A COMPARATIVE STUDY OF STATISTICAL TECHNIQUES IN EDUCATION AND LANGUAGE & LINGUISTICS RESEARCH ARTICLES

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Abstract

This study compared statistical techniques frequently used in Education and Language & Linguistics research to identify disciplinary similarities and differences. To achieve this, 80 research articles (40 from each field) published between 2021 and 2025 in Cambridge University Press journal database were analyzed and categorized into descriptive, inferential, and advanced statistics. The findings revealed that descriptive statistics were prevalently observed in both fields. Regarding inferential statistics, they were more frequently applied in Education than in Language & Linguistics. These indicated Education's stronger focus on hypothesis testing. The most striking difference was the use of advanced statistics, which appeared far more frequently in Education—though often inconsistently—than in Language & Linguistics. These results underscore distinct methodological emphases and highlight the need to support researchers' statistical literacy to produce rigorous studies in their respective disciplines.

Keywords: Statistical Use, Statistical Techniques, Education, Language & Linguistics, Peer-Reviewed Research Articles

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Introduction

Statistical analysis remains paramount for producing rigorous and impactful research in Education as well as Language & Linguistics. It might be true that methodological textbooks proffer foundational techniques, but real-world applications of statistics diverge depending on disciplinary norms, research aims, and researcher expertise (Azmay et al., 2023). Examining how these methods are reported in published research articles offers practical insights beyond textbook explanations and instructions. This allows scholars and researchers to see precisely how common techniques are used and adapted in authentic studies. As seen in Null hypothesis significance testing (NHST), it still dominates quantitative inquiries, despite ongoing debates about its value relative to effect size estimation and confidence intervals (Loewen et al., 2013). Descriptive statistics, Pearson correlation, ANOVA, and t-test likewise remain prevalent (Lazaraton, 2000). Though advanced approaches such as Structural Equation Modeling and Bayesian analysis have gained traction, a number of researchers persist in relying on fundamental statistical procedures—often due to limited statistical training (Azmay et al., 2023). Therefore, appropriate method selection is critical for ensuring methodological rigor, transparency, and replicability.

To fill the gap between theories and real-world applications, this comparative study compiles and systematically appraises frequently used statistical methods in research articles across Education and Language & Linguistics. By identifying prevalent techniques, exploring diverse research designs, and assessing the extent to which sophisticated methods are adopted, the study underscores the real-world uses of statistics that often surpass what is detailed in textbooks. The study's findings are intended to provide educators, researchers, and journal editors with a comprehensive understanding of the statistical methodologies that are predominantly employed within the domains of Education and Language and Linguistics.

Objectives

This study aims to examine how statistical methods are used in the disciplines of Education and Language & Linguistics by analyzing their frequency, application, and trends from 2021 to 2025. It seeks to highlight methodological choices made by researchers, ranging from basic descriptive statistics to advanced modeling techniques, and to determine how these statistical uses reflect disciplinary characteristics. Additionally, the study aims to

provide a practical understanding of real-world statistical practices, which could be highly significant for researchers in these fields.

Research Questions

The study addresses three key questions:

- RQ1: What are the most frequently used statistical techniques in research articles within Education and Language & Linguistics?

- RQ2: How are the most frequently used statistical methods applied in Education and Language & Linguistics research, and what patterns or purposes emerge?"

- RQ3: What trends emerge in the use of statistical methods in Education and Language & Linguistics research over time?

Literature Review

The Role of Statistics in Education and Language & Linguistics Research

Statistical methods constitute a cornerstone of validity, reliability, and generalizability in Education and Language & Linguistics research. More specifically, they provide a structured framework for measurement, data interpretation, and hypothesis testing, which reduces biases in research design. Proper application yields meaningful conclusions from sample data and fosters replicable, robust results (Loewen and Gass, 2009; Ravid and Oyer, 2011). Notably, Loewen and Gass (2009: 181-190) emphasize descriptive and inferential statistics as indispensable tools in second language acquisition studies. Equally important, reliability and validity, being core components of rigorous methodology, produce consistent measurements across repeated observations and ensure the accurate assessment of intended constructs (Loewen and Gass, 2009). Likewise, Ravid and Oyer (2011) warn that improper inferential tests or assumption violations can compromise findings. Mulder (2020) critiques overreliance on p-values in NHST and advocates a stronger focus on effect sizes and confidence intervals. Statistical literacy is vital for precise data interpretation, as Mulder (2020) notes that flawed test selection or erroneous effect size reporting undermines research integrity. Correspondingly, Riazi and Farsani (2024) document the mechanical application of statistical tests without verifying their alignment with research questions. Education studies often misuse NHST, overemphasize p-values, and overlook effect sizes or confidence intervals (Ravid and Oyer, 2011). In Language & Linguistics, misguided corpus-

based analyses present similar concerns (Mulder, 2020; Riazi and Farsani, 2024). Nevertheless, advanced modeling and multivariate analyses have received increasing attention, although many researchers still rely on descriptive and basic inferential tests (Loewen and Gass, 2009; Ravid and Oyer, 2011). SEM and Bayesian inference remain underutilized (Mulder, 2020; Riazi and Farsani, 2024). Indeed, Riazi and Farsani (2024) cite persistent methodological oversights. Ravid and Oyer (2011) propose that graduate programs lack sufficient training in statistical reasoning, which fosters a gap between theoretical knowledge and real-world application. Accordingly, closer analysis of published studies illuminates methodological strengths and weaknesses, reveals disciplinary norms, and highlights evolving practices. This approach underscores the broad significance of statistical literacy in both Education and Language & Linguistics research (Mulder, 2020; Riazi and Farsani, 2024).

Regarding studies on statistical use in Education and Language & Linguistics Research between 2020 and 2025, they consider statistical methods central to their fields, though approaches differ across these fields. Education researchers adopt inferential techniques (e.g., ANOVA, regression, and t-test) to measure learning outcomes and examine causality (Azmay et al., 2023). These methods allow for generalization and reveal patterns in student performance. In contrast, descriptive and correlational methods are commonly employed in Language & Linguistics (e.g., frequency counts and Chi-square tests) (Crowther et al., 2020). This disparity signals a significant methodological gap. Education has embraced experimental designs, whereas the adoption of advanced quantitative approaches has progressed at a slower pace in Language & Linguistics (Azmay et al., 2023; Riazi and Farsani, 2024).

Many researchers question existing practices because factor analysis, Structural Equation Modeling, and predictive modeling remain underused (Azmay et al., 2023; Mulder, 2020). The omission of effect sizes and incomplete confidence intervals also diminishes the clarity of findings (Riazi and Farsani, 2024). The lack of integration of statistical methods across disciplines presents another concern. Education commonly uses experimental designs, whereas Language & Linguistics often favors descriptive analyses rooted in historical preferences (Azmay et al., 2023). Misapplied reliability coefficients (e.g., Cronbach's alpha) undermine study credibility (Crowther et al., 2020). Implementing stronger reporting standards and utilizing advanced statistical models could significantly enhance empirical

findings. Scholars emphasize that deeper engagement with statistical concepts fosters transparency, rigor, and reproducibility. Azmay et al. (2023) note that critical thinking is essential to connect theory and practice. Riazi and Farsani (2024) argue that stronger familiarity with statistical methods enhances credibility in Education and Language & Linguistics research. Refined methodological approaches would improve the overall impact of both fields.

Methodology

1. Data and Journal Selection Hence, data were drawn from peer-reviewed articles in Education and Language & Linguistics journals within Cambridge University Press, dating from 2021 to 2025. This timeframe reflects recent statistical developments. Only studies with quantitative or mixed-methods designs that mention or apply statistical techniques were included; purely qualitative or theoretical works were excluded. The final set of Education journals comprises *Australasian Journal of Special and Inclusive Education, Language Teaching, Memory, Mind & Media,* and *ReCALL*. In Language & Linguistics, the sample features *Bilingualism: Language and Cognition, English Language & Linguistics, Journal of Linguistics, and Language Variation and Change.*

2. Research Article Selection A systematic approach ensured comprehensive coverage of relevant research outputs. Each article underwent screening for explicit or implicit statistical methods. Book reviews, editorials, and theoretical papers were omitted. Purposive sampling reinforced methodological relevance and targeted articles with clear statistical analyses, resulting in a balanced set across the selected journals.

3. Data Analysis The study documented each statistical technique verbatim, then grouped them into descriptive (e.g., mean, standard deviation), inferential (e.g., t-test, ANOVA, correlation, regression), or advanced (e.g., Structural Equation Modeling, factor analysis, Bayesian analysis, multilevel modeling). Each technique counted once per article to avoid inflated frequencies. Two coders examined 80 articles, recorded technique names, and assigned them to categories, which yielded substantial interrater reliability (Cohen's kappa = .75). Microsoft Excel supported data classification and calculations, thereby strengthening consistency and accuracy.

4. Research Ethics This study adheres to strict ethical research standards, ensuring the responsible and appropriate handling of published academic work. As the study does

not involve human participants, it qualifies for an Exemption Review under institutional research ethics guidelines. This ethical approval was granted by the Mahasarakham University Ethics Committee for Research Involving Human Subjects under approval number 375-410/2024. As a secondary analysis of published research articles, no personal or sensitive data were collected, thereby minimizing ethical concerns. To maintain academic integrity, all selected research articles were analyzed in aggregate rather than on an individual basis, ensuring that no single study was misrepresented or disproportionately emphasized. This approach aligns with ethical guidelines for content analysis, ensuring that published materials are examined solely for academic purposes.

5. Limitations of the Study Regarding the limitations of the study, this study is confined to two disciplines: Education and Language and Linguistics; thus, limiting the generalizability of the findings to other fields with differing methodological conventions. With the humble number of selected research articles (2021–2025), the results could not fully capture longitudinal developments in statistical practices. Moreover, this current study intentionally avoided employing complex statistical analyses to preserve interpretive clarity and readability for readers because their inclusion and comprehension could be obscured via explanations and discussion heavily used with statistical terms. This decision was deliberately made to increase the content accessibility to a wider academic audience, especially those without advanced statistical knowledge. Future studies could possibly consider integrating more advanced tools or statistical models to pull together deeper correlations between research design, disciplinary focus, and statistical choices with the increased number of research articles with more various fields.

Findings

The research result found that:

Table 1: The number of research articles in selected journals (2021–2025)

Types of journals	The number of research articles					Total
	2025	2024	2023	2022	2021	
Journals in Education						
1. Australasian Journal of Special and Inclusive Education	-	2	5	2	1	10
2. Language Teaching	1	2	6	1	-	10
3. Memory, Mind & Media	-	5	2	3	-	10
4. ReCALL	7	3	-	-	-	10
Journals in Language and Linguistics						
1. Bilingualism: Language and Cognition	10	-	-	-	-	10
2. English Language & Linguistics	3	7	-	-	-	10
3. Journal of Linguistics	3	6	1	-	-	10
4. Language Variation and Change	2	8	-	-	-	10
						80

The number of research articles analyzed per year varies across journals due to natural fluctuations in academic publishing. In Educational journals, the highest number of studies was published in 2023 (13 articles), while the lowest was in 2021 (1 article). Language and Linguistics journals, on the other hand, had the highest number of publications in 2024 (21 articles), which may indicate variations in research output across years. This current study prioritizes capturing the most recent and relevant research articles based on journal availability, ensuring its findings reflect real-world publication trends rather than adhering to a predetermined numerical balance. This distribution also highlights distinct publishing patterns across journals, such as Bilingualism: Language and Cognition publishing all its statistical-based articles in 2025 (10 articles), while ReCALL focused its empirical and statistical-based publications in 2025 and 2024. These variations may reflect shifts in research priorities and methodological advancements. By addressing these fundamental differences, this study provides a more accurate interpretation of findings.

RQ1: What are the most frequently used statistical techniques in research articles within Education and Language & Linguistics?

Table 2: Most frequently used statistical techniques in research articles (Education vs. Language & Linguistics)

Statistical category	Education (40 research articles)	Language & Linguistics (40 research articles)
1. Descriptive statistics	29	33
2. Inferential statistics	12	16
3. Advanced statistics	57	9

Table 2 summarizes how 40 Education articles and 40 Language & Linguistics articles applied descriptive statistics, inferential statistics, and Advanced Modeling Techniques. Descriptive methods feature prominently in both fields, with 29 Education articles and 33 Language & Linguistics articles using measures such as means, frequencies, and standard deviations to summarize data. This high usage in both disciplines underscores the universal role of descriptive statistics in presenting and exploring data before advancing to more complex analyses. Moving beyond description, inferential statistics are also widely used, though with varying frequency. Education research applies inferential methods in 12 instances, often through t-test, ANOVA, or correlational analyses, to examine group differences and relationships. In contrast, Language & Linguistics reports 16 instances, indicating a more moderate application of tests aimed at inferring population-level trends. This difference likely reflects the stronger focus on experimental or quasi-experimental designs in Education, where causal inferences are frequently sought. Most notably, a marked divergence appears in the use of advanced statistics. Education employs advanced methods 57 times, far exceeding the 9 instances in Language & Linguistics. These advanced approaches in Education may include multilevel modeling, Structural Equation Modeling, and other frameworks for analyzing complex, nested data. Although Language & Linguistics occasionally uses advanced techniques such as mixed-effects models, these are significantly less common, highlighting different methodological traditions. Overall, while both fields rely on descriptive statistics, Education demonstrates greater engagement with both inferential and advanced techniques, likely driven by a stronger emphasis on intervention-based and large-scale studies, whereas Language & Linguistics adopts complex models more selectively across its diverse research topics.

RQ2: How are the most frequently used statistical methods applied in Education and Language & Linguistics research, and what patterns or purposes emerge?

Table 3: Most frequently used statistical methods and their applications in Education and Language & Linguistics research articles

Field	Statistical Technique	Category	Instances*
Education (40 research articles)	1. descriptive statistics	descriptive statistics	29 (27.4%)
	2. Chi-square test	inferential statistics	5 (4.7%)
	3. t-test	inferential statistics	5 (4.7%)
	4. Cohen's d (Effect Size)	descriptive statistics	4 (3.8%)
	5. Cronbach's Alpha	descriptive statistics	4 (3.8%)
	6. ANOVA	interferential statistics	2 (1.9%)
	7. Multiple regression analysis	advanced statistics	2 (1.9%)
	8. Regression Analysis	advanced statistics	2 (1.9%)
	9. All other advanced statistics (e.g., Kendall's W, Meta-analysis, Mixed Models, each used once)	advanced statistics	53 (50%)
Language & Linguistics (40 research articles)	1. descriptive statistics	descriptive statistics	33 (55%)
	2. ANOVA	inferential statistics	5 (8.3%)
	3. mixed-effects logistic regression	advanced statistics	3 (5%)
	4. Bayesian probabilistic modeling	advanced statistics	3 (5%)
	5. Chi-square significance testing	inferential statistics	4 (6.7%)
	6. Chi-square test for Categorical Data	inferential statistics	4 (6.7%)
	7. generalized linear mixed models (GLMM)	advanced statistics	3 (5%)
	8. t-test	inferential statistics	3 (5%)
	9. acceptability judgment task (Likert Scale)	descriptive statistics	2 (3.3)

Note: Instance* refers to the single occurrence counted in each research article.

Table 3 highlights both the prevalence and variation of statistical methods across Education and Language & Linguistics. Descriptive statistics remain central in both fields, with 29 instances in Education and 33 in Language & Linguistics. However, Education frequently supplements these with Cohen's d and Cronbach's Alpha (4 instances each) to report effect sizes and reliability, while Language & Linguistics includes acceptability judgment tasks (2 instances) to assess linguistic responses. Thus, although both fields focus on data

summarization, Education emphasizes reliability, whereas Language & Linguistics applies field-specific descriptive measures. Furthermore, inferential statistics play a pivotal yet differently emphasized role. Education relies equally on Chi-square tests and t-tests (5 instances each) to analyze categorical relationships and group comparisons. Conversely, Language & Linguistics employs ANOVA most often (5 instances), alongside Chi-square (4 instances each) and t-tests (3 instances). Hence, while Education favors Chi-square and t-test, Language & Linguistics adopts a broader set, particularly ANOVA, to examine more complex group differences, though both share foundational tools like Chi-square and t-test for hypothesis testing. Most significantly, advanced statistics underscore the sharpest divergence. Education reports 59 instances, though most techniques—aside from Multiple Regression and regression analysis (2 instances each)—are used only once, showing a fragmented approach. By contrast, Language & Linguistics records 9 instances, focusing consistently on mixed-effects logistic regression, Bayesian modeling, and GLMM (3 instances each). Thus, Education demonstrates broader but less consistent use, while Language & Linguistics applies advanced models in a more targeted and systematic way, reflecting differences in data complexity and research traditions.

In addition to the raw frequencies, this section employed percentages to further clarify the patterns of statistical methods across the two disciplines. For doing so, the percentages were calculated by dividing the number of instances of each statistical category (descriptive, inferential, and advanced) by the total number of statistical techniques observed in each field. Specifically, the total instances were 106 for Education and 60 for Language & Linguistics. In Education, descriptive statistics accounted for 27.4% of the total statistical techniques employed, while inferential statistics represented 11.3% and advanced statistics 61.3%. In contrast, Language & Linguistics exhibited 55% use of descriptive statistics, 26.6% of inferential statistics, and 18.3% of advanced statistics. These percentages illustrate that Education places greater emphasis on advanced statistical modeling, albeit inconsistently. Conversely, Language & Linguistics relies more on descriptive techniques with selective, systematic adoption of advanced methods. This additional quantification provides a more precise visualization of disciplinary tendencies in statistical practices.

RQ3: What trends emerge in the use of statistical methods in Education and Language and Linguistics research over time?

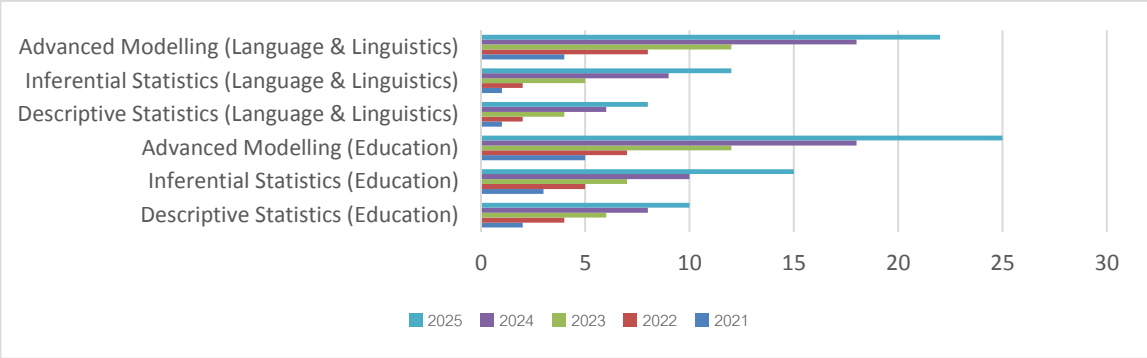

Figure 1 Trends in the use of statistical methods in Education and Language & Linguistics Research (2021–2025)

Figure 1 illustrates trends in the use of statistical methods in Education and Language & Linguistics research from 2021 to 2025, highlighting shifts in descriptive statistics and Advanced Modeling. To begin with, descriptive statistics remain inferential statistics consistently employed across both fields, though they are slightly more frequent in Education. Over the years, Education shows steady growth in the use of descriptive techniques, while Language & Linguistics maintains moderate but stable usage. This reflects both fields' shared reliance on descriptive tools for summarizing data, although Education appears to integrate them more systematically. In addition to descriptive methods, Inferential statistics reveal divergent patterns between the two fields. Education shows a steady increase, reaching a peak in 2023 and maintaining high usage in subsequent years, indicating a sustained focus on testing relationships and group comparisons. Conversely, Language & Linguistics demonstrates more modest and fluctuating use of inferential techniques, suggesting less consistent reliance on hypothesis testing. This contrast may reflect differences in research designs, with Education often favoring experimental studies that require inferential tools.

Regarding the most striking difference between the two disciplines, it is observed in the use of advanced statistics. Education demonstrates a sharp increase in the use of advanced methods, particularly in 2025, which reflects the growing interest in complex analyses. In contrast, Language and Linguistics shows a gradual but smaller rise, reaching its peak in 2025, though remaining less extensive than in Education. This suggests that, while both fields are adopting more advanced techniques over time, Education is progressing

toward complex models at a faster rate – possibly due to the need for more robust analyses in large-scale or intervention-based studies.

Discussion

Descriptive statistics function as universal tools across both Education and Language & Linguistics research articles; it underscores shared emphasis on data summarization. However, distinct tendencies emerge between the two fields. Education frequently supplements descriptive analyses with measures of reliability and effect size, such as Cohen's d and Cronbach's Alpha, aligning with Mulder's (2020) call for rigorous statistical reporting. For Language & Linguistics, it often integrates field-specific descriptive tools, such as acceptability judgment tasks, which relatively reflect a methodological orientation toward capturing subjective linguistic evaluations. Thus, while both fields prioritize descriptive techniques, Education emphasizes statistical reliability and quantification, whereas Language & Linguistics adapts its descriptive approaches to the nuances of linguistic inquiry.

Moreover, inferential statistics play a crucial role in both fields, though used differently. According to Table 2, Education employs inferential methods 30 times, nearly double the 16 instances in Language & Linguistics, highlighting Education's stronger focus on hypothesis testing within intervention-based research (Ravid and Oyer, 2011). Table 3 further indicates that Chi-square tests and t-tests (5 instances each) dominate Education, whereas Language & Linguistics relies more on ANOVA (5 instances), supplemented by Chi-square (4 instances each) and t-tests (3 instances). These patterns reflect broader methodological shifts noted by Gonulal (2020) and Azmay et al. (2023), where Language & Linguistics increasingly adopts experimental designs. Nevertheless, both fields consistently use Chi-square and t-test as core tools, supporting Riazi and Farsani's (2024) argument on the growing role of quantitative analysis in applied linguistics.

Finally, the use of advanced statistics marks the most significant divergence and yields the trends over time (2021-2025). As Table 2 reveals, Education reports 57 instances, compared to simply 9 instances in Language & Linguistics; this finding highlights a fragmented application (Crowther et al., 2020). This fragmented application of advanced statistics in Education further indicates a broad yet inconsistent use of statistical methods. At this point, researchers in this discipline employ a plurality of advanced techniques. As seen in Table 3, advanced techniques appear only once across studies, which shows an exploratory rather

than systematic approach. This is incongruent with research articles in Language and Linguistics. There are fewer advanced methods found; however, they are applied more consistently. It denotes that the lack of repeated statistical models in Education features ongoing experimentation rather than the establishment of standardized methodologies, which may affect methodological coherence and replicability in the field. In contrast, Language and Linguistics demonstrates a gradual use of advanced techniques but remains relatively far from Education. Language and Linguistics apply mixed-effects logistic regression, Bayesian modeling, and GLMM (3 instances each). This is in line with its need to model nested linguistic data (Azmay et al., 2023; Gonulal, 2020). Therefore, while Education experiments widely but inconsistently with advanced tools, Language and Linguistics applies fewer but methodologically coherent models, reflecting distinct research designs and analytical traditions. These findings echo calls by Felix and Felix (2024) and Mulder (2020) for improved statistical literacy and consistent use of effect sizes and confidence intervals in both fields.

Conclusion and recommendation

This study has elucidated the pivotal role of statistical techniques in Education and Language & Linguistics research while accentuating distinct disciplinary trends. Through an analysis of 80 peer-reviewed articles published between 2021 and 2025, it was found that although descriptive statistics are ubiquitously employed across both fields, the extent and sophistication of inferential and advanced statistical applications diverge markedly. Education research exhibits a broader yet less coherent engagement with advanced statistical methods; this reflects a propensity toward methodological experimentation. Conversely, Language & Linguistics research demonstrates a more judicious and methodologically cogent application of advanced techniques. In terms of findings, they collectively reflect that Education research articles are increasingly embracing a plethora of statistical models, albeit with variable consistency. On the contrary, Language & Linguistics ones prioritize methodological rigor through targeted analytical strategies. Such disciplinary divergences underscore the imperative to foster greater statistical literacy, thereby enhancing methodological transparency, replicability, and scrutiny within and across fields.

Apart from the conclusion, it is suggestive that researchers in these two disciplines (Education and Language & Linguistics), including related fields, cultivate greater statistical

acumen regarding the judicious adoption of advanced statistical techniques in addition to descriptive and inferential statistics. For future studies in similar topics, researchers are to further strive for methodological coherence by selecting sound statistical techniques that align cogently and logically with their research design so as to produce robust and reliable findings. With decent statistics, expanding comparative analyses across additional disciplines would augment the deep understanding of statistical practices in diverse academic fields.

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