Main Issues of Pedagogy and Psychology (MIOPAP)
ISSN: 1829-1295
Volume-4, Issue-1 (Jan - June 2026)

FACTOR ANALYSIS AND CONSTRUCT VALIDITY IN EDUCATIONAL RESEARCH: "A CRITICAL ANALYSIS OF ITS USE IN EDUCATIONAL AND PSYCHOLOGICAL MEASUREMENT"

Dr. Kadi Hanane
Specialization: Measurement in Psychology and Educational Sciences
University of M'sila, Algeria

Received: 14/12/2025 ; Accepted: 26/05/2026 ; Published: 11/06/2026

Abstract

Factor analysis occupies a central position in psychological and educational research as a method for examining the internal structure of measurement instruments. However, its value for making inferences about construct validity depends on the consistency between statistical evidence and the theoretical and content foundations of the construct being measured.

Against this background, the present study analyzes actual practices in the use of factor analysis in psychological and educational research. It also examines the relationship between factor-analytic findings and theoretical assumptions in instrument development and interpretation. The study adopts a critical analytical-documentary approach. It analyzes **50 studies**, including academic theses and scientific journal articles. The analysis focuses on the type of factor analysis used, factor extraction methods, the foundations of confirmatory factor models, and researchers' responses to agreement or disagreement between theoretical structures and empirical findings.

The results show that exploratory factor analysis was the most frequently used approach (**56%**). A further **24%** of the studies combined exploratory and confirmatory factor analysis, indicating a tendency to move from structural exploration to structural testing. Principal component analysis was the most frequently used method among the exploratory studies (**70%**). This finding raises a methodological concern about the distinction between data reduction and the identification of latent factors. The confirmatory models relied on previously established theoretical models in **59%** of the cases. The comparison between theoretical assumptions and factor-analytic findings also showed agreement in **74%** of the studies, while the remaining studies showed disagreement.

The study concludes that factor-analytic indicators provide important evidence regarding internal structure, but they cannot independently establish construct validity. Sound inference requires methodological integration of theoretical foundations, appropriate factor-analytic procedures, scientific interpretation of findings, and multiple sources of validity evidence. The study therefore proposes an integrative approach that treats factor analysis as one component of a broader validity argument rather than as a decisive and independent statistical criterion.

Keywords: Factor analysis; exploratory factor analysis; confirmatory factor analysis; factor structure; construct validity; psychometrics and educational measurement.

1. Introduction

Psychological and educational measurement provides a fundamental approach for moving the study of psychological and educational phenomena from description toward systematic and objective

measurement. However, measuring psychological traits such as intelligence, anxiety, motivation, adjustment, and thinking styles remains complex because these traits represent theoretical constructs that can not be observed directly.

Researchers therefore do not measure the trait itself. They infer it from behavioral indicators that represent its dimensions and components. Test development consequently begins with a theoretical conception of the target construct. It then identifies its dimensions and components and translates them into measurable indicators and items before subjecting the instrument to empirical examination.

Within this context, factor analysis has gained considerable importance as a statistical method for examining relationships among multiple variables and reducing them to latent factors that may explain part of their shared variance. Researchers widely use factor analysis in test development and internal-structure assessment, particularly through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). However, these two approaches differ in their assumptions and functions. EFA explores a possible structure when the dimensions remain insufficiently defined. CFA tests a factor model specified in advance. Principal component analysis (PCA) also differs conceptually and mathematically from common factor analysis.

Despite the scientific value of factor analysis, statistical findings alone cannot establish the validity of a psychological construct. High factor loadings or good model-fit indices do not necessarily show that the items adequately represent the theoretical construct or that the extracted factors correspond to the nature of the measured trait. This position agrees with the modern view of validity. This view no longer treats validity as a fixed property of a test. Instead, it considers validity in terms of the evidence that supports the interpretation and use of test scores. The *Standards for Educational and Psychological Testing* published by AERA, APA, and NCME emphasize that a validity argument requires multiple sources of evidence. These sources include evidence based on test content, response processes, internal structure, and relations with other variables.

Accordingly, factor analysis represents one source of evidence concerning internal structure. It does not represent test validity as a whole. A key methodological issue therefore concerns the relationship between theoretical expectations and empirical data. When factor analysis produces a structure that differs from the proposed theoretical structure, should researchers reject the theoretical model immediately? Should they revise it? Or should they examine other factors such as item quality, sample characteristics, administration conditions, data characteristics, extraction and rotation methods, and factor-retention criteria?

The present study adopts a critical approach. It does not seek to diminish the importance of factor analysis. Rather, it seeks to define its methodological limits and its appropriate position within test development and construct-validity assessment. The study examines the extent to which psychological and educational research practices integrate statistical evidence with theoretical foundations.
Accordingly, the study addresses the following main question:

To what extent do actual practices in the use of factor analysis in psychological and educational research integrate statistical evidence and theoretical foundations when researchers evaluate factor structure and the construct validity of psychological tests and scales?

The following sub-questions derive from this main question:

1. **What patterns characterize the use of exploratory and confirmatory factor analysis in the studies included in the analysis?**

2. **Which factor-extraction methods do researchers use most frequently in studies that employ exploratory factor analysis?**
3. **To what extent do confirmatory factor models rely on theoretical frameworks or previously established models?**
4. **How do researchers address discrepancies between theoretical structures and statistical findings?**
5. **Are factor-analytic indicators alone sufficient to establish the construct validity of psychological measures?**
6. **What methodological controls should researchers adopt to integrate statistical and theoretical approaches in test development and validity assessment?**

Objectives of the Study

The study aims to:

1. Analyze patterns of factor-analysis use in a set of psychological and educational studies.
2. Identify the factor-analytic procedures that researchers use most frequently, particularly in exploratory analysis and factor extraction.
3. Determine the extent to which theoretical foundations inform the development of confirmatory factor models.
4. Analyze how researchers address discrepancies between theoretical models and empirical data.
5. Examine the limits of relying solely on statistical indicators when evaluating psychological construct validity.
6. Propose an integrative methodological framework that combines theoretical and logical analysis with statistical analysis in the development of psychological and educational tests and scales.

Significance of the Study

The significance of this study rests on three main considerations.

- **Theoretical significance:** The study clarifies the relationship between construct validity and factor analysis. It emphasizes that factor structure should represent a clearly defined theoretical construct with specified dimensions and components. It should not simply represent a mathematical product of a correlation matrix.
- **Methodological significance:** The study seeks to promote a more rigorous use of factor analysis in psychological and educational research. Researchers should not treat factor analysis as an automatic procedure or as final evidence of test validity. Instead, they should consider it part of an integrated system of theoretical and statistical evidence that supports validity.
- **Practical significance:** The study provides a framework that may assist researchers and graduate students in psychology, educational sciences, and psychometrics when they develop, adapt, and evaluate measurement instruments and their psychometric properties.

2. Theoretical Framework and Definition of Key Concepts

2.1. The Concept of Validity in Psychological and Educational Measurement

Validity represents a fundamental concept in psychological and educational measurement because it concerns the **justification of interpretations and inferences based on test scores**. The concept has evolved from viewing validity as a fixed property of a test toward viewing it as a body of

evidence that supports score interpretations and uses according to the intended purpose of the instrument.

In this context, **Bringle et al. (2004)** argue that validity concerns the soundness of the basis underlying measurement and its correspondence with what the measure should represent. For a test, validity reflects the extent to which the test successfully measures what it was designed to measure **(Bringle et al., 2004, p. 10).** This view corresponds with **Cronbach and Meehl's (1955)** conception of construct validity. They relate test validity to the extent to which a test measures the intended theoretical construct and to the consistency between test scores and theoretical expectations concerning the nature, components, and relations of that construct with other variables **(Cronbach & Meehl, 1955, p. 281).**

Cronbach (1971) expanded this perspective by emphasizing **inferences derived from test scores**. He viewed validation as a process of collecting evidence that justifies such inferences. Researchers should therefore identify the intended inference first and then select the evidence that can support it **(Cronbach, 1971, p. 449).** Similarly, **Messick (1995)** conceptualizes validity as an overall evaluative judgment based on theoretical and empirical evidence concerning the extent to which evidence supports the interpretation and use of scores. A single source of evidence cannot establish validity **(Messick, 1995, p. 743).**

AERA (2006) states that validity concerns the extent to which evidence and theory support the proposed interpretation of test scores. The nature of this support varies according to the intended use of the instrument **(AERA, 2006, p. 35).** The **AERA, APA, and NCME (2014)** Standards also link validity evidence to the purposes of testing. These purposes include diagnosing current performance, predicting future performance, and estimating the extent to which an individual possesses the targeted trait or characteristic **(AERA, APA, & NCME, 2014, p. 13).**

From the **COSMIN** perspective, validity concerns the extent to which an instrument successfully measures the construct or constructs that it claims to measure. This perspective emphasizes the correspondence between the instrument and the target construct rather than the instrument's formal characteristics alone **(Mokkink et al., 2018, p. 1178).**

Accordingly, modern measurement theory views validity as **an integrated scientific argument based on accumulating theoretical and empirical evidence**. From this perspective, factor analysis provides an important source of evidence concerning internal structure. However, it cannot independently provide a final judgment of construct validity. Researchers should interpret factor-analytic findings in relation to the theoretical construct, the purpose of measurement, and other available sources of validity evidence.

2.2. Development of the Classification of Validity Evidence

The concept of validity has undergone several classifications in psychometric literature before contemporary measurement theory moved toward a **unified concept supported by multiple sources of evidence**. **Tigza (2008)** notes that the first guidelines classified validity into four major forms: content validity, predictive validity, concurrent validity, and construct validity. Later guidelines reorganized these forms into three types. They retained content validity and construct validity and integrated predictive and concurrent validity into the broader concept of criterion-related validity **(Tigza, 2008, p. 2).**

This classification followed a functional logic. Each form of validity served particular purposes. Content validity applied more directly to achievement tests. Criterion-related validity suited ability

and aptitude tests. Construct validity showed greater relevance to personality measures **(Tigza, 2008, p. 2).**

Later developments in measurement theory moved beyond this separation. They began to treat these forms as **multiple sources of evidence that contribute to a single validity argument**. The **AERA, APA, and NCME (2014)** Standards support this perspective. They no longer treat the earlier forms as independent types of validity. Instead, they view them as different sources of evidence that contribute to the interpretation of the target construct or psychological construct **(AERA, APA, & NCME, 2014, p. 10).**

This shift has direct relevance to the present study. It shows that **construct validity cannot be reduced to a single statistical finding**, including factor-analytic results. Factor analysis provides important evidence about internal structure and relationships among items and latent factors. However, it remains part of a broader body of evidence. It cannot independently resolve all questions concerning the validity of score interpretations or their intended uses.

2.3. Construct Validity

Construct validity emerged relatively late compared with other forms of validity. Its development closely relates to the need to measure **abstract psychological concepts that cannot be observed directly**. In this context, **Cronbach and Meehl (1955)** define construct validity in terms of the extent to which a test successfully measures the hypothetical trait or characteristic that it was designed to measure **(Cronbach & Meehl, 1955, p. 282).**

Constructs include broad concepts derived from common patterns across observable behavioral variables. The theoretical construct itself remains inaccessible to direct observation. Interest in such constructs therefore contributed to the development of construct validity as a central basis for evaluating psychological measures **(Anastasi & Urbina, 2015, p. 150).**

Researchers should not view construct validity as a final outcome that they establish once and for all. Instead, construct validity represents a cumulative and continuous process. This process involves testing hypotheses about the construct and interpreting the resulting scores in light of available evidence. In this context, **Loevinger (1979)**, as cited in **Al-Nabhani (2013)**, places construct validity within two complementary questions:

1. To what extent does the test measure a trait or characteristic that actually exists?

2. To what extent does the proposed interpretation of this trait or characteristic correspond to what the test actually measures?

The first question concerns the relationship between the test and the target characteristic. The second concerns the validity of the interpretation based on the scores. Researchers cannot fully separate the two perspectives. Evidence concerning relationships among test items provides a psychometric basis for understanding the instrument, while the second perspective allows researchers to assign psychological, educational, or professional meaning to these findings **(Al-Nabhani, 2013, p. 358).**

From this perspective, construct validity does not simply require researchers to verify that test items cluster statistically into specific factors. It also requires a deeper question: **Does the extracted statistical structure actually represent the theoretical construct that the instrument intends to measure?** This question constitutes the core of the present study.

2.4. Evidence Based on Internal Structure

Internal structure represents one of the major sources of evidence used to evaluate construct validity. It concerns the consistency between relationships among test elements and components and

the structure underlying the proposed interpretations of test scores. The theoretical structure may be unidimensional, where all items should belong to a single dimension, or multidimensional, where several distinct components should exist. Each component should also demonstrate an appropriate level of internal homogeneity **(AERA, APA, & NCME, 2014, p. 16).**

Accordingly, evidence based on internal structure addresses the following central question:

- **To what extent does the internal structure of the test reflect the theoretical conception of the construct that the test intends to measure?**

This question matters because internal structure reveals the relationships among the different components of an instrument. These components may include factors, dimensions, subcomponents, or individual items. When these relationships correspond to the theoretical conception, they provide important support for a validity argument.

Santee et al. (2019) noted that factor analysis and internal-consistency reliability represent among the most common procedures used to obtain evidence related to internal structure **(Santee et al., 2019, p. 224).**

However, the importance of internal structure does not make it the only source of construct-validity evidence. A statistically clear factor structure does not automatically establish that the extracted factors represent the proposed psychological constructs. Researchers should therefore interpret internal-structure findings in relation to the theoretical framework, item characteristics, expected relationships among dimensions, and other available sources of evidence.

2.5. Factor Analysis as a Tool for Examining Internal Structure

Factor analysis represents one of the main methods for examining the **internal structure** of tests and scales. It helps researchers identify patterns of relationships among items and the underlying dimensions or latent factors that may explain them. However, factor analysis does not represent a single procedure. It includes different approaches with different objectives and applications.

Furr and Bacharach (2014) distinguish three major approaches: **principal component analysis (PCA), exploratory factor analysis (EFA), and confirmatory factor analysis (CFA) (Furr & Bacharach, 2014, p. 210).**

These approaches differ in their underlying logic. **PCA and EFA** primarily support the exploration of patterns within the data. Researchers may also use rotation to obtain a clearer and more interpretable structure. **CFA**, by contrast, starts from a specified model. The model defines the factors, their relationships, and the items associated with each factor. Researchers then test the degree of correspondence between this model and the observed data **(Costello & Osborne, 2005).** The difference between exploratory and confirmatory analysis therefore involves more than technical procedures. It concerns the process of hypothesis development. Exploratory analysis gives the data a greater role in revealing a possible structure. Confirmatory analysis tests a specified structure derived from a theoretical conception or previous hypothesis.

Accordingly, factor analysis should not become an automatic search for a statistically acceptable structure. It should form part of a process that **begins with a clear theoretical conception and then uses statistical evidence to examine its consistency with empirical data**. A statistically acceptable factor structure does not automatically establish construct validity.

From this perspective, factor analysis represents **one source of evidence concerning the internal structure of an instrument**. It does not represent construct validity itself and cannot replace its multiple sources of evidence. The relationship among these concepts can be represented as follows: **Validity → An integrated, multi-source validity argument → Evidence based on internal structure → Factor analysis.**

This distinction becomes particularly important when factor-analytic findings lead researchers to delete items, modify the model, or reassign items to other factors. Researchers should not make such decisions solely on the basis of statistical indicators. They should also consider the **theoretical framework, item content, and psychometric interpretation**.

The present study therefore integrates two levels of analysis: an **empirical-statistical level**, which examines the fit of the factor structure to the data, and a **theoretical and interpretive level**, which determines the meaning of this structure and its consistency with the proposed psychological construct. The strength of factor-analytic evidence therefore depends not only on fit indices and factor loadings. It also depends on its contribution, together with other evidence, to a **coherent scientific interpretation of the instrument's scores**.

6. Methodology

6.1. Research Method

The present study adopted a **critical analytical-documentary approach** rather than merely describing the statistical procedures reported in the selected studies.

This approach fits the purpose of the study because the research does not seek to conduct a new factor analysis on original data. Instead, it seeks to **analyze and critically evaluate research practices themselves**.

6.2. Sample Characteristics

The sample consisted of **50 studies** in psychology, including academic studies and scientific articles published in peer-reviewed journals. The researcher selected the studies purposively according to criteria related to the research topic and the use of factor analysis. The researcher excluded any published article that had already been extracted from a master's thesis or doctoral dissertation included in the sample in order to avoid counting the same study more than once.

The selected studies were distributed as follows:

Type of study	Number	Percentage
Master's studies	10	20%
Doctoral studies	15	30%
Scientific articles	25	50%
Total	**50**	**100%**

6.3. Data Extraction and Coding Instrument

To ensure analytical transparency and consistency in data collection, the study used a structured **Content Analysis Coding Sheet** developed specifically for the present review. The coding instrument enabled the systematic extraction and classification of psychometric and methodological information from the 50 studies included in the corpus (N = 50).

The coding framework covered five main dimensions:

- **Bibliographic and Structural Profile:** This dimension recorded the type of study, including Master's thesis, Doctoral dissertation, or peer-reviewed journal article, as well as the field addressed by the study.
- **Type of Factor Analysis:** This dimension classified the reported factor-analytic approach as **Exploratory Factor Analysis (EFA)**, **Confirmatory Factor Analysis (CFA)**, or a combined **EFA-CFA approach**.
- **Factor Extraction and Model Specifications:** This dimension identified the factor extraction procedures used in exploratory analyses, with particular attention to the distinction between **Principal Component Analysis (PCA)** and **common-factor methods**. For CFA, the coding also recorded whether the tested model originated from an established theoretical framework or from an empirical model proposed by the researcher.
- **Decision-Making and Factor Retention Criteria:** This dimension captured the procedures used to determine the number of retained factors and to evaluate individual items. It included factor-retention criteria, factor-loading thresholds, item deletion, cross-loading decisions, and procedures for reassigning items to factors.
- **Theoretical Convergence:** This dimension assessed the degree of correspondence between the empirical factor structure and the theoretical structure specified before the factor analysis. It also recorded cases in which the statistical findings diverged from the initial theoretical expectations.

To assess the reliability of the coding process, an **inter-coder agreement procedure** was conducted on a randomly selected subsample of 10 studies, representing 20% of the total corpus. An external expert in psychometrics independently coded the selected studies using the same coding sheet. Agreement between the two coders was assessed using **Cohen's Kappa coefficient**. The analysis yielded a high agreement coefficient (kappa = 0.88), indicating a high level of coding consistency and supporting the reliability of the coding procedure before the full-scale data extraction and analysis.

7. Results

7.1. Type of Factor Analysis Used

The analysis of the studies included in the sample revealed variation in the use of factor analysis, as shown in the following table:

Type of analysis	Number	Percentage
Exploratory factor analysis (EFA)	28	56%
Confirmatory factor analysis (CFA)	10	20%
Both EFA and CFA	12	24%
Total	**50**	**100%**

Exploratory factor analysis showed the highest frequency of use. The combined use of exploratory and confirmatory factor analysis followed. Confirmatory factor analysis alone ranked last.

7.2. Exploratory Factor-Analysis Methods

This stage included **40 studies** out of the 50 studies that used exploratory factor analysis (EFA). The distribution of extraction methods was as follows:

Method	Number	Percentage
Principal component analysis (PCA)	28	70%
Other methods	12	30%
Total	**40**	**100%**

The results show that **principal component analysis (PCA)** was the most frequently used method among the studies that employed exploratory factor analysis, compared with other extraction methods.

7.3. Models Used in Confirmatory Factor Analysis

This stage included **22 studies** out of the 50 studies that used confirmatory factor analysis (CFA). The models were distributed as follows:

Model	Number	Percentage
Theoretical model of the scale	13	59%
Researcher-proposed model	9	41%
Total	**22**	**100%**

Theoretical models appeared more frequently in CFA applications. Some researchers also tested models that they proposed on the basis of the study findings.

7.4. Practices Used to Interpret Factor-Analytic Findings

The review identified several recurring practices in the interpretation of factor-analytic findings. These practices mainly included:

- Determining the number of factors according to statistical criteria.
- Examining eigenvalues and the percentage of explained variance.
- Examining factor loadings.
- Deleting items with weak or cross-loadings.
- Deleting factors that contained an insufficient number of items.
- Reassigning items according to their highest loading.
- Using theoretical meaning when interpreting some items and factors.

These practices reveal the use of multiple procedures for interpreting factor-analytic findings. They also show the presence of both statistical and interpretive considerations in the analysis of factor structure.

7.5. Agreement Between Theoretical Structure and Factor-Analytic Findings

The findings concerning the agreement between the theoretical structure and factor-analytic results were as follows:

Degree of agreement	Number	Percentage
Agreement between theoretical structure and factor-analytic findings	37	74%
Disagreement between theoretical structure and factor-analytic findings	13	26%
Total	**50**	**100%**

The results show that most studies reported agreement between the theoretical structure and the factor-analytic findings. However, a considerable proportion of studies showed disagreement. The

methodological implications of this variation require further interpretation in the discussion of the findings.

8. Discussion of the Findings

The findings show that factor analysis occupies a prominent position in the validation of measurement instruments, particularly exploratory factor analysis (EFA), either as a standalone procedure or in combination with confirmatory factor analysis (CFA). This practice agrees with the contemporary view of validity, which considers **internal structure one source of validity evidence** without treating it as sufficient evidence or as a final judgment of the validity of test-score interpretations and uses (AERA, APA, & NCME, 2014).

The findings also show that **24% of the studies combined EFA and CFA**. This practice represents a positive methodological tendency because it allows researchers to move from structural exploration to structural testing. However, the strength of this approach depends on the independence of the validation stage from the exploratory stage. The evidence becomes stronger when researchers test the model with an independent sample or new data rather than retesting the model on the same data from which they derived it.

The findings also reveal that **PCA accounted for 70% of the methods used in the exploratory studies**. This result highlights the need to distinguish between variable reduction and the identification of latent factors. Researchers should not automatically select PCA when the theoretical objective involves identifying an underlying psychological structure. The extraction method should correspond to the nature of the construct and the purpose of the analysis.

Regarding CFA, **59% of the studies used a theoretical model**, whereas 41% used a model proposed by the researcher. This finding emphasizes the importance of a **clear theoretical and content-based foundation** for factor models. Researchers should not evaluate a model only through statistical fit indices. The critical criterion concerns the extent to which the model supports the intended theoretical interpretation of scores.

The findings also show that researchers interpret factor structure through an interaction between **statistical evidence and theoretical judgment**. Factor loadings and fit indices alone cannot justify decisions such as item deletion or item reassignment. Factor analysis mainly shows how the data organize themselves. Determining whether this organization represents the proposed psychological construct requires additional theoretical and content-based judgment.

The finding that **74% of the studies showed agreement between the theoretical structure and factor-analytic results, whereas 26% showed disagreement**, deserves particular attention. Agreement provides empirical support for the proposed structure, but it does not constitute final evidence of validity. Conversely, disagreement does not necessarily indicate failure of the theoretical construct. It may result from sample characteristics, cultural context, item wording, sample size, factor-extraction method, or other sources of variation. Researchers should therefore treat disagreement as **diagnostic evidence that requires interpretation** rather than as a direct judgment against the theory.

The practices involving **item deletion and model modification** also require caution. Researchers should distinguish between improved statistical fit and improved measurement quality. Data-driven modifications without theoretical support may improve fit indices but reduce the instrument's representation of the construct or its content domain. Researchers should therefore provide theoretical and content-based justification for model modifications and verify these modifications in subsequent analyses.

Overall, the findings confirm that **the real value of factor analysis does not lie solely in producing a statistically acceptable model. It lies in its contribution to an integrated validity argument**. Such an approach requires a clear theoretical definition of the construct, systematic analysis of item content, an appropriate factor-analytic method, and interpretation of the findings in relation to theory, sample characteristics, and data properties. This position agrees with contemporary measurement standards, which define validity in terms of the extent to which evidence and theory support the interpretation of test scores for their intended uses.

9. General Conclusion

The study concludes that the main methodological issue does not concern the use of factor analysis itself. It concerns **how researchers use factor analysis and where they place it within the process of test development and validity assessment**. Factor analysis provides important evidence concerning internal structure, but it can not independently establish the validity of score interpretations and uses. Rigorous psychometric practice therefore requires integration among **theoretical foundations, content analysis, factor-analytic evidence, and other sources of validity evidence**. This integration supports a coherent and scientifically defensible validity argument.

10. Recommendations

Based on the findings, the study recommends the following:

- Researchers should begin with a **clear theoretical construct**, including its expected dimensions and relationships, before conducting factor analysis.
- Researchers should select the **factor-analytic method that matches the research objective** and clearly distinguish among PCA, EFA, and CFA.
- Researchers should strengthen the use of **EFA followed by CFA with independent samples** when they develop factor models and when methodological conditions allow such an approach.
- Researchers should link decisions concerning **item deletion and model modification** to theoretical and content-based justifications rather than relying only on fit indices or statistical loadings.
- Researchers should treat factor analysis as **evidence concerning internal structure within a broader validity argument**, rather than as an independent or final criterion for establishing construct validity

References

1. Al-Nabhan, M. (2013). *Fundamentals of Measurement in Behavioral Sciences* (2nd ed.). Dar Al-Shorouk for Publishing and Distribution.
2. American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME]. (2014). *Standards for educational and psychological testing*. American Educational Research Association.
3. Anastasi, A., & Urbina, S. (2015). *Psychological Testing* (1st ed.) (Salah El-Din Mahmoud Allam, Trans.). Dar Al-Fikr Al-Arabi Publishers and Distributors.
4. Bringle, R. G., Phillips, M. A., & Hudson, M. (2004). *The measure of service learning: Research scales to assess student experiences* (2nd ed.). American Psychological Association.
5. Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation*, 10(7), 1–9.

6. Cronbach, L. J. (1971). Test validation. In R. L. Thorndike (Ed.), *Educational Measurement* (2nd ed., pp. 443–507). American Council on Education.
7. Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*, 52(4), 281–302.
8. Furr, R. M., & Bacharach, V. R. (2014). *Psychometrics: An Introduction* (2nd ed.). SAGE Publications.
9. Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist*, 50(9), 741–749.
10. Mokkink, L. B., de Vet, H. C. W., Prinsen, C. A. C., Patrick, D. L., Alonso, J., Bouter, L. M., & Terwee, C. B. (2018). COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. *Quality of Life Research*, 27(5), 1171–1179.
11. Santee, J. A., Marszalek, J. M., & Hardinger, K. L. (2019). A critique of validity analysis from instruments assessing the affective domain. *Currents in Pharmacy Teaching and Learning*, 11(2), 221–225.
12. Tigza, M. B. (2008). *Modern Validity Theory and Its Developmental Implications for the Reality of Measurement*. College of Education, Department of Psychology, King Saud University.