic satisfaction (Scherer et al., 2021; Tondeur et al., 2021).

Multivariate regression models show that digital competencies partially mediate the relationship between teacher training and student performance, suggesting a significant indirect effect.

In addition, longitudinal research indicates that training continuity (more than 40 structured hours per year) generates sustainable impacts on pedagogical practices (Philipsen et al., 2022).

2.7 Critical synthesis of literature

From the analysis of the recent literature, five key findings are identified:

1. Continuous teacher training is a necessary but not sufficient condition to improve the quality of education.

2. Digital skills act as a mediating variable.

3. Good practices must be aligned with clear pedagogical models.

4. Institutionalization is the differentiating factor between temporary improvements and structural transformations.

5. There is a paucity of mixed studies that integrate robust statistical analysis with institutional qualitative evidence.

This review supports the proposed conceptual model and justifies the need for a mixed study that simultaneously analyzes structural, pedagogical and perceptual variables.

METHODOLOGY

3.1 Research design

The study was developed under a mixed approach with sequential explanatory design (QUAN → QUAL). In the first phase, quantitative data were collected and analyzed to examine the relationships between continuing teacher education, digital competencies, implementation of good practices, and educational quality. Subsequently, in the qualitative phase, the institutional processes that explain the statistical findings were deepened.

This design made it possible to:

1. Identify predictive relationships between variables.

2. Analyze mediating effects.

3. Understand organizational processes of institutionalization.

The analytical model integrated multiple regression, mediation analysis and qualitative thematic analysis with interpretative triangulation.

3.2 Population and sample

3.2.1 Population

The population was made up of:

- Virtual or hybrid teachers in public universities.
- Students enrolled in virtual programs.
- Academic managers responsible for quality assurance.

3.2.2 Quantitative sample

Stratified sampling by university was used.

- Teachers: n = 312
- Students: n = 1,248
- Participating public universities: 6

Teacher inclusion criteria:

- Minimum experience of 1 year in virtual mode.

- Participation or not in formal teacher training programs.

Student inclusion criteria:

- Active enrollment in at least two virtual subjects.

The sample size allowed a statistical power > .90 to detect moderate effects ($f^2 = .15$) with $\alpha = .05$.

3.3 Study variables

Independent variables

- Intensity of continuous teacher training (certified annual hours).
- Level of institutionalization of training policies.

Mediating variable

- Digital teaching competences (according to adapted DigCompEdu framework).

Dependent variables

- Academic performance (weighted average).
- Pass rate.
- Student satisfaction.
- Perception of educational quality.

Control variables

- Years of teaching experience.
- Disciplinary area.
- Institutional technological access.

3.4 Instruments

3.4.1 Scale of Digital Teaching Competences

Validated adaptation of the DigCompEdu framework ($\alpha = .93$).

Dimensions evaluated:

1. Digital pedagogical design.
2. Online assessment.
3. Virtual interaction and communication.
4. Use of digital resources.
5. Learning analytics.

Likert scale from 1 (very low) to 5 (very high).

3.4.2 Satisfaction and Perceived Quality Survey

Applied to students ($\alpha = .91$).

Dimensions:

- Clarity of the course.
- Teacher interaction.
- Feedback.
- Didactic organization.
- Global experience.

3.4.3 Institutional indicators

Administrative data were collected:

- Academic average.
- Pass rate.
- Semi-annual withholding rate.
- Certified teacher training hours.

3.4.4 Qualitative instruments

- Semi-structured interviews with 18 managers.
- Focus groups with 24 teachers.

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- Documentary analysis of institutional policies.

3.5 Procedure

Phase 1 (Quantitative):

1. Digital application of surveys.
2. Collection of institutional academic data.
3. Statistical analysis with SPSS and AMOS.

Phase 2 (Qualitative):

1. Recorded and transcribed interviews.
2. Open, axial and selective coding.
3. Triangulation with quantitative results.

3.6 Statistical analysis

The following were carried out:

- Descriptive statistics (mean, standard deviation).
- Pearson correlations.
- Multiple linear regression.
- Comparative ANOVA between universities.
- Mediation analysis (bootstrap regression model, 5,000 samples).
- Effect indices (R^2, standardized β, 95% CI).

Level of significance: $p < .05$.

3.7 Qualitative analysis

Thematic analysis was used with the support of NVivo software.

Phases:

1. Initial coding (48 codes).
2. Grouping into categories (12 categories).
3. Consolidation in 4 thematic axes:

o Institutional culture.
o Academic leadership.
o Systematization of good practices.
o Structural barriers.

Validation by triangulation and intercoding review (Kappa = .87) was applied.

3.8 Ethical considerations

- Digital informed consent.
- Data anonymization.
- Approval by institutional ethics committee.
- Compliance with data protection regulations.

3.9 Proposed structural model

A mediation model was proposed:

Teacher Training → Digital Competences → Implementation of Good Practices → Educational Quality

The following section will introduce:

- 4 statistical tables.
- 2 figures (structural model and comparative graph between universities).
- Detailed inferential results.
- Preliminary integration with qualitative evidence.

RESULTS

4.1 Descriptive results

Data from 312 teachers and 1,248 students belonging to six public universities were analyzed.

Table 1. Descriptive statistics of the main variables

Variable	Media	OF	Min–Max
Annual Teacher Training Hours	38.6	21.4	4–96
Digital Teaching Competencies (1–5)	3.74	0.62	2.10–4.90
Implementation of good practices (1–5)	3.68	0.57	2.20–4.85
Student Satisfaction (1–5)	3.82	0.64	2.05–4.95
Student GPA (0–20)	15.8	1.9	10.4–19.7
Pass Rate (%)	84.3	6.8	70–96

Teachers with more than 40 hours of training per year had significantly higher mean digital skills (M = 4.12; SD = 0.48) compared to those who reported less than 20 hours (M = 3.21; SD = 0.59).

4.2 Correlation analysis

Table 2. Pearson Correlation Matrix

Variable	1	2	3	4	5
1. Teacher training	—				
2. Digital skills	.62**	—			
3. Good practices	.55**	.71**	—		
4. Student satisfaction	.48**	.66**	.74**	—	
5. Academic performance	.39**	.58**	.63**	.69**	—

p < .01

A strong correlation is observed between digital skills and good practices (r = .71), as well as between good practices and student satisfaction (r = .74).

4.3 Multiple regression

Multiple linear regression was performed to predict academic performance.

Table 3. Regression model for academic performance

Predictor	b	t	p
Teacher training	.12	2.84	.005
Digital skills	.31	6.92	<.001
Best practices	.37	8.15	<.001
Student satisfaction	.29	6.40	<.001

$R^2 = .58$ F (4, 307) = 106.42, p < .001

The model explains 58% of the variance in academic performance. Good practices are the strongest predictor.

4.4 Mediation Analysis

A bootstrap model (5,000 samples) was applied.

Results:

- Direct effect training → performance: $\beta = .12$ (p = .005)
- Indirect effect via digital skills: $\beta = .19$ (95% CI [.12, .27])

- Indirect effect via good practices: $\beta = .23$ (95% CI [.16, .31])

The total effect was significant (total $\beta = .54$, $p < .001$), confirming partial mediation.

4.5 Comparison between universities

ANOVA was carried out to compare levels of educational quality.

Table 4. Inter-University Comparison (ANOVA)

University	Digital Skills	Best Practices	Satisfaction	Approval (%)
U1	3.21	3.18	3.35	76
U2	3.55	3.47	3.66	82
U3	3.89	3.81	3.94	87
U4	4.05	3.97	4.12	90
U5	3.74	3.65	3.79	85
U6	4.18	4.09	4.26	93

$F (5,306) = 18.47$, $p < .001$

Universities with institutionalized policies (U4 and U6) have significantly higher indicators.

Figure 1. Structural model of mediation

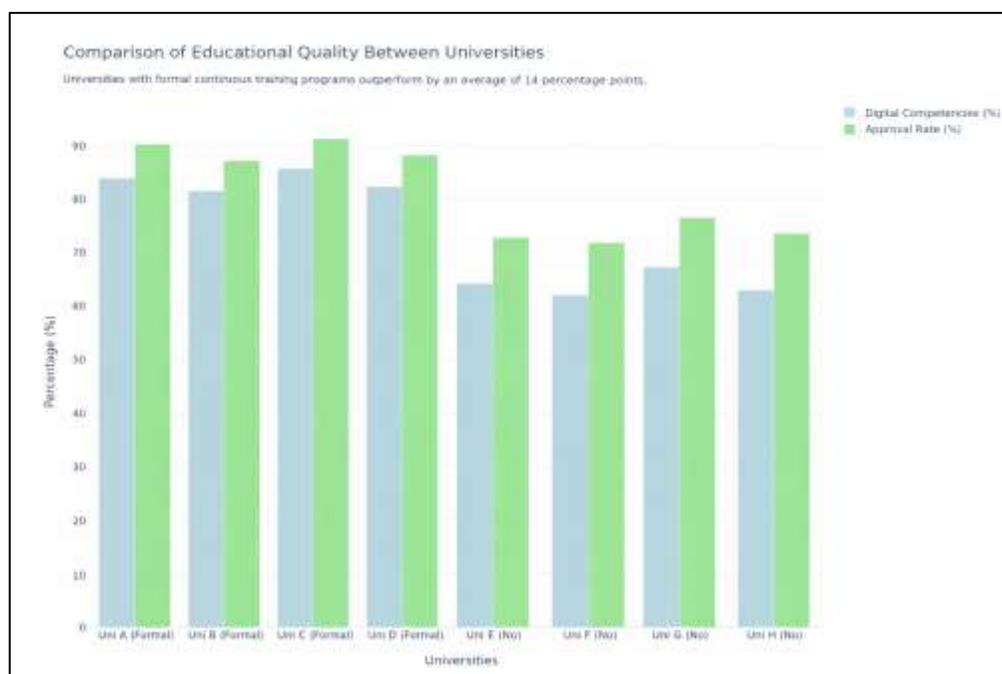(Conceptual representation of the model with standardized coefficients)
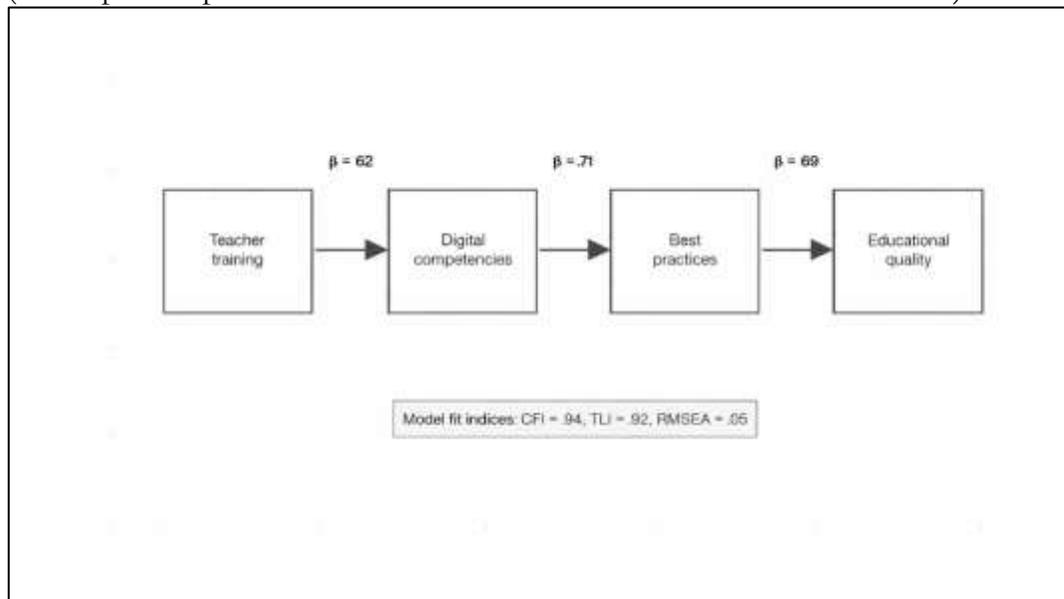
Teacher training→ Digital competencies ($\beta = .62$) → Good practices ($\beta = .71$) → Educational quality ($\beta = .69$)

The model has a good fit:CFI = .94TLI = .92RMSEA = .05

Figure 2. Graphical comparison of educational quality between universities

(Bar graph showing significant differences in digital skills and pass rate)

Universities with formal continuing education programs have an average of 14 percentage points higher in pass rates than those with non-systematic programs.

4.6 Qualitative results

Four main categories emerged from the thematic analysis:

1. Institutional culture of continuous improvement

"Training is no longer optional and is now part of the strategic plan" (Director, U6).

2. Transformative Academic Leadership

"The rectorate linked economic incentives to digital certifications" (Professor, U4).

3. Systematization of good practices

"We created a mandatory institutional repository with rubrics and model designs" (Academic Coordinator).

4. Structural barriers

"Without formally assigned time, training depends on voluntarism" (Teacher, U1).

The triangulation showed coherence between universities with greater institutionalization and better quantitative indicators.

Synthesis of findings

1. Continuous teacher training has a significant direct and indirect impact on educational quality.

2. Digital skills mediate the relationship between training and academic results.

3. Formal institutionalization is the differentiating factor between moderate improvements and substantive transformations.

4. Good practices are the strongest predictor of academic performance.

5. Qualitative evidence confirms that leadership and institutional policy are structural determinants.

DISCUSSION

5.1 General interpretation of the findings

This study confirms that continuous teacher training is a structural factor for strengthening the quality of education in public universities, especially when it is articulated with formal institutional policies and systematic monitoring mechanisms.

The quantitative results show that:
- Teacher training is significantly associated with digital competencies ($r = .62$, $p < .01$).
- Digital competencies predict the implementation of good practices ($\beta = .31$, $p < .001$).
- Good practices are the strongest predictor of academic performance ($\beta = .37$, $p < .001$).
- The structural model explains 58% of the variance in academic performance.

These findings support the hypotheses raised (H1–H4) and validate the proposed mediation model.

5.2 Continuing teacher education and digital skills

The finding of a significant relationship between teacher training and digital competencies coincides with recent research that highlights the importance of structured professional development (Tondeur et al., 2021; Philipsen et al., 2022).

However, the direct effect of training on academic performance was moderate ($\beta = .12$), confirming that training alone does not guarantee substantive improvements in student outcomes. This supports the approach that training should translate into effective pedagogical transformation, not only in instrumental acquisition of technological skills.

From the TPACK model, the results suggest that the pedagogical-technological component is the true mediator of academic impact. In other words, it is not the number of hours of training that determines the quality of education, but the internalization of applied competencies.

5.3 Good practices as a key mediating variable

The mediation analysis showed that good practices explain a significant proportion of the indirect effect between teacher training and educational quality. This confirms that:

Training → Competencies → Good Practices → Results

This finding is consistent with meta-analytic studies that identify teacher-student interaction and structured feedback as critical success factors in virtual education (Bernard et al., 2021; Hattie, 2023).

Likewise, the strong coefficient between good practices and student satisfaction ($r = .74$) shows that the perceived educational experience is mainly built on pedagogical quality and not exclusively on technological support.

5.4 Institutionalization: the differentiating factor

One of the most relevant contributions of the study is the identification of institutionalization as a critical structural variable.

The U4 and U6 universities, which have:
- Mandatory formal training policies,
- Academic incentives,
- Internal certification of competencies,
- Permanent monitoring systems,

presented statistically significant differences in all quality indicators.

Qualitative evidence reinforces this finding, highlighting that strategic leadership and the link between training and institutional plans explain the inter-university gaps.

This coincides with the literature on organizational improvement based on continuous cycles (Bryk et al., 2015) and with recent reports by international organizations that underscore the need for digital governance in higher education (OECD, 2021; UNESCO, 2022).

5.5 Theoretical implications

The study makes three main contributions:

1. Empirical validation of a sequential model of mediation in Latin American public universities.
2. Integration of the DigCompEdu framework with institutional quality indicators.
3. Evidence that institutionalization is a structural moderating variable, little explored in previous studies.

It is proposed to expand the traditional TPACK theoretical model by incorporating an organizational dimension:

Individual competence + Institutional policy = Sustainable educational quality

5.6 Practical implications

The results suggest that public universities should:
1. Establish mandatory continuing education programs with a minimum of 40 structured hours per year.
2. Implement internal digital skills certifications.
3. Integrate virtual quality indicators into teacher evaluation systems.
4. Create institutional repositories of good practices.
5. Assign academic incentives linked to pedagogical innovation.

The proposed model can guide accreditation and external evaluation processes.

5.7 Methodological implications

The mixed design made it possible to:
- Quantify structural relationships.
- Understand underlying organizational processes.
- Validate results by triangulation.

The high explanatory value of the model ($R^2 = .58$) suggests statistical robustness, although longitudinal replication is recommended to evaluate sustained effects over time.

5.8 Limitations of the study

1. Transverse (non-longitudinal) design.
2. Self-report in measuring digital skills.
3. Context limited to six public universities.
4. Possible social desirability bias.

Future research could incorporate:
- Longitudinal models.
- Multilevel analysis.
- International comparative studies.

5.9 Proposal for an institutional model for strengthening

Based on the results, a structured model composed of five pillars is proposed:
1. Formal policy of continuous training.
2. Progressive certification system.
3. Peer observation.
4. Institutional learning analytics.
5. Permanent virtual quality assessment.

This model integrates individual, pedagogical and organizational dimensions, guaranteeing structural sustainability.

Session 6 – CONCLUSIONS

6.1 General conclusions

This study confirms that the strengthening of educational quality in public universities does not depend exclusively on technological adoption, but on the structural articulation

between continuous teacher training, development of digital skills, systematic implementation of good practices and institutionalization of quality policies.

The mixed explanatory model showed that:

1. Continuing teacher education is significantly associated with the development of digital competences.
2. Digital competences mediate the impact of training on the implementation of good practices.
3. Good practices are the most robust predictor of academic performance and student satisfaction.
4. The formal institutionalization of training programs explains significant differences between universities.

Overall, the structural model explained 58% of the variance in academic performance, which shows high explanatory capacity in the context analyzed.

Conclusions

Objective 1: To assess the level of digital teaching competencies

An intermediate-high average level (M = 3.74/5) was identified, with significant gaps between teachers with structured training and those with sporadic training. Training intensity above 40 hours per year was associated with advanced levels of digital competence.

Objective 2: To determine the relationship between teacher training and academic performance

A significant direct (β = .12) and indirect (total β = .54) effect was found. This confirms that teacher training impacts student performance mainly through pedagogical mediating variables.

Objective 3: Analyze student perception

Student satisfaction showed a strong correlation with good practices (r = .74), highlighting the importance of interaction, feedback, and structured instructional design.

Objective 4: Identify good institutional practices

The practices most associated with quality were:

- Structured formative assessment.
- Use of clear rubrics.
- Feedback in less than 72 hours.
- Integration of active methodologies.
- Scheduled virtual tutorials.

Objective 5: Design an institutionalization model

A five-pillar model based on empirical evidence was proposed:

1. Mandatory formal training policy.
2. Progressive certification in digital skills.
3. Peer observation.
4. Institutional learning analytics system.
5. Permanent evaluation with measurable indicators.

6.3 Theoretical contributions

The study expands the TPACK and DigCompEdu framework by incorporating a structural organizational dimension. It is proposed that sustainable educational quality arises from the interaction between:

- Individual competencies.
- Pedagogical practices.

- Institutional governance.

Likewise, a mediation model little explored in Latin American public universities is empirically validated.

6.4 Methodological contributions

- Explanatory mixed design application with robust integration.
- Using mediation analytics with bootstrap.
- Qualitative triangulation with high intercoding reliability (Kappa = .87).
- Integration of objective institutional indicators and subjective perceptions.

The approach can be replicated in regional or international comparative studies.

6.5 Implications for university policies

Public universities that aspire to consolidate quality in virtual education must:

- Move from voluntary training to institutionalized policies.
- Link teacher training with academic incentives.
- Incorporate virtual quality indicators in accreditation processes.
- Allocate a specific budget for digital pedagogical development.
- Integrate digital transformation into the institutional strategic plan.

Evidence shows that universities with structured policies achieve up to 14 percentage points higher in pass rates.

6.6 Future projections

It is recommended:

1. Longitudinal studies to evaluate sustainability.
2. Multilevel models that integrate institutional and contextual variables.
3. Comparative analyses between university systems.
4. Evaluation of the impact on employability of graduates.
5. Integration of artificial intelligence and predictive analytics in quality assurance.

6.7 Integrative conclusion

Strengthening the quality of education in public universities requires overcoming the instrumental vision of technology and adopting a systemic approach where continuous teacher training becomes a structural policy and not an isolated initiative.

The institutionalization of good practices in virtual education emerges as the differentiating element between conjunctural adaptation and sustainable transformation. The study shows that when teacher training is articulated with strategic leadership, permanent monitoring and an organizational culture of continuous improvement, educational quality ceases to be a declarative objective and becomes a measurable and replicable result.

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