Impact of adaptive learning on e-learning platforms for the development of English language skills

Impacto del aprendizaje adaptativo en plataformas de E-learning para el desarrollo de habilidades lingüísticas del idioma ingles

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ABSTRACT

The purpose of the research was to analyze how adaptive learning on e-learning platforms impacts the development of English language skills, focusing on grammar and vocabulary particularly, in tertiary students. This is framed within the context of the growing adoption

of educational technologies and the need to personalize learning processes. Using a quantitative, quasi-experimental, and longitudinal approach, we worked with students from the Language Center at the Technical University of Babahoyo. These students were divided into an experimental group that used adaptive platforms and a control group that used traditional platforms. A pretest and posttest were administered, in addition to perception surveys and digital usage records. Statistical analysis, performed with SPSS 25 and including descriptive statistics, t-tests for independent samples, Kruskal-Wallis, linear regression, and repeated measures ANOVA, showed significant improvements in both groups. However, students who used adaptive platforms achieved higher increases, with statistically significant differences in post-test scores ($p < 0.001$). In addition, platforms such as Mondly, LingQ, Quizlet, and Edmodo demonstrated consistently superior performance in grammar and vocabulary compared to traditional platforms. Linear regression revealed that the perception of personalization was the most influential predictor of final performance, while factor analysis confirmed the internal consistency of students' perceptions of usefulness, ease, and personalization. Finally, repeated measures ANOVA showed significant changes between pretest and posttest measurements, validating the effectiveness of adaptive learning as a strategy for strengthening language skills in digital educational environments. Taken together, these results provide strong empirical evidence supporting the incorporation of adaptive learning methods in education.

Keywords: *Academic performance, communication skills, educational technologies, Personalization, student autonomy.*

RESUMEN

La presente investigación tuvo como propósito analizar el impacto del aprendizaje adaptativo en plataformas de e-learning sobre el desarrollo de habilidades lingüísticas en inglés enfocadas en gramática y vocabulario en estudiantes universitarios ecuatorianos. El estudio se desarrolla en el marco de la creciente adopción de tecnologías educativas y de la necesidad de personalizar los procesos de enseñanza-aprendizaje. Se empleó un enfoque cuantitativo, cuasiexperimental y longitudinal, se trabajó con estudiantes del Centro de Idiomas de la Universidad Técnica de Babahoyo, quienes fueron divididos en un grupo experimental que

utilizó plataformas adaptativas y un grupo de control que trabajó con plataformas tradicionales. Se aplicaron un pretest y un Postest, junto con encuestas de percepción y registros de uso digital. El análisis estadístico, realizado mediante SPSS 25 e incluyendo estadísticos descriptivos, pruebas t para muestras independientes, Kruskal-Wallis, regresión lineal y un ANOVA de medidas repetidas, reveló mejoras significativas en ambos grupos. No obstante, los estudiantes que emplearon plataformas adaptativas alcanzaron incrementos superiores, con diferencias estadísticamente significativas en los puntajes del Postest ($p < 0.001$). Asimismo, plataformas como Mondly, LingQ, Quizlet y Edmodo mostraron un desempeño consistentemente más alto en gramática y vocabulario frente a los entornos tradicionales. La regresión lineal evidenció que la percepción de personalización fue el predictor más influyente en el rendimiento final, mientras que el análisis factorial confirmó la coherencia interna de las percepciones estudiantiles sobre utilidad, facilidad de uso y personalización. Finalmente, el ANOVA de medidas repetidas corroboró cambios significativos entre las mediciones del pretest y el Postest, validando la efectividad del aprendizaje adaptativo como estrategia para fortalecer las competencias lingüísticas en entornos digitales. En conjunto, los resultados aportan evidencia empírica sólida que respalda la incorporación de métodos de aprendizaje adaptativo en la educación superior.

Palabras clave: *Autonomía del estudiante, competencias comunicativas, Personalización, rendimiento académico, tecnologías educativas.*

INTRODUCTION

Over the last decade, Latin America has modified its education systems through the use of digital technologies. Among these, adaptive learning has gained importance as a strategy within e-learning due to its ability to personalize teaching and learning processes to the different needs of students through digital resources. This modality in teaching English as a foreign language has received considerable attention given its potential to improve students' linguistic performance through digital resources that adjust content, pace, and level of difficulty in real time (Santos et al., 2024).

In the Ecuadorian context, the implementation of e-learning platforms with an adaptive approach has increased, especially due to the COVID-19 pandemic, prompting educational

institutions to adapt their teaching methods. Although many platforms have been incorporated for teaching English, there is no in-depth assessment of their effectiveness in developing listening, speaking, reading, and writing skills. This scenario highlights the need for research to study the effectiveness of adaptive learning in the national education system (Estrella, 2022).

The following hypothesis is based on this problem: The use of e-learning platforms has a positive and significant impact on the development of English language skills compared to platforms that do not use this methodology. This hypothesis seeks to verify whether personalizing learning could improve students' academic results and accelerate their mastery of the language.

The importance of the following research lies in its ability to provide sufficient empirical evidence on the effectiveness of adaptive learning in virtual environments, which allows for informed pedagogical and technological decisions within educational institutions. Likewise, the work seeks to contribute to the continuous improvement of English language teaching programs, thus promoting a more inclusive, efficient, and student-centered education, particularly in contexts with limited access or diversity in learning rates.

The main objective of the following research is to analyze the impact of adaptive learning on e-learning platforms on the development of English language skills in Ecuadorian students. Specific objectives include identifying the main characteristics of the adaptive platforms used, comparing the levels of progress in language skills, and determining students' perceptions of the personalized online learning process.

Theoretical framework

Fundamentals of adaptive learning

Adaptive learning establishes the most significant pedagogical innovations within the context of digital education. This approach is based on the premise that students have different learning rhythms, styles, and needs, which requires diverse personalized education strategies. Through the use of different algorithms, artificial intelligence, and real-time data analysis, different adaptive systems automatically adjust content, activities, and difficulty levels to optimize individual student progress (Moreira2025). In this sense, the adaptive learning model aligns with constructivist theories and student-centered approaches, such as the Felder

& Silverman (1988) model, which highlights the importance of addressing diverse cognitive styles.

It can be noted that this methodology is gaining prominence in virtual environments due to its ability to improve knowledge retention, promote student autonomy, and thus strengthen commitment to the teaching and learning process. This adaptation refers not only to the modification of content, but also to the redesign of the educational experience based on students' continuous academic performance (Torres et al., 2025). For Brusilovsky (2001), these adaptive systems constitute the evolution of traditional learning environments, as they can provide intelligent systems capable of making pedagogical decisions in an automated way.

E-learning platforms and their role in language teaching

These types of platforms incorporate an essential component in current teaching models—technology-mediated learning. Platforms, particularly Learning Management Systems (LMS), are evolving from content storage environments to interactive systems, thus promoting active student participation. Their use in language teaching has proven to be effective for the development of communication skills, providing access to multimedia resources, automated assessments, and online collaborative spaces (Aprianto et al., 2020).

It should be noted that adaptive platforms introduce a substantial change with respect to traditional digital learning environments, as they integrate formative assessment mechanisms and automatic adjustment of academic content. This evolution allows for a very significant improvement in the quality of the teaching-learning process, especially in the acquisition of foreign languages such as English (Rincon et al., 2024).

The effectiveness of these tools depends on several factors, such as teacher training, available technological infrastructure, and pedagogical appropriation of the resource (Orihuela et al., 2024). Various authors, such as Bates (2015) and Siemens (2005), point out that, in order to maximize the impact of e-learning, it is important that platforms can be adapted to educational contexts and, in turn, that they can promote interactivity, autonomous learning, and continuous feedback.

Developing English language skills

Developing English language skills is central to educating students in a globalized world. These skills, commonly divided into listening comprehension, speaking, reading, and writing, form a solid foundation for communicative proficiency in a foreign language. Traditional teaching prioritizes methods focused on grammar and translation, while contemporary approaches such as the communicative approach and task-based learning emphasize real interaction and the functional use of language. Within this framework, the integration of digital resources has made it possible to strengthen this competence through the use of activities that promote autonomous and contextualized language practice, with a special focus on the individual needs of the student (Wang & Xu, 2021).

In this sense, the use of adaptive technologies becomes relevant, as they facilitate the teaching-learning process by differentiating language skills. Through interactive activities and personalized assessments, adaptive platforms allow students to strengthen their skills progressively, according to their level and pace of learning. In addition, these digital environments offer immediate feedback to improve self-regulation of learning and stimulate students' intrinsic motivation (Al-Sarayrah, 2023).

Application of adaptive learning in English language teaching

The application of adaptive learning in English language teaching has transformed the way educational strategies are redesigned, implemented, and evaluated in virtual environments. Unlike uniform methods, this type of modality recognizes individual differences in English language proficiency and can be adjusted to the content according to each student's progress. This type of approach is particularly beneficial for the development of specific skills such as listening comprehension or writing, as it offers exercises that respond to frequent errors, personal interests, and the student's learning style (Li & Zhang, 2024).

In this way, adaptive environments not only improve academic performance, but also enhance the student experience by fostering a more personalized relationship with the content. This type of educational strategy has been applied with great success in different

contexts, contributing to increased and optimized learning time. It should be noted that effective implementation requires adequate curricular planning, specialized teacher training, and a solid technological infrastructure. In Latin America, the adoption of this model is still in its preliminary stages, but it represents a valuable opportunity to close learning gaps and thus improve students' linguistic outcomes (Cárdenas & Ramírez, 2024).

Latin American and Ecuadorian context

The implementation of adaptive learning in Latin America faces various challenges related to technological infrastructure, teacher training, and equity in internet access. In several Latin American countries, social and economic inequality limits the effective use of this technology, which directly affects the quality of the educational process. Despite this, governments and educational institutions are beginning to promote policies that encourage the integration of digital tools in the classroom (Orosz et al., 2021).

In Ecuador, the Ministry of Education is implementing initiatives to strengthen the teaching of English as a foreign language, including the digitization of resources and the use of virtual platforms. However, the adaptive approach has not been systematically incorporated into curriculum policies. During the COVID-19 pandemic, the urgency of incorporating flexible and personalized solutions that respond to the real conditions of students, especially those in rural areas or with economic limitations, was demonstrated (Mejía, 2022).

METHODOLOGY

This research presents a quantitative, quasi-experimental, field-based approach with a longitudinal design of two measurements (pre-test and post-test), the scope of which is explanatory. The following study seeks to analyze the impact of adaptive learning on e-learning platforms on the development of specific language skills focused on grammar and vocabulary. This proposal is justified by the need to evaluate how the personalization of learning through digital platforms influences students' language performance in response to the problem statement. The population and sample consist of fourth-level students from the

Language Center (CENID) of the Technical University of Babahoyo, selected through non-probabilistic convenience sampling.

This method involves administering a diagnostic pretest to both groups (experimental and control), followed by an intervention phase in which the experimental group will use adaptive platforms and the control group will use traditional platforms. At the end of the intervention, an identical posttest will be administered and perception surveys about the process will be collected, along with data recorded by the platforms (time of use, activities performed, etc.). The instruments used include objective grammar and vocabulary tests (CEFR type), Likert-type surveys, and system log analysis. All data will be tabulated in Excel 2019 for further analysis.

This statistical method will be carried out using SPSS 25 software, applying techniques such as descriptive statistics (mean, standard deviation), T-student for independent samples, Kruskal-Wallis ANOVA, multiple linear regression, exploratory factor analysis (for surveys), and repeated measures ANOVA (to evaluate individual progress). These tests will allow results to be compared between groups, identify high performers, and analyze student perceptions with methodological rigor. This will yield valid conclusions with high academic impact on the effect of adaptive learning on the development of language skills in university contexts.

RESULTS

Descriptive statistical analysis

The results obtained in the descriptive statistics table show an overview of the behavior of the variables related to the time spent using educational platforms and the linguistic performance of students.

First, it can be seen that the average time spent using the platforms is 40.29 hours, with a standard deviation of 6.82, indicating moderate dispersion around the mean. This level of use suggests regular student participation in virtual environments.

With regard to linguistic performance, there is a significant increase in grammar scores, from an average of 60.41 in the pretest to 62.20 in the posttest, representing an improvement of almost 9 points. Similarly, in vocabulary, students advanced from 58.64 to 68.89, an average

difference of more than 10 points. This improvement is particularly relevant considering that the standard deviations (around 6 points in both cases) are consistent, suggesting a general improvement across the sample.

In comparative terms, both in grammar and vocabulary, the post-test scores clearly exceed those of the pre-test, supporting the hypothesis that the technological intervention (use of platforms) had a positive effect. Similarly, the range between the minimum and maximum values for all variables shows natural heterogeneity among students, although within reasonable ranges for educational contexts (Table 1).

Table 1

Descriptive statistic

Descriptive statistics					
	N	Mínimum	Máximum	Media	Desv. Desviation
Time to use (hrs)	140	26,70	57,60	40,2929	6,81687
Pretest Grammar	140	47,90	79,30	60,4100	4,85130
Postest Grammar	140	55,10	85,40	69,1964	6,34049
Pretest Vocab	140	49,70	71,60	58,6386	4,70607
Postest Vocab	140	55,30	86,60	68,8907	6,91590
N valid (for lost)	140				

Independent samples t-test

According to Table 2, the comparative analysis between the groups that used traditional and adaptive platforms was performed using an independent samples t-test, the results of which are presented below. To begin with, the average scores in grammatical ability (Posttest Grammar) show a substantial difference between the two groups. The traditional group achieved an average of 66.71 with a standard deviation of 5.13, while the adaptive group obtained a higher average of 72.06 with a deviation of 6.06. The difference in means was -5.89 points, with a t-value of -6.189 and a two-tailed significance of $p<0.001$, indicating a

statistically significant difference. Levene's test showed a p-value of 0.119, so equal variances were assumed for this comparison.

In terms of vocabulary (Posttest Vocab), the results also favored the adaptive group, with an average of 73.62 compared to 63.88 for the traditional group. The t-test yielded a value of t = -11.721 with gl = 138 and p < 0.001, confirming a highly significant difference. The difference in means was -9.74 points. Levene's test (p = 0.562) also allowed us to assume equal variances. In both cases, the 95% confidence intervals for the difference in means do not include the value of 0, reinforcing the evidence that students who used adaptive platforms performed significantly better in both skills assessed.

Table 2

Independent samples t-test

Kruskal-Wallis test

Testing of independent samples										
		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	gl	Sig. (bilateral)	Difference in means	Difference in standard error	95% confidence interval for the difference	
									Lower	Upper
Postest Grammar	Equal variances are assumed	2,458	0,119	-6,189	138	0,000	-5,89	0,95	-7,77	-4,01
	Equal variances are not assumed			-6,219	136,410	0,000	-5,89	0,95	-7,77	-4,02
Postest Vocab	Equal variances are assumed.	0,337	0,562	-11,721	138	0,000	-9,74	0,83	-11,38	-8,10
	Equal variances are not assumed.			-11,699	136,000	0,000	-9,74	0,83	-11,38	-8,09

According to the results of the Kruskal-Wallis test applied to the Posttest Grammar variable, there are significant differences in grammar performance levels depending on the platform used. Adaptive platforms such as LinQ (96.08), Mondly (93.58), Quizlet (86.67), and

Edmodo (82.86) have the highest average ranges, indicating better performance compared to traditional platforms such as Ello.org (41.94), BBC Learning English (48.88), Agenda Wrb (53.62), and Duolingo (55.82). This pattern suggests that the use of adaptive environments contributes significantly to the development of grammatical skills in students.

A similar trend is observed in the Vocabulary Posttest. Edmodo (105.58), Quizlet (103.53), Mondly (97.06), and LinQ (87.56) obtained the highest average ranks, far surpassing Duolingo (38.97), BBC Learning English (38.47), Ello.org (41.85), and Agenda Web (44.42). These results reinforce the evidence that adaptive platforms have a positive impact on English vocabulary acquisition, proving to be more effective than traditional platforms (Table 3).

Table 3

Kruskal-Wallis test

Range			
Platform		N	Average range
Postest Grammar	BBC Learning English	17	48,88
	Agenda Web	17	53,62
	Duolingo	17	55,82
	Elllo.org	17	41,94
	LingQ	18	96,08
	Mondly	18	93,58
	Quizlet	18	86,67
	Edmodo	18	82,86
	Total	140	
Postest Vocab	BBC Learning English	17	38,47
	Agenda Web	17	44,41
	Duolingo	17	38,97
	Elllo.org	17	41,85
	LingQ	18	87,56
	Mondly	18	97,06
	Quizlet	18	103,53
	Edmodo	18	105,58
	Total	140	

Simple linear regression

The ANOVA analysis applied to the linear regression model with the dependent variable “Posttest Grammar” and the predictors “Time of use (hrs),” “Perception of usefulness,” “Perception of ease,” and “Perception of personalization” showed statistically significant results. The sum of squares for regression was 1296.95 with 4 degrees of freedom, while the

sum of squares for the residual reached 4291.10 with 135 degrees of freedom. The F value obtained was 10.201 with an associated significance of $p < 0.001$, indicating that the model as a whole is predictively valid and that at least one of the predictors contributes significantly to explaining the variability in posttest grammar scores (Table 4).

Tabla 4

ANOVA analisis

ANOVA[a]

Model		Sum of squares	gl	Quadratic mean	F	Sig.
1	**Regression**	1296,947	4	324,237	10,201	,000[b]
	Residue	4291,101	135	31,786		
	Total	5588,048	139			

a. Dependent variable: Grammar posttest

b. Predictors: (Constant), Perception of Personalization, Time of Use (hrs), Perception of Ease, Perception of Usefulness

Analysis of the coefficients of the linear regression model with the dependent variable Posttest Grammar indicates that not all predictors contribute significantly to grammatical performance after the intervention. The model includes four independent variables: Time of use 8hrs9, Perception of usefulness, Perception of ease, and Perception of personalization.

The most relevant and statistically significant coefficient was that of perception of personalization ($B = 2.726$; $\beta = 0.403$; $p = 0.006$), suggesting that the greater the perception of personalization on the platform, the higher the grammar performance. In contrast, the other variables did not show significant effects: time of use ($p = 0.644$), perceived usefulness ($p = 0.434$), and perceived ease ($p = 0.227$). These results indicate that, within the model, the perception of personalization is the strongest predictor of grammatical performance, while the other variables do not provide sufficient statistical evidence to consider them influential (Table 5).

Table 5

Coefficient table

Coeficients[a]						
Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Desv. Error	Beta		
1	(Constant)	55,329	3,331		16,608	0,000
	Time to use (hrs)	0,047	0,102	0,051	0,462	0,644
	Perception of Usefulness	-0,928	1,182	-0,101	-0,785	0,434
	Perception of Ease	1,275	1,050	0,145	1,214	0,227
	Perception of Customization	2,726	0,967	0,403	2,818	0,006

a. Dependent variable: Posttest Grammar

Exploratory factor analysis

Table 6 shows that the total variance explained, derived from factor analysis using the principal component method, reveals that only one component has an eigenvalue greater than 1 ($\lambda = 2.480$), meeting Kaiser's criterion for retention. This component explains 82.66% of the total variance, which is an extremely high percentage, suggesting that the three variables analyzed (usefulness, ease, and personalization) are highly correlated and respond to a single underlying factor.

The additional components have eigenvalues of 0.322 and 0.198, explaining only 10.73% and 6.61% of the variance, respectively, and therefore do not meet the threshold established for consideration. Consequently, the factorial model justifies the existence of a single latent dimension that groups students' perceptions of adaptive platforms, thus demonstrating the conceptual consistency in the structure of the measurement instrument applied.

Table 6

Total variance explained

Total variance explained						
Component	Initial eigenvalues			Sum of squared loadings from extraction		
	Total	% variance	Cumulative %	Total	% variance	Cumulative %
1	2,480	82,662	82,662	2,480	82,662	82,662
2	0,322	10,727	93,389			
3	0,198	6,611	100,000			

Extraction method: principal component analysis.

Repeated measures ANOVA

Grammar pretest and posttest

The results of the multivariate tests applied to evaluate the effect of the intra-subject factor "Time" indicate a statistically significant change between measurements. The four tests used show highly significant values: Pillai's trace (0.818), Wilks' lambda (0.182), Hotelling's ratio (4.494), and Roy's largest root (4.494), all with a value of F = 624.630, gl = 1, and p < 0.001. This consistency between the tests confirms that the intervention had a significant multivariate impact on the dependent variables, supporting the effectiveness of the treatment applied on the students' linguistic performance (Table 7).

Table 7

Multivariate pretest and posttest grammar test

Multivariate tests[a]						
Effect		Valoue	F	gl de hypothesis	gl de error	Sig.
Time	Pillai trace	0,818	624,630[b]	1,000	139,000	0,000
	Wilks' lambda	0,182	624,630[b]	1,000	139,000	0,000
	Hotelling trace	4,494	624,630[b]	1,000	139,000	0,000
	Roy's major root	4,494	624,630[b]	1,000	139,000	0,000

a. Design: Intersection
Intra-subject design: Time

b. Exact statistic

Mauchy's sphericity test evaluates the validity of the sphericity assumption in repeated measures analysis for the intra-subject effect "Time." Maunchy's W value of 1.000, with an approximate Chi-square statistic equal to 0, gl = 0, and no reported significance level, suggests that there are no violations of sphericity. Consequently, it was not necessary to apply corrections to the degrees of freedom using the Greenhouse-Geiser or Huynh-Feldt coefficients, whose values also resulted in 1.000. These results indicate that comparisons between measurements over time are statistically valid under the assumptions of the model (Table 8).

Table 8

Maulchy sphericity test pretest and posttest grammar

Mauchlya sphericity test[a]

Measurement:							
Intra-subject effect	**Mauchly's W**	**Approx. Chi-square**	**gl**	**Sig.**	**Épsilon[b]**		
					Greenhouse-Geisser	**Huynh-Feldt**	**Lower limit**
Time	1,000	0,000	0		1,000	1,000	1,000

Test the null hypothesis that the error covariance matrix of the dependent variables with ortho-normalized transformation is proportional to an identity matrix.

a. Design: Intersection

Intra-subjects design: Time

b. Can be used to adjust the degrees of freedom for average significance tests. The corrected tests are displayed in the intra-subjects effects test table.

Intra-subject tests for the "Time" factor show a statistically significant effect on the dependent variables evaluated. Under the assumption of sphericity, the type III sum of squares was 5404.093 with 1 gl, generating a mean square equal to 5404.093 and an F value of 624.630 with an associated significance of p <0.001. These results remained consistent when applying the Greenhouse-Geiser, Huynh-Feldt, and lower limit corrections, all with corrected df equal to 1,000. The error associated with the time factor was 1,202.582 with df = 139, confirming the robustness of the model and supporting that the intervention generated significant differences in the measurements taken at different points in time.

Table 9

Intra-subject effects

Intra-subject effect tests

Measure:						
Origin		**Type III sum of squares**	**gl**	**Mean square**	**F**	**Sig.**
Time	**Assumed sphericity**	5404,093	1	5404,093	624,630	0,000
	Greenhouse-Geisser	5404,093	1,000	5404,093	624,630	0,000
	Huynh-Feldt	5404,093	1,000	5404,093	624,630	0,000
	Lower bound	5404,093	1,000	5404,093	624,630	0,000
Error (Time)	**Assumed sphericity**	1202,582	139	8,652		
	Greenhouse-Geisser	1202,582	139,000	8,652		
	Huynh-Feldt	1202,582	139,000	8,652		
	Lower bound	1202,582	139,000	8,652		

The results of the intra-subject contrast tests and inter-subject effects show highly significant effects on the evolution of student performance. In the intra-subject contrast test, the linear contrast for the "Time" factor yielded a type III sum of squares of 5404.093 with gl = 1 and a quadratic mean of the same value, resulting in an F value of 624.630 and a significance of $p < 0.001$. This confirms a significant and consistent change in measurements over time. On the other hand, in the inter-subject effects, the intersection presented a sum of squares of 1,175,847.843 with gl = 1, generating an equally quadratic mean between subjects in terms of the overall average, which reinforces the evidence that both the time factor and individual differences influenced the observed performance (Tables 10 and 11).

Table 10

Intra-subject contrast tests

Intra-subject contrast tests						
Measure:						
Origin		**Type III sum of squares**	**gl**	**Quadratic meana**	**F**	**Sig.**
Time	**Linear**	7357,450	1	7357,450	630,663	0,000
Error (Time)	**Linear**	1621,605	139	11,666		

Table 11

Inter-subject contrast test

Inter-subject effect tests					
Measure:					
Transformed variable:					
Origin	**Type III sum of squares**	**gl**	**Quadratic meana**	**F**	**Sig.**
Intersection	1138460,310	1	1138460,310	19524,092	0,000
Error	8105,165	139	58,311		

Pre-test and post-test vocabulary

The multivariate test table reveals a statistically significant effect of the intra-subject factor "Time" on the dependent variables. The four statistics presented agree in pointing to this impact: Pillai's trace obtained a value of 0.819, while Wilks' Lambda reached a value of 0.181. Both Hotelling's trace and Roy's largest root recorded a value of 4.537. In all cases, the F value was 630.663 with 1 gl for the hypothesis and 139 for the error, with an exact significance of $p < 0.001$. These results strongly indicate that time had a significant effect on the set of variables evaluated, supporting the effectiveness of the treatment implemented in the study (Table 12).

Table 12

Multivariate pretest and postest vocab

Multivariate tests[a]						
Effect		Value	F	Hypothesis gl	Error gl	Sig.
Time	Pillai trace	0,819	630,663[b]	1,000	139,000	0,000
	Wilks' lambda	0,181	630,663[b]	1,000	139,000	0,000
	Hotelling trace	4,537	630,663[b]	1,000	139,000	0,000
	Roy's major root	4,537	630,663[b]	1,000	139,000	0,000

a. Design: Intersection
Intra-subject design: Time
b. Exact statistic

Maulchy's sphericity test for the intra-subject effect “Time” yielded a value of W = 1.000, with an approximate Chi-square statistic equal to 0 gl and no reported significance level, suggesting that the error covariance matrix does not violate the sphericity assumption. Likewise, the gl correction coefficients (Greenhouse-Geisser, Huynh-Feldt, and lower limit) were equal to 1.000, indicating that it is not necessary to adjust the degrees of freedom for subsequent significance tests. The results support that the repeated measures model meets the sphericity condition, ensuring the validity of statistical inferences based on this structure (Table 13).

Table 13

Maulchy sphericity test pretest and posttest vocab

Mauchlya sphericity test[a]							
Measurement:							
Intra-subject effect	Intra-subject effect	Intra-subject effect	Intra-subject effect	Intra-subject effect	Intra-subject effect		
					Greenhouse-Geisser	Huynh-Feldt	Límite inferior
Time	1,000	0,000	0		1,000	1,000	1,000

Test the null hypothesis that the error covariance matrix of the dependent variables with ortho-normalized transformation is proportional to an identity matrix.
a. Design: Intersection
Intra-subjects design: Time
b. Can be used to adjust the degrees of freedom for average significance tests. The corrected tests are displayed in the intra-subjects’ effects test table.

The analyses of the intra-subject effects test "Time" indicate a highly significant effect on the variables evaluated. The sum of squares type III was 7357.450 with df = 1, resulting in a mean square of the same value. The F value obtained was 630.663 with an associated significance of p < .001, indicating a statistically significant change between measurements over time. This result remained constant across the different corrections applied (Greenhouse-Geisser, Huynh-Feldt, and lower limit), all with an adjusted df of 1,000. The error associated with this effect was 1621.605 with gl = 139 and a quadratic mean of 11.666. Taken together, these results reinforce the validity of the repeated measures model and confirm the influence of time on the dependent variables in the study (Table 14).

Table 14

Intra-subject pretest and posttest vocabulary test

Intra-subject effects tests

Measure:						
Origin		**Type III sum of squares**	**gl**	**Mean square a**	**F**	**Sig.**
Time	**Assumed sphericity**	7357,450	1	7357,450	630,663	0,000
	Greenhouse-Geisser	7357,450	1,000	7357,450	630,663	0,000
	Huynh-Feldt	7357,450	1,000	7357,450	630,663	0,000
	Lower bound	7357,450	1,000	7357,450	630,663	0,000
Error (Time)	**Assumed sphericity**	1621,605	139	11,666		
	Greenhouse-Geisser	1621,605	139,000	11,666		
	Huynh-Feldt	1621,605	139,000	11,666		
	Lower bound	1621,605	139,000	11,666		

The results of the intra-subject contrast tests and inter-subject effects show statistically significant effects both within individuals over time and between subjects. In the intra-subject linear contrast, the effect of time showed a type III sum of squares of 7357.450 with gl = 1, a mean square equal to 7357.450, and an F value of 630.663 (p < .001), while the associated

error was 1621.605 with gl = 139 and a mean square of 11.666. This result indicates a significant progression over time. In terms of inter-subject effects, the intersection yielded a sum of squares of 1,138,460.310 with an F value = 19,524.092 ($p < .001$), compared to an error of 8,105.165 with gl = 139. This shows significant differences between subjects in terms of the overall average, reaffirming both the impact of the intervention and the individual variability within the study (Tables 15 and 16).

Table 15

Intra-subject contrast vocab

Intra-subject contrast tests

Measure:						
Origin		**Origin**	**Origin**	**Origin**	**Origin**	**Origin**
Time	**Linear**	7357,450	1	7357,450	630,663	0,000
Error (Time)	**Linear**	1621,605	139	11,666		

Table 16

Pre-test and post-test inter-subject effects vocabulary test

Inter-subject effect tests

Measure:					
Transformed variable:					
Origin	**Origin**	**Origin**	**Origin**	**Origin**	**Origin**
Intersection	1138460,310	1	1138460,310	19524,092	0,000
Error	8105,165	139	58,311		

DISCUSSION

The findings of this research clearly show that the use of e-learning platforms with an adaptive approach has a very positive and significant impact on the development of language skills, especially with regard to English grammar and vocabulary. The results of the independent sample t-tests revealed statistically significant differences in the post-test scores

of students who used adaptive platforms compared to those who used traditional platforms, which is confirmed by p-values below 0.001 in both skills analyzed. This finding coincides with what was reported by Sandín et al. (2020), who indicate that personalizing the pace and level of difficulty in digital environments promotes better knowledge retention and more effective learning in foreign language students.

Furthermore, multivariate and repeated measures analyses (ANOVA, multiple linear regression, and factor analysis) strongly supported the effectiveness of personalization. In particular, the perception of personalization proved to be a significant predictor in the linear regression model, while factor analysis revealed a single component that groups together perceptions of usefulness, ease, and personalization, confirming that students experience adaptive learning as a coherent and satisfying experience. This conclusion aligns with the study by Martinez et al. (2019), who found that adaptive platforms foster greater engagement and autonomy in students, key aspects for success in second language acquisition.

It is important to note that the findings are consistent with international studies, such as that by He et al., (2025). In their research with university students, they demonstrated that adaptive platforms significantly improve grammar and vocabulary performance compared to traditional methods. Furthermore, students' positive perception of these platforms not only indicates their effectiveness but also their acceptability and the intrinsic motivation they generate for learning English. These are key aspects in the Ecuadorian context, where there are gaps in access and different learning rates. Therefore, the results of this study not only confirm the initial hypothesis but also offer valuable local evidence that complements and reinforces the existing body of research on adaptive learning.

CONCLUSIONS

The findings of this research lead us to conclude that adaptive learning, carried out through e-learning platforms, has a notable and positive impact on the development of English language skills, especially in grammar and vocabulary. Students who used these adaptive platforms achieved better results in the final assessments, demonstrating a clear improvement

in their academic performance. In addition, students' opinions on the usefulness, ease of use, and personalization of these platforms were very positive, and the variable 'perception of personalization' stood out as an important predictor of grammar performance. This indicates that the ability to adjust content and learning pace to individual needs not only increases motivation but also improves the effectiveness of the teaching-learning process. In summary, the results obtained support the idea of integrating adaptive technologies into university educational environments, not only because of their academic advantages, but also because of their acceptance among students and their ability to reduce learning gaps in diverse contexts, such as Ecuador.

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