

Journal of Engineering Research

STUDENTS AND ACADEMICS PERSPECTIVE ON FAILURE IN CHEMICAL ENGINEERING

María Guadalupe Amado Moreno

Department of Basic Sciences, Tecnológico
Nacional de México Campus Mexicali
California, México

Ángel García Velázquez

Department of Basic Sciences, Tecnológico
Nacional de México Campus Mexicali
California, México

Reyna Arcelia Brito Páez

Department of Basic Sciences, Tecnológico
Nacional de México Campus Mexicali
California, México

Carlos Alfonso Sagaste Bernal

Department of Basic Sciences, Tecnológico
Nacional de México Campus Mexicali
California, México

Bertha Ivonne Sánchez Luján

Department of Basic Sciences, Tecnológico
Nacional de México Campus Cd. Jiménez
Chihuahua, México

Lydia Toscano Palomar

Department of Chemical and Biochemical
Engineering, Tecnológico Nacional de
México Campus Mexicali
California, México

Oscar Enrique Callejas Melgoza

Department of Basic Sciences, Tecnológico
Nacional de México Campus Mexicali
California, México

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



Abstract: This paper presents the perspective of students and academics on failure in chemical engineering and is part of the results of the Project: “ANALYSIS OF THE CAUSES OF FAILURE IN ENGINEERING IN PUBLIC INSTITUTIONS”, which was carried out at the Tecnológico Nacional de México Mexicali campus. A questionnaire was applied to students and academics of the Department of Chemical and Biochemical Engineering to obtain information that allows relating and categorizing the perspective that these educational actors have on the problem of failure. Failure has increased in recent years, due to different factors, which for their study were grouped into psychological, social and family, physical and economic causes and attributable to school performance, the teacher, and the institution. Concluding that from the perspective of students and academics, the causes attributable to school performance, psychological causes and those attributable to the institution are the ones with the greatest influence on failure.

INTRODUCTION

The problem of failure is common in higher education institutions, but it is particularly notorious in careers where the student's profile is very specific, such as Chemical Engineering (IQ). The causes of student failure are varied, and include academic, vocational, family, and economic aspects, among others. Only a thorough analysis of the causes of this problem could effectively help to implement corrective measures with the aim of reducing it. Failure causes, in addition to economic costs to families and educational institutions, frustration and discouragement in the student that can lead to desertion.

In this regard, Duran's work [1] divides the causes of student dropout into four categories: Academic, economic-professional, and personal. The first refer to the performance

of teachers and administrators, as well as self-assessment of their own use by students. Economic variables include expenses associated with education, such as materials, enrollment costs, and the need to work.

For her part, Abril et al. [2] carried out a random sampling in the state of Sonora, Mexico, in order to find out the causes of dropout in upper secondary education. Failing subjects was identified as the main cause by 49% of the male respondents, and by 25% of the female dropouts. While, among the dropout students without failed subjects, they considered the economic conditions more relevant.

According to data from the Universidad Autónoma Metropolitana, more than half of the cases of dropout in engineering careers were students who obtained an average of less than 8 in their high school studies, on a scale of 0 to 10 [3]. Similarly, a notable majority of dropouts earned less than 10% of the credits in their study plans.

The curricula of various engineering careers usually include some basic chemistry courses, which is usually a choice for many students, affecting the final efficiency of the careers. This problem was documented by Reyes and Obaya [4] in the Agricultural Engineering degree at UNAM, highlighting the lack of study discipline in the matter as a notable cause.

In the IQ educational program taught at the Autonomous University of Tabasco, Domínguez points out that failure is one of the primary causes of low terminal efficiency. Locating the highest prevalence of failure cases in basic subjects of chemical engineering, such as calculus, thermodynamics and laboratory activities [5].

Table 1 shows the classification of the causes of failure in the upper secondary university level according to Espinoza [6].

Causes of disapproval according to its origin	Causes of failure
Physical and economic	Lack of financial resources and financial problems.
Attributable to the institution	Extensive programs, many students per group, teacher does not master the subject, laboratories and workshops with deficiency.
Attributable to the master	The teacher does not explain the topics clearly, the teacher is very demanding, insufficient teaching material, the exams do not evaluate the topics covered in class.
Attributable to school performance	Lack of motivation to study, do not solve additional exercises, lack of study habits, lack of foundations to study the subject, have difficulty understanding the subjects, do not pay attention to explanations, do not attend counseling and do not take notes or notes in class.
Psychological	Lack of time, they don't like the subject, their job doesn't allow them to study, emotional problems, they don't like the degree and they don't want to continue studying.
Social and family	They do not finish the subject, they miss classes a lot, family problems, small children to take care of and pregnancy (their own or their partner's).

Table 1. Classification of the causes of failure according to their origin

Source: [6].

At the Tecnológico Nacional de México (TecNM) Aguascalientes campus, a complete statistical analysis was carried out on an entire generation of the IQ career, highlighting the subjects that had the highest number of failed students. In the earliest semesters, the subjects of mathematics and numerical methods stand out. On the other hand, in advanced semesters the cases of failure are concentrated in IQ pillar subjects such as transport phenomena, material and energy balance, process design and unit operations [7]. That is why this paper aims to identify the causes of the problem of failure in IQ from the perspective of two of the main actors involved in it: students and teachers.

METHODOLOGY

The study is based on the design and application of a questionnaire to gather information on the problem of failure, to know how students and academics conceive the problem and how they behave before it. Two questionnaires were designed to collect the information, one was applied to the students and the other to the teachers of the Chemical and Biochemical Engineering Department of the TecNM Mexicali campus. The student questionnaire answers general information such as age, gender, whether or not they work, and the subject(s) they have failed. The students and academics selected, in order of influence, from 29 probable causes of failure, the ones that were most important to them. For analysis, the causes of failure were grouped according to Espinoza's classification [6].

The validation of the questionnaires was carried out with Cronbach's Alpha test, obtaining a value of 0.83, which validates the questionnaire. The analysis of results was carried out with the statistical package SPSS (Statistical Package for the Social Sciences) version 14.

The sampling carried out was simple random and was applied to the population of students from the second to thirteenth semester who had failed at least one subject (irregular students) in their career.

As of 2013-1, the number of students enrolled in engineering was 2,619, 52.8% (1,383) were irregular. While the total number of IQ students enrolled was 216 and 7.7% (106) had failed at least one subject. Of the sample of irregular students, 73.6% (78) were surveyed. There were 14 academics assigned to the IQ Department and 78.5% (11) of them were surveyed.

RESULTS

Table 2 shows the age of 60% of the IQ

students surveyed who report an age between 18 and 21 years, while 10% of them are between 25 and 35 years.

Age (years)	% of students	% Women	% Men
18 - 21	60	51	49
22 - 24	30	48	52
25 - 35	10	25	75

Table 2. Age of the Chemical Engineering students surveyed.

Source: Project: "Analysis of the causes of failure in engineering in public institutions"

68% of students do not work, while 32% do, perhaps because most of them are young.

Students report failing Analytical Chemistry, Separation Processes I, Momentum Balance, Heat and Mass, Organic Chemistry I and Physical Chemistry II and Basic Sciences Differential, Integral Calculus and Differential Equations

Table 3 shows that 80% of the causes of failure from both perspectives present common causes such as: those attributable to school performance, psychological, and those attributable to the institution.

Students	%	Students	%
Attributable to school performance	29.3	Attributable to school performance	32.2
Causes attributable to the teacher	24.1	Psychological causes	21.3
Attributable to the institution	19.9	Social and family causes	18.3
Psychological causes	13.4	Attributable to the institution	13.1
	86.6		84.9

Table 3. Perspective of students and teachers on failure in Chemical Engineering.

Source: Project: "Analysis of the causes of failure in engineering in public institutions"

- Table 3 shows that IQ students and academics agree from their perspective that the main cause of failure is

attributable to school performance due to lack of habits and motivation for study, not solving additional exercises, lacking foundations or previous knowledge, difficulty understanding the materials, not paying attention to explanations or attending counseling and not taking notes or notes in class.

- For students, the second most important cause that influences failure is that attributable to the teacher, since they consider that the teacher does not explain the topics clearly, is very demanding, the exams do not evaluate the topics covered in class, and there is insufficient material. didactic, observing that the academic does not consider it of any importance because it could be that from his perspective he considers himself qualified to teach his subject.

- The third cause of failure, the student attributes to the institution, seems to consider that extensive programs, large groups and that the teacher does not master the subject are activities that the institution must improve; for the academic, although he selects it as one of the causes of failure, it is of less importance.

- Psychological causes such as lack of time to study, that they do not like the subject, the work does not allow them to study, emotional problems, that they do not like the degree and that they do not want to continue studying, the student perceives it as less important, however, from the perspective of the academic it is the second in importance.

The academic, perhaps in search of the reasons for failure, considers that the third cause that leads to this problem is social and family, students miss classes a lot and do not complete the subject, family problems,

small children (as) to take care of and their own pregnancy or that of their partner, also observing in Table 3 that from the student's perspective this cause is not important.

CONCLUSIONS

From the results shown, from their analysis and discussion, the following conclusions can be drawn from the perspective of students and academics on failure in chemical engineering:

Both consider that the main cause of failure is attributable to school performance, the causes attributable to the institution are of greater importance for the students than for the academic, but not the psychological causes that are of greater importance for the academic than for the student.

It is noteworthy that social and family causes are important for the academic while the student does not consider them.

The student reports dissatisfaction with the teacher's performance since for him the causes attributable to the teacher are of greater importance, but not for the academic.

The causes of failure are many and depending on the perspective some will be more important than others, the phenomenon is complex, but it can be assumed that the actors who influence these problems want to reduce or eradicate it (the student does not want to fail and the teacher does not want to fail).

Therefore, it is considered necessary to generate actions to reduce this problem: better selection systems, both for students and academics, educational guidance for students and review of the systems for the assignment of subjects and monitoring of the grid.

REFERENCES

1. Durán, J., Díaz, G., "Análisis de la deserción estudiantil en la universidad Autónoma Metropolitana," *Revista de Educación superior*, no. 74, pp. 1-18, 1990.
2. Abril, E., Román, R., Cubillas, M. y Moreno, I., "¿Deserción o autoexclusión? Un análisis de las causas de abandono escolar en estudiantes de educación media superior en Sonora, México", *Revista Electrónica de Investigación Educativa*, Vol. 10, no. 1, pp. 1-16, 2008.
3. D. Elizarraráz, A. Pérez, Á. Martínez and O. González, "Deserción estudiantil dentro del tronco general de asignaturas en la división de ciencias básicas e ingeniería de la unidad Azcapotzalco," *Universidad Autónoma Metropolitana, Azcapotzalco*, 2008.
4. Reyes, L., Obaya, V., "Hábitos de Estudio de Alumnos de Ingeniería Agrícola y su Impacto en el Rendimiento Obtenido en un Curso de Química Básica", *Revista Formación Universitaria*, vol. 1, no. 5, 2008.
5. D. Domínguez, M. Sandoval and C. Frankling, "Problemas relacionados con la eficiencia terminal desde la perspectiva de estudiantes universitarios," *Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación*, vol. 12, no. 1, pp. 25-34, 2013.
6. Espinoza García, C. et al., "Propuesta de sistema integral de tutorías académicas para el nivel medio superior universitario", Foro Reforma del Bachillerato Universitario. Benemérita Universidad Autónoma de Puebla, 28 - 30 nov., Puebla, Puebla, México, 2005.
7. Medina, R., Lomelí, J., "Estudio estadístico de la generación 93-98 de la carrera de ingeniería química", *Conciencia Tecnológica*, vol. 1, no. 13, 2000.