

Factors Associated with Educational Lag among Eighth-Semester Industrial Engineering Students at the Instituto Tecnológico de León

Margarita Sarabia Saldaña*

*(Department of Industrial Engineering, Instituto Tecnológico de León,
Tecnológico Nacional de México, León, Guanajuato, Mexico
Email: margarita.sarabia@leon.tecnm.mx)

Abstract:

Educational lag in higher education is a complex phenomenon that can affect academic progression, persistence, and terminal efficiency. This study analyzed factors associated with educational lag among eighth-semester Industrial Engineering students at the Instituto Tecnológico de León, from the perspective of faculty members. A qualitative approach was used, with an explanatory design and thematic content analysis. Data were collected through a questionnaire administered to 15 faculty members of the Industrial Engineering Department. The analytical process included transcription and organization of responses, exploratory reading and initial coding, construction of thematic categories, and interpretive analysis. Findings indicate that educational lag is multifactorial and emerges from the interaction of socioeconomic, personal and socioemotional, academic, and process-related conditions. In the socioeconomic dimension, 73.3% of participating faculty estimated that at least half of the students work while studying. In the personal dimension, 73.3% reported that family or partner problems affect academic performance, while 66.7% perceived anxiety or attention-related difficulties and all respondents considered such conditions harmful to performance. In the academic-process dimension, 93.3% evaluated the faculty-student relationship as good and considered it influential on motivation, whereas the tutoring system showed limited visibility and perceived effectiveness. The findings support an integrated institutional response that combines socioemotional support, academic-work flexibility, early risk detection, and strengthened tutoring.

Keywords — Educational lag, higher education, Industrial Engineering, socioemotional factors, academic performance, tutoring, student persistence.

I. INTRODUCTION

Educational lag represents a significant challenge for higher education because delayed progression through a curriculum can affect students' academic trajectories, persistence, graduation, and future professional opportunities. In Mexico, research has associated educational lag with academic failure, delayed enrollment in planned subjects, abandonment, and low terminal efficiency [1]–[4].

The phenomenon is particularly relevant in engineering programs, where curricular demands, technical subjects, workload, and the need to combine study

with employment may interact with personal and institutional conditions.

The literature reviewed in the doctoral thesis identifies educational lag as a multidimensional phenomenon rather than the consequence of a single academic deficiency. Mexican studies have documented the relevance of socioeconomic conditions, academic trajectories, institutional support, and personal circumstances in explaining delay and dropout [2], [5]–[9]. Murillo et al. [10], for example, examined university students experiencing lag due to course failure and highlighted the importance of understanding the academic context in which delayed

trajectories develop. Similarly, research on institutional tutoring emphasizes the role of monitoring and support systems in following students' trajectories [11].

At the Instituto Tecnológico de León (ITL), the problem acquires particular relevance in Industrial Engineering, a program located within a region characterized by strong industrial and labor activity. The doctoral study that supports this article focused specifically on students in the eighth semester, a stage in which accumulated failed or pending subjects can prolong graduation and increase the risk of withdrawal. The study therefore sought to answer the following question: What factors, from the perspective of Industrial Engineering faculty, contribute to educational lag among eighth-semester students at the ITL?

The objective was to analyze the factors contributing to educational lag among eighth-semester Industrial Engineering students at the Instituto Tecnológico de León in order to identify elements that can guide integrated educational strategies. The study was based on the premise that lag results from the interaction of academic, socioeconomic, personal, and institutional conditions rather than from students' academic ability alone.

II. LITERATURE REVIEW

An Educational lag has been conceptualized in the Mexican literature as a condition in which students do not progress through their educational trajectory according to the expected curricular timetable. Muñoz [12] emphasizes its social construction and the need to understand the conditions that produce and reproduce it. Núñez [13] similarly presents lag as a multidimensional problem whose causes extend beyond the individual student. More recent work has continued to frame educational lag as a risk associated with social vulnerability and unequal educational trajectories [14].

Within higher education, academic failure is one important pathway to lag. Vera-Noriega et al. [1] identified factors associated with lag in a Mexican higher education institution, while Murillo et al. [10] analyzed the academic context of university students in a condition of lag due to failure. These studies support the idea that delayed trajectories should be

examined through the interaction of student characteristics and the institutional environment.

Socioeconomic factors are also relevant. Studies of university dropout and persistence have found that economic conditions can influence students' ability to remain enrolled and devote sufficient time to academic activities [8], [15]. For students who work while studying, employment may reduce time available for independent study, tutoring, and extracurricular academic activities. In an industrial region, the compatibility between employment schedules and curricular demands becomes especially important.

Personal and socioemotional conditions constitute another dimension. Anxiety, family conflicts, relationship difficulties, attention problems, and other circumstances can affect concentration, motivation, and academic engagement. The thesis findings are consistent with the broader perspective that academic performance cannot be understood independently from students' lived circumstances. The institutional response therefore needs to combine academic support with early identification and referral mechanisms.

Finally, the institutional dimension includes teaching practices, the faculty-student relationship, tutoring, and other support mechanisms. A positive relationship with faculty may function as a protective factor because it can facilitate communication, trust, motivation, and early identification of risk. Conversely, support programs may have limited impact when students and faculty do not know how to access or use them effectively [11].

III. MATERIALS AND METHODS

The study adopted a qualitative approach with an explanatory design, focusing on faculty perceptions concerning the factors associated with educational lag among eighth-semester Industrial Engineering students at the Instituto Tecnológico de León. The unit of analysis was the set of perceptions, observations, and experiences reported by faculty members regarding students' academic trajectories.

Participants

The study included 15 faculty members from the Industrial Engineering Department who had experience teaching students in the program.

Participation was oriented toward obtaining informed professional perspectives on the causes of lag, academic failure, personal circumstances, and institutional support.

Data collection

A questionnaire developed in Google Forms was administered to participating faculty. The instrument explored socioeconomic and labor conditions, personal and socioemotional factors, academic and process-related conditions, faculty-student relationships, course failure, and the use and effectiveness of tutoring. The thesis documents the organization and transcription of the responses as the first stage of the analysis.

Data analysis

The information was analyzed through thematic content analysis. The process consisted of four principal phases: (1) transcription and organization of the collected material; (2) exploratory reading and initial coding; (3) construction of thematic categories; and (4) interpretive analysis and triangulation. The thematic organization converged around three principal axes: socioeconomic and labor factors; personal and socioemotional factors; and academic and process-related factors.

Ethical and interpretive considerations. The analysis presents aggregated perceptions rather than identifying individual faculty members. Percentages are reported descriptively to summarize questionnaire responses; they are not intended as population estimates. Consequently, the findings should be interpreted as evidence of faculty perceptions within the study context and not as causal estimates for all Industrial Engineering students.

IV. RESULTS AND DISCUSSION

A. Socioeconomic and Labor Factors

The socioeconomic axis showed that 66.7% of participating faculty perceived the predominant socioeconomic level of the students as medium-low, while 33.3% perceived it as medium. No participating faculty characterized the group as belonging predominantly to a high socioeconomic level. More importantly, 73.3% estimated that at least half of their students work while studying. Faculty described employment as a structural characteristic rather than

an exceptional circumstance, linking the double academic-labor workload with reduced time for independent study, tutoring, and extracurricular activities.

These findings support the interpretation of educational lag as a process shaped by students' social and economic context. The need to work can reduce the time and energy available for demanding engineering courses and may increase fatigue and stress. The finding is consistent with research that links economic conditions and educational persistence [8], [15], and with the literature reviewed in the thesis concerning delayed trajectories in Mexican higher education [1], [12].

B. Personal and Socioemotional Factors

The personal and socioemotional axis emerged as the most critical dimension in the faculty assessment. Seventy-three point three percent of respondents stated that family or partner problems affect students' academic performance. In addition, 66.7% perceived the presence of anxiety or attention-related difficulties among students, and 100% considered these conditions harmful to academic performance. Faculty associated these circumstances with lack of concentration, emotional strain, difficulties retaining information, and reduced problem-solving capacity.

When asked about the principal cause of failure, 57.1% selected a combination of personal and academic factors, while 42.9% selected personal factors. No respondent selected academic factors alone. Thus, within the study sample, 100% of faculty considered personal factors to be either part of or the sole explanation for course failure. This result is important because it challenges interpretations that attribute lag exclusively to curricular difficulty or teaching quality.

The results suggest that the student's capacity to sustain academic engagement is influenced by the conditions in which learning takes place. Anxiety, family or relationship conflicts, and work-related pressure can interact with the demands of technical courses, producing cumulative effects on concentration and performance. The interpretation is consistent with the thesis conclusion that educational lag is a systemic phenomenon produced by the interaction of internal and external pressures rather than by a single cause.

C. Academic and Process-Related Factors

Regarding curricular workload, 66.7% of faculty considered the eighth-semester course load adequate, while 33.3% considered it overloaded. The result suggests that curricular workload cannot be interpreted independently from students' circumstances: a load considered manageable in isolation may become excessive for a student who works, experiences family problems, or has accumulated academic difficulties.

The faculty-student relationship was identified as a strength. Ninety-three point three percent of respondents described the relationship as good, and the same percentage considered it influential on student motivation. This finding indicates that interpersonal interaction with faculty represents an institutional asset that can be used to support retention and early risk detection.

In contrast, the tutoring system showed a clear weakness. Only 20% of respondents knew whether students used the tutoring program, while 64.3% evaluated its effectiveness as regular. The result suggests a gap between the existence of institutional support and its visibility, accessibility, and perceived effectiveness. Rather than indicating an absence of support, the evidence points to a need for more targeted and proactive mechanisms capable of identifying students at risk before academic failure becomes cumulative.

Taken together, the three axes demonstrate that educational lag is multifactorial. Socioeconomic pressure reduces available time and energy; personal and socioemotional conditions affect concentration and motivation; and academic processes can either mitigate or intensify these pressures. At the same time, the positive faculty-student relationship constitutes a protective resource that can be strategically connected to tutoring and early intervention systems.

D. Implications for Institutional Intervention

The model is organized around three operational axes: socioemotional strengthening, academic-labor flexibility, and optimization of institutional support. The first includes brief psychoeducational support, stress and concentration strategies, and a "teacher-sentinel" mechanism for early identification and referral. The second proposes greater compatibility between academic schedules and students'

employment realities, including priority scheduling and high-quality asynchronous resources. The third proposes high-impact tutoring, preventive reinforcement seminars, and continuous feedback from faculty regarding overloaded courses.

These strategies should be understood as an intervention proposal derived from the diagnostic findings, not as experimentally validated outcomes. The thesis identifies expected benefits such as reducing educational lag, improving performance in critical courses, strengthening learning autonomy, supporting sustainable academic trajectories, and improving terminal efficiency. Future research should therefore evaluate the implementation and effectiveness of the MIEI through longitudinal indicators.

V. CONCLUSIONS

The study achieved its objective of analyzing factors associated with educational lag among eighth-semester Industrial Engineering students at the Instituto Tecnológico de León from the perspective of faculty. The evidence supports the interpretation of lag as a multifactorial and systemic phenomenon generated through the interaction of socioeconomic, personal and socioemotional, academic, and institutional conditions.

The socioemotional dimension emerged as a critical catalyst. Family and relationship problems, anxiety, and attention-related difficulties were perceived by faculty as strongly associated with concentration, motivation, and performance. The socioeconomic dimension also showed structural relevance because most respondents estimated that at least half of their students work while studying, suggesting that the academic trajectory must be understood in relation to employment demands.

The academic-process findings reveal a differentiated institutional picture. The faculty-student relationship is a significant strength and potential protective factor, whereas tutoring presents limited visibility and only moderate perceived effectiveness. This contrast indicates that the institution possesses relational resources that can be connected more effectively with formal support mechanisms. Consequently, educational lag should not be addressed exclusively through remedial academic measures. A more appropriate response is

an integrated strategy that combines early socioemotional support, academic-work flexibility, faculty participation in risk detection, and targeted tutoring. The MIEI proposed in the thesis provides a contextual framework for this response, although its effectiveness must be tested empirically through future implementation and evaluation studies.

The main limitation of this article is that the evidence is based on the perceptions of 15 faculty members from a single Industrial Engineering department. The findings therefore cannot be generalized statistically to all students or institutions. Future studies should incorporate students' perspectives, longitudinal academic records, and evaluation of the proposed intervention to establish how the identified factors evolve over time and which strategies produce measurable improvements in persistence and terminal efficiency.

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