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# The Establishment of A Program to Act Against Dropout and Retention Rates on Biochemical Engineering

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### Abstract

The highest rates of evasion and dropout on the Biochemical Engineering major at Universidade Federal do Rio Grande are observed during the first semesters of the undergraduate degree, in which are offered the courses that compose the basic cycle of Engineering and are the foundation for the advanced courses. Literature confirms that entering the University can be a very stressful and life changing process, reinforcing the need of special institutional attention to the freshmen. As an alternative to fight this negative scenario and promote integration among the students, a series of activities were proposed through the Program of Incentive to Academic Activities of Biochemical Engineering Students (PAIEB), supported by the Institutional Program of Student Development (PDE-FURG). During the school year of 2016, PAIEB offered a series of testimonies of juniors and seniors about their experiences on college (primary action), in addition to motivational speeches, and time management workshops (secondary action). To evaluate the activities and identify punctual problems to take directed actions, opinion and reflection surveys were conducted to all students that participated in the program activities. It was found that difficulty on time management and demotivation were key problems among the freshmen. In addition, the evasion level in 2016 remained stable when compared to the 2015 level (about 17%) and decreased roughly 3% when compared to 2014, and the retention level within the freshmen year did not show significant decrease. Therefore, the answers to the surveys applied showed that the program is helping on freshman interest and motivation and helped identifying actual problems representing that PAIEB could be working, in this case, as a complementation the recurrent traditional learning and education. Moreover, data collected from the University database implied that the program needs to be amplified and intensified to help decreasing evasion and retention among the Biochemical Engineering students.

**Keywords:** Academic Skills, Freshmen, Motivational Speeches, Testimonies, Time Management.

## 1. Introduction

Leaving high school and entering the University is considered a very complex and stressful process to the students; they must learn to conciliate issues related to academic, social, family, and sometimes even paid employment responsibilities<sup>1</sup>. Dropout and retention rates are commonly higher among freshmen, and the reasons that lead students to dropout are usually not simple<sup>2</sup> and so are not the reasons that influence on their retention<sup>3</sup>.

In the case of the Brazilian Higher Education, in recent years occurred the creation of several public policies towards expanding the access to the Universities. Thus, the enrollments on the Higher Education have significantly increased in the country. However, the national dropout rates have also reached levels as high as 37.4%<sup>4</sup>. Addressing the problem to Brazilian Engineering courses, we find that only 40% of the students finish their degree, meaning that more than half of the students give up on Engineering along the duration of the course<sup>5</sup>. Literature from de 1980's found that student and institutional commitment are key factors that influence high retention and dropout rates on Engineering courses<sup>6</sup>. However, more recent studies found that other factors like gender differences, extracurricular activities, integration with classmates, financial conditions, and psychological encouragement are decisive on that matter<sup>3</sup>.

Elevated dropout and retention rates on Higher Education have been raising doubt on the traditional methods of learning and education<sup>6</sup>. Many studies have recently reported about the application of alternative methodologies to the traditional learning worldwide<sup>7, 8, 9</sup>. Although active learning and education methodologies are increasingly gaining the spotlight on that matter, the traditional method is still more widespread and well established on the

academic environment<sup>10</sup>.

Biochemical Engineering is an undergraduate course that touches many fields of knowledge, such as Mathematics, Physics, Biology, Chemistry and Biochemistry, which can make it especially stressful to students that, at the first moment, don't identify with all the areas and struggle to adapt to the course. During the years of 2014 and 2015, for example, the retention rates on the first semesters of the Biochemical Engineering Major at the Universidade Federal do Rio Grande (FURG) were roughly around 57% of all the registered students. In addition to that, the dropout rates for 2014 and 2015 were 20% and 17% of all registered students, respectively. Considering these worrying rates, professors created the Program of Incentive to Academic Activities of Biochemical Engineering Students (PAIEB), supported by the Institutional Program of Student Development (PDE-FURG).

The purpose of this paper is to describe a work performed on Biochemical Engineering freshmen students that aimed to identify the main reasons that lead to students' retention and dropout, and take action to try reducing these rates.

## 2. Methodology

During the school year of 2016, a series of activities were proposed through the PAIEB. The activities were composed by a primary action that was performed to combat what was thought to be the problem, a survey that aimed to evaluate the primary action and highlight actual problems, and a secondary action that was then constructed from the identified problems.

### 2.1.1. Primary action

The purpose of the primary action was to increase freshmen interest and motivation. PAIEB<sup>11</sup> organized a series of testimonies of Biochemical Engineering juniors and seniors about their experiences on college related activities such as research projects, studying abroad and internship programs, and other personal experiences.

The students who gave their testimonies were volunteers who had some constructive experience to share. Some volunteers participated on exchange programs and talked about the importance of speaking a second language and their experiences in several different countries. Others, who had already had internship experiences, talked about their work and receptivity of the market with Biochemical Engineers. There were some volunteers who talked about their experiences within the course, overcoming their difficulties. These testimonies happened on the Biochemical Engineering Fundamentals I course, offered on the first semester to the freshman class. Although the focus was on the freshmen, the activities were extended to all Biochemical Engineering students.

### 2.1.2. Survey

At the end of the primary action activities, the survey 1 in Table 1 was applied to the students who participated in order to evaluate the activities. The presented questions in Table 1 were answered with "yes" or "no".

Table 1. Questions of the applied survey 1.

Number	Question
1	Do you still want to have your bachelor's degree on Biochemical Engineering?
2	Do you feel more motivated to study?
3	Could you visualize new areas that you could work in?
4	Could you visualize actual applications for your current classes in the testimonies?

In the beginning of the second semester of 2016, survey 2 was applied identify the actual problems the students were struggling with along the semester. The questions of the applied survey 2 in Table 2 were constructed altogether with a pedagogue from the Pro-Rectorate of Students Affairs (PRAE-FURG).

Table 2. Questions of the applied survey 2.

Number	Question
1	Do you consider your academic performance so far below expected?
2	Are you doing something different this semester to improve your academic performance? If yes, what?
3	Do you think you manage your time well?
4	How many hours per week you dedicate to extra class studies?
5	Do you think you could dedicate more time to your studies?
6	Are you aware of the courses offered by the Program of Accompaniment and Pedagogic Support from PRAE-FURG?
7	Do you think that students' participation on the courses offered by the Program of Accompaniment and Pedagogic Support, such as Pre-Calculus, Basic Informatics, Animated Mathematics, and Euclidian Geometry help on improving academic performance?
8	Have you ever participated in one of these courses?
9	Do you think you seize all the opportunities of academic growth that the University offers? If no, why?
10	Do you usually seek for the professors during their office hours when you feel some difficulty studying?
11	Do you usually seek, when existent, for the monitors of the courses you take?
12	How do you learn?
13	Do you follow any study strategy to learn a subject or overcome a difficulty?

The questions were answered with "yes" or "no", except questions 4 and 12 that had multiple choices. Questions 2 and 9 had also a descriptive part. In total, 35 students, freshmen in the great majority, answered to the applied survey.

### 2.1.3. Secondary action

After analyzing the answers of the surveys, the secondary action took place. PAIEB then organized motivational speeches about college life, expectations and the construction of academic skills, and time management workshops. These activities were offered to help the students conciliate college responsibilities with their other obligations and the essential leisure time, as well as to provide them a journey of self-knowledge. Both the latter were performed by appropriate professionals. The secondary action activities were performed during the Biochemical Engineering Fundamentals II course, offered during the second semester.

### 3. Results and discussion

The answers to the “yes” or “no” questions of the survey 1 are presented in Table 3.

Table 3. Answers to the survey 1.

Number	Question	Yes	No
1	Do you still want to have your bachelor's degree on Biochemical Engineering?	97.5 %	2.5 %
2	Do you feel more motivated to study?	97.5 %	2.5 %
3	Could you visualize new areas that you could work in?	95 %	5 %
4	Could you visualize actual applications for your current classes in the testimonies?	92.5 %	7.5 %

The answers to the survey 1 showed that a high number of students had positive responses to the program activities. It could represent that the activities of the primary action were indeed effective on its purpose of increasing the freshmen interest and motivation in their academic life and Biochemical Engineering related activities and experiences.

The answers to the yes or no questions of the survey 2 are presented in Table 4 and the answers to the questions 4 and 12 are presented in Figures 1 and 2, respectively.

Table 4. Answers to the yes or no questions of the survey 2.

Number	Question	Yes	No
1	Do you consider your academic performance so far below expected?	60 %	40 %
2	Are you doing something different this semester to improve your academic performance? If yes, what?	61 %	39 %
3	Do you think you manage your time well?	23 %	77 %
5	Do you think you could dedicate more time to your studies?	94 %	6 %
6	Are you aware of the courses offered by the Program of Accompaniment and Pedagogic Support from PRAE-FURG?	63 %	37 %
7	Do you think that students' participation on the courses offered by the Program of Accompaniment and Pedagogic Support, such as Pre-Calculus, Basic Informatics, Animated Mathematics, and Euclidian Geometry help on improving academic performance?	94 %	6 %

8	Have you ever participated in one of these courses?	43 %	57 %
9	Do you think you seize all the opportunities of academic growth that the University offers? If no, why?	43 %	57 %
10	Do you usually seek for the professors during their office hours when you feel some difficulty studying?	46 %	54 %
11	Do you usually seek, when existent, for the monitors of the courses you take?	34 %	66 %
13	Do you follow any study strategy to learn a subject or overcome a difficulty?	46 %	64 %

For the descriptive part of the question 2, most of the students who answered “yes” said they were trying to avail better their time, study more, improve their focus and be more organized than in the previous semester.

For the descriptive part of the question 9, most of the students who answered “no” said that they do not seize all the opportunities because they lack time, the divulgation is not very effective, or they were passing through personal complications.

Answers to the questions 1 show that many students are still struggling with their expectations and academic performance (40 %) what represents that a big fraction of the freshmen requires an intervention in order to adjust their perspective and encourage their academic activities. Moreover, on question 2, it is found that 61 % of the students said they were leaving the inertia and taking action for the improvement of their academic performance, what could be a result of the good evaluation on the advanced students testimonies.

The questions 3, 4 and 5 highlight a key factor that seems to be strongly influencing on the students’ performance: time management. Answering to the third question, 77 % of the students said they do not think they manage their time well, which is an indicative of the problem. In addition, on question 4 the students expose how many hours per week they dedicate studying and, even though the majority said they study 7 hours or more, 94 % think they could dedicate even more time according to question 5.

Analyzing the answers to the questions 6, 7, 8, and 9 it is possible to conclude that most of the students consider important and effective their participation on extra-classes activities such as the named courses (94 %), although, they either do not have time to dedicate to these activities or do not get access to some of the because of inefficient information spreading. This could be explained by the difficulty on managing their own time, found on the previous questions.

Answers to questions 10 and 11 also point out an important finding: most of the students do not seek for neither the professors nor the monitors when they feel a difficulty on their studies. This could also be a consequence of the lack of time management since the students have difficulty on organizing their studies and end up studying only before exams do not having able time to seek help.

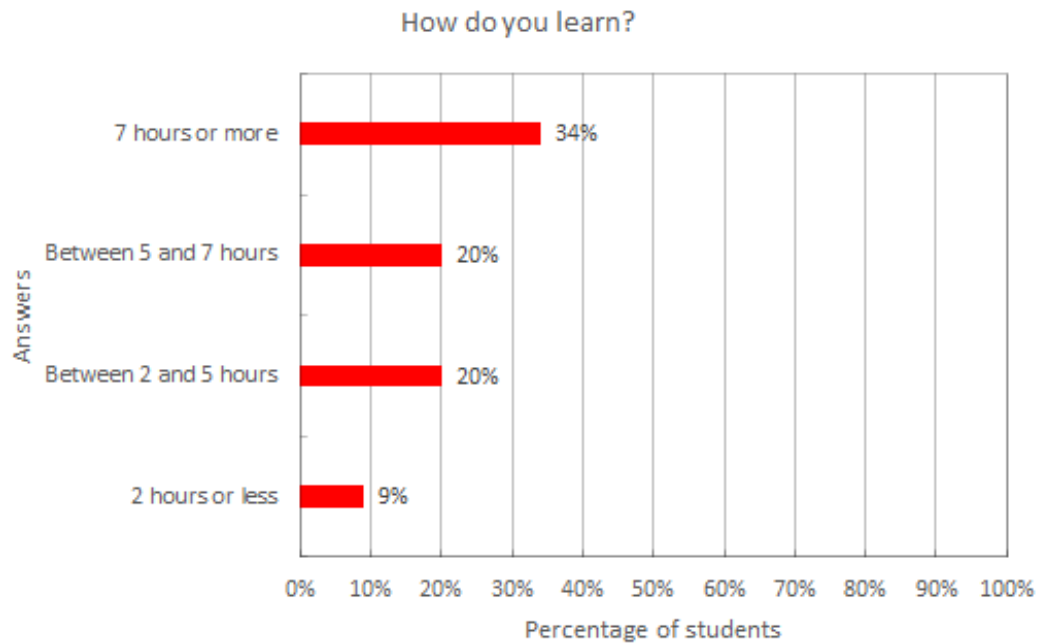


Figure 1. Answers to the question 4: “How many hours per week you dedicate to extra classes studies?”.



Figure 2. Answers to the question 12: “How do you learn?”.

The findings of this work were compatible with the results of a work performed on Engineering students that found a relationship between time management skills and motivation consequently influencing on academic success and failure<sup>12</sup>. Our conclusion that increasing students' motivation and interest is important to combat negative rates is also coherent with other work that reports the improvement of performance and retention of Engineering students through motivation and identity formation<sup>13</sup>. In addition to that, literature also shows that personality traits such as conscientiousness is a significant factor on Engineering students retention<sup>14</sup>, what indicates the importance of the development of academic skills among freshmen students.

These results led to the secondary actions approaching college life and development of academic skills, and time management. They were, respectively, a speech given by a specialized Psychologist from PRAE-FURG, and a time management workshop given by a specialized pedagogue also from PRAE-FURG.

The first activity meant to guide students through self-knowledge and help them find themselves on the chosen career as well as demonstrate how to control expectations and take actions for performance improvement. The second activity meant to help students organizing this studies and conciliate the academic life with personal life activities, highlighting the importance of leisure moments and well defined goals and study hours.

After all the described activities, data was collected from the University database to verify the dropout and retention rates for the year of 2016. Data showed that the dropout rate in 2016 was about 17%, this number remained stable when compared to the 2015 level and decreased roughly 3% when compared to 2014. Also, the retention level within the freshmen year was about 58% in 2016 and did not show significant increase when compared to the two past years. These data show that in the year of the occurrence of the activities, there was no increase on the dropout and retention levels for the Biochemical Engineering students at FURG.

## 4. Conclusions

The results of the work indicate that PAIEB activities are helping to increase Biochemical Engineering's freshmen interest and motivation as way to combat dropout and retention within the course. Moreover, the planned activities identified punctual problems generating directed actions and creating a panorama to further actions.

PAIEB team recognizes the importance and necessity of the implementation of active methodologies of learning and education as an alternative to the outworn traditional method. However, we are also aware that the traditional education is still the majoritarian in the Higher Education structure and planned actions as the ones described on this paper are needed in order to reduce dropout and retention rates and assist students within this recurrent scenario.

## Acknowledgment

We would like to thank to all the professionals Joice Rejane Pardo Maurell and Lauro Demenech from PRAE-FURG that helped on the concretization of the program activities. We would also like to thank the Institutional Program of Student Development (PDE-FURG) that provided financial support for PAIEB.



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