

Quantitative and Qualitative Analysis Techniques for Evaluation Results

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Abstract

Educational evaluation is a crucial process for measuring the effectiveness of learning; however, the data obtained is often not analyzed optimally due to a limited understanding of appropriate analytical techniques. This study aims to conduct an in-depth examination of the technical procedures for analyzing evaluation data, both numerical (quantitative) and narrative (qualitative). The method used is a literature review by examining textbooks and national and international journal articles published between 2017 and 2025. The results of the study indicate that a comprehensive evaluation requires the integration of statistical analysis techniques to test the validity, reliability, and discriminant power of test instruments, as well as qualitative analysis using an interactive model to understand the meaning behind non-test data. A combination of both approaches (mixed methods) is recommended to provide a complete picture of student competencies and the quality of educational programs.

INTRODUCTION

Assessment is a fundamental pillar of the education system that serves to determine the value and merit of a learning program in order to ensure educational quality (Widoyoko, 2017). However, empirical evidence shows that education practitioners often get bogged down in the administrative routines of assessment without conducting in-depth data analysis, thereby failing to capture the full essence of student development. This problem is exacerbated by methodological confusion in processing evaluation data, which is polarized into quantitative and qualitative data (Ghafar, 2024).

In the quantitative realm, the validity of instruments is an absolute prerequisite. Manual analysis is now considered inadequate; the use of computational technologies such as ANATES and SPSS has become imperative for accurately detecting the psychometric parameters of test items, particularly in logically structured subjects like mathematics (Dewi et al., 2025). On the other hand, quantitative approaches often fail to address the affective-spiritual dimensions that are crucial in Islamic education. This is where qualitative analysis through data reduction and verification plays a vital role in reconstructing contextual meanings that cannot be measured numerically (Jakiyah et al., 2025; Rangkuti & Albina, 2025).

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Educational evaluation is one of the main pillars in ensuring the quality of learning and the achievement of educational goals. Through evaluation, educators and policymakers can assess the effectiveness of programs as well as student competencies. However, evaluation practices often face obstacles due to a limited understanding of appropriate data analysis techniques, so the results obtained do not always fully reflect the quality of learning.

On the other hand, quantitative analysis plays a crucial role in ensuring the validity and reliability of evaluation instruments. The use of statistical techniques allows for more accurate detection of parameters such as discriminative power, difficulty level, and item effectiveness. This serves as the foundation for objective, data-driven decision-making, while minimizing measurement errors that could distort students' competency profiles.

In addition, qualitative analysis is necessary to capture the non-numerical dimensions of the educational process, such as the internalization of values, character development, and school culture dynamics. Through data condensation, presentation, and verification procedures, evaluators can reconstruct the meaning behind learning phenomena that cannot be revealed by numbers alone. This approach is highly relevant in the context of Islamic education, which emphasizes affective-spiritual aspects and values-based leadership.

Thus, this study aims to conduct an in-depth examination of the technical procedures for analyzing evaluation data through a literature review of the latest national and international literature. The integration of quantitative and qualitative approaches, or mixed methods, is recommended as a strategy capable of providing a comprehensive picture of both student competencies and the quality of educational programs. This approach is expected to strengthen the foundation for decision-making that is more objective, accountable, and meaningful for improving the quality of national education.

Recent trends in the literature point to a shift toward methodological pragmatism through the use of mixed methods to strengthen the validity of findings (Syauqi et al., 2026). Given this need, this article aims to synthesize the technical procedures of quantitative and qualitative data analysis in order to provide an accountable and comprehensive evaluation framework.

METHODS

This study employs a qualitative approach in the form of a literature review. This approach was chosen because the primary focus of the study is texts and literature, rather than direct field data. As explained by (Rinaldi & Albina, 2025), library research aims to collect in-depth information and data through the examination of various written documents, including reference books, scientific journals, and other relevant documents, to build a robust theoretical framework (Arbeni et al., 2024; Engkizar et al., 2018, 2025; Magdalena et al., 2021; Pariama et al., 2025; Susanna et al., 2024).

The data sources in this study consist of secondary data derived from 13 selected documents, including methodology textbooks and national and international scientific journal articles published over the past ten years (2017–2026). The selection of literature was based on criteria of relevance to the topics of data analysis techniques, learning evaluation, and instrument development. These sources include theoretical studies on evaluation (Ropii & Fahrurrozi, 2017; Widoyoko, 2017), empirical studies on item validity (Dewi et al., 2025), and the application of evaluation in the context of Islamic education and local wisdom (Baroud et al., 2025; Jakiyah et al., 2025; Kasheem et al., 2025; Rangkuti & Albina, 2025).

Data collection was conducted using a literature review method. The researchers searched for, inventoried, and classified literature discussing quantitative

(statistical) and qualitative (narrative) data analysis procedures. This process adapted the steps of a Systematic Literature Review (SLR) in a simplified manner, specifically by identifying, evaluating, and selecting articles that addressed validity, reliability, and mixed-methods data analysis techniques to ensure the currency and validity of the references used (Syauqi et al., 2026).

Data analysis was conducted using content analysis with the interactive model by Miles, Huberman, and Saldana. The analysis process consists of three main stages: First, data condensation: The researcher sorts and focuses the data on the technical procedures of the evaluation analysis, separating basic concepts from applied steps. Second, data display: the reduced data is systematically organized to map the differences and commonalities between quantitative and qualitative analysis techniques. Third, conclusion drawing/verification: synthesizing findings from various literature to formulate integrative guidelines for analyzing educational evaluation results (Sidiq & Choiri, 2019).

RESULT AND DISCUSSION

Based on an in-depth literature review of 13 reference documents, including methodological textbooks, empirical research reports, and recent scientific journal articles, this study successfully mapped the fundamental structure and technical procedures involved in educational evaluation data analysis. The findings of this study indicate that the effectiveness of evaluation depends heavily on the appropriate selection of analytical techniques that align with the ontological characteristics of the data. The following discussion presents the results of the analysis, categorized into the dimensions of data characteristics and comprehensive quantitative analysis procedures.

Ontological Characteristics and Dichotomies of Educational Evaluation Data

The most crucial first step in any evaluation process is understanding the nature or fundamental characteristics of the collected data. In the discourse on educational research methodology, data cannot be viewed as a single, homogeneous entity but is instead divided into two main categories that have different analytical implications. First, quantitative data, as a numerical representation referring to the methodological study presented by Sofwatillah et al., (2024) is defined as a set of information manifested in the form of numbers or numerical values. This type of data is generally obtained through standardized measurement instruments, such as cognitive learning outcome tests, Likert-scale questionnaires, or structured observation sheets converted into scores. The main characteristics of quantitative data are its objective, measurable, and generalizable nature. The epistemological advantage of this data lies in its ability to be processed using mathematical and statistical operations, thereby enabling researchers to test hypotheses, examine correlations between variables, and draw conclusions based on probability and statistical significance (Sofwatillah et al., 2024).

Second, qualitative data as a representation of meaning; on the other hand, Sidiq & Choiri, (2019) explain in their methodology textbook that qualitative data is characterized by being narrative, interpretive, and highly context-bound. This data does not take the form of numbers, but rather consists of transcripts of in-depth interviews, field notes from participatory observation, policy documents, or other visual artifacts. The primary function of qualitative data in evaluation is not to measure frequency or intensity, but to deconstruct the “meaning” behind educational phenomena. Ghafar, (2024), in his comparative study, emphasizes that while quantitative data focuses on the question “how much,” qualitative data serves to answer the questions “why” and “how” a learning outcome is formed. Understanding this dichotomy is vital, as errors in classifying data types can have fatal consequences for the choice of analytical techniques; imposing statistical logic

on qualitative data reduces its richness of meaning, while interpreting quantitative data subjectively without statistical testing undermines its scientific validity (Ghafar, 2024).

Quantitative Analysis Procedures: Psychometric Validation of Instruments

In the quantitative paradigm, data quality is highly dependent on the quality of the measurement instruments (instrument-dependent). Data will not have valid interpretive value if the instrument used to obtain it is flawed in its construction. Therefore, quantitative data analysis procedures always begin with testing the psychometric characteristics of the instrument, which include validity, reliability, difficulty level, discriminant power, and the effectiveness of distractors.

First, Instrument Validity Analysis (Validity). Validity is the most fundamental parameter in the development of evaluation instruments. Rinaldi & Albina, (2025) assert that validity refers to the extent to which an instrument actually measures what it is intended to measure. An invalid instrument will produce biased data (measurement error), thereby rendering the evaluation conclusions invalid. In the context of educational evaluation, there are three dimensions of validity that must be carefully analyzed. First, content validity, which ensures that the test items or statements in the instrument represent the subject matter or behavioral constructs intended to be measured. This analysis is typically conducted through expert judgment. Second, construct validity, which tests whether the instrument's structure aligns with the underlying theoretical concepts. Third, empirical or criterion validity, which is tested statistically. An empirical study conducted by Dewi et al., (2025) on 11th-grade matrix material demonstrates the technical procedures for testing empirical validity.

In the study, item validity was tested by correlating the score for each item with the total score using the Point Biserial correlation formula (for dichotomous data) or the Product Moment correlation formula (for polytomous data). The criteria for accepting test items were determined statistically, namely if the correlation coefficient ($r_{\text{calculated}}$) was greater than (r_{table}) at a 5% significance level. The findings of Dewi et al., (2025) underscore that test items with low correlation coefficients (e.g., < 0.30) should be eliminated or revised because they have been shown to lack accurate measurement power regarding student competencies.

Second, Instrument Reliability Analysis (Reliability). In addition to validity, evaluation instruments must also meet reliability criteria. Ropii & Fahrurrozi, (2017) define reliability as the degree of consistency or stability of measurement results. A test is considered reliable if, when administered repeatedly to the same subjects under relatively similar conditions, it yields stable results. Reliability analysis procedures vary depending on the type of instrument. For objective tests (multiple-choice), the commonly used technique is the Kuder-Richardson 20 (KR-20) formula, whereas for essay tests or psychological scale questionnaires, Cronbach's Alpha is frequently used. In evaluation practice, particularly for high-stakes testing such as final exams or national exams, a high level of reliability is an absolute requirement to ensure fairness for students. Dewi et al., (2025) established a standard in their analysis that an instrument is categorized as having good reliability if its reliability coefficient (r_{11}) is greater than 0.70. A value below this threshold indicates that the instrument has a large error variance and its internal structure needs to be improved (Dewi et al., 2025; Ropii & Fahrurrozi, 2017).

Third, Difficulty Index Analysis. The balance of a test instrument is largely determined by the proportion of items at different difficulty levels. Items that are too easy will not provide an adequate cognitive challenge, while items that are too difficult can reduce student motivation and fail to provide useful information about their actual abilities. Difficulty level analysis is conducted by calculating the proportion of students who answered correctly relative to the total number of test

participants. Based on a computational analysis using ANATES 4.1.0 software, Dewi et al., (2025) classified test items into three hierarchical categories. The first category is “Easy” items, defined as those with a difficulty index (P) greater than 0.70. The second category is “Moderate” items, with a difficulty index ranging from 0.30 to 0.70. The third category is ‘Difficult’ items, with a difficulty index less than 0.30. A key finding from this analysis is the need for evaluators to exercise caution regarding items falling into the “Very Difficult” category. Often, high student error rates on specific items are not caused by the complexity of the material, but rather by linguistic ambiguity or confusing sentence structures within the item. Therefore, statistical analysis of difficulty levels must always be followed by a qualitative review of the item wording.

Fourth, Analysis of Discriminatory Power. Discriminatory power is the ability of a test item to distinguish between groups of high-ability students (the top group) and low-ability students (the bottom group). Ropii & Fahrurrozi, (2017) explain that this analysis is conducted by comparing the proportion of correct answers among the top 27% of students and the bottom 27% of students. The discriminatory power index (D) ranges from -1.00 to +1.00. A good test item must have a significant positive discriminatory index (typically $D \geq 0.30$). If a test item is found to have a discriminatory power index close to zero, it means the item is unable to distinguish between students’ abilities. It is even more serious if a negative index is found, which means that students with lower ability actually answer correctly more often than high-achieving students. This condition indicates a serious construction flaw or an incorrect answer key, so the test item must be discarded or completely revised (Ropii & Fahrurrozi, 2017).

Fifth, Analysis of Distractor Efficiency. Specifically in multiple-choice test formats, the quality of the instrument is also determined by the effectiveness of the incorrect answer options, or distractors. Distractors are created not merely to fill the required number of options, but to mislead students who do not master the material well. Dewi et al., (2025) found in their study that a distractor is considered effective if it is selected by at least 5% of the total test participants. Additionally, the distribution pattern of responses must indicate that distractors are chosen more frequently by students in the lower-performing group compared to the higher-performing group. Distractors that are not selected at all by test takers are categorized as “junk” or non-functional, as they only increase the cognitive load of reading without contributing to the measurement of competency. These findings suggest that ineffective distractors should be revised immediately to make them more plausible for less competent students.

Technological Transformation in Quantitative Data Analysis

One significant finding in the contemporary methodological literature is the paradigm shift in analysis from manual methods to digital computation. The complexity of statistical formulas and the large volume of data in educational evaluations often lead to human error when performed manually. Dewi et al., (2025) demonstrated in their study the effectiveness of using two primary software programs that are highly recommended for education practitioners.

First, ANATES Version 4.1.0 for Classical Item Analysis. This software is specifically designed for item analysis using the Classical Test Theory approach. Its main advantages lie in its user-friendly interface and its ability to process five parameters simultaneously (validity, reliability, difficulty level, discriminative power, and distractor quality) in a single data run. Additionally, the output generated by ANATES provides direct categorical interpretations (e.g., “Good,” “Poor,” “Needs Revision”), making it much easier for teachers to decide the fate of a test item.

Second, IBM SPSS Statistics 26 for Inferential Analysis. For more complex analytical needs, such as testing construct validity through factor analysis, testing data

normality, or conducting regression analysis to examine the influence of variables, IBM SPSS Statistics is the top choice. This software offers calculation precision down to the smallest decimal place a level of accuracy that is difficult to achieve through manual calculations. The integration of technology into these analytical procedures has proven to not only enhance the accuracy and validity of findings but also improve time efficiency for educators and researchers. Therefore, proficiency in this statistical software has become an imperative competency for educational evaluators in the digital age (Dewi et al., 2025).

Descriptive Statistical Analysis for Evaluating Program Effectiveness

In addition to focusing on instrument testing, quantitative analysis techniques are also widely applied to evaluate the effectiveness of a program, method, or learning medium. Riyadi, (2024), in his research at Yogyakarta State University, provides a concrete example of the application of descriptive statistics to measure perceptions and the effectiveness of information technology use in mechanical engineering education. The analysis procedure applied involves several systematic stages. First, Data Tabulation and Conversion. The initial step is to tabulate the raw data obtained from student and faculty response questionnaires. Data, which is typically in the form of ordinal scores (Likert scale), is then converted into interval data or percentages to facilitate interpretation.

Second, Calculation of Measures of Central Tendency. The analysis continues with the calculation of measures of central tendency, such as the mean, median, and mode, as well as measures of dispersion, such as the standard deviation. These figures provide a general overview of the group's performance or perception regarding the evaluated object. Third, Categorical Interpretation: The average scores obtained are then categorized into predefined effectiveness criteria (e.g., Very Effective, Effective, Fair, Poor, Very Poor). Riyadi, (2024) used this technique to empirically demonstrate that the integration of digital learning platforms such as YouTube, Google Classroom, and Zoom Meetings has a significant impact on enhancing students' learning flexibility and conceptual understanding. This quantitative analysis provides a robust evidence-based foundation for policymakers to continue or modify technology-based learning strategies.

Qualitative Data Analysis Procedures: Meaning Reduction and the Construction of Reality

Although quantitative analysis offers numerical precision, this approach often faces epistemological limitations in capturing the "meaning" (*verstehen*) dimension of an educational phenomenon. Therefore, qualitative data analysis becomes a vital instrument to fill this gap, particularly in evaluating processual, affective, and cultural aspects. Based on a literature review of the Textbook on Research Methodology (2019) and (Ghafar, 2023) study, the procedures of qualitative analysis in educational evaluation do not proceed linearly but rather in a circular and iterative manner.

First, the Interactive Analysis Model. The most widely adopted technical procedure in qualitative educational evaluation is the interactive model developed by Miles, Huberman, and Saldana. As elaborated by Sidiq & Choiri, (2019), this model consists of three streams of activities that occur simultaneously during and after data collection. The first is Data Condensation. This stage is not merely a reduction of data but a process of transforming raw data. Evaluators conduct rigorous selection, focusing, simplification, and abstraction of data derived from field notes, interview transcripts, and documents. In the context of curriculum evaluation, for example, researchers sort through teachers' responses relevant to implementation barriers and discard data that is repetitive or insubstantial. Second is Data Display.

The condensed data is then organized into structured information sets. Sidiq & Choiri, (2019) emphasize that the presentation of qualitative data is not limited to lengthy narrative texts but can also take the form of matrices, graphs, networks, or

flowcharts. The goal is to make it easier for the evaluator to identify patterns of relationships among evaluation components and plan subsequent actions. Third is Conclusion Drawing and Verification. Evaluators begin to seek meaning from the patterns, causal explanations, and propositions that have emerged since the beginning of data collection. Initial conclusions, which are still tentative and vague, are then re-verified in the field to test their validity and robustness.

Second, the Role of the Researcher as a Key Instrument (Human Instrument) Unlike quantitative evaluation, which relies on the validity of test instruments, in qualitative analysis, data validity depends heavily on the researcher's own integrity and theoretical sensitivity. Rinaldi & Albina, (2025) emphasize that the researcher acts as a human instrument who determines the research focus, selects key informants, interprets data, and draws conclusions. Therefore, the researcher's ability to practice bracketing (setting aside personal assumptions) and reflexivity is an absolute requirement to ensure the analysis results are unbiased (Rinaldi & Albina, 2025).

The Application of Qualitative Analysis in the Contextualization of Islamic Values

The importance of qualitative analysis becomes increasingly relevant when applied to educational evaluation within Islamic educational institutions. Evaluation in this context is not only oriented toward the transfer of knowledge but also the transfer of values, which are often intangible. First, Evaluation of the Affective and Spiritual Dimensions the Rangkuti & Albina, 2025, in their study on the effectiveness of learning in Islamic educational institutions, highlights that indicators of educational success in madrasahs or *pesantren* include the cultivation of noble character and the internalization of religious values. These aspects are difficult to quantify precisely using objective tests. Through qualitative analysis in the form of participant observation and in-depth interviews, evaluators can capture the school's religious atmosphere, the depth of students' spiritual understanding, and the implementation of the hidden curriculum that shapes students' character. Narrative analysis of anecdotal records allows evaluators to assess the consistency of students' religious behavior outside the classroom, which is an authentic indicator of the success of Islamic education (Rangkuti & Albina, 2025).

Second, Case Study: Value-Based School Principal Leadership. A concrete application of qualitative analysis can be seen in the research and development (R&D) study conducted by Jakiyah et al., (2025). In developing a principal leadership module, the researchers used qualitative data analysis from Focus Group Discussions (FGDs) and expert interviews to validate the integration of Islamic values such as *amanah*, *tablig*, *fathonah*, and local wisdom. Qualitative analysis allows researchers to explore how these abstract concepts can be translated into operational performance indicators for school principals. These qualitative findings then became the philosophical foundation for the development of teacher performance evaluation instruments, demonstrating that qualitative analysis can bridge the gap between normative religious theory and educational managerial practice (Jakiyah et al., 2025).

Paradigmatic Integration through a Mixed-Methods Approach

Recent developments in educational research methodology indicate a shift from the "paradigm war" toward methodological pragmatism. Syauqi et al., (2026), through a Systematic Literature Review (SLR) of national journal articles, found a significant upward trend in the use of mixed methods. This approach is viewed as a comprehensive solution to address the weaknesses of each single-method approach.

Sequential Explanatory Design One of the most relevant mixed-methods designs in educational evaluation is the sequential explanatory design. Syauqi et al., (2026) explain that this design begins with the extensive collection and analysis of quantitative data, which is then followed by the collection of qualitative data to

explain those quantitative results in greater detail. For example, in language learning evaluations, language proficiency test data (quantitative) is used to map students' general competency levels. Subsequently, interview data (qualitative) is used to diagnose specific factors causing learning difficulties among students with low scores. This integration allows evaluators to not only understand “what” is happening (through numbers) but also “why” it is happening (through narratives) (Syauqi et al., 2026).

Methodological Triangulation for Robust Validity The use of mixed methods enables methodological triangulation, which is the process of comparing and cross-checking the reliability of information obtained through different time frames and tools. Ghafar, (2024) highlights that the combination of these two methods can be complementary: the subjectivity of qualitative data can be minimized with the support of objective statistical data, while the rigidity of statistical data can be enriched with a deep narrative context. This results in more robust and comprehensive evaluation findings, which are urgently needed by policymakers to formulate accurate, evidence-based educational improvement strategies (evidence-based policy).

CONCLUSION

This study confirms that educational evaluation analysis is not merely an administrative procedure, but rather a hermeneutic and statistical process that determines the quality of decision-making. In the quantitative realm, the validity and reliability of instruments are key requirements, supported by computational technologies such as ANATES and SPSS to precisely detect item parameters. Meanwhile, qualitative analysis plays a crucial role in uncovering the dimensions of values, character, and school culture, particularly in Islamic educational institutions that emphasize affective-spiritual aspects and values-based leadership.

The future direction of educational evaluation is moving toward the integration of mixed-methods approaches, which combine the strength of statistical generalization with the depth of narrative interpretation. This synergy strengthens validity through data triangulation and produces a holistic portrait of the effectiveness of learning and educational programs. Thus, evaluators and policymakers need to develop multidisciplinary competencies so that the evaluation system they build is not only objective and accountable but also meaningful and has tangible implications for improving the quality of national education.

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