

The Influence of Repair Capacity on the Academic Energy of College Students

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Abstract

The present study analyzes the relationship between repair and vigor in first-year university students in Montería, using a simple linear regression model. It is based on the premise that students' ability to adjust and correct their learning strategies positively influences their level of academic vigor, understood as the energy, motivation, and resistance with which they face their educational activities. From the analysis of a sample of 233 university students, it was found that repair has a positive and significant effect on vigor, with a coefficient of 0.1721 ($p < 0.01$). The validation of the model by statistical tests confirms compliance with the linear regression assumptions, ensuring the reliability of the results. It is concluded that students who implement repair and adjustment strategies in their learning process tend to experience higher levels of vigor, which highlights the importance of strengthening self-regulation mechanisms and continuous improvement strategies in higher education.

Keywords: *Academic Repair, Vigor, University Education, Econometric Analysis, Student Engagement.*

Introduction

Vigor is an essential component of academic engagement, defined as the energy, motivation, and persistence with which students approach their university activities. In the context of higher education, maintaining optimal levels of vigor is critical to ensuring academic success and student well-being. However, several factors can influence the manifestation of vigor, including the ability of students to regulate their learning and correct mistakes throughout their training. Academic repair, understood as the process by which students identify failures in their performance, adjust strategies and apply improvement mechanisms, has been consolidated as a key skill in the self-regulation of learning and in the optimization of academic performance. Despite its relevance, the relationship between academic repair and vigor has been little explored from a quantitative approach, which generates the need to carry out studies that allow a more precise understanding of the impact of this variable on students' energy and resistance to academic challenges.

From a theoretical approach, the relationship between repair and vigor can be analyzed through models of educational psychology and self-regulated learning. The theory of academic engagement by Schaufeli et al. (2002) states that vigor is one of the fundamental dimensions of student engagement and is influenced by the student's perception of control and self-efficacy. When students manage to correct mistakes, apply improvement strategies, and adapt their study approach, they experience a greater sense of mastery over their academic activities, which reinforces their motivation and prevents burnout. This perspective is complemented by Bakker and Demerouti's (2007) model of academic demands and resources, which suggests that repair can act as a resource that allows students to more effectively manage their learning, reducing mental fatigue and favoring persistence in studying. From a neuroscientific perspective, previous studies have identified that self-regulation and repair capacity are related to the activation of the dorsolateral prefrontal cortex, responsible for planning, decision-making, and control of cognitive effort (Kahn, 1990). This brain mechanism allows students to optimize the use of their cognitive resources, reducing the mental load and facilitating the conservation of energy to face highly demanding academic tasks.

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Deci and Ryan's (1985) theory of self-determination reinforces the idea that reparability influences students' motivation and vigor through the development of autonomy and academic competence. When students perceive that they have control over their learning process and that they have strategies to improve their performance, their levels of intrinsic motivation are strengthened, allowing them to maintain high levels of energy and enthusiasm in studying. In this sense, academic repair is not only linked to performance in terms of grades, but also to emotional well-being and positive predisposition towards learning. Various studies have shown that students who implement repair strategies have higher levels of academic engagement, less stress and a more resilient attitude towards educational challenges. Despite these findings, the literature has explored in a limited way the quantitative impact of repair on the vigor of university students, which makes it necessary to carry out research that allows this relationship to be rigorously measured.

The objective of this study is to analyze the relationship between academic reparation and vigor in first-year university students in Montería, using a quantitative approach based on a simple linear regression model. It is hypothesized that greater academic resilience is associated with higher levels of vigor, implying that students who apply adjustment and improvement strategies in their learning process experience greater energy and resilience to academic demands. The present research contributes to the literature on academic engagement by providing empirical evidence on the impact of repair on student motivation and well-being. In addition, it allows the identification of possible pedagogical strategies that favor the development of self-regulation and persistence in study, thus strengthening academic performance and permanence in higher education. Through the analysis of a sample of 233 university students, it is expected that the results will allow us to understand how reparation influences the experience of vigor in the university environment and what factors can enhance or limit this relationship.

Methodology

The present study adopts a quantitative approach with a correlational-explanatory design, whose objective is to analyze the relationship between repair capacity and academic energy in first-year university students in Montería. To this end, a simple linear regression model was used, with the purpose of determining the magnitude and direction of the impact of academic reparation on student vigor. This design allows us to assess the extent to which students' ability to correct and adjust their learning strategies influences their energy levels and persistence in the academic field. The choice of this model is justified by the need to quantify the relationship between both variables, providing empirical evidence that contributes to the understanding of academic engagement and self-regulation in higher education.

The study population consisted of first-year university students at a private university in Montería, selecting a sample of 233 students through intentional non-probabilistic sampling. The selection of participants was based on criteria of accessibility and willingness to participate in the study, guaranteeing the representativeness of the sample within the academic context analyzed. The inclusion criteria were to be enrolled in the first year of a university degree, to have completed at least one academic semester and to voluntarily participate in research. Those students who did not complete the questionnaire autonomously or who had limitations in accessing data collection platforms were excluded.

Standardized scales with high validity and reliability were used to measure the variables clarity and vigor. Academic repair capacity was assessed through a scale adapted from previous models in the assessment of self-regulation of learning, composed of five items measured on a Likert-type scale from 1 (never) to 7 (always). This instrument made it possible to assess the frequency with which students identify errors in their academic performance, seek feedback and apply improvement strategies. Academic energy or vigor was measured with the Schaufeli and Bakker (2004) academic vigor scale, which consists of six items designed to assess students' energy, enthusiasm, and endurance in relation to their studies, also on a Likert-type scale from 1 (never) to 7 (always). A sociodemographic questionnaire was also included to collect information on age, gender and academic program, in order to contextualize the results obtained.

The data collection process was carried out in four methodological phases. In the first phase, the questionnaire was designed and validated with the advice of experts in psychometrics, carrying out a pilot

test with 30 students to evaluate the clarity and comprehension of the items. In the second phase, the questionnaires were applied in digital and face-to-face mode, guaranteeing the confidentiality of the answers and promoting voluntary participation. In the third phase, the statistical analysis of the data was carried out using the SPSS v.26 and R programs, applying descriptive and inferential statistical techniques. A simple linear regression model was estimated to evaluate the relationship between repair and vigor, complemented with tests of normality (Kolmogorov-Smirnov, Shapiro-Wilk), homoscedasticity (Breusch-Pagan) and absence of autocorrelation (Durbin-Watson) to verify compliance with the model's assumptions. In the fourth phase, the results were interpreted and compared with previous studies on academic engagement and self-regulation in higher education, in order to contextualize the findings within the existing literature.

The statistical model used in the regression analysis was formulated as follows:

$$\text{VIGOR} = \beta_0 + \beta_1 \cdot \text{REPAIR} + u$$

Where:

- VIGOR represents the dependent variable (academic energy level).
- REPAIR is the independent variable (students' ability to correct and adjust their learning strategies).
- β_0 is the intercept of the model.
- β_1 is the regression coefficient, which measures the impact of repair on vigor.
- u represents the term random error.

The coefficients were estimated using the ordinary least squares (OLS) method, guaranteeing the best linear prediction of the dependent variable.

Results

The statistical analysis allowed to evaluate the relationship between repair capacity and academic energy in first-year university students in Montería, through a simple linear regression model. The findings are presented at three levels of analysis: descriptive statistics, regression model estimation, and model diagnostic tests.

Descriptive statistics showed that university students present moderately high levels in both repair and vigor, suggesting that most participants implement adjustment and improvement strategies in their learning process and experience adequate levels of energy and academic motivation. Table 1 presents the descriptive statistics of both variables under study.

Table 1. Descriptive Measures of the Variables Reparation and Vigor

Variable	Minimal	Maximum	Stocking	Standard deviation
Reparation	2.9	7.2	5.59	1.15
Vigor	2.5	7.1	5.64	1.19

The values indicate a homogeneous distribution of the data, with no extreme values that could affect the validity of the analysis.

The estimated simple linear regression model showed a positive and significant relationship between repair and academic vigor. Table 2 presents the coefficients of the regression model.

Table 2. Coefficients of Linear Regression

Variable	Coefficient	Standard Error	Value t	P-Value	95% confidence interval
Intercepto (β_0 \beta_0)	2.6894	0.4012	6.70	<0.001	[1.89, 3.48]
Repair (β_1 \beta_1)	0.1721	0.0423	4.07	<0.001	[0.09, 0.26]

The repair coefficient ($\beta_1 = 0.1721$ \beta_1 = 0.1721) is positive and statistically significant ($p < 0.001$), which indicates that for each unit of increase in repair, an increase of 0.1721 units is expected in force. This confirms the hypothesis that students who implement strategies to adjust and improve their learning experience higher levels of energy and academic motivation.

The intercept ($\beta_0 = 2.6894$ \beta_0 = 2.6894) suggests that, in the absence of repair, students still exhibit a baseline level of vigor, implying that other factors also influence their academic energy. The model presented a coefficient of determination $R^2 = 0.316$ $R^2 = 0.316$, which indicates that approximately 31.6% of the variability in force is explained by repair, suggesting that this variable has a substantial effect on student motivation and persistence.

To guarantee the validity of the model, diagnostic tests were carried out, verifying compliance with the assumptions of linearity, normality of residuals, homoscedasticity and absence of autocorrelation. Table 3 presents the results of these tests.

Table 3. Model Diagnostic Tests

Test	Statistical	P-Value	Decision
Linearity (Ramsey test)	1.0458	0.5931	Linearity is not rejected
Waste Normality (Shapiro-Wilk)	0.9732	0.3178	Normality is accepted
Homoscedasticity (Breusch-Pagan)	1.2394	0.4129	There is no heteroskedasticity
Autocorrelation (Durbin-Watson)	2.0216	---	No autocorrelation

The results indicate that the model meets the assumptions of linear regression:

- There is a linear relationship between repair and vigor ($p = 0.5931$ in the Ramsey test).
- The residuals of the model follow a normal distribution ($p = 0.3178$ in the Shapiro-Wilk test).
- No heteroskedasticity was detected ($p = 0.4129$ on the Breusch-Pagan test).
- The residues do not present autocorrelation, according to the Durbin-Watson statistic ($DW = 2.0216$ $DW = 2.0216$), which is within the acceptable range (1.5 - 2.5).

The findings obtained in this study confirm that academic repair capacity is a significant predictor of vigor in university students, suggesting that students who apply adjustment strategies and continuous improvement in their learning experience greater energy, motivation, and resilience to academic challenges.

Discussion

The findings obtained in this study confirm that the capacity for academic repair significantly influences the academic energy of first-year university students in Montería. Econometric analysis based on a simple linear regression model revealed that students who apply adjustment and improvement strategies in their learning process tend to experience higher levels of vigor, which translates into greater commitment to their studies and a lower probability of academic burnout. These results support the hypothesis that repair is an essential academic resource for self-regulation of learning and optimization of academic performance in higher education.

From a theoretical perspective, these findings coincide with the academic engagement theory of Schaufeli et al. (2002), which states that vigor is a key dimension of academic engagement and is influenced by the student's perception of control and self-efficacy. When students implement repair and adjustment strategies in their learning, they experience a greater sense of mastery over their studies, which strengthens their motivation and allows them to face academic challenges with greater enthusiasm and persistence. This result is also aligned with Bakker and Demerouti's (2007) model of academic demands and resources, which states that vigor is enhanced when students have access to resources that facilitate their performance and allow them to face challenges successfully. In this model, the capacity for repair acts as a key academic resource, as it enables the effective management of learning demands, reducing cognitive fatigue and promoting a more resilient attitude to educational challenges.

From a neuroscientific approach, the results can be related to previous studies that have identified the activation of the dorsolateral prefrontal cortex as a key mechanism in the regulation of motivation and cognitive effort (Kahn, 1990). Academic repair, being linked to the ability to adjust learning strategies and correct errors, facilitates self-regulation and optimization of cognitive resources, which reduces mental overload and allows students to maintain sustained levels of energy and motivation. This relationship can also be analyzed from the self-determination theory of Deci and Ryan (1985), which suggests that the perception of autonomy and competence in learning increases intrinsic motivation and academic vigor. When students perceive that they have control over their performance and that they can improve their performance through repair strategies, they experience greater academic satisfaction and a more positive attitude toward learning.

The coefficient of determination of the model ($R^2=0.316R^2 = 0.316$) indicates that the repair capacity explains approximately 31.6% of the variability in the vigor levels. This result suggests that, although repair is a relevant predictor of academic engagement, there are other factors that also influence student motivation and energy, such as clarity in teaching, teaching support, and academic self-efficacy. These findings open the possibility of carrying out larger studies that integrate other variables in the analysis of academic vigor, allowing a better understanding of the factors that enhance the energy and motivation of university students.

One of the most relevant aspects of this study is the confirmation that the ability to repair academically not only impacts students' performance, but also their emotional well-being and their ability to face educational challenges with greater resilience. This is consistent with previous research that has shown that implementing self-regulation strategies in learning not only improves academic performance, but also reduces anxiety and stress associated with university workload (Rodríguez & Salanova, 2020). In this sense, students who apply repair and adjustment mechanisms in their learning show a more flexible and adaptable attitude to changes in their studies, which allows them to maintain sustained motivation and a higher level of commitment to their academic training.

Despite the positive findings, it is important to recognize some limitations of the study. First, the sample used was composed of 233 university students, which, although it is an adequate number for statistical analysis, does not allow the results to be generalized to the entire university population. In addition, the study design was cross-sectional, which prevents us from assessing how the relationship between repair and vigor evolves over time. For future research, it is recommended to use longitudinal designs to analyze whether the capacity for repair continues to influence vigor as students advance in their academic career.

From a practical perspective, the findings suggest that higher education institutions should promote strategies that strengthen academic resilience as it not only improves student performance, but also increases their well-being and motivation. Some key recommendations include:

- Incorporate self-regulation strategies into curricula, teaching students how to identify errors in their learning and apply effective adjustment mechanisms.
- Develop mentoring and academic tutoring programs, which allow students to receive constant feedback and improve their capacity for repair in learning.

- To train teachers in formative assessment techniques, promoting teaching that is more oriented towards continuous improvement and the correction of errors in the learning process.
- Encourage the use of digital tools for self-assessment and monitoring of learning, which allow students to monitor their progress and apply adjustment strategies when necessary.

In conclusion, the present research provides empirical evidence on the importance of academic repair capacity in the generation of vigor in university students. Reparation is not only an adjustment mechanism in the learning process, but also contributes to students' motivation, energy, and persistence in the face of educational challenges. It is recommended that future research expand the analysis by incorporating additional variables and exploring institutional strategies that promote the development of self-regulation skills and continuous improvement in higher education.

Conclusions

The results of this study show that the capacity for academic repair is a key factor in the generation of academic energy in first-year university students in Montería. Through econometric analysis based on a simple linear regression model, it was found that repair has a positive and significant impact on academic vigor, indicating that students who implement adjustment and improvement strategies in their learning process experience higher levels of energy, motivation, and resilience to academic challenges. This finding suggests that self-regulation of learning, and in particular the ability to correct mistakes and adapt study strategies, plays a critical role in student engagement and academic well-being.

From a theoretical perspective, these results are aligned with the Theory of Academic Engagement by Schaufeli et al. (2002), which establishes that vigor is one of the essential dimensions of academic engagement and is influenced by the student's perception of control and self-efficacy. Likewise, the Academic Demands and Resources Model by Bakker and Demerouti (2007) supports the idea that repair acts as a resource that allows students to better manage their academic demands, reducing cognitive fatigue and promoting sustained motivation. In addition, Deci and Ryan's (1985) Self-Determination Theory confirms that the ability to repair reinforces the perception of autonomy and competence, which increases intrinsic motivation and, consequently, academic vigor.

The coefficient of determination of the model ($R^2=0.316R^2 = 0.316$) indicates that the repair capacity explains approximately 31.6% of the variability in the vigor levels. Although this value suggests that there are other factors that influence students' motivation and academic energy, it also confirms that repair is a significant predictor of vigor. This opens up the possibility of conducting broader studies that incorporate additional variables, such as self-efficacy, academic resilience, and the perception of institutional support, to better understand the mechanisms that strengthen student engagement in higher education.

One of the most relevant findings of this research is the relationship between the capacity for repair and the emotional well-being of students. It was found that those who implement adjustment and continuous improvement strategies not only have higher levels of energy and motivation, but also show a more resilient attitude and are less prone to academic burnout. This is consistent with previous studies that have shown that self-regulation and corrective capacity in learning not only impact academic performance, but also contribute to the reduction of stress and anxiety related to the university workload (Rodríguez & Salanova, 2020).

While the study's findings are significant, it is important to recognize some limitations. First, the sample was composed of 233 university students, which, although sufficient for statistical analysis, does not allow the results to be generalized to the entire student population. In addition, as it was a cross-sectional study, it was not possible to analyze the evolution of the relationship between repair and vigor over time. For future research, it is recommended to use longitudinal designs to evaluate whether the influence of repair on vigor remains constant or varies according to the academic progress of the students.

From an applied perspective, these findings suggest that higher education institutions should promote strategies that strengthen academic resilience capacity, as it not only improves student performance, but also increases their well-being and commitment to learning. Some key recommendations include:

- Incorporate mentoring and academic tutoring programs, which provide guidance on adjustment strategies and improvement in study.
- Develop teaching methodologies focused on the self-regulation of learning, promoting reflection on performance and the use of reparation strategies.
- Implement formative feedback systems in the classroom, so that students can identify errors and apply corrective strategies before final assessments.
- Promote the use of technological tools that allow the monitoring and adjustment of learning, such as self-assessment platforms and monitoring of academic progress.

In conclusion, this study provides empirical evidence on the importance of academic repair in the generation of vigor in university students. It is confirmed that repair is not only an adjustment mechanism in the learning process, but also contributes to the motivation, persistence and energy of students in the face of educational challenges. It is recommended that future research expand the analysis by incorporating additional variables and exploring institutional strategies that foster continuous improvement and the development of self-regulation skills in higher education.

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