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Dimensions and Indicators for Assessing Faculty Research Competencies and Educational Quality

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Abstract: This article develops an expanded proposal for the operationalization and measurement of two complex constructs in higher education: university faculty research competencies and the quality of academic training. Building upon the methodological matrix of the baseline study, it organizes eight dimensions, observable indicators, evidence sources, instruments, and analytical criteria. It examines the structural logic of a 40-item questionnaire using a five-point Likert scale and proposes a validation roadmap encompassing expert judgment, pilot testing, internal consistency, descriptive analysis, and association testing via Spearman's Rho. Additionally, document review is incorporated to mitigate reliance on self-reporting. The article represents a methodological proposal and does not report empirically derived psychometric properties; thus, its results should be understood as a measurement design subject to subsequent validation.

Keywords: Operationalization; Measurement; Research competencies; Educational quality; Likert scale; Instrument validation

Introduction

Educational measurement requires translating abstract concepts into observable indicators without diluting their theoretical complexity. This process proves particularly challenging when examining broad constructs such as research competencies and the quality of academic training. Both integrate cognitive, methodological, pedagogical, and organizational components; consequently, flawed operationalization yields lengthy yet unrepresentative instruments. The foundational research adopts a quantitative, non-experimental, cross-sectional, and correlational design, utilizing a structured 40-item questionnaire scored on a five-point Likert scale. The underlying matrix delineates four dimensions per variable and integrates survey data with documentary review. The strength of this framework rests on its systematic alignment of conceptual definitions, empirical evidence, dimensions, indicators, techniques, instruments, and measurement scales. This article aims to expand that measurement framework, formalize indicator design criteria, establish a validation pipeline, and structure an analytical plan tailored to ordinal data. Rather than offering a fully validated questionnaire, this work presents a adaptable methodological architecture designed for prospective evaluation, refinement, and empirical deployment.

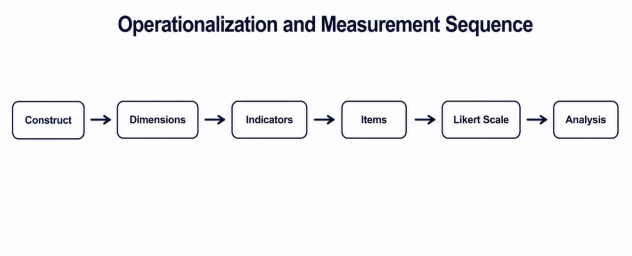

Figure 1. Sequence of operationalization from theoretical construct to statistical analysis

Epistemological and Methodological Foundations of Measurement This thesis falls within the positivist paradigm because it seeks to observe, measure, and test relationships between previously defined variables. [15] point out that paradigms guide how evidence is constructed, while [16] highlights the centrality of verifiability and measurement within positivist perspectives. Within this framework, operationalization means establishing explicit rules to translate a theoretical category into comparable observations. The quantitative approach requires indicators to be consistent with the conceptual definition, and items must reflect concrete behaviors, perceptions, or evidence. It is not enough for a question to be understandable; it must represent the content of the construct, avoid ambiguity, and correspond directly to its underlying dimension. Content validity thus becomes a prerequisite for statistical analysis.6 The use of Likert scales is suitable for capturing levels of perception or appraisal, but it requires interpretative caution. An ordinal scale establishes order among categories, though the intervals between scale points are not necessarily equal. For this reason, the analysis must justify how scores are constructed and select statistical procedures aligned with the nature of the measurement .

Table 1. Methodological alignment matrix and study design

Component	Proposed Decision	Justification
Paradigm	Positivist	Observation and testing of relationships between variables.
Approach	Quantitative	Structured, comparable, and analyzable data.
Instrument	40-item questionnaire	Coverage of eight dimensions.
Scale	Likert 1–5	Allows ordering intensity or valuation.
Complement	Documentary review	Contrasts perception with observable evidence.
Analysis	Descriptive + Spearman's Rho	Characterizes dimensions and estimates ordinal association.

Operationalization of the Independent Variable The variable faculty research competencies is defined as a comprehensive professional capability that integrates knowledge, skills, attitudes, and methodological criteria to conduct research, produce knowledge, and guide inquiry processes. The empirical definition focuses observation across four dimensions: methodological mastery, scholarly production, research mentorship, and the integration of research into teaching. Methodological mastery must be translated into indicators that evaluate the ability to formulate research problems, select methods, design instruments, analyze data, and interpret findings. Item construction should avoid overly general statements such as "the instructor knows how to conduct research" and instead favor behavioral or situational prompts that enable the evaluation of specific actions. Scholarly production requires distinguishing among product output quantity, project participation, and dissemination capabilities. While aspects of this dimension can be measured through self-perception, they should also be verified against documentary evidence. Reviewing repositories, institutional records, or project documentation helps mitigate self-reporting bias and enhances data interpretation. Research mentorship is operationalized through methodological tutoring, guidance, monitoring, feedback, and support throughout degree completion processes. This dimension can be evaluated via student perceptions, which provide insights into the lived experience of mentorship. Meanwhile, research-teaching integration encompasses formative research activities, critical thinking cultivation, inquiry-based assignments, and the bridging of theory and practice.

Table 2. Operationalization matrix for the research competencies variable

Dimension	Suggested Indicators	Primary Source	Example Item Focus
Methodological mastery	Problem formulation, methodology, instruments, analysis, interpretation	Faculty and students	Coherence of methodological guidance.
Scholarly production	Articles, projects, conference presentations, dissemination	Faculty + documentation	Verifiable participation in scientific activities.
Research mentorship	Tutoring, monitoring, feedback, degree completion support	Students	Timeliness and usefulness of feedback.
Research-teaching integration	Inquiry, critical thinking, bridging theory and practice	Students	Presence of research activities in coursework.

Variable	Conceptual conceptual	Empirical Definition	Dimensions	Indicators	Data Col-Technq ique	Instrument	Unit of Mea-sure ment / Scale
University faculty investigativas del docente universitario	An integrated professional capacity that articulates knowledge, skills, attitud, and ethical criteria to investigate, produce and scientific and humanistic knowledge, and to guide and develop investigative processes in academic settings.	The competence level will be observed throu-gh a composite score derived from indicators of methodolo-gical mastery, scientific and humanistic production, research mentorship, and the integration of research into university teaching.	Methodological mastery co	Formulation of research problems, selection and justification of methods, design and validation of data collection instruments, data analysis, and interpretation of results.	Survey	Questionnaire	Ordinal Likert scale Likert (1 to 5) 5)

Figure 2. Visual extract of the original operationalization matrix for the independent variable contained in the thesis

Operationalization of the Dependent Variable The quality of academic training is defined as the degree to which the university process develops rigorous, relevant, reflective, and comprehensive learning. The thesis proposes observing it through academic rigor, student research competencies, relevance of faculty guidance, and the quality of academic outputs. This structure shifts measurement from an abstract notion of quality toward tangible manifestations of the educational experience. Academic rigor can be evaluated through intellectual demand, depth of content, coherence of the educational process, and analytical capability. Items must avoid confusing rigor with workload: a course can be demanding without necessarily promoting deep thinking. Therefore, it is advisable to formulate indicators related to argumentation, clarity of criteria, and the use of evidence. Student research competencies incorporate problem formulation, searching for scientific sources,

argumentation, methodological application, and interpretation. This dimension lends itself to combining perception with observable performance. A rubric applied to written assignments can provide additional evidence regarding the extent to which self-reported skills actually appear in academic work. The relevance of faculty guidance and the quality of academic outputs constitute dimensions closely related to the independent variable, but they must remain conceptually distinct. The former evaluates the support experience received; the latter examines the characteristics of the final product. Keeping them separate avoids circularity and allows for testing whether highly valued guidance effectively correlates with more robust outputs.

Table 3. Operationalization matrix of the academic training quality variable

Dimension	Suggested Indicators	Recommended Evidence
Academic rigor	Intellectual demand, depth, coherence, analysis	Survey + contextual academic indicators.
Student research competencies	Problems, sources, argumentation, methodology, interpretation	Survey + product rubric.
Relevance of faculty guidance	larity, monitoring, availability, feedback	Student survey.
Output quality	Coherence, methodological rigor, sources, analysis, robustness	Documentary review with rubric.

Scale Design and Score Interpretation In Figure 3, the proposed scale uses five alternatives: 1 very low, 2 low, 3 medium, 4 high, and 5 very high. This structure is simple for participants and facilitates coding. However, before establishing rigid cutoff points to classify global scores, it is advisable to analyze the empirical distribution, item consistency, and the logic of each dimension. A recommended practice consists of first calculating scores by dimension and then, if sufficient evidence of consistency exists, constructing a score per variable. This prevents a global value from concealing different profiles. For instance, two faculty members may obtain the same overall score even when one is strong in methodology and weak in scholarly production, while the other exhibits the opposite pattern. Interpretation should report descriptive measures, response distributions, and, when applicable, justified intervals or categories. Using means exclusively may oversimplify ordinal data; frequencies and percentages provide a transparent reading of response concentration.

Value	Rating scale
1	Very low
2	Low
3	Medium
4	High
5	Very high

Figure 3. Five-level rating scale proposed in the base thesis

Table 4. Operational interpretation of the five-level rating scale

Value	Category	Operational Interpretation
1	Very low	Minimal presence or clearly insufficient performance
2	Low	Limited presence
3	Medium	Intermediate level or irregular performance
4	High	Frequent and consistent presence
5	Very high	Highly consistent or outstanding presence

Instrument Validation Pathway The operationalization matrix serves as a starting point, but it does not replace validation. Prior to final administration, the questionnaire should be submitted to expert judgment to examine the clarity, relevance, and representativeness of each item. This review can employ quantified criteria alongside qualitative comments to identify redundancies, ambiguities, or content gaps. Subsequently, a pilot test should be conducted with participants sharing characteristics similar to the target population. The pilot allows for estimating response times, detecting problematic items, assessing omission patterns, and observing whether response categories function properly. It also provides an opportunity to review coding logic and database quality. Internal consistency can be analyzed using appropriate coefficients for multi-item scales. However, a high value should not automatically be interpreted as validity. An instrument can be internally consistent yet still measure the construct incompletely. Therefore, reliability must be integrated with content evidence and, sample size permitting, structural dimensional analysis. The validation process must be documented transparently. The final paper should report the number and profile of experts, selection criteria, modifications made, pilot test characteristics, coefficients obtained, and decisions regarding item elimination or rephrasing. This traceability strengthens the reproducibility of the study Table 5.

Table 5. Instrument validation process and expected outputs

Phase	Purpose	Expected Output
Expert judgment	Clarity, relevance, representativeness	Revised version of the questionnaire.
Pilot test	Comprehension, response time, omissions, response behavior	Operational adjustments.
Reliability	Item consistency per dimension	Coefficients and item review.
Structure	Examine correspondence between items and dimensions	Additional validity evidence.
Final administration	Obtain institutional data	Refined analytical database.

Statistical Analysis Strategy The analysis should begin with database cleaning, identification of missing values, range verification, and duplicate control. Each item must maintain a stable code and a documented scoring direction. Traceability among the operationalization matrix, questionnaire, and database prevents processing errors. The descriptive phase will include absolute frequencies, relative frequencies, percentages, and dimensional profiles. Bar charts can be particularly useful for comparing distributions, always accompanied by textual interpretation. If aggregated scores are constructed, the procedure must be explained and the

combination of items justified. To examine relationships between variables, the thesis proposes Spearman's Rho. This test is coherent with ordinal data and allows for estimating the strength and direction of a monotonic relationship. The reporting should include the coefficient, significance level, sample size, and an interpretation that avoids equating correlation with causality. Examining correlations among dimensions is also recommended, as they offer more actionable insights than a single overall coefficient.

Table 6. Levels of statistical analysis and key research questions

Level of analysis	Procedure	Question addressed
Item	Frequencies and percentages	How are responses distributed?
Dimension	Aggregated scores or profiles	What is the relative level of each component?
Variable	Cautious global synthesis	How does the overall construct behave?
Relationship	Spearman's Rho	Is there an association between variables or dimensions?
Documentary contrast	Perception-evidence comparison	Do ratings align with observable outputs?

Measurement Risks and Control Strategies Self-reporting can be affected by social desirability, selective memory, or differing interpretations of the same category. Combining self-reports with academic documents and outputs partially mitigates this risk. It is also recommended to guarantee anonymity, clarify that responses will carry no job or academic consequences, and draft neutral items. Another risk is conceptual overlap between variables. Certain indicators of mentoring or guidance appear within both the faculty profile and educational quality. To avoid circular reasoning, the measurement process must clearly distinguish instructor behavior from the evaluation of the educational outcome. Expert review can assist in detecting redundant items. Questionnaire length also warrants attention. A forty-item instrument can remain manageable if the phrasing is clear and completion time is kept reasonable, but the pilot test must verify participant fatigue and dropout rates. Should it become necessary to shorten the instrument, item elimination must be grounded in content relevance and empirical evidence rather than mere convenience.

Discussion

The operationalization proposal presents a key strength: it bridges theory and measurement through explicit dimensions while combining a survey with documentary review. This structure supports a richer evaluation than mere self-perception alone. Furthermore, it enables profile-based analysis, which is particularly useful for designing targeted faculty development initiatives. Its primary limitation is the current lack of dedicated psychometric evidence. Consequently, any practical application must be preceded by validation. Rather than presenting a finalized instrument, this article provides a measurement architecture derived from institutional research, designed to be refined and empirically tested.

Conclusions

Measuring research competencies and educational quality requires preserving the multidimensional nature of both constructs. The eight-dimension proposal provides a coherent foundation for constructing a structured questionnaire and organizing complementary evidence. The instrument's validity will depend on item quality, expert judgment, pilot testing, internal consistency, and analytical transparency. The incorporation of documentary review serves as an exceptionally valuable resource for contrasting perception with observable evidence. Future empirical phases should separately report descriptive results, reliability evidence, and statistical associations, maintaining caution regarding causal interpretation.

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