

# The experience of Tutoria Científico-Acadêmica in the Astronomy B.Sc. at IAG/USP

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**Abstract.** The dropout rate in undergraduate courses in areas such as exact sciences has been a persistent challenge for a long time. As a way of partially mitigating this problem, the astronomy course offered by the Instituto de Astronomia, Geofísica e Ciências Atmosféricas (IAG) at the Universidade de São Paulo (IAG/USP) created the Tutoria Científico-Acadêmica. The program aims to promote the permanence of the student in the undergraduate program, with the goal of introducing freshmen Astronomy B.Sc. students to the academic environment, providing firsthand exposure to the functioning of research groups. The program offers several activities suited to the study pace of first-year students. Supervised study plans are proposed, which help reinforce learning, or introductory research projects, aimed at learning basic tools used in scientific studies. In addition, students are invited to participate in research group meetings, seminar presentations, and other activities related to the daily routine of the Departamento de Astronomia and the IAG/USP. This paper explores the experiences of an undergraduate student who actively participated in this support program, showing the impacts on his career and thus the importance of this type of program in an undergraduate course.

**Resumo.** A evasão em cursos de graduação em áreas como ciências exatas é um desafio persistente há muito tempo. Como forma de minimizar esse problema, o curso de astronomia oferecido pelo Instituto de Astronomia, Geofísica e Ciências Atmosféricas (IAG) da Universidade de São Paulo (IAG/USP) criou a Tutoria Científico-Acadêmica. O programa visa apoiar a permanência de alunos na graduação, com o objetivo de introduzir novos alunos de astronomia ao ambiente acadêmico, proporcionando contato direto com o funcionamento de grupos de pesquisa. O programa oferece diversas atividades adequadas ao ritmo de estudo dos alunos do primeiro ano. São propostos planos de estudo-dirigido, que auxiliam no reforço do aprendizado, ou projetos de pesquisa introdutórios, voltados ao aprendizado de ferramentas básicas utilizadas em estudos científicos. Além disso, os alunos são convidados a participar de reuniões de grupos de pesquisa, apresentações de seminários e outras atividades relacionadas à rotina diária do Departamento de Astronomia e do IAG/USP. Este artigo explora as experiências de um aluno de graduação que participou ativamente desse programa de apoio, mostrando os impactos na sua carreira e com isso a importância desse tipo de programa em um curso de graduação.

**Keywords.** Teaching of Astronomy – Ensino da Astronomia

## 1. Introduction

Dropout rates in undergraduate courses in the exact sciences have consistently remained high. This is due to several reasons, with two key aspects being highlighted. The first is the often weak mathematical foundation of the freshman students, which has even worsened due to learning gaps exacerbated by the recent pandemic. In addition, the inherent difficulty of the course creates a major barrier in the initial years, especially with subjects in the so-called basic cycle, such as the initial disciplines of calculus and physics. The second is the challenge of integrating into the university environment, as isolation often ends up creating the impression that “the course is not for me”. Furthermore, study groups formed during the first semesters play a critical role in student permanence.

As a result, some institutional measures have been implemented to minimize this problem. Among them, the Tutoria Científico-Acadêmica in the Departamento de Astronomia aims to insert new students into the academic environment through guided study plans and activities for learning basic tools used in scientific studies. It is worth noting that this is not only academic, but also integration and identification with the course itself. Often, the interaction among students who have gone through similar difficulties and who have overcome them is ultimately inspiring for students.

## 2. The program in its extension

The objective of the program is to (i) Insert new students into the academic environment; (ii) Integrate them into the course; (iii) Offering a support mechanism.

The program activities take place weekly, according to the participants' pace, aiming not to interfere with the courses they are currently taking. This paper involves participation in two research groups, with the first focusing on star formation and the second on Be type stars.

The tutoring activities carried out with the open cluster and young star research group consisted of weekly meetings (see Figure 1, with debates about the development of research by graduate and undergraduate students, with an open space for questions about what was being discussed and familiarizing the students with the jargon used. There were also weekly guided studies based on chapters from the book “An Introduction to Modern Astrophysics” (Carroll & Ostlie, 2017). We choose to study topics involving the celestial sphere, celestial mechanics, the continuous spectrum of light and the special theory of relativity. We also learned how to use the SIMBAD and Aladin databases.

Tutoring activities carried out with the Be star research group consisted of a didactic visit to the Observatório Pico dos Dias (OPD) (see Figure 2) and the Laboratório Nacional de Astrofísica (LNA). In addition, as with the previous group, weekly meetings were held to discuss Carroll & Ostlie's book and



FIGURE 1. Example of weekly star formation group meetings



FIGURE 2. Photo taken in October 2023. (OPD, Brazópolis, Minas Gerais).

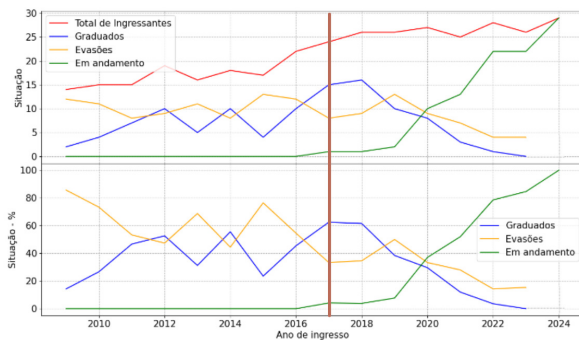


FIGURE 3. Top: Number of new students (red), graduates (blue), dropouts (yellow) and students with ongoing studies (green) according to the year of entry. Bottom: Percentage of graduates (blue), dropouts (yellow) and students with ongoing studies (green) in relation to the total number of new students.

later the thesis of Professor Alex Carciofi, “Classical Be Stars: Rapidly Rotating Stars with Viscous Decretion Disks”.

### 3. Results

The importance of programs like this in enhancing undergraduate education is evident in the observed outcomes, of which in the astronomy course it was possible to implement Tutoria Científico-Acadêmica. Figures 3 and 4 show significant changes were observed from 2017 onwards, highlighted by the brown vertical line. Among them, a decrease in the absolute number of student dropouts, that is, the percentage of dropouts decreases. This occurs because internal transfers increase the number of new students, and since they are already closer to the academic environment, they have a better idea of what to expect from the course avoid the dropout. There is also an increase in grades and a decrease in failures, effects caused by the support given by the program and the better integration of the undergraduate student into the course.

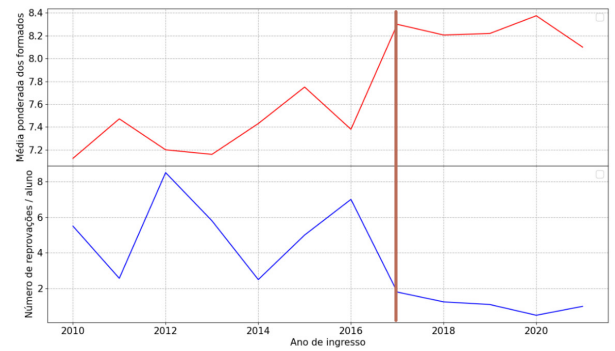


FIGURE 4. Top: Average of the weighted averages of the undergraduates of each class. Bottom: average number of students not approved per student.

FIGURE 5. Left: didactic trip of the Astronomy B.Sc. students visiting the OAM, in May 2024. Right: Example of integration of students in the first semester of the course on a didactic trip to the ROPK in May 2024.

### 4. Extracurricular activities

There are other initiatives to promote permanence and integration into the course. Among these initiatives is the educational trip carried out by the introductory discipline offered in the first period Introdução à Física da Terra e do Universo (AGA0500), in which we accompanied them to the Observatório Abrahão de Moraes (OAM, Vinhedo) and the Rádio Observatório Pierre Kauffmann (ROPK, Atibaia), where the 2024 class of new students can be seen in Figure 5.

### 5. Conclusion

We concluded that the implementation of the project allowed us to see improvements in the course. This is not only due to the dropout rate, but also to the performance of those who remain, as their grades and non-pass rates have decreased.

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### References

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