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Abstract

The undergraduate degree in Industrial Engineering at the Faculty of Technology (FT) of the Federal University of Amazonas (UFAM) completed 15 years in the first semester of 2019. During this period, enrolled 837 students, of which 238 (28%) have already graduated, 335 (40 %) continue to study and 263 (32%) have left the course. Given this percentage of dropout and the need to research more about the topic, this article aims to investigate the main causes of abandonment in this course in order to propose strategies to minimize the problem. The method used was the Survey, which applied a five-part electronic questionnaire sent to 203 dropout students who had e-mail. After analyzing the answers of 39 (19.21%), it was concluded that most students did not receive vocational orientation before joining the University and the main reasons that influenced the students to quit the course were the didactic-pedagogical deficiency of the teachers, the difficulty in conciliating study and work, and the course did not satisfy their expectations.

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Abstract

The undergraduate degree in Industrial Engineering at the Faculty of Technology (FT) of the Federal University of Amazonas (UFAM) completed 15 years in the first semester of 2019. During this period, enrolled 837 students, of which 238 (28%) have already graduated, 335 (40 %) continue to study and 263 (32%) have left the course. Given this percentage of dropout and the need to research more about the topic, this article aims to investigate the main causes of abandonment in this course in order to propose strategies to minimize the problem. The method used was the Survey, which applied a five-part electronic questionnaire sent to 203 dropout students who had e-mail. After analyzing the answers of 39 (19.21%), it was concluded that most students did not receive vocational orientation before joining the University and the main reasons that influenced the students to quit the course were the didactic-pedagogical deficiency of the teachers, the difficulty in conciliating study and work, and the course did not satisfy their expectations.

Keywords: Industrial Engineering; University's Evasion; Causes;

1. Introduction

The evasion is one of the problems that affect Higher Education Institutions whether public or private, thus affecting the society in its social, academic, economic and political field (SANTOS; LAGE JUNIOR; RIBEIRO, 2015).

It can be said that student evasion, whether in higher education or basic education, is a phenomenon that will always exist, even if it reaches minimum limits. It is the duty of the institutions, at least, to ensure this (AMARAL, 2013).

Although evasion commonly means a student quitting a university course, the different factors involved cannot be overlooked when the objective is to analyze this concept in specific local and courses. (FEITOSA, 2016).

Gomes et al (2010) emphasize that dropout may occur for different reasons: financial difficulties, lack of vocation, discontent about the institution's didactic-pedagogical method, personal reasons such as serious illness or death, transfer of domicile, etc. Therefore, evasion is a problem to be faced in several higher education courses, including engineering.

When analyzing the situation of the Federal University of Amazonas (UFAM), it can be seen that in October 2018, it was considered the 12th public University with the lowest dropout rate (10.81%) among the Public

Universities of Brazil, according to survey conducted by Quero Bolsa (2018), a platform for the inclusion of students at higher education, using the database of the National Institute for Educational Studies and Research Anísio Teixeira (INEP) for 2017.

Although the statistics presented by Quero Bolsa (2018) are encouraging, as the national average was 24.58%, studies need to be performed with scientific rigor in Engineering courses, since the evasion rate may be higher and there are Engineering students of the Faculty of Technology (FT) of UFAM which were affected. FT has twelve courses, one of them being Industrial Engineering, created in 2004 and which until the first semester of 2019 already enrolled 837 students, 238 (28%) have already graduated, 335 (40%) are still studying and 263 (32%) have left the course. Even this course is 15 years old, so far no scientific research has been conducted to understand the problem of dropout and its causes to find ways to combat it over time.

Thus, the general objective of this article is to investigate the main causes of the evasion of Industrial Engineering students of FT/UFAM, aiming to propose strategies to minimize the problem. The specific objectives are: a) identify the profile and the school trajectory of the dropout students; b) identify if they have received vocational orientation during high school and the reasons for choosing the course; c) investigate the main causes that contributed to student leaving the course; d) suggest action strategies to reduce dropout rates of students in this course.

The topic is relevant since the dropout in higher education generates irreparable losses both economic and in the formation of skills for the country, which needs to increasingly insert itself in the globalized world. The research is important for the managers of the Industrial Engineering course at UFAM since the course received grade "4" in 2018 in the evaluation of the Ministry of Education (MEC) and aims to reach grade "5" in 2021. Thus, knowing the main causes will help find ways to combat them, reduce costs, raise the concept and increase the number of graduates in society. For the academy, the research will foment debates and new research projects to be implemented over time, focusing on the study of dropout in all Engineering courses of FT/UFAM.

1.1 University Evasion

Joining higher education does not guarantee students' educational success, as the characteristics of this level of education are quite different from those of high school. This new phase causes to students some uncertainty about what is to come and sometimes requires significant changes in habits.

University evasion can be understood as the student's permanent withdrawal from the course in which he/she is inserted. It is a problem that generates great debates since public and private investments are significant for society to have access to higher education. (SANTOS; JUNIOR; RIBEIRO, 2015).

The dropout in higher education is problematic because the undergraduate process has cycles, that is, a course has a minimum time of completion, so any dropout is very difficult to reverse and generates an idle vacancy for several years. Given this characteristic, evasion is a problem that affects all undergraduate educational institutions (WEISE, 2015).

In Engineering, the reasons leading to evasion are multiple, the main cause of abandonment of the course is the deficiency that students have with a basic education in mathematics, algebra, and physics, compromising their performance throughout the course.

The national average of evasion in engineering courses was 50% between 2001 and 2011. Develop innovative projects and mechanisms to combat high dropout rates would be helpful to increase the number of engineering graduates so there is no need to add courses or vacancies (OLIVEIRA, 2016).

For the student, dropout is also a problem. The sooner a college student graduates, the sooner he will be independent and in the job market. However, that student who leaves the course is delaying their insertion in the job market as a professional with higher education or, worse, is giving up the search for a diploma and a better-paid profession (STOFFEL; ZIZA, 2014).

When the university is unable to keep the student until the end of the course, there is an institutional failure, ranging from the teacher who has not been able to play its role to the programs and plans established by HEI for not fulfilling the institutional mission of forming its student. In other words, evasion prevents HEI from fulfilling its purpose of producing knowledge and providing services to society (SOUZA, TOMIO, 2010).

1.2 Types and Evasion Causes

The types of evasion vary by author. According to Colvero e Jovino (2014) there are three types of evasion: evasion of the course, evasion of the institution and the evasion of the university system, characterized as follows:

- a) Evasion of the course - occurs when the student leaves the course in various situations such as abandonment (cease enrolling), waiver (official), transfer or reentry (change of course), locking, exclusion by institutional rule;
- b) Evasion of the institution - happens when the student leaves the institution in which he/she is enrolled;
- c) Evasion of the university system - occurs when the student permanently or temporarily leaves higher education.

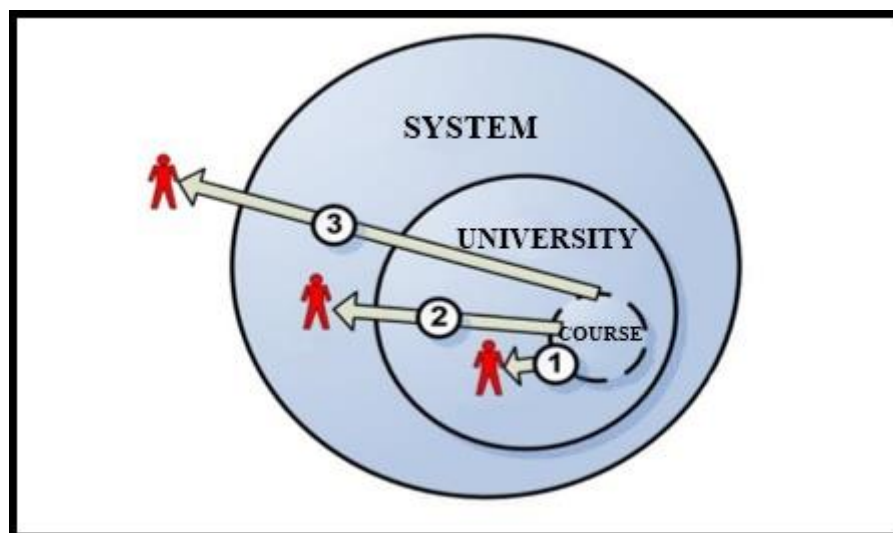


Figure 1. Higher Education's different levels of evasion

Source: Ney (2010).

Ney (2010) used Figure 1 to illustrate student dropout. The existence of evasions of the institution and the system depends primarily on evasion of the course since a student can only evade the institution if evaded the course. The evasion of the system depends on the simultaneous occurrence of both the evasion of the course and the institution.

Thus, course dropout may occur without abandonment from the institution when dropout occurs by transferring from one course to another within the same institution. If the student leaves the course of an institution to attend another course in another institution of higher education, in this case, the course evasion and the institution evasion occurs, however, the system does not occur because the student keeps a link with the University education.

The evasion of the system occurs when the student leaves the course and the institution and does not migrate to another higher education institution. Besides, the author also highlights that evasion can occur due to work need, serious illness, death, transfer of domicile, among others.

Augustin (2005) relates another important factor: the students do not know how to choose the profession they want to pursue:

A good career choice considers at least three elements: who is the person, what is the job market and what is university life. The major causes of university dropout [...] are related to the student's misinformation about himself, about market difficulties and college subjects (AUGUSTIN, 2005).

Regarding the faculty and considering that the first periods of the courses are the ones that have the most relevant impact on the student, Bardagi (2007) discusses that the bad performance of the teacher contributes in a way to the student giving up the course. In the author's view, teachers, especially from these periods, should develop motivating, qualified and meaningful methodological practices to stimulate the academic to create a bond with the educational institution.

For Campos (2016) the incompatibility between the schedules of courses and work characterizes a reality that must be faced by Higher Education Institutions (HEI) seeking solutions to avoid dropout. Still in the line of thought of this author:

The difficulty of conciliating workday and class is a very important factor in the decision to leave college. When professional obligations conflict with study commitments, these last ones are the most often postponed (CAMPOS, 2016, p.18).

Personal Factors	Internal Factors	External Factors
<ul style="list-style-type: none"> - The course did not satisfy the expectations; - Lack of vocational orientation; - Unsatisfactory basis of previous education; - Difficulty to keep pace (fail); - Need to work due to financial difficulties; - Difficulty in conciliating studies and work; - Childbirths; - Health problems. 	<ul style="list-style-type: none"> - Didactic-pedagogical deficiency of the teachers; - Rigid prerequisite chain; - High failure rates; - Precarious infrastructure (classroom, laboratories) - Lack of student financial support program; - Lack of student adaptation to the university system 	<ul style="list-style-type: none"> - Go on strike; - University Location; - Devaluation of the profession; - The financial difficulty of the university.

Chart 1. Types of Dropout Causes Organized by Factors

Source: Adapted from Cislighi (2006).

Also, the causes of evasion can be classified as personal, internal and external. Chart 1 presents eight personal factors, six internal factors and four external factors that can be considered causes of dropout, such as the course did not satisfy the expectations, lack of vocational orientation, rigid prerequisite chain, precarious infrastructure, etc.

1. 3 Profile of Industrial Engineering Course of FT-UFAM

In 1998, the idea came to implement the Industrial Engineering course at FT / UFAM to meet the growing demand of the Manaus Industrial Pole (PIM) for professionals in this area. However, the formal implementation of the course only took place on November 6, 2003, authorized by UFAM's Resolution 12/2002.

Over the years, the Pedagogical Project of the Industrial Engineering Course of FT / UFAM has already been revised at two different times, and its last version was approved in the second semester of 2018, which was implemented in the first semester of 2019. In this new version, the course is offered in a face-to-face mode, evening-night period, with five years of duration and a maximum integration time of 7 years and 6 months. The course load is 3,685 hours, of which 3,645 hours contain mandatory subjects, 120 hours optional subjects, 180 hours supervised internship, 120 hours of Final Paper, 100 hours in academic, scientific and cultural activities.

According to the new Pedagogical Project of the Course (UFAM, 2019), the purpose of the course is:

Train citizens with full, technical and scientific training in the areas of knowledge of Industrial Engineering, with skills to develop and optimize products and processes of organizational systems, considering the political, economic, technological, social, environmental and cultural aspects and professional conduct guided by ethical and citizenship principles.

Regarding the infrastructure offered, there are about 32 classrooms, several laboratories, and the Industrial engineering department has an effective faculty with 11 professors (10 with doctoral degree and 1 with master's degree).

2. Methodology

For the data collection, the target was students who evaded the course in the last 15 years, whose data were obtained from the Dean of Undergraduate Teaching (PROEG) of UFAM. According to PROEG the types of abandonment are evasion, dismiss, withdrawal, transfer, and initial withdrawal, where:

- a) Evasion - Student's absence from the course in which he/she was enrolled before completing it;
- b) Dismiss - occurs when the student has not been able to complete the course within the deadline set by the Council for Teaching and Research (CONSEPE) and not enrolling for more than four semesters;
- c) Withdrawal - cancellation of enrollment by request;
- d) Transfer - the departure of the student from UFAM to another institution by formal request;
- e) Initial withdrawal - occurs when the student does not enroll for the beginning of the school year.

After analyzing PROEG data, it was noticed that between 2004/1 and 2019/1, among the 837 students who enrolled in the Industrial Engineering course, 264 (31.4%) evaded as follows: 181 were dismissed (21.62%),

70 requested withdrawal (8.4%), 12 (1.4%) were transferred and 1 concluded but did not attend graduation ceremony. Altogether, 206 students had registered an e-mail while 58 only registered the telephone number. Another analysis showed that of these 206 students, 3 were able to reverse the dismiss and complete the course, which is why the research focused on 203 students with e-mail since they will be contacted by mail electronic.

A questionnaire was developed in Google Forms (Appendix 1) consisting of five parts: section 1 has four questions about the student's educational profile; Section 2 has two questions regarding the reasons why the student chose the course and if he had any orientation in high school; Section 3 consists of three questions that focus on the main reasons for evasion; Section 4 has only one open question for suggestions to reduce evasion; Section 5 concludes with three questions about the student's data.

To evaluate the level of comprehension of the questionnaire, the pilot test was applied with 50 randomly selected students from June 13 to 17, 2019, which was sent to each of them by e-mail.

Among the 50 emails sent, 12 emails returned (24%) without target students receiving, while another 12 (24%) correctly answered the questionnaire. After completing the pilot test, some adjustments were made to the questionnaire, and on June 18, 2019, an invitation containing the link to access the online questionnaire was sent, which was available for 14 days.

In the end, from 203 emails sent, 34 (17%) returned because of the incorrect addressee, while 39 (19.2%) answered the questionnaire, whose data were collected and analyzed with spreadsheet editor, for discussion of results.

3. Results

3.1 Profile and School Trajectory of the Respondents

One of the first questions concerned about gender, where 33 (84.6%) answered and 6 (15.4%) did not wish to identify themselves. Regarding the respondents, most (56.4%) are male and 33.6% are female.

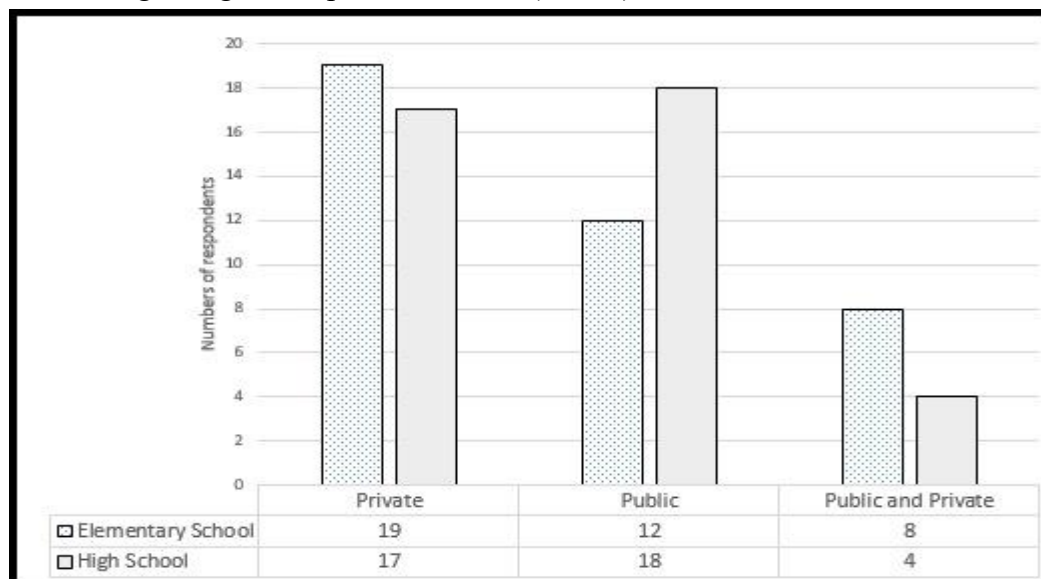


Figure 2: School trajectory of respondents before University enrollment

Source: Author (2019)

Figure 2 presents the school trajectory of 39 respondents before University entrance. During their

elementary school time, 19 (48.7%) attended only private elementary schools, 12 (33.33%) only public schools, while 8 (20.5%) studied in both types of schools. Concerning to high school, the situation changes for public school preference, with 17 (43.59%) of respondents reported having studied in a private school, another 18 (46.15%) in public school. Only 4 (10.25%) of the dropout students attended public and private schools.

When asked about switching to another course, 56.41% said they had completed another college course, while 43.49% said they did not completed other undergraduate course. Other courses completed by students include Civil Engineering, Mechatronic Engineering, Quality Management, Psychology, History, Economy, Biology, Medicine or Law, all the information were also checked by consulting the information of respondents in Brazilian CNPQ Search Research web site <<http://buscatextual.cnpq.br/buscatextual/busca.do>>.

3.2 Vocational Orientation and Reasons for Choosing Industrial Engineering

Section 2 asked about vocational orientation and the reasons for choosing the course.

Regarding the question “During high school, did you receive any vocational guidance about the Industrial Engineering course?”, 37 answers were submitted, and the majority (31; 83.78%) reported that they did not receive the guidance, while only 6 (16.22%) gave a positive answer. This result shows that high school students have no instructions about university courses. Due to their lack of experience, they choose the undergraduate course without criteria, resulting in its abandonment over time.

About the question “What are the top three reasons why you chose UFAM's Industrial Engineering course?”, 38 answered the question. Among the eleven options placed on multiple choices, the three most prominent reasons were (Figure 3): wide scope (20; 52.63%), good financial remuneration (17; 44.74%) and vocation (10; 26.31%).

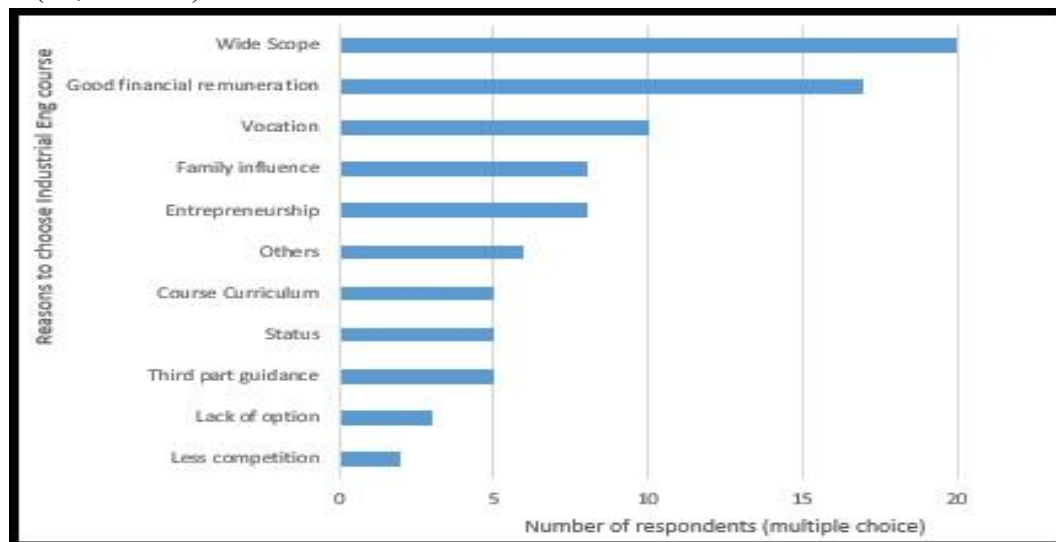


Figure 3. Reasons for choosing the Industrial Engineering course in FT/UFAM.

Source: Author (2019)

In this sense, it is important to mention that the Industrial Engineering course is divided into ten areas with 56 subareas, according to the Brazilian Association of Industrial Engineering (ABEPRO). This makes the course attractive because of its wide scope.

According to Leppel (2005), students expect to be successful and see in the undergraduate course a

possibility of future gains to improve their living conditions. On average, an Industrial engineer in Brazil earns close to R\$ 6,228.85 (CATHO, 2018), varying by region, working time, experience, type and size of the company. Because of this, the item “good financial remuneration” had relevance in the answers. Besides, the respondents who marked the item “by vocation” are noteworthy since they did not finish the course.

3.3 Major Causes of Evasion in the Industrial Engineering Course

To identify the main reasons for evasion, the third section asked the respondent three times to report the main reason for abandonment, dividing the answers into the following classes: external causes with 5 possible answers; institutional causes with 5 choices and personal causes with 9 options, as explained ahead.

3.3.1 External Causes

About this question, 38 answered correctly, while only 1 declined to answer. Of those who responded (Figure 4), it is noteworthy that the majority (20; 52.6%) reported that there was no external factor that contributed to their withdrawal, which is the largest response when compared to institutional (17; 44.7%) and personal causes (5; 12.8%). Regarding external reasons, the two main ones (Figure 4) were the location of the university (7; 18.42%) and strikes (5; 13.16%).

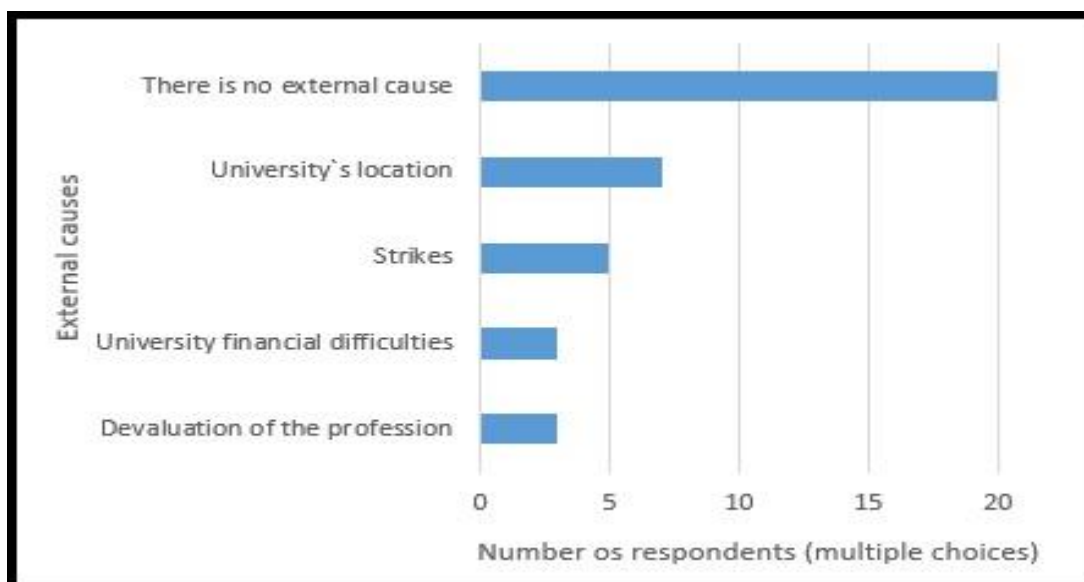


Figure 4. External causes that contribute to student dropout

Source: Author (2019)

Regarding to location of the university, it is suggested to speed up the construction of the Student Residence, which is located near UFAM to shelter especially low-income students who live in distant neighborhoods or neighboring cities of Manaus.

The strike, however fair it may be, when it paralyzes activities for a long time ends up affecting students' motivation, especially those who urgently need to advance their studies within the planned timeframe, due to a job promotion or other personal dream.

3.3.2 Internal Causes of the Institution

Regarding this question, 39 returned correctly, while only one preferred not to answer (Figure 5). Of the 38 respondents, the majority (17; 44.7%) reported that there was no internal cause.

However, the main internal reason that contributed to the dropout of the students of the course was the

didactic-pedagogical deficiency of the teachers (16; 42.1%), which shows the necessity of UFAM to perform constant pedagogical training for the teachers, aiming to improve the didactics teaching them over time. Great teaching and learning practices could also be cataloged and disseminated throughout the institution, recognizing those teachers who each semester seeks to innovate in providing their services to students.

3.3.3 Personal Causes

About this question, the 40 respondents contributed (Figure 6) and the personal reasons most relevant were the difficulty of conciliating study and work (10; 25.64%), the course did not satisfy their expectations (10; 25.64%) and transfer of work/residence (6; 15.38%).

It is noteworthy that the Industrial Engineering course is evening-night period and some students have difficulty conciliating their studies with work. A possible solution to this problem would be for course managers to raise funds for research or extension projects by allocating studentships to students, especially those with greater social vulnerability.

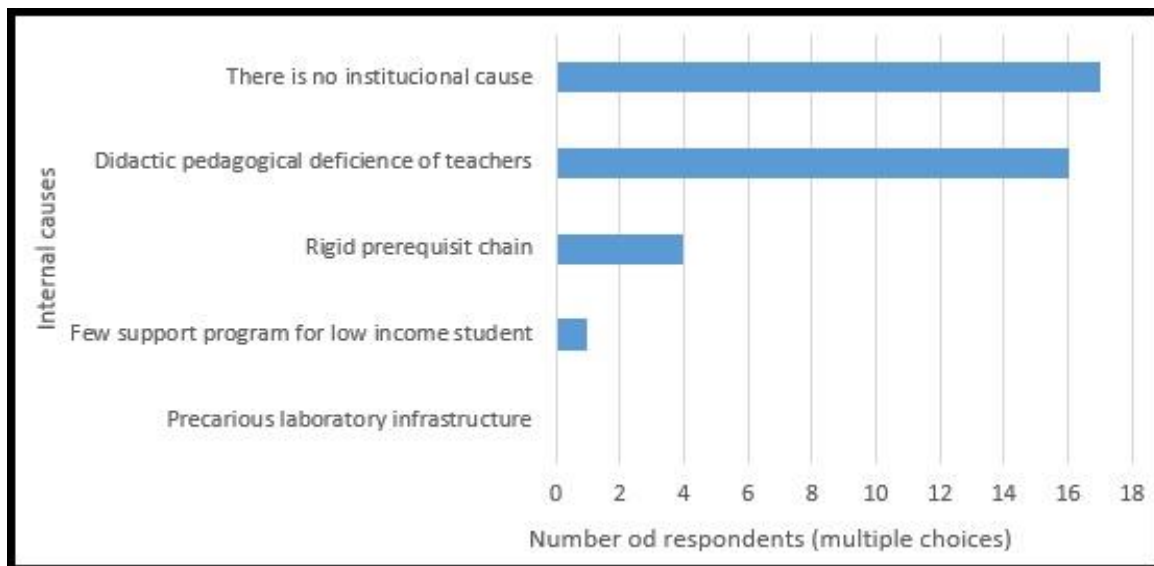


Figure 5. Internal Causes of the Institution.

Source: Author (2019)

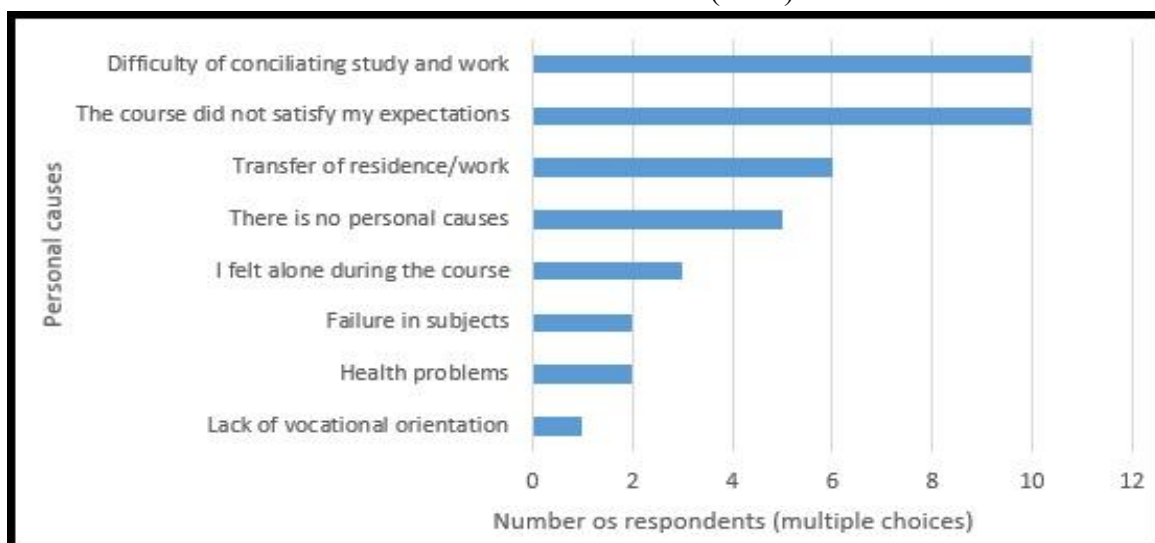


Figure 6: Personal Causes.

Source: Author (2019)

3.4 Suggestions from dropouts to tackle evasion in Industrial Engineering

In this section, each respondent was asked to present actions or suggestions that could reduce the causes of evasion in the course. As a result, 30 (77%) respondents answered and the most common suggestions presented were: accompany and encourage students with psychological administrative and pedagogical supports (20%), realize activities and promote lectures in schools about the Industrial Engineering course (13%), promote more practical lessons (10%) with content aligned with the reality of the market, developing teaching weeks (29%) to discuss and disseminate good teaching practices (7%), conducting lectures with inspire guests (7%), and offer out-of-period courses for unperiodized students (7%). Not common suggestions considered interesting were: be flexible with presence and timing by using distance learning approach, identify and create an approach to be flexible the returning of dropouts.

4. Conclusions

The research aimed to investigate the main causes of the evasion of Industrial Engineering students of FT/UFAM, aiming to propose strategies to minimize the problem. To this end, a five-section questionnaire was designed and answered by about 39 students who dropped out of the course over the 15 years. Based on the results, it is concluded that:

- a) Regarding the school trajectory, the majority (49%) attended only private schools in elementary school, while 31% only public school and 20% studied in both types of schools. During high school, 44% of respondents attended only private, while 45% public schools. Around 11% of respondents studied both types of schools;
- b) Most (84%) of dropouts reported that they did not receive vocational guidance in high school, while only 16% gave a positive answer;
- c) The main reasons that led the students to choose UFAM's Industrial Engineering course were the scope of the course, great financial remuneration and the vocation for the course;
- d) In 15 years, the course has lost almost 1/3 of its students, mostly by dismiss, and the course coordinator needs to conduct a study to identify which of the dismissed students would need a few subjects to graduate to run an incentive campaign for students to complete the course.
- e) Concerning external, internal and personal causes, the personal cause tends to be decisive, highlighting the difficulty in conciliating the study and work, the course did not satisfy their expectations, and the transfer for work or family reasons.
- f) Regarding external causes, the location of the university and the strikes were the most relevant;
- g) Concerning internal causes, the didactic-pedagogical deficiency of teachers was highlighted.

To reduce evasion in the course, it is suggested to implement a significant number of scholarships or grants to encourage students to stay, such as research grants, work grants, food allowance, housing allowance (Student House) and transportation allowance. Scholarships are not the definitive solution, but they would help reduce students' drop out due to personal causes. There is also the need to conduct psycho-pedagogical follow-up with students. A new pedagogical program should be developed in order to improve teachers' teaching competencies, as well as to identify, recognize and disseminate the best teaching methodologies, including the use of new technologies and contents more aligned with the professional reality.

It is necessary to carry out course dissemination and vocational guidance actions for high school students,

even encouraging them to visit the university to meet teachers, laboratories and their extension and research projects. It could be done by partnership between Government Educational Secretary and University.

Finally, it is suggested that other similar research could be conducted to reach at least 50% of dropouts to make the analysis more robust and perhaps initiate a rescue process, especially among the dismissed students who dropped out with few subjects missing. Also new research could be done to identify main predictive factors that point out the possibility of the student quitting the course, such as misbehavior, failing in Physics or Calculus, poor attendance, lack of motivation, etc.

5. Acknowledgment

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Appendix 1: Industrial Engineering student evasion questionnaire.

Section 1 - Schooling Profile of interviewed

- 1.1- Which type of school did you study in elementary school?
- (a) Public;
 - (b) Private;
 - (c) Public and Private
- 1.2- Which type of school did you study in high school?
- (a) Public;
 - (b) Private;
 - (c) Public and Private
- 1.3- Have you completed another higher-level course?
- (a) No;
 - (b) Yes
- 1.4- If answer 1.3 is positive, inform the name of the course and institution.

Section 2 - Vocational orientation and reasons for choosing the course

- 2.1 - During high school, did you receive any professional guidance about the Industrial Engineering course?
- (a) No;
 - (b) Yes
- 2.2 - What are the top three reasons why you chose UFAM's Industrial Engineering course?
- (a) Wide Scope;
 - (b) Good financial remuneration;
 - (c) Less competition;
 - (d) Vocation;
 - (e) Entrepreneurship;
 - (f) Family influence;
 - (g) Course curriculum;
 - (h) Third party guidance;
 - (i) Status;
 - (j) Lack of option;
 - (k) Others.

Section 3 - Identification of causes of abandonment.

- 3.1- Enter the main external cause that caused your evasion of the course:
- (a) Devaluation of the profession;
 - (b) University financial difficulty;
 - (c) Strike;
 - (d) University location;
 - (e) There is no external cause.

3.2- Enter the main institutional cause that caused your evasion of the course:

- (a) Few support programs for low-income students;
- (b) Rigid prerequisites chain;
- (c) Precarious laboratory infrastructure;
- (d) Didactic-pedagogical deficiency of teachers;
- (e) There is no institutional cause.

3.3- Enter the main personal cause that caused your evasion of the course:

- (a) The course did not satisfy my expectations;
- (b) Lack of vocational orientation;
- (c) I felt alone during the course;
- (d) Failure in subjects;
- (e) Difficulty of conciliating study and work;
- (f) Health problems;
- (g) Death of family member;
- (h) Transfer of residence/work;
- (i) There is no personal cause.

Section 4 - Suggestions to reduce evasion.

4.1 -What do you suggest for course managers to reduce their students' evasion?

Section 5 -Respondent Information.

5.1 - Full name:

5.2 - Year of entry to the course:

5.3 - Email:

Thank you very much for your participation.

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