

The discrete mathematics of computing in remote teaching



<https://doi.org/10.56238/sevened2023.006-065>

Heitor Silva Avila

Highest degree of training: Higher Education, Graduating

Academic institution: Federal University of Pelotas

E-mail: hsavila@inf.ufpel.edu.br

Luciana Foss

Highest degree of training: Doctorate in Computing

Academic institution: Federal University of Rio Grande do Sul, 2008

E-mail: lfoss@inf.ufpel.edu.br

Simone André da Costa Cavalheiro

Highest degree of training: Doctorate in Computer Science

Academic institution: Federal University of Rio Grande do Sul, 2010

E-mail: simone.costa@inf.ufpel.edu.br

ABSTRACT

During Emergency Remote Teaching, several obstacles were encountered in teaching logical and mathematical foundations and teaching discrete mathematics to those entering Computing courses. The distance directly impacted the way in which content was approached: concepts were presented in asynchronous video classes and doubts were resolved in synchronous meetings. However, even with the possibility of a replay, there were still students who were unable to fully understand the concepts in a satisfactory manner. Due to factors like this, the remote monitoring project was designed for the Discrete Systems discipline in the Computer Science and Computer Engineering courses at the Federal University of Pelotas.

Keywords: Discrete Mathematics, Remote Teaching, Discrete Systems, Remote Monitoring, Computing Education.

1 INTRODUCTION

During Emergency Remote Teaching, several obstacles were encountered in teaching logical and mathematical foundations and teaching discrete mathematics to those entering Computing courses. The distance directly impacted the way in which content was approached: concepts were presented in asynchronous video classes and doubts were resolved in synchronous meetings. However, even with the possibility of a replay, there were still students who were unable to fully understand the concepts in a satisfactory manner. Due to factors like this, the remote monitoring project was designed for the Discrete Systems discipline in the Computer Science and Computer Engineering courses at the Federal University of Pelotas.

The Discrete Systems subject is part of the list of subjects for the first semester of each course. It can be considered one of the most difficult, as it is heavily based on mathematics and actively depends on logical foundations and concepts that students often do not know when entering higher education, for various reasons. The objective of the subject is also to prepare the student for the next subjects in the Computer Science course curriculum, such as Combinatorial Analysis and Graph Theory, and Formal Languages, which make use of the fundamentals seen here.



The discipline was conducted using the flipped classroom model, where students were expected to: watch the material recorded in the form of videos; complete a self-assessment, which was used to prepare for the synchronous meeting; and perform exercises. As monitoring activities, in addition to weekly synchronous meetings to clarify doubts, asynchronous support was provided to clarify doubts and provide feedback on the development of the exercises.

The theoretical foundation of the project was provided by the professors teaching the discipline in 2021, indicating the basic bibliography (GERSTING, 1995; MENEZES 2005), including books that work with a simple approach and are rich sources of content. For example, GERSTING (1995)'s main characteristic is the fundamentals necessary to “immerse yourself” in the computational mathematical universe, with several lists of exercises, allowing you to take root from the simplest concepts, such as sets, to more elaborate concepts, such as graphs and their applications. in computing systems. At the same time, MENEZES (2005), using even simpler academic language, presents all the content covered in the discipline, defines the concepts involved and exemplifies them in the context of Computing.

This article presents, in Section 2, the methodology covered in monitoring the discipline and, in Section 3, the results obtained. In Section 4, final considerations are made.

2 METHODOLOGY

It was then established, together with the students, that the remote monitoring project would have a weekly period of 2 hours for synchronous assistance and a space for asynchronous assistance in the e-AULA environment (Virtual Learning Environment) to clarify doubts and/or or review of content, from another language and/or point of view.

It was then established, together with the students, that the remote monitoring project would have a weekly period of 2 hours for synchronous assistance and a space for asynchronous assistance in the e-AULA environment (Virtual Learning Environment) to clarify doubts and/or or review of content, from another language and/or point of view.

Students now have two institutional forms of contact with monitors through the Discord and e-AULA platform, where everyone can receive synchronous or asynchronous assistance, depending on availability.

Exercise lists were made available weekly and students received weekly feedback on their answers, as well as an index, from 0 to 10, indicating their weekly progress throughout the semester. Based on the feedback received, students were encouraged to contact the monitoring department to clarify their doubts.

Exercise lists were made available weekly and students received weekly feedback on their answers, as well as an index, from 0 to 10, indicating their weekly progress throughout the semester.



Based on the feedback received, students were encouraged to contact the monitoring department to clarify their doubts.

Sporadic activities were also proposed, when the presence of online students was noticed on the Discord platform, promoting asynchronous discussions to discuss the progress of the Discrete Systems discipline, in friendly and always recreational language in order to bring a welcoming tone to new students. of Computing courses.

3 RESULTS AND DISCUSSION

During the semester, every time service was provided, a record was made in an electronic spreadsheet containing the platform used, student identification, date and content covered, thus consolidating 40 services in Computer Science and 7 in Computer Engineering. The information, summarized in Table 1, was used in preparing the final monitoring report.

During the semester, every time service was provided, a record was made in an electronic spreadsheet containing the platform used, student identification, date and content covered, thus consolidating 40 services in Computer Science and 7 in Computer Engineering. The information, summarized in Table 1, was used in preparing the final monitoring report.

Based on these records, it can be seen that both in Computer Science and Computer Engineering, students had a greater preference for Discord than other communication channels.

Table 1 — Services by platform

Platform	Computer Science	Computer Engineering
Discord	26	6
Meet	11	0
Email	2	0
e-AULA	1	1

If we analyze the number of uses of each platform, disregarding two or more services provided to the same student, the results remain the same. Discord is the preferred means of communication among students. In Table 2 it is possible to check the number of students served on each platform.

Table 2 — Students served by platform

Platform	Computer Science	Computer engineering
Discord	9	3
Meet	6	0
Email	1	0
e-AULA	1	1



In synchronous sessions, it was observed that the use of a digitizing table would facilitate the development of exercises. The use of a keyboard and mouse often slowed down the explanation of exercises or forced the monitor to resort to other platforms. In some cases, Microsoft Word formula formatting tools were used.

Many students were encountering remote learning for the first time, an environment where the student is the main protagonist of their academic history, without in-person human contact, which can often keep the student's memory active and even maximize their focus. in a suitable study environment.

It was necessary not only for the students, but also for the monitoring project to see what a suitable environment for studying really was. Students often found themselves in situations close to construction sites, external noises and force majeure factors that could not be contained and yet there was a commitment to remain active in their academic journey to achieve the desired results.

There was a conversation between the monitors and the students in an asynchronous meeting through the Discord platform, where there was an exchange of interpersonal experiences “from student to student” so that everyone could benefit from some learning.

To help with the academic development of students, “summary sheets” were developed with the main mathematical definitions covered throughout the course, with the aim of avoiding memorization and synthesizing the information covered in class, as well as stimulating the interpretation of mathematical language, so that students learned to read the formal (mathematical) definitions of concepts, without having to resort to natural language, which can often result in long and ambiguous definitions.

There is also a less active participation of Computer Engineering students, as, no matter how much publicity there was about synchronous and/or asynchronous meetings, there was a low demand for students, and of the 36 enrolled, only 3 students made use of the monitoring spaces available.

Every week, the monitoring project held a private synchronous meeting with the teaching teachers, in which the students' greatest difficulties were highlighted, enabling the resumption of content that was still not clear after the traditional sessions.

At the end of the semester, students from both classes were invited to respond to an anonymous survey about the subject and monitoring. There was a question about monitoring, which asked: “Select the monitoring activities in which you participated”. Table 3 shows the answers to this question.



Table 3 — Participation in Monitoring Activities by Course.

Origin course	Synchronous Monitoring	Discussion Forums	Study Groups	None
Computer Science	10	8	14	12
Computer Engineering	3	2	5	18

In the area of suggestions for improvement, students reported that they would like WhatsApp, Discord and Telegram groups to be created for parallel monitoring during the course.

The project is completed, as the 2021/1 semester was taught in the second half of the 2021 calendar year.

It is still clear that students need to be welcomed outside the classroom, whether physical or virtual, because when they participate in an active monitoring project, they begin to interact more and consequently end up even undoing bad impressions. initial shocks that mathematics may have given you in high school.

4 CONCLUSIONS

The project achieved its objective, all students attended were successful in their approval and a satisfactory final grade. It is concluded that emergency remote teaching allowed students and teachers to experience new forms of teaching, these more dynamic, visual and interactive, which often ended up overcoming difficulties that students presented.

An active monitoring proposal is seen as a differentiator, as it encourages students not to be shy and shows that it is extremely normal to have doubts or not know something, reinforcing that the university exists so that we can all acquire new knowledge.



REFERENCES

GERSTING, Judith. Fundamentos Matemáticos para a Ciência da Computação – 3^a edição. Editora LTC, 1995.

MENEZES, Paulo Blauth. Matemática Discreta para Computação e Informática. Série Livros Didáticos – Instituto de Informática da UFRGS, Editora Sagra Luzzatto S/A, 2005.

PET COMPUTAÇÃO. Server “Computação UFPel”. Available at: <<https://discord.gg/akn5wV7/>>. Accessed on: 28 de maio de 2022.