Disclaimer: This example does not strictly adhere to APA format.

The dataset was obtained from Kaggle:
https://www.kaggle.com/datasets/otuakpeboy/manova-dataset-for-teaching-methods

This analysis was performed using Jamovi and interpreted by Dr. Kimberly A Ford.
(https://www.jamovi.org/)
Jamovi is an open-source statistical software similar to SPSS.

Only the English scores were analyzed for this research; no other mean scores from other courses were used from the dataset.

Research Question

Does the type of teaching method significantly affect students' English exam scores?

Hypothesis Statements

Null Hypothesis (H_0):
There is no significant difference in English exam scores among students taught using different teaching methods.

Alternative Hypothesis (H_1):

At least one teaching method leads to a significantly different mean English exam score compared to the others.

Results

Assumption Checks

Initial tests were conducted to evaluate the assumptions underlying ANOVA. The Shapiro–Wilk test indicated that the distribution of English scores deviated from normality ($W = .955$, $p = .002$). While this result suggests some departure from the ideal bell curve, the Levene's test for homogeneity of variances was not significant ($F(6, 93) = 0.149$, $p = .989$), indicating that the spread of scores across teaching-method groups was sufficiently consistent. Given the violation of normality but equal variances, a Welch one-way ANOVA was selected to reduce the risk of Type I error.

Although the Shapiro–Wilk result flagged nonnormality, the Q–Q plot (Figure 1) shows that residuals generally follow the expected diagonal pattern, with only minor deviations at the tails. This visual confirmation supports the decision to proceed with Welch's correction.

One-Way ANOVA Analysis

The Welch ANOVA revealed a statistically significant difference in English exam scores across the seven teaching methods, $F(6, 37.4) = 110.00$, $p < .001$. This result suggests that instructional format plays a meaningful role in student performance.

To better understand the magnitude of this effect, an omega-squared estimate was calculated ($\omega^2 = 0.68$), indicating that approximately 68% of the variance in scores can be attributed to differences in teaching method. Confidence intervals for group means (e.g., Group Learning: 89.3 to 90.9) were narrow, suggesting stable estimates across samples.

Table 1.

One-Way ANOVA (Welch's)

	F	df1	df2	p
EnglishScore	110	6	37.4	<.001

Descriptive Statistics

Table 2 presents the mean English scores, standard deviations, and standard errors for each teaching method. Group Learning produced the highest average score (M = 90.1), while Lecture-based Instruction yielded the lowest (M = 77.9). Differentiated and Inquiry-based methods also performed well, with means above 87.

When grouped by performance tiers—high (≥87), moderate (83–86), and low (≤82)-collaborative and inquiry-driven formats consistently appeared in the top tier. In contrast, more passive or physically oriented methods, such as Lecture-based and Kinesthetic Learning, tended to fall into the lower range.

Table 2.

Group Descriptives

	TeachingMethod	N	Mean	SD	SE
EnglishScore	**Differentiated Instruction**	14	87.0	1.80	0.480
	Group Learning	13	90.1	1.44	0.400
	Individual Learning	10	82.0	1.49	0.471
	Inquiry-based Learning	11	87.9	1.45	0.436
	Kinesthetic Learning	24	80.2	1.52	0.311
	Lecture-based Instruction	14	77.9	1.61	0.430
	Technology-based Learning	14	83.6	1.55	0.416

Table 3.

Normality Results

Normality Test (Shapiro-Wilk)

	W	p
EnglishScore	0.955	0.002

Note. A low p-value suggests a violation of the assumption of normality.

Table 4.

Homogeneity of Variances Results

Homogeneity of Variances Test (Levene's)

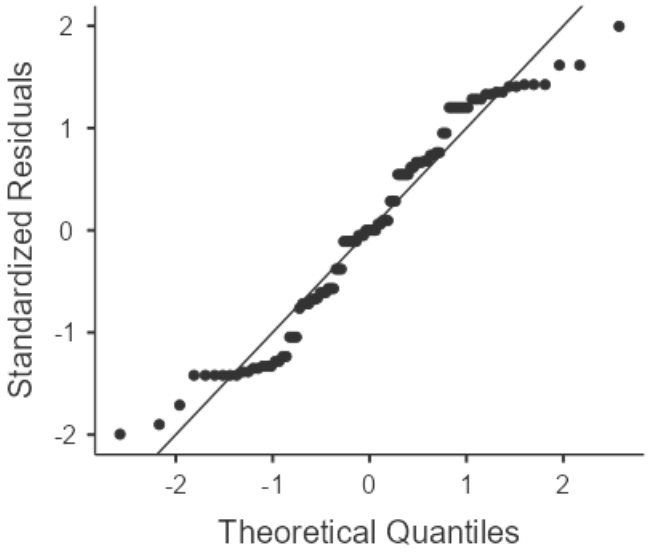
	F	df1	df2	p
EnglishScore	0.149	6	93	0.989

As illustrated in Table 4, the spread of scores is comparable across groups, supporting the Levene's test result of equal variances (p = .989). Additionally, the largest-to-smallest variance ratio was 2.31:1, well within acceptable bounds and consistent with Levene's conclusion of equal variances.

Plots

Figure 1.

Q–Q plot of standardized residuals for English scores.



Although the Shapiro–Wilk test indicated nonnormality, the Q–Q plot (Figure 1) shows residuals aligning closely to the diagonal, supporting the use of the Welch ANOVA. Deviations are minimal and confined to the upper tail, affirming that the assumption is met in practice.

Post Hoc Analysis

Tukey's HSD post hoc comparisons revealed several significant pairwise differences. The most

pronounced gap was between Group Learning and Lecture-based Instruction (mean difference = 12.22, $p < .001$). Other notable contrasts included Inquiry-based Learning outperforming Kinesthetic and Lecture-based formats by margins of 7.74 and 10.05 points, respectively.

Only two comparisons failed to reach significance: Differentiated Instruction vs. Inquiry-based Learning ($p = .775$) and Individual Learning vs. Technology-based Learning ($p = .197$). These results suggest that while most instructional methods differ meaningfully in their impact on English scores, a few produce comparable outcomes.

Table 5.

Post Hoc Tests

Tukey Post-Hoc Test – EnglishScore

		Differentiated Instruction	Group Learning	Individual Learning	Inquiry-based Learning	Kinesthetic Learning	Lecture-based Instruction	Technology-based Learning
Differentiated Instruction	**Mean difference**	—	-3.08	5.00	-0.909	6.83	9.14	3.43
	p-value	—	<.001	<.001	0.775	<.001	<.001	<.001
Group Learning	**Mean difference**		—	8.08	2.168	9.91	12.22	6.51
	p-value		—	<.001	0.017	<.001	<.001	<.001
Individual Learning	**Mean difference**			—	-5.909	1.83	4.14	-1.57
	p-value			—	<.001	0.037	<.001	0.197
Inquiry-based Learning	**Mean difference**				—	7.74	10.05	4.34
	p-value				—	<.001	<.001	<.001
Kinesthetic Learning	**Mean difference**					—	2.31	-3.40
	p-value					—	<.001	<.001
Lecture-based Instruction	**Mean difference**						—	-5.71
	p-value						—	<.001

Tukey Post-Hoc Test – EnglishScore

		Differentiated Instruction	Group Learning	Individual Learning	Inquiry-based Learning	Kinesthetic Learning	Lecture-based Instruction	Technology-based Learning
Technology-based Learning	**Mean difference**							—
	p-value							—

The largest mean difference occurred between Group Learning and Lecture-based Instruction (12.22 points), underscoring the pedagogical leap from passive lecture formats to active collaboration. Non-significant contrasts between Differentiated Instruction and Inquiry-based Learning (p = .775) and between Individual Learning and Technology-based Learning (p = .197) indicate comparable outcomes for those pairs.

Hypothesis Testing and Results

The results of the Welch one-way ANOVA provided sufficient statistical evidence to reject the null hypothesis, which posited no significant difference in English exam scores across teaching methods. The test yielded a highly significant result, $F(6, 37.4) = 110.00$, $p < .001$, indicating that at least one group mean differs from the others. While this does not identify which specific methods differ, it confirms that instructional format is associated with variation in student performance.

Post hoc comparisons using Tukey's HSD clarified these differences, revealing that Group Learning and Inquiry-based Instruction consistently produced higher scores than Lecture-based and Kinesthetic formats. The most pronounced contrast was observed between Group Learning and Lecture-based Instruction, with a mean difference of 12.22 points ($p < .001$). These findings suggest that collaborative and inquiry-driven approaches may be more effective in supporting student achievement in English.

The observed patterns align with contemporary applications of constructivist learning theory, which emphasize active engagement, peer interaction, and learner autonomy. Inquiry-based models have been shown to enhance critical thinking and content mastery by encouraging students to explore, question, and reflect (Lakha, 2025; Bodner & Elmas, 2020). Similarly, group-based formats such as Peer-Led Team Learning leverage social scaffolding to support deeper understanding (Wibowo et al., 2025). In contrast, more passive formats like Lecture-based instruction may lack the interactive and adaptive elements necessary for sustained comprehension (Luberger, 2025), while Kinesthetic methods may require additional cognitive structuring to be effective (Oladele, 2024).

Taken together, the statistical and theoretical evidence suggests that instructional design is not merely a logistical choice but a pedagogical determinant of student achievement. The following section explores these implications in greater depth, considering how collaborative and inquiry-based strategies can be leveraged to enhance learning outcomes, particularly in language education contexts where engagement, autonomy, and critical thinking are essential.

Discussion

The results of this study underscore the significant impact that teaching method has on student performance in English language assessments. Group Learning and Inquiry-based Instruction emerged as the most effective formats, producing consistently higher scores compared to more traditional or passive approaches such as Lecture-based and Kinesthetic Learning. These findings contribute to a growing body of evidence that supports active, student-centered pedagogies as superior for fostering academic achievement and engagement.

Recent research reinforces the efficacy of collaborative and inquiry-driven models. For instance, Wibowo et al. (2025) found that Peer-Led Team Learning significantly improved comprehension and retention in language courses, particularly among students from diverse academic backgrounds. Similarly, Lakha (2025) demonstrated that inquiry-based frameworks enhanced critical thinking and self-regulation, especially when paired with formative feedback and reflective activities. These approaches align with constructivist principles, which posit that learners build knowledge through interaction, exploration, and contextualized problem-solving.

The comparatively lower performance of Lecture-based and Kinesthetic methods may reflect limitations in cognitive engagement and scaffolding. While lectures can efficiently transmit information, they often lack opportunities for dialogue, feedback, and personalized learning pathways (Luberger, 2025). Kinesthetic strategies, though valuable for activating physical engagement, may not support deeper comprehension unless integrated with structured reflection or conceptual mapping (Oladele, 2024). These findings suggest that instructional formats must balance engagement with cognitive rigor to optimize learning outcomes.

From a pedagogical standpoint, the results advocate for a shift toward instructional designs that prioritize collaboration, inquiry, and differentiation. Incorporating Universal Design for Learning (UDL) principles—such as multiple means of representation, engagement, and expression—can help educators tailor instruction to diverse learner needs while maintaining academic rigor. Differentiated instruction, when grounded in formative assessment and flexible grouping, offers a pathway to equitable learning outcomes across varied student populations (Bodner & Elmas, 2020).

Moreover, the strong effect size observed ($\omega^2 = 0.68$) suggests that teaching method is not a peripheral variable but a central determinant of academic success. This has implications for curriculum development, teacher training, and policy-making, particularly in contexts where standardized testing and accountability measures dominate instructional priorities.

Limitations and Future Research

While the study provides compelling evidence for the role of teaching method in student performance, several limitations warrant consideration. The cross-sectional design limits causal inference, and unequal group sizes may have influenced variance estimates. Future research should explore longitudinal designs, incorporate qualitative measures of student engagement, and examine how instructional formats interact with learner characteristics such as motivation, prior knowledge, and cultural background.

Additionally, expanding the scope to include hybrid or technology-enhanced methods—such as flipped classrooms or adaptive learning platforms—could offer insights into how digital tools mediate instructional effectiveness. Investigating teacher fidelity to instructional models and classroom dynamics may also deepen understanding of how pedagogical strategies translate into outcomes.

Summary

This study provides strong evidence that teaching method significantly influences student performance in English. Group Learning emerged as the most effective approach, followed closely by Inquiry-based and Differentiated Instruction. In contrast, Lecture-based and Kinesthetic formats were associated with lower scores. These findings support contemporary educational theory, which emphasizes active engagement, peer collaboration, and learner autonomy as critical components of academic success. By demonstrating that instructional design directly affects learning outcomes, the results highlight the need for pedagogical strategies that prioritize cognitive scaffolding, interaction, and adaptability. While the study's cross-sectional nature and unequal group sizes present limitations, the observed patterns offer a compelling foundation for future research and instructional innovation.

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