

Online teaching modality in a pandemic time: the opinion from a group of undergraduate physics students

Modalidade de ensino remoto em tempos de pandemia: opinião de um grupo de estudantes de Física

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The pandemic of SARS-CoV-2 affected educational activities around the world. In this scenario, online teaching was the main strategy adopted by Brazilian universities. The literature presents possibilities and boundaries to physics teaching on distance learning modality. In this context, this article aimed to investigate the opinion from a group of physics undergraduate students to have an overview of challenges for Brazilian universities. This group had the face-to-face classes changed abruptly to online modality. An electronic quiz was conducted to analyse data based on Content Analysis procedures. The group believes in the potential of online teaching during the pandemic time, but agrees that several aspects need to change. The students report that they have faced problems related to technical, pedagogical, and socioeconomic aspects. As consequence of distance learning modality, students have presented symptoms of anxiety, depression, and lack of motivation. The group points out professor training as a focus that might help improve online teaching.

Keywords: Pandemic, online teaching, student's opinion.

A pandemia ocasionada pelo coronavírus SARS-CoV-2 afetou as atividades educacionais em todo o mundo. Nesse cenário, a modalidade de ensino remoto foi a principal estratégia adotada por diversas universidades no Brasil. Na literatura é possível encontrar considerações acerca das limitações e possibilidades do Ensino de Física delineado na modalidade não-presencial. Neste contexto, o presente trabalho tem por objetivo investigar a opinião de um grupo de estudantes de Física, visando panoramizar os desafios enfrentados por universidades brasileiras. O referido grupo de estudantes defrontaram-se com os desafios da mudança abrupta do ensino presencial para o ensino remoto. Os dados advindos de um questionário virtual foram analisados sob a ótica dos procedimentos da Análise de Conteúdo. Como resultado, identificou-se que esses estudantes acreditam no potencial do ensino remoto durante o período de pandemia, no entanto, há ressalvas no que tange diferentes aspectos. Problemas de naturezas técnicas, pedagógicas e socioeconômica foram reportados. Em adição, como consequência do ensino remoto, os estudantes apontaram apresentar sintomas de ansiedade, depressão e desmotivação. Por fim, o grupo chama a atenção para a importância da formação docente como possibilidade de contribuir com uma melhor adequação do ensino na modalidade remota.

Palavras-chave: Pandemia, ensino remoto, opinião de estudantes.

1. Introduction

The pandemic caused by SARS-CoV-2 presents many and important challenges for humanity. One of these are the implications in social activities, including the educational process. From kindergarten to college, the Brazilian educational system has worked on the online model, based on synchronous and asynchronous educational activities, since March 2020. Brazilian public universities received recommendations from the Ministry of Education to adopt an online teaching modality [1]. In addition, that document determined

that universities were responsible to provide tools and evaluation strategies.

Terminologically “online teaching” came up with Goodyear *et al.* [2]. This term “online teaching” has been used to express many perspectives in which educational activities are mediated by Digital Information and Communication Technology – DICT [3].

Regardless of the current pandemic problem, it is important to highlight that education mediated by DICT offers good opportunities to rethink different aspects of the educational process [4]. However, it is relevant that DICT may be associated with a perspective more actively focused on reflective, critical, and autonomous learning [4].

Digital technologies are a tendency in the science education field [5]. Nonetheless, the challenges of carrying

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out science education through online learning, such as the problem related to laboratory activities could be highlighted [6, 7].

In Brazil, some colleges (private colleges and universities) offer distance-learning courses, including undergraduate courses in physics. At the beginning of the pandemic, there was an understanding that these colleges were better prepared for the challenge of offering most of their courses online. However, it was much more complex and many problems have been faced [8].

In that context, it is possible to have an overview of challenges for Brazilian universities from physics undergraduate courses that were, at first, face-to-face courses. This study is focused on what students of the physics undergraduate course think about the online teaching modality adopted abruptly due to the pandemic of the SARS-CoV-2 in Brazilian universities. Data were collected among some students from three Brazilian universities.

2. Design

This is a qualitative study [9]. This type of study might offer good opportunities to understand human behaviour and social relations. An online form has been sent to a group composed of 84 undergraduate physics students for data collection.

Students from three public Brazilian universities were contacted: the Federal University of Itajubá (UNIFEI), the Federal University of São Carlos (UFSCar), and the University of São Paulo (USP). These universities have at least 25 years of tradition in undergraduate physics courses. The online teaching method has been adopted since March 2020.

The invitation to take part in the research was sent through the institutional email address and academic groups in social media. Between 10% and 15% of students from all these three universities accepted the solicitation. This estimative is imprecise due to the dynamic permanency of the students in Physics undergraduate courses. The group was constituted by students that responded voluntarily an electronic form.

The electronic form was composed of four different sections and each section presented different research goals: 1- Identification; 2- Educational process in the pandemic time; 3- Interactive process in the pandemic time; and 4- Final considerations. It was composed of 4 open-ended questions and 34 multiple-choice questions. The data obtained with the open-ended questions were systematized from a technique called Analysis of Content [10]. In this context, groups of similarities named units of meanings were carried out based on the codification of the contents presented in the open-ended responses prepared by the students. The answers obtained with the multiple-choice questions were used throughout this text to detail the context of the investigation.

3. Findings

3.1. General impressions

In this section, considerations expressed by the students related to general impressions about online teaching are presented.

Table 1 shows the systematization of data on the main difficulties faced by students in online education. Groups were formed from units of meaning and the frequency indicate the amount of the same content in the responses.

The excerpt is accompanied by encoding in brackets. This coding is the identity of a single student in this study. Furthermore, the percentage is related to the group as a whole.

The first group in Table 1 is named Online Teaching Critics. This group presents arguments in which students are opposed to online teaching (6%). These criticisms may have arisen due to all the consequences of the pandemic period, including restrictions on being in the stimulating environment of the university. According to these students, none of the online teaching can replace the face-to-face learning process in terms of interaction possibilities.

Online education can be even worse for students in vulnerable economic conditions as a matter of having an appropriate place to study (49%). Excerpts-related can be appreciated in the group named Environment for attending classes in Table 1. Online education can be very problematic for implementation in countries with

Table 1: Impressions about online education.

| Unit of meaning | Excerpts and frequency |
|-----------------------------------|--|
| Online teaching critics | The main problem probably is the online teaching process. It can be solved out only through face-to-face teaching [S48]. |
| Environment for attending classes | Attending the class is not just about having a computer and watching the class. The student needs to be in an appropriate environment to attend classes. Many students do not have this environment at home [S20]. |
| Technical problems | Some problems with internet connection, frozen screen, data errors, internet connection dropping, etc. [S27]. |
| Mental health | Many activities with a short deadline may lead students to anxiety. I do not perform well in subjects with these characteristics, unless it is in the face-to-face modality [S40]. |
| Lack of motivation | I feel that I am not learning very well and I am in a bad mood to study [S45]. |
| Bright side | Free time. Explanations can be watched several times [...] I think that some disciplines could be online [S34]. |

high rates of social inequality such as Brazil [11, 12]. The presence of other people at home (61%), the possibility of doing other things (55%), and social networking sites (32%) were pointed out by students as factors that cause distractions.

Data also indicates that some students have wide access to information and computer technologies (ICT) in their homes (29%), while others have limited access (51%) or very few resources to attend classes from home (20%). This information is also highlighted in the group named Technical problems in Table 1. Favourable technical conditions are fundamental for online learning. It becomes clear when students report problems with concentration to attend classes, which are caused by technical problems (79%). According to [13], the study space is essential for the student learning process.

This inaccessibility is a matter of concern for many Brazilian universities regarding online education. About 2% of undergraduate students do not have access to the internet [8]. The authors point out that some universities try to solve this problem through palliative actions, such as the distribution of computer equipment to students in situations of economic vulnerability. In this context, in the second half of 2020, some institutions provided laptops and internet access to students [8].

Other difficulties mentioned by the students as medium or high level was the adaptation to the electronic tools (53%). Digital platforms for communication were very important to this moment. The group said that Google Meet (94%), Moodle (56%), and others – YouTube, Discord, etc. – (32%) were used to study. An appropriate internet connection is required by platforms, which is not widely available in the country. This concern is in line with the increase of internet use and complaints during the pandemic as replaced by ANATEL (National Telecommunications Agency).

Problems related to mental health are also mentioned by students, such as the intensification of anxiety. When asked about their feelings during the pandemic times, a large number of students reported anxiety (73%) and depression (23%). The speeches of [S40] in the grouping named “Mental health” indicate that feelings such as anxiety can be intensified with online teaching. Anxiety disorder and depression can be intensified by social isolation, especially during pandemic time [14]. In addition, the group of students said they were unmotivated (79%) as exemplified in the group named “Lack of motivation”.

Although social isolation presents many and important challenges for students, some of them indicate positive aspects of online education. The “Bright side” grouping indicated some advantages of online education like being able to watch the lessons that were recorded as many times as possible (69%) and to stop the video in the relevant sections (65%). In addition, some students related to being positive to have a chance to choose a specific time to attend classes (43%). In this sense, the data show that some students would like the university

to adopt some pedagogical practices developed during these times of social isolation after the pandemic.

3.2. Teaching practice

In this section, data on students’ understanding of the online teaching process will be presented. The Table 2 shows these data in a systematic way.

The first group in Table 2 is named Excessive pedagogical activities. These students (37%) complain about the amount of activities, once the professors send more exercises and texts to compensate for the distance learning. The group pondered that time is not enough and they feel overwhelmed. This situation could be related to the distance learning conception of the professors.

The group Pedagogical mistakes explicit professors’ perception, when students (40%) require diversification in pedagogical strategies in online education. Schools need to think outside the box in remote learning to provide quality teaching [15]. Trying to use the same methods as in-class is usually not an adequate approach. The group reported PowerPoint presentations (84%), videos (82%), speech (81%), graphics tablets (32%), and simulations (23%) as mainly pedagogical resources used by professors. Except for the simulations, the other resources put the students in a passive position, named by Paulo Freire as education bank [16].

It is worth highlighting that the pedagogical resources used in-class might not be a good option for online modality. Moreover, students (27%) were expecting adaptations that could also motivate them. Considering the possibilities offered by ICT [4], professors must prepare dynamic activities without the lack of quality and content depth.

Table 2: Teaching practice.

| Unit of meaning | Excerpts and frequency |
|----------------------------------|--|
| Excessive pedagogical activities | There is an excess of activities to do and this is bad for students [S77]. |
| Pedagogical mistakes | Some teachers use the blackboard to give online video classes as if they were teaching face-to-face [S78]. |
| Lack of pedagogical resources | Lack of good material or very summarized content leading to a less efficient learning process [S64]. |
| Peer instruction | Some teachers create interactive classes using methodologies such as peer instruction that help us a lot [S8]. |
| Evaluation | Professors believe that students will copy each other’s answers. If this is the fear they need to solve it with evaluations based on groups, texts, or projects [S83]. |
| Teacher training | The qualification of professors to teach online is essential, such a thing has not happened [S2]. |

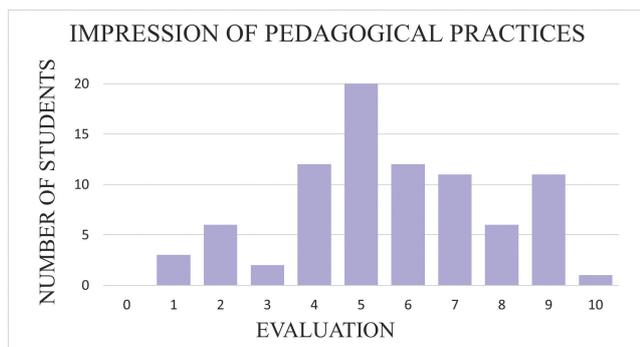


Figure 1: Graph of students' impression of pedagogical practices.

This is clarified in the fourth group named Peer instruction when students (20%) approve strategies involving more interaction. Peer instruction appears to be an interesting approach. This approach was developed to improve physics teaching, valorising the conceptualization of natural phenomena [17].

The next group brings considerations about the evaluation process. The students (19%) said that tests are very hard and long in compensation to be taken at home. These evaluations are based on traditional retrograde models and need to be changed. It is a consensus of evaluation's complexities in the education field, mainly in the online modality. The students report on a scale of 0 to 10, where 0 denotes insecurity related to the evaluation, an average of 4 points. In addition, they inform that projects and homework assignment (76%), exercises list (67%), written test (65%), and seminar (36%) are chosen by professors as part of evaluation methods.

Online teaching is challenging for teachers and according to [S63] they try to give their best. The group assigned an average of 5.6 on a scale of 0 to 10, where 10 indicates a good impression of pedagogical practices, such as exhibited in the Figure 1.

It might indicate that they understand the potential of the online modality, but it needs to be accomplished better. Professors' background is fundamental to overcoming these boundaries, as pointed out in the last group named Teacher training (14%). Professor training is fundamental [18]. The absence of preparation might be possible because not everyone has the opportunity and time enough to take qualifying courses.

3.3. Interaction process

In this section, data related to interaction process of the online teaching will be presented. The Table 3 shows these data in a systematic way.

The social distance brings many implications, including school dynamics. The adaptation process occurs with different levels of difficulty for each student. It is reasonable that universities offer some type of support.

Table 3: Interaction process.

| Unit of meaning | Excerpts and frequency |
|-------------------------------|---|
| Orientation importance | Meeting periodically with course coordinators and advisers [S59]. I think there should be more tutors [S84]. |
| Professor-student interaction | I've realized the importance of professional relationship with the professor [S84]. |
| Student-student relations | The possibility to solve questions as soon as possible through a forum where the students help each other or something similar [S42]. |

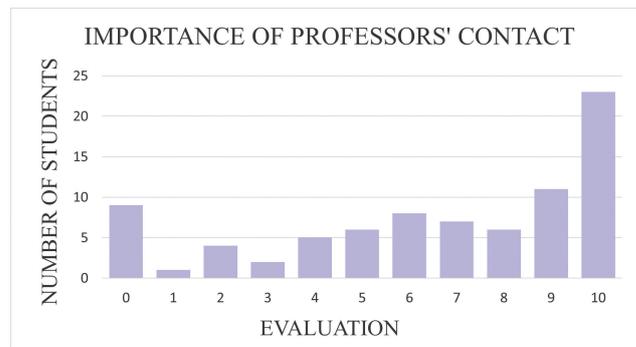


Figure 2: Graph of the importance of professors' contact.

The students (11%) believe that an efficient communication channel to solve questions is important. It would include tutors to help them understand the content along with the distance learning.

Tutors can support professors that teach in classes with many students. If the contact between students and professors were arduous before, nowadays it is tougher and crucial. The second group named professor-student interaction presents the importance of the connection between both. On a scale of 0 to 10, where 10 denotes the relevance of professors' contact, the average reported by the group is 7.1. The answers are presented in the Figure 2.

Interaction is an important element in distance learning [19]. The dialog cannot be restricted by professor-students. The students who constitute the third group Student-student relations address that contact among them is important to study performance. Group studies are preferred by 28% of students, 24% are neutral and 48% prefer to study alone.

According to [S32], distance learning has serious problems related to communication, because sometimes several professors do not answer the emails and students feel harmed. Some professors' comment that before online teaching few students sought them to solve questions.

4. Conclusions

This work focused on what students of the physics undergraduate course think about the online teaching

adopted exceptionally in the pandemic of the Sars-CoV-2 coronavirus. Three groups were found through data systematization: 1) General impressions, 2) Teaching practice, and 3) Interaction process. In general lines, the group reports critics to the online modality. They are facing problems related to environmental availability to study at home and technical problems from ICT. Mental health such as anxiety, depression, and lack of motivation were also systematically pointed out. The pandemic context brought many challenges to educators.

The number of activities, evaluation strategies, resources, and pedagogical mistakes thrown light by students' group and it needs more attention to them. They believe that interaction processes between teachers-students and students-students are fundamental to distance learning and they understand the relevance of encouraging it. Nevertheless, the group agrees that online teaching implementation has potential while the pandemic lasts. To that, professors' training needs to be improved. Studies as developed, with different groups, could offer a good opportunity to increase the understanding of online teaching in pandemic time. In addition, this study can provide data to the future, once several aspects of online teaching might be integrated in the physics teaching.

Supplementary Material

The following online material is available for this article:
Appendix: Questions applied on the electronic quiz.

References

- [1] MINISTÉRIO DA EDUCAÇÃO. Portaria nº 343, de 17 de março de 2020.
- [2] P. Goodyear, G. Salmon, J.M. Spector, C. Steeples and S. Tickner, *Educational Technology Research and Development* **49**, 65 (2001).
- [3] A.M.A. Al-Arimia, *Procedia – Social and Behavioral Sciences* **152**, 82 (2014).
- [4] J. Moran, em: *Metodologias ativas para uma educação inovadora: uma abordagem teórico-prática*, edited by L. Bacich and J. Moran (Penso, Porto Alegre, 2018).
- [5] A.S. Jesus and D.L.P. Souto, *Educação & Tecnologia* **21**, 43 (2018).
- [6] M. Pietrocola, E. Rodrigues, F. Bercot and S. Schnorr, *Science & Education* **30**, 209 (2021).
- [7] P. Gustafsson, *European Journal of Physics* **23**, 469 (2002).
- [8] R. Castioni, A.A.S. Melo, P.M. Nascimento and D.L. Ramos, *Ensaio: aval. pol. públ. educ.* **29**, 399 (2021).
- [9] A.S. Godoy, *Revista de Administração de Empresas* **35**, 57 (1995).
- [10] L. Bardin, *Análise de conteúdo* (Edições 70, Lisboa, 1997).
- [11] F. Brito, *Rev. bras. estud. popul.* **25**, 5 (2008).
- [12] P.M.A.C. Bustamante and M.E. Leite, *Sociedade em Debate* **26**, 83 (2020).
- [13] R. Aplegate, *The Journal of Academic Librarianship* **35**, 341 (2009).
- [14] H. Xiao, W. Shu, M. Li, Z. Li, F. Tao, X. Wu, Y. Yu, H. Meng, S.H. Vermund and Y. Hu, *Int. J. Environ. Res. Public Health* **17**, 5047 (2020).
- [15] H. Morgan, *The Clearing House: A Journal of Educational Strategies, Issues and Ideas* **93**, 135 (2020).
- [16] P. Freire, *Pedagogia da autonomia: Saberes necessários à prática educativa* (Paz e Terra, São Paulo, 1997).
- [17] S. Pilzer, *PRIMUS* **11**, 185 (2001).
- [18] Januar, A. Rahmi, Andryadi, Hadini and Yudelnilastia, *Journal of Physics: Conference Series* **1779**, 012043 (2021).
- [19] A. Parker, *AACE Review*, 13 (2020).