Relation between school attendance and score results in subjects

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Relación de la asistencia escolar y los resultados de calificaciones en asignaturas de estudio

Abstract

The transcendent dimension of an educational research process lies in its results contributing to decision-making that leads to the improvement of results and impacts. In the present study, the possible relationship between student attendance and the improvement of Language and Literature, and mathematics grades have been analyzed through a process composed of two stages: applying Chi square and Kendall's Tau-b tests, to initially define correlation and intensity, in addition, an econometric model of ordinary least squares was constructed with which the direction and magnitude of the relationship between attendance and grades has been defined. The results have allowed us to verify that there is a significant correlation between the study variables, even considering the existence of other variables that complement the relation. In addition, the magnitude size and positive direction between attendance and the subjects included in the study have been made explicit, which has allowed us to conclude the need to focus educational policies that encourage student attendance as part of the efforts to improve school performance, as well as defining future investigative processes that allow inferences regarding the causality between attendance and the subjects of study.

Resumen

La dimensión trascendente de un proceso de investigación educativa radica en que sus resultados aporten a la toma de decisiones que conlleven a la mejora de resultados e impactos. En el presente estudio se ha analizado la posible relación entre la asistencia de estudiantes y la mejora de las calificaciones de lengua y literatura y matemáticas de secundaria, mediante un proceso de dos etapas: aplicando pruebas de Chi cuadrado y Tau-b de Kendall para, inicialmente, definir correlación e intensidad de la misma; además, se construyó un modelo econométrico de mínimos cuadrados ordinarios con el que se ha definido la dirección y la magnitud de la relación entre la asistencia y las calificaciones. Los resultados han permitido comprobar que existe correlación significativa entre las variables de estudio, aun tomando en cuenta la existencia de otras variables que complementen la relación. Además, se ha hecho explícito el tamaño de la magnitud y una dirección positiva entre la asistencia y las asignaturas incluidas en el estudio, lo que ha permitido concluir la necesidad de enfocar políticas educativas que fomenten la asistencia de estudiantes como parte de los esfuerzos por mejorar el rendimiento escolar, así como definir futuros procesos investigativos que permitan inferir respecto de la causalidad entre la asistencia y las asignaturas en estudio.

Palabras clave: asistencia escolar, toma de decisiones, calidad de la educación, correlación, causalidad.

Introduction

School attendance, perceived from an abstract collective, is associated with academic performance, as reflected in students' scores on the various subjects across the curriculum. However, it is a more intricate phenomenon than assumed, given the multicausality and dimensionality of factors and variables that compose it. This research presents qualitative, descriptive and correlational findings to delve further into the relation between attendance and academic achievements among seventh, ninth and eleventh grade students in Nicaraguan public schools, on the subjects Language and Literature, and Mathematics.

Attendance is one of the foundational pillars of exercising the human right to education. It creates conditions to engage on the progress of contents and learnings processes' construction; impacts the socioemotional interaction and tributes to a culture of achievement and capacity development from their systematic immersion on the educational

process. Previous research in different countries align with the results of this study by approaching the phenomenon's comprehension.

School attendance, for Saccone (2020), is relevant due to the influence over the structure of approval, disapproval, and recovery processes. Orozco (2020) stresses that, beyond socio-economic factors of the students' environment, it exists factors associated to the scholar context and educational system which influence the attendance, depicting the topic's nuance. Undoubtedly, London et al. (2016) express how students with systematic non-attendance miss key learning and personal development opportunities. Moreover, the accumulative character of absences affects the results of students' school performance.

Barreno-Freire, et al. (2019), aligning with similar studies, found a positive, directly proportional correlation between academic performance and school attendance, applying Pearson's correlation coefficient, which means it exists a positive moderated and directly proportional correlation between variables. It implies that if the percentage of class attendance from students increases, their academic performance mirrors it. Pérez & Graell (2004), measuring it through t of Student and Chi2 Test (Chi-square), found the average score of students who regularly attend to class is higher to those who do not, establishing it generally exists a positive relation between attendance and academic performance.

This research adds to the discussion of world order about the relation and value between attendance and academic performance, particularly within paradigms and mandated attendance policies and sanctions, employed in educational institutions worldwide. In our context, results show it can be stated it exists a significant statistic correlation between attendance and score of Language and Literature, and Mathematics of the selected grades for the study, exhibiting elements to consider for defining the existent correlation's magnitude. Evidence overlaps with similar studies in which, although true, students' attendance is relevant in the learning process. However, it is not the only variable influencing it.

The result's relevance stems from verifying how attendance is inescapable regarding analysis and policy decisions, given it is an inherent part of the variables associated with students' performance, separated from the existent relation's intensity.

Materials and methods

Investigation methodology

The research employed a quantitative, observational, cross-sectional type. The main goal entailed the exploration between students' attendance and their scores on the subjects of Language and Literature, and Mathematics during the second assessment period of 2023. Statistical methods, including proofs of correlation (Chi-squared, Kendall's Tau-b) and econometric models of Ordinary Least Squares, were applied; the outcomes reveal the course and magnitude of the relation between attendance and subjects of study. The processing of data expansion was conducted with the purpose of adjusting the estimations so results can imply the total population from where the sample was extracted.

Selection of study sample

Sampling framework

The population was selected from the country's high school students, particularly seventh, ninth, and eleventh grade of urban area educational centers.

The sample frame selection, in line with the objectives this research aims at, was conducted considering the following criteria:

→ Centers that administer the full cycle of high school, namely from seventh to eleventh grade.

→ Centers that belong to regular high school modality.

→ Seventh, ninth, and eleventh grade, originally belonging to the universe of centers from the sample frame of high school. This selection was made due to these students representing the transition from elementary school to high school and the end of lower and upper high school.

Grounded on the above-mentioned criteria, the sample frame features 291 educational centers, with 1,141 seventh grades, 1,047 ninth grades, and 750 eleventh grades. These represent a total of 87,462 students from 19 province delegations nationally.

Sample selection

For the selection, the methodology of proportional stratified sampling was applied, representative of the 19 province delegations of which proportions were established considering the quantity of educational centers meeting the selection criteria of the sample frame and for each of the province delegations.

The sample was assembled in a two-stage process. First, educational centers were unsystematically selected by province; subsequently, selecting sections of the seventh, ninth, and eleventh grades. Upon selection, vital information is compiled for all students currently active in those sections (current classrooms' enrolment). In this regard, the attendance of Language and Literature, and Mathematics score of 2,528 students are compiled.

Data collection instruments

Data collection was guided to obtain two types of information: primarily, the attendance percentage of all currently enrolled students from the selected grades and sections. These data was compiled for the months of April and May of 2023 (2023 II evaluation cut); the average attendance is determined for the two months, adding the quantity of days student attended class, divided by the quantity of working days. Secondly, it is required to gather each students' score of Language and Literature, and Mathematics in the same period.

Along the aforementioned data, the compilation instrument included other variables of utility to complete the analysis, these were: province and municipality delegation where the educational center is located, school shifts, section, students' sex and age. For the compilation of the data described above, digital formats elaborated in spreadsheets were used, one for the compilation of attendance and another for the compilation of score.

Database register and processing

The data register is executed by technical typists previously trained on Excell format, which databases were conformed by centers, grades, sections, and students are generated. These are subsequently uploaded and processed on the statistic program Statistical Package for Social Sciences (SPSS).

With the entered data, a database of attendance and one of students' scores was built, which were united through the proceeding of SPSS "Merge Files", taking as reference the key variable "Student Code".

Processing and main results for the information analysis

The alternative hypothesis of the study denotes it exists a significant relation between students' attendance and their respective scores on Language and Literature, and Mathematics. To verify this hypothesis, two methodologies allowing to accept or reject it were applied:

→ The analysis of cross-tabulation (cross tab for short) using statistics of Chi Square and Correlation Coefficient of Kendall's Tau-b range (since coupled variables exist), allows to have a first approximation to the possible association between the variables.

Using models of simple lineal regression, which, according to Liviano & Pujol (2013), study the behaviour of a variable defined as "explained variable", in function of another or other variables often referred as "explanatory variables".

Regarding the Chi Square test, when the calculation is carried out, a p-value is determined, indicating the odds of obtaining extreme results as the ones observed in our sample if the null hypothesis is true, stating there is no association between variables. To elucidate the results of Chi Square, we compare the p-value with the level of significance established (generally 3.005). If the p-value is lower than the level of significance ($p < 0.05$), we reject the null hypothesis and conclude there is sufficient evidence to state a significant association between the variables. In this regard, it is noted results are statistically significant. The 0.05 represents the threshold, determining how improbable the results under the null hypothesis must be, with the aim of considering enough evidence exists to reject it.

Results and discussion

Results

Analysis of cross-tabulation using the statistics of Chi Square and Kendall's Tau-b (Language and Literature)

For the simplification of the cross tabs' analysis between the attendance and score of Language and Literature, the variables have been discretised on the following manner:

Regarding attendance:

→ Low attendance (Lower than 70 %)

→ Intermediate attendance (Between 70 % and lower than 90 %)

→ High attendance (Higher or equal to 90 %)

Regarding the scores in Language and Literature and Mathematics:

→ Low score (lower than 70 points)

→ Intermediate score (Between 70 and lower than 90 points)

→ High score (Higher or equal to 90 points)

When analysing the score behaviour in Language and Literature versus attendance, it is possible to observe a defined behaviour in said relation, based on a group with low attendance and score (48.8 %), tending to decrease as the attendance increases (27.3 %). Alternatively, a small group with low attendance and high score (22.4 %) increases as attendance does the same (48.9 %). With the observation method, we can state it exists a likelihood the level of students' attendance can be related with their score in Language and Literature indicating, if attendance is positively increased, score will follow.

To validate the possible statistical relation between attendance and score of Language and Literature, primarily, the analysis of Chi Square was applied through the independence test on contingency tables with multiple classifications.

The goal of making this type of analysis is to determine if there is a relation between two classification criteria or if they are independent when studied simultaneously, under the null hypothesis that there is an independence between both (Ochoa, 2014).

For the analysis with Chi Square, the hypothesis to use has been defined:

H_0**:** The level of students' attendance is not associated to the level of score they obtain in Language and Literature.

H_1**:** The level of students' attendance is associated to the level of score they obtain in Language and Literature.

The test is done with significance level of 5 %. The null hypothesis will be rejected if the coefficient of "bilateral asymptotic significance" (p-value) of Chi Square Test is higher than 5 percent, otherwise the null hypothesis is accepted.

Table 1

Percentage of students according to attendance and marks obtained in Language and Literature, (measured as ranges for both variables)

			SCORE LEVEL
	Low score	Intermediate score	High score
Low Attendance	48,8	28,8	22,4
Intermediate Attendance	43,6	24,6	31,8
High Attendance	27,3	23,8	48,9

Own Work

Given:

$$X^2 = \sum (Fo\text{-}Fe)/Fe$$

Where:

X2 = Value of Chi Square

Fo = Observed frequence

Fe = Expected frequence

Table 2

Results of the Chi Square test: level of attendance versus level of marks in Language and Literature

Chi Square Tests: Attendance vs Marks in Language and Literature			
	Value	**gl**	**Asymptotic significance (bilateral)**
Pearson's CHI-Square	4,475.514[a]	4	0.000
Plausibility ratio	4,593.083	4	0.000
Linear by linear association	4,190.349	1	0.000
N OF Valid cases	85,017		

a. 0 squares (0.0 %) have expected a count lower than 5. The minimum recount expected is 318.02.

Own Work

By observing the p-value of asymptotic significance (bilateral), revealing is lower than 5 %, allowing to reject the null hypothesis (the level of students' attendance is not associated to the level of score they obtain in Language and Literature), and accept the alternative hypothesis, indicating the following: the level of students' attendance is associated to score level in Language and Literature obtained.

To expand the results' validation, Kendall's Tau-b, a coefficient test of range correlation, was executed, which is a non-parametric measure of correlation for ordinal variables or ranges which considers ties, meaning, tables with the same number of measurement levels, 2x2, 3x3, etc.

As observed on table 3, by making the correlation for the ranges of attendance and score of Language and Literature,

the p-value, or bilateral significance test, is 0.00 which is lower than 5 %, allowing to reject the null hypothesis, implying a correlation between the variables does not exist, therefore, the alternative hypothesis is accepted expressing a correlation between the variables exists. The intensity values of the test's correlation range from –4 to 0 if the relation is negative and from 0 to 1 if the relation is positive; the closer to 1 or –1, the relation's intensity is stronger. In this matter, it is important to mention the intensity of the correlation is low (0.211), indicating the existence of other variables that can alter this relation.

Table 3
Results of Kendall's Tau-b for the level of attendance versus marks in Language and Literature

Correlations: Attendance level versus level of marks Language and Literature			Level of attendance	Level of marks in Language and Literature
Kendall's Tau-b	**Level of attendance**	Correlation coefficient	v	0,211
		Sig. (bilateral)	-	0,000
		N	86458	84618
	Level of marks in Language and Literature	Correlation coefficient	0,211	1,000
		Sig. (bilateral)	0,000	-
		N	84618	85173

** The correlation is significative on the level 0,01 (bilateral)
Own Work

Analysis of the relation between attendance and score in Language and Literature, using models of simple regression for ordinary least squares

Thus far, the analysis indicated it exists a relation between attendance and score in Language and Literature; however, the direction and magnitude of the relation has not been defined. Regarding the direction, if the increase or decrease of a variable produces the increase or decrease on another (positive direction); or if the increase or decrease of a variable is associated with a decrease or increase on another variable (negative direction).

The relation's magnitude refers to the force or intensity with which a variable is associated to another. In this case, we will use the model of simple regression for least squares to, through the independent variables, imply how much it changes the dependent variable or each unity of change on the independent variable. The models of regression are a functional relation, which constitute an affirmation (frequently expressed as an equation) where a variable, titled the dependent variable, as its name indicates, depends on or is explained by one or more variables expressed as independent variables (Copete, 2007).

Referring to the current research, it can be established the hypothesis of functional relation, in which the score obtained by students (Y) depends on their attendance level (X) on the period of study and, positively, if attendance increases, the score obtained by students in their score increases (positive direction), therefore Y is in function of X.

$$Y= f(X)$$

Analysis of the dispersion graph of variables

The dispersion graph displays a first approximation on the relation's direction, shown on the general tendency of the points in the graphic. In this regard, we observe a positive relation, additionally to the form and strength of the relation, in which the points do not follow a completely straight line, implying a non-lineal or weak relation.

Figure 1
Graphic of Simple dispersion for model of lineal regression, attendance versus marks in Language and Literature
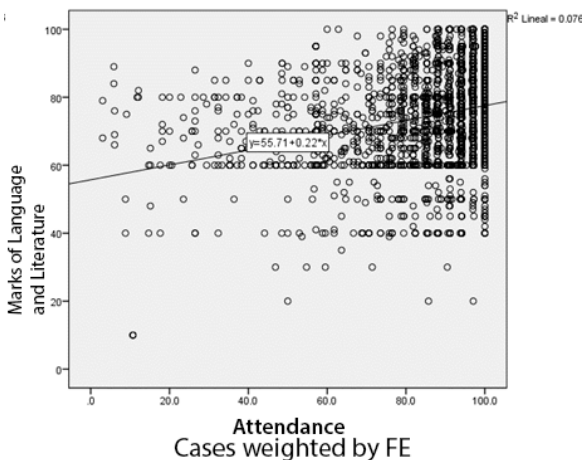
Own Work

F Test of joint significance: results of the table ANOVA

The results contained on the table ANOVA (Analysis of Variance) showcase the possible acceptability of the model in statistical terms. Simplifying the analysis, it can be affirmed it is possible to build a model of lineal regression with these variables, if the resulting significance on the table ANOVA is lower than 5 %.

Table 4

Analysis of variance for the model of lineal regression

	Model	Sum of squares	gl	Root-mean-square (RMS)	F	Sig.
			ANOVAa			
M1	Regression	1384754,744	1	1384754,744	6982,570	.000b
	Residue	16859758,392	85015	198,316		
	Total	18244513,136	85016			

a Dependent variable. LL.
b Predictors (Constant). P_Asist

Own Work

Before analysing the results of significance of the table ANOVA, the pertinent statistical hypothesis must be established:

H_0: $\beta = 0$

H_1: $\beta \neq 0$

In this case, for the lineal model to be valid, it is relevant for the value of beta to be different from zero. Observing table 4, the value of significance (Sig.) is lower than 5 %, meaning the value of beta is different from zero, indicating the model of lineal regression is valid. Essentially, variables are related lineally.

Regression coefficient model

As shown on table 5, the p-value or significance of the independent variable

Table 5

Results of the simple regression model

Coefficients of the lineal regression modela

	Model	Non-standardized Coefficients		Standardized Coefficients		
		B	r	Beta	t	Sig.
M1	(Constant)	55,715	,228		244,8730	0,000
	P_Asist	,218	,003	,275	83,562	0,000

a. Dependent variable. LL

Own Work

is lower than 5 %, denoting the relation between dependent and independent variables is statistically significant.

From the information of table 5, the coefficients conforming the equation of the regression line can be extracted:

$$\hat{Y}=a+bx\pm Se$$

Language and literature=
55.715+0.218* Attendance

Aside from statistically significant, the relation is also positive (positive beta coefficient). The above implies an increase of 1 percentual point in attendance would generate an increase of 0.218 points on the score of Language and Literature.

Analysis of cross tabs using the statistics of Chi Square and Kendall's Tau-b (Mathematics)

As in Language and Literature, in Mathematics a behaviour in the relation can be perceived, although less incident than in the subject of Language and Literature. The above is possible to

Table 6

Percentage of students according to attendance and score obtained in Mathematics (measured as ranges for both variables)

Attendance Rane (percentage)	Range of Marks in Mathematics (points)		
	Less than 70	Higher or equal to 70 and less than 80	Higher or equal to 80
Less than 70	60,4	15,3	24,3
Between 70 and less than 90	55,8	21,5	22,7
Higher or equal to 90	39,7	22,7	37,6

Own Work

Table 7

Results of the Chi Square Test: level of attendance versus level of marks in Mathematics

Chi Square Tests: Attendance vs marks in Mathematics

	Valor	gl	Asymptotic signification (bilateral)
Pearson's Chi-Square	3110.913	4	0,000
Plausibility ratio	3.155,909	4	0,000
Lineal by lineal association	2.478,341	1	0.000
N of valid cases	86.376		

[a]. 0 squares (0.0 %) have expected a recount lower than 5. The minimum expected recount is 3184.02.

Own Work

secure, since the students' proportion moves from getting high scores (24.3 %) when their attendance is low, to obtaining high score with high attendance (37.6 %), is lower to the increase observed in Language and Literature.

By observing the p-value or asymptotic significance (bilateral), it can be ascertained this value is lower than 5 %, allowing to reject the null hypothesis implying the level of students' attendance is not associated to the level of scores in Mathematics and accept the alternative hypothesis, denoting the level of students' attendance is associated to the score level in Mathematics.

By applying Kendall's Tau-b rank correlation coefficient the following results are collected:

By analysing the relation for attendance ranks and scores in Mathematics, the p-value or bilateral significance of the test is of 0.00, lower than 5 %, allowing to reject the null hypothesis which indicates a correlation between the variables does not exist. Therefore, the alternative hypothesis is accepted. Yet, the coefficient of the correlation's intensity is low (0.187) and even lower than the one observed in Language and Literature (0.211), validating what was observed on table 6, where the increase of those who obtain higher grades when they improve their attendance, is less significant than the one observed in Language and Literature.

Analysis of the relation between attendance and score of Mathematics, using models of simple regression by ordinary least squares

To complement the analysis of correlation between attendance and score in Mathematics, a model of simple regression by ordinary least squares was applied.

Table 8

Results of Kendall's Tau-b for the level of attendance versus marks of Mathematics

Correlations: Level of attendance versus level of marks in Mathematics

			Attendance level	Level of attendance level of Language and Literature
Kendall's Tau-b	**Attendance level**	Correlation coefficient	1,000	0,187
		Sig. (bilateral)		0,000
		N	86458	85964
	Score levels of Language and Literature	Correlation coefficient	0,187	1,000
		Sig. (bilateral)	0,000	
		N	85964	86389

**. The correlation is significative on the level 0,01 (bilateral).
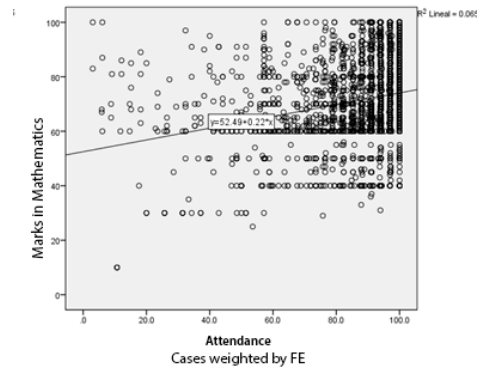
Own Work

Graphic analysis of variables' dispersion

Simply by observation, the behaviour of the associated variables does not show a definitive tendency can be analysed. However, when drawing the line of total adjustment, it is possible to observe a slight increasing behaviour on the points regarding it as a first testing tool, it exists a positive relation between attendance and score in Language and Literature.

Test F of joint significance: ANOVA table results

Results presented on the ANOVA table, explaining the acceptance of the model from a statistical point of view, are the following:

As observed on table 9, the p-value (0.000) is lower than 5 %, indicating it is possible to build a model of lineal regression with these variables.

Figure 2

Results of the Chi Square test: attendance level versus score levels in Language and Literature

Own Work

Table 9

Analysis of variance for linear regression model

ANOVA[a]

	Model	Sum of squares	gl	Quadratic mean	F	Sig.
M2	Regression	1312744,315	1	1312744,315	59998,407	.000[b]
	Residue	18902747,478	86374	218,849		
	Total	20215491,792	86375			

a. Dependent variable: MAT

b. Predictors: (Constant), P_Asist

Own Work

Regression model coefficients

As shown on table 10, the p-value or significance of independent variable is lower than 5 %, indicating the score is accumulated by students in Mathematics can be explained by the percentage of their school attendance.

From the information on table 10, the coefficients that conform the equation of the regression line can be derived follows

$$\hat{Y}=a+bx\pm Se$$

Language and literature=52.494+0.216*Attendance

The above implies an increase of 1 percentage on attendance would generate an increase of 0.216 points on the score in Mathematics.

Discussion

The research aligns with previous studies, by stressing the importance of students' attendance as a key factor related to the learning process of students. From this lens, the variable is positively related with the increase of students' score, variable considered as proxy of the aforementioned learning, hence the importance of valuing the effect this has on the performance of high school students, specifically on the score of Language and Literature, and Mathematics.

Results stress a statistically significant correlation between attendance and score in Language and Literature, and Mathematics exists on the selected grades. However, it is important to note the existent correlation between these variables and for both subjects is low. While it is true students' attendance is important in the learning process, there are other variables which can affect, as is the case of the educational centres' conditions, the pedagogy and teaching didactics, motivation, support from parents, plus the socioeconomical condition of students, variables resulting as significant on the impact of international test results such as Regional Comparative and Explanatory Study (Estudio Regional Comparativo y Explicativo, ERCE).

Table 10
Results of the simple regression model

		Coefficient				
Model		**Non-standardised coefficient**		**Standardised coefficient**		
		B	**Standard error**	**Beta**	**t**	**Sig.**
M2	(Constant)	52,494	,243		215,806	0,000
	P_Asist	,216	,003	,255	77,449	0,000

a. Dependent variable: MAT

Own Work

Main theme: Relation between school attendance and score results in subjects

In this case, the results' importance lies in the fact of being possible to evidence how attendance is one of the elements present and part of the variables associated with student performance, independent from existent relation's intensity. Another result of attendance to highlight is the relation and intensity when it is about Language and Literature, regarding Mathematics; in line with the conducted tests, it is possible that the intensity of the relation is higher with Language and Literature concerning Mathematics.

Conclusions

As shown in previous studies, including the Regional Comparative and Explanatory Study of Quality, particularly in the analysis of associated factors, education is multidimensional and multicausal phenomenon, influenced by social and family surroundings, the economic condition, environment and scholar management, the teaching training and applied didactics on the classroom, learning evaluation model, among others. Therefore, no single variable can explain in its cornucopia the results obtained by students on the classroom, although it can be investigated and explicitly demonstrate their relation, direction and intensity.

From the gathered data, it can be stated with evidence it exists a significative statistical correlation between attendance and score in Language and Literature, and Mathematics on the selected grades.

Promoting high levels of students' attendance on their educational centres results of vital importance due to the goal of improvement on quality education,

considering multiple challenges faced to achieve quality of learnings. Knowing and deepening about the type of relations between attendance and academic results contributes to closing the gap on the identification of the factors' diversity that could be affecting student performance and, consequently, act to transform the reality facing the challenges it involves.

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