

## Strategies for conducting Scientific Initiation in times of a pandemic: mitigating losses

Estratégias de condução da Iniciação Científica em tempos de pandemia: mitigando perdas

Estrategias para realizar Iniciación Científica en tiempos de pandemia: mitigar pérdidas

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### Resumo

O presente trabalho teve por objetivo apontar as estratégias adotadas para a condução da Iniciação Científica em tempos de pandemia de forma a mitigar perdas neste momento desafiador. Trata-se de um estudo descritivo, primário, qualitativo e reflexivo do tipo relato de experiência, tendo por base um projeto de pesquisa da área de Medicina Veterinária realizado no IFNMG – Campus Araçuaí. Em decorrência da Pandemia da COVID-19, a condução do projeto de pesquisa foi replanejada de forma a manter a continuidade e qualidade da pesquisa e amenizar os sentimentos de tensão provocados pelo isolamento social. As estratégias adotadas para que o projeto de pesquisa fosse executado de forma remota foram: revisão sistemática de literatura, análise bioinformática, construção do website ARACÃO, elaboração de protótipos de aplicativo para o homem do campo. Extraiu-se da revisão que a bioinformática traz o levantamento do maior número de informações biológicas e estatísticas possível. Na atividade prática de bioinformática conseguiu-se elaborar diversas redes de interação proteica, auxiliando na investigação de vias de sinalização de proteínas que é um dos objetivos específicos do projeto. Com relação à construção da website ARACÃO, a experiência foi bastante prazerosa por oferecer meios de a comunidade participar, refletir e manifestar-se sobre as consequências sociais e ambientais do abandono de animais domésticos. As plataformas MANZOTEC e FITOVET ONLINE se mostraram como tecnologias que se apresentam com potencial para motivar a transformação digital na pecuária, através da disponibilização de informação relevante e que apoie o processo de tomada de decisão nas atividades de produção rural.

**Palavras-chave:** Pesquisa; Ciência; Tecnologia; Computação; Atividades remotas; Ensino.

### Abstract

The present work aimed to point out the strategies adopted for conducting Scientific Initiation in times of pandemic in order to mitigate losses at this challenging time. This is a descriptive, primary, qualitative and reflective study of the experience report type, based on a research project in the area of Veterinary Medicine carried out at IFNMG – Campus Araçuaí. As a result of the COVID-19 Pandemic, the conduction of the research project was replanned in order to maintain the continuity and quality of the research and alleviate the feelings of tension caused by social isolation. The strategies adopted for the research project to be carried out remotely were: Systematic literature review, bioinformatics analysis, construction of the ARACÃO website, development of application prototypes for

the rural man. It was extracted from the review that bioinformatics brings the collection of as much biological and statistical information as possible. In the practical activity of bioinformatics, it was possible to elaborate several networks of protein interaction, helping in the investigation of protein signaling pathways, which is one of the specific objectives of the project. Regarding the construction of the website ARACÃO, the experience was very pleasant as it offered ways for the community to participate, reflect and express itself on the social and environmental consequences of the abandonment of domestic animals. The MANZOTEC and FITOVET ONLINE platforms have shown themselves to be technologies that have the potential to motivate the digital transformation in livestock, through the provision of relevant information that supports the decision-making process in rural production activities.

**Keywords:** Research; Science; Technology; Computing; Remote activities; Teaching.

### Resumen

El presente trabajo tuvo como objetivo señalar las estrategias adoptadas para la realización de la Iniciación Científica en tiempos de pandemia con el fin de mitigar las pérdidas en este momento desafiante. Se trata de un estudio descriptivo, primario, cualitativo y reflexivo del tipo relato de experiencia, basado en un proyecto de investigación en el área de Medicina Veterinaria realizado en el IFNMG – Campus Araçuaí. A raíz de la Pandemia del COVID-19, se replanteó la conducción del proyecto de investigación con el fin de mantener la continuidad y calidad de la investigación y aliviar los sentimientos de tensión provocados por el aislamiento social. Las estrategias adoptadas para la realización del proyecto de investigación a distancia fueron: Revisión sistemática de la literatura, análisis bioinformático, construcción del sitio web ARACÃO, desarrollo de prototipos de aplicación para el hombre rural. Se extrajo de la revisión que la bioinformática trae la recopilación de la mayor cantidad de información biológica y estadística posible. En la actividad práctica de bioinformática, fue posible elaborar varias redes de interacción de proteínas, ayudando en la investigación de vías de señalización de proteínas, que es uno de los objetivos específicos del proyecto. En cuanto a la construcción del sitio web de ARACÃO, la experiencia fue muy agradable, ya que ofreció formas para que la comunidad participe, reflexione y se exprese sobre las consecuencias sociales y ambientales del abandono de animales domésticos. Las plataformas MANZOTEC y FITOVET ONLINE demostraron ser tecnologías que tienen el potencial de incentivar la transformación digital en la ganadería, mediante el suministro de información relevante que apoye la toma de decisiones en las actividades productivas rurales.

**Palabras clave:** Investigación; Ciencias; Tecnología; Informática; Actividades remotas; Enseñanza.

## 1. Introduction

Scientific initiation is the horizon of introductory events in the academic life of the beginning researcher. It is the moment when the student of Brazilian education passes to the new level of his student life. Academic research opens up a range of opportunities for students, enabling them to stimulate their thinking and certainly bringing them closer to their area of study (Ferreira, 2010; Barroz et al. 2006; Massi, Queiroz, 2015).

According to Ldben 9394/96, scientific initiation can be considered as one of the essential curricular components in Higher Education, being treated and thought of as a scientific and educational principle. In this direction, scientific initiation should be seen as a continuous process that involves students and teachers and that goes beyond the formal space of the classroom. Thus, as recommended by legislation, Scientific Initiation is a special way of awakening the scientific vocation of undergraduate students and of stimulating greater articulation between undergraduate and graduate students.

This scientific activity should be seen as a process that involves students and teachers (Pereira, 2013). In this process, an experienced advisor with aptitude in the field of study is required. In this way, in addition to benefiting from research in its development, it introduces the student as its “learner”, making this student, in a way, contribute not only to the teaching process, but also to learning.

According to Glasser (1998), discussion and debate, as well as interaction between teacher and student, increase the ability to assimilate new ideas and teachings. According to the author, good education is one in which the teacher asks his students to think and dedicate themselves to promoting a dialogue to promote understanding and student growth. Once again, the teacher becomes a fundamental piece in this teaching process from the scientific initiation, being a mediator of research, where the debate of ideas and theories in order to solve or understand a certain problem, is the fundamental part of the study (Glasser, 1998).

Over the years, scientific initiation has become increasingly popular and of paramount importance as a strategy to reduce school dropout. Machado (2005) reports that one of the techniques used with the intention of reducing the dropout rate of chemistry courses at the Instituto de Química of the Federal University of Rio De Janeiro was the offer of scientific initiation scholarships to interested students. The awarded students were selected according to the grade. It is noted that in addition to the incentive promoted by the value of the scholarship, the research, in a way, brings the student closer to the institution, opening his mind to new tasks that go beyond the classroom with repetitive or even non-involving activities.

In the year 2020, students, teachers and other people linked to Brazilian educational institutions and scientific initiation found a peculiar scenario. Virtually all of the academic curriculum planning that was ready had to be reinvented. This situation brought an immense amount of uncertainties to society and even more to educational education, which, as of Ordinance No. 343 of the Ministry of Education (MEC), had its entire calendar suspended at the beginning of March, and soon activities face-to-face meetings were impossible.

Thus, activities carried out through the use of digital technologies have become popular and an option for performing academic tasks at the present time. As a result of the COVID-19 pandemic, digital technologies have become the main tool used to bring quality education to students who are confined to their homes. Note that despite the existence of the distance education modality since the 19th century, most teaching and learning are still guaranteed in person. Therefore, the emergency context of changes in teaching activities due to the need for social isolation brought many uncertainties about the feasibility of these activities, especially for students and teachers who felt the lack of adequate training (Carneiro et al., 2020).

In this very peculiar moment, it is important to highlight the relevance of doing scientific initiation as a strategy, valuing student protagonism and its environment. The scientific initiation student must be placed as a builder of knowledge. And working with the knowledge of reality means giving voice to the student and inserting him into the content being worked on. In this sense, the contribution of scientific initiation activities in times of isolation is challenging.

The development of a research project in scientific initiation provides the opportunity to apply the theory learned in the classroom in the daily life of students. Therefore, for the development of the research project, it was necessary to develop practices within the students' living environment, proposing activities that allow them to perceive their home and their environment as the "laboratories" of the school.

In view of the above, this article aims to point out the strategies adopted for conducting Scientific Initiation in times of pandemic in order to mitigate losses at this challenging time in the teaching and learning process during the emergency remote teaching period.

## **2. Materials and Methods**

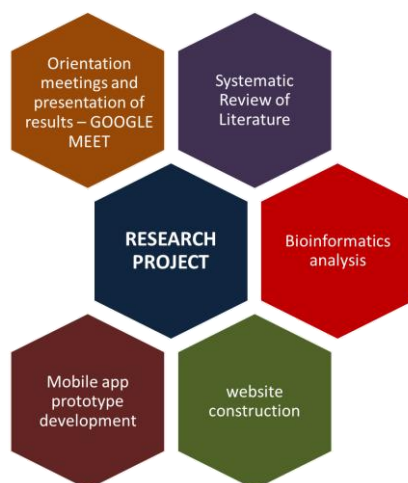
This is a descriptive, primary, qualitative and reflective study of the experience report type, based on a research project in the area of Veterinary Medicine carried out at IFNMG – Campus Araçuaí. The resulting reflection is based on a specific situation experienced by the authors and which constitutes a contribution to other research groups in the same area. In this way, the report was built together, following the formal steps of the development of scientific research with the respective descriptions and reflections of the participants of this process.

Thus, anchored in the epistemological assumptions of Paiva (2019), this study is characterized as an empirically-based research, as it does not predict the applicability of knowledge aimed at solving a problem. The experience report genre is a social activity whose nomenclature depends on the theoretical approach, and Literature classifies it under the category of narrative genres and Linguistics classifies it under the category of personal experience reports (Carvalho, 2011).

Initially, the project had been designed to be conducted face-to-face in the laboratory and in the field. However, as a result of the COVID-19 Pandemic, the conduction of the research project was replanned in order to maintain the continuity

and quality of the research and alleviate the feelings of tension caused by social isolation. The strategies adopted for the research project to be carried out remotely are shown in Figure 1.

**Figure 1** - Strategies adopted for conducting the Scientific Initiation project in times of pandemic.



Source: Authors (2022).

Briefly, the methodologies adopted to carry out each of the stages of the research project are described below.

## 2.1 Systematic literature review

Specifically about the activities carried out as part of the requirements of the research project, a literature review on the subject was first carried out. This action was developed from a review of the literature in the relevant databases, between March and June 2020. The keywords used were "bioinformatics" and its metrics, such as "betweenness centrality", degree, density, clustering coefficient, diameter, "closeness centrality", and "neighborhood overlap". Articles published before 1990 were exclusion criteria. After reading the titles of the articles, it was noticed that some of them were repeated in the different bases and others did not fulfill the criteria of this study. Articles were selected for reading the abstract and those that did not relate to the purpose of this study were excluded. After reading the abstracts, the articles that met the initially proposed criteria were selected and were read in full.

It was extracted from the review that bioinformatics brings the collection of as much biological and statistical information as possible. Besides, the researcher compares, analyzes and understands the meaning of the data under study (Hogeweg, 2011). After the literature review was carried out, it was presented to the entire project team through a videoconference via Google Meet application. All participants were able to discuss the subject, answer questions and propose ideas for activities related to the topic.

**Table 1** - Characterization of the protein interaction networks.

Network	V	E	$\delta$	D	CC	d
bmyC	37	382	30	0.287	0.403	3
srfAA	37	406	36	0.305	0.418	3
fenE	37	416	29	0.312	0.431	3

V: set of vertices; E: set of edges;  $\delta$  max degree; D: density; CC: clustering coefficient; d: diameter. Source: Authors.

## 2.2 Bioinformatics analysis: construction and interpretation of interaction networks

Like informatics, bioinformatics is defined as the storage, processing, analysis, prediction and modeling of biological data with the help of computer sciences and technologies (Guo et al., 2018). In data analysis, it is common to use graph theory to create interaction networks, and thus analyze the relationship between them with the connection between the vertices from the edges. Specific techniques are used that will help in the analysis of these interactions, such as betweenness centrality, degree, closeness centrality, neighborhood overlap (Leão et al., 2018).

The central idea was to use interaction network analysis methods, which according to Leão et al., (2018), allows identifying patterns in the evolution of interactions between network members and estimating variations and trends. The analyzed data are predominantly interactions of proteins and were used to build the interaction networks. This process can be used to show the relationship between genes and proteins, collecting as much biological and statistical information as possible with analysis techniques, which would not be possible to obtain manually (Alves, 2013).

Thus, one of the objectives of the project that is the basis of this report was to develop protein interaction networks for the study of molecular mechanisms. For this, the graph-based data model was used, formed by a set of elements called vertices that represent the proteins and a set of edges that represent their interactions (Leão et al., 2019). Note that in this modeling each edge of this set connects an unordered pair of different vertices and corresponds to an interaction between two proteins.

Using the Cytoscape tool<sup>1</sup> (Shannon, 2003), it was possible to build three protein interaction networks, in order to investigate protein pathways (see Table 1). The molecular interactions obtained from the STRING platform (SZKLARCZYK et al., 2019) were loaded into this tool from files containing protein interactions data. It was possible to characterize some of the main properties of molecular interaction networks. A summary of these properties is presented in Table 1, where it is possible to observe that they are networks with different topological characteristics. The closing of this activity resulted in the presentation of the study prepared for professionals with expertise in bioinformatics and network mining.

## 2.3 Construction of the website ARACÃO

With the distance from everyday activities, a greater abandonment of animals on the streets was noticed, so the construction of the ARACÃO website had the purpose of stimulating the online donation of domestic animals and presenting news related to the animal world in order to motivate and make people aware of responsible custody.

The first stage of this action consisted of by the search for the software development, in this case a website called ARACÃO, for the most diverse user profiles, thus aiming to apply the technical knowledge acquired during the Technology and Systems Analysis (TADS) course to develop a product that meets the diverse requirements of these users.

In addition, concepts and technologies that go beyond the content provided in the course were applied to the product of this work, such as cloud hosting management platforms and specific tools to support development. In addition, knowledge about different technologies was also required, as this site was developed with the integration of a multi-tiered system architecture. The product generated was a website that will be used as an awareness tool for the responsible custody of animals and a source of important information about coronavirus and domestic animals.

## 2.4 Application prototyping for the field man

The production of information about good practices in rural areas has been expanding over the years, supported by the improvement of data collection and storage technologies. Then, the need arises to enrich and make this information

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<sup>1</sup> Cytoscape is an open source bioinformatics software platform for visualizing molecular interaction networks and integrating with gene expression profiles and other state data.

available in a more effective way. In this context, Web technologies become useful to, in addition to sharing, enable the production of content in a collaborative way (Santos Junior, 2020).

In livestock, web technologies can help the rural producer in various activities of his day to day, such as herd control; sanitary, reproductive and nutritional management of animals; forage production; managing your farm and your business as a whole. Thus, we also developed a platform based on Web technologies to share information about the use of phytotherapy in animal production. For this, HTML5, CSS and Bootstrap technologies were used to develop the pages, and PHP to implement the rules of interaction with the user and access to the database. Through the proposed system, useful information will be made available for the rural producer, such as how to prepare herbal medicines to be used in the fight against diseases in production animals.

The study consists of an applied methodological research, of technological production, characterized by being the process of development and creation of a new product, activity or service (Polit et al., 2011), since there was the construction of prototypes of a digital application for sanitary, reproductive and zootechnical management (MANZOTEC) and an online guide to phytotherapy in animals (FITOVET ONLINE).

Among the advantages of phytotherapy are the reduction of costs with treatments and medicines, the easy application, the reduction of disease resistance to antibiotics, the short grace period, as it does not contaminate meat, milk and their derivatives and the environment environment (Yunes et al., 2001). Considering the proven advantages of herbal medicine, the development of the FITOVET ONLINE platform is justified as an option for sharing information on herbal medicines in animal production that can be used freely.

Before putting the application into production, it was decided to develop a prototype based on web technologies to be improved until its release version. The application for Reproductive, Sanitary and Zootechnical Management will be a practical tool that will allow the planning and monitoring of the main routine activities in the production of animals in the marked periods, and aims to contribute to the increase of production in the properties.

### 3. Results e Discussion

The research project, which was the basis of this report, opened up possibilities for scientific initiation activities to be carried out at home under the online tutoring of the coordinator/advisor teacher. The research project was designed to be developed largely using digital technologies, such as STRING<sup>2</sup> online platforms for bioinformatics studies. This proposal was implemented as a result of the need to find alternative and innovative ways to maintain the bond between students and school in the context of social isolation.

In this way, using interactive and easy-to-use web technologies in scientific initiation proved to be a way to bring people together at a time of social isolation. The coordinator/advisor teacher was also challenged in this scenario, since his entire coordination and guidance plan, which had been carried out over the years by face-to-face means, is no longer possible in this format. And in this context, conducting the research project remotely was a successful way to reduce the delay in research, and the removal of students from the educational institution. Cordeiro (2020) complements about these technological tools:

The use of technological tools in education must be seen from the perspective of a new teaching methodology, enabling the digital interaction of the students with the content, that is, the student starts to interact with several tools that allow him to use his mental schemes. from the rational and mediating use of information.

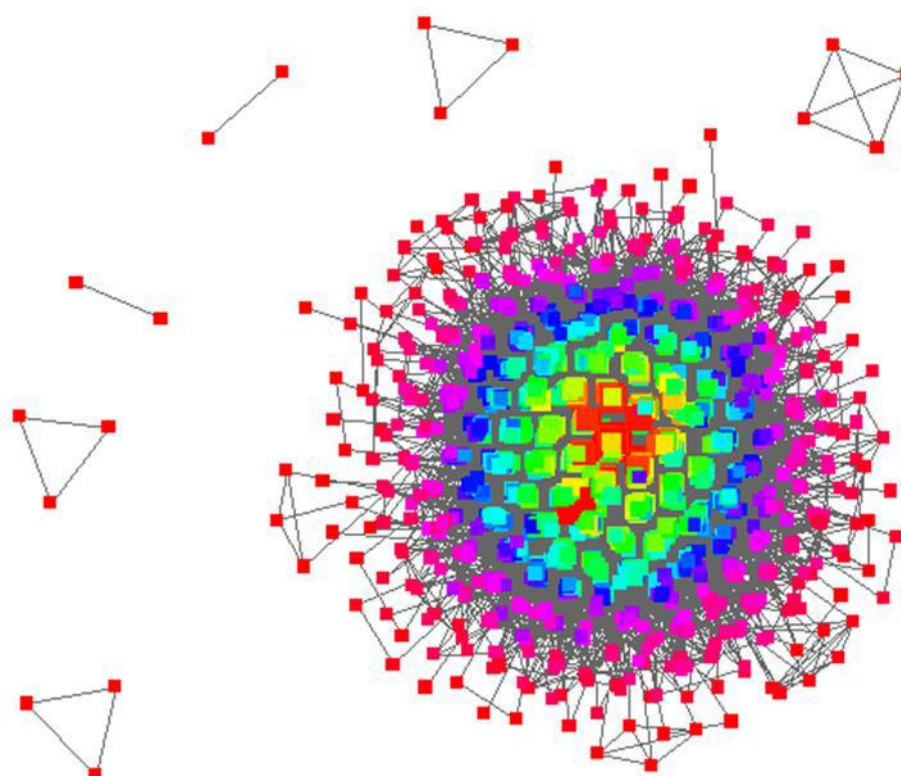
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<sup>2</sup>The STRING (Search Tool for the Retrieval of Interacting Genes/Proteins) is a biological database of protein-protein interactions available at: <http://string-db.org/>.

Some practices mediated by these technologies can be exemplified and that enabled students and professors to maintain the continuity of institutional activities of knowledge construction, albeit virtually: orientation meetings and participation in scientific events were done using video communication services offered by companies such as Google Meet and Zoom. In addition, several digital contents of an academic-scientific nature were produced and consumed in audio and video format. Note that, the pandemic context and the recommended control measures affect the population in many dimensions of living and health conditions and, among them, significantly, the mental health (Barros et al., 2020). So, the return of scientific initiation activities, carried out remotely, represented for the student the possibility of resuming their activities and going beyond what was expected for the traditional classroom before the context of social isolation. More importantly, it allows the student to occupy his mind and maintain a routine of activities, contributing to the promotion of physical or mental health.

In the practical activity of bioinformatics, it was possible to elaborate several networks of protein interaction, helping in the investigation of protein signaling pathways, which is one of the specific objectives of the project. Figure 2 shows one of the elaborated protein interaction networks.

**Figure 2** – Example of a protein interaction network created using the Cytoscape platform.



Source 2: Cytoscape platform.

With the application of network analysis in bioinformatics, it was possible for students to apply the knowledge obtained in their undergraduate course and improved in previous opportunities to participate in scientific research as in the work developed in collaboration with Leão et al. (2019). The student also reported his perception of the importance of data analysis, tools and computational techniques for the area of bioinformatics.

Regarding the construction of the ARACÃO website, the experience was very pleasant because it offered ways for the community to participate, reflect and express itself on the social and environmental consequences of the abandonment of

domestic animals and the importance of adopting measures, individual and collective, to reduce this problem. In the construction of this site, web technologies such as HTML, CSS and Bootstrap were used. The homepage of the site is shown in Figure 3.

**Figure 3** – Home page of the ARACÃO website (<http://wisci.com.br/aracao/>).



Source: ARACÃO Website.

Finally, as the research project highlights the need for improvements regarding animal health and welfare, the construction of a prototype application for sanitary, reproductive and zootechnical management (MANZOTEC) (Figure 4) may be useful for the development of local and regional livestock. This website, a prototype of an application, aims to inform the rural man about a calendar for sanitary, reproductive and zootechnical management of production animals, making life easier for the farmer, keeping all this information in the palm of his hand. The construction of the application is in progress and will be made available to allow access to information on animal management.



**Figure 4** – MANZOOTEC homepage (<https://wisci.com.br/manejo/>).

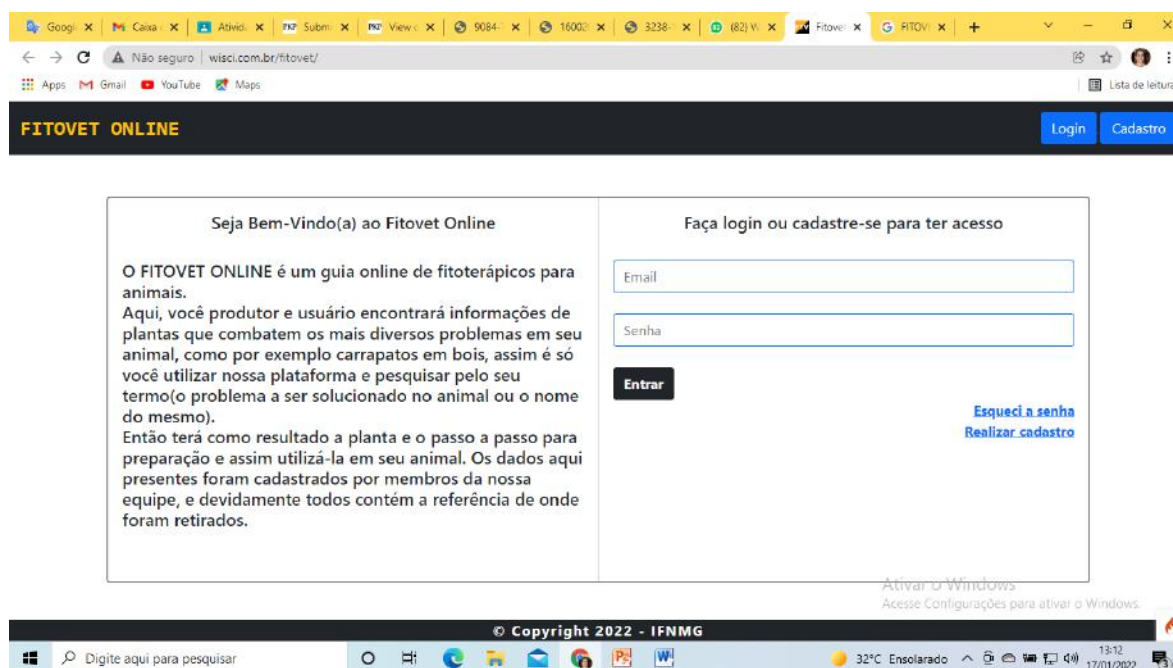


Source: MANZOOTEC Website.

The platform under development called FITOVET ONLINE (Figure 5) is an online guide to herbal medicines for production animals. On the platform, rural producers will be able to find information on plants that combat the most diverse problems of production animals, such as ticks and worms. The search can be done on the platform by providing some terms related to the animal species or the problem to be solved. As a result of the search, information about the plant to be used and the step-by-step instructions for preparing the herbal medicine will be presented.

The developed platform is yet another technology that has the potential to motivate the digital transformation in livestock, through the provision of relevant information that supports the decision-making process in rural production activities. However, there are still many obstacles to be overcome to prepare for a broad digital transformation in livestock. For example, in order to make the use of information technologies viable in rural areas, primary requirements such as those related to high-quality connectivity must be met. Thus, multiple initiatives to support the digitization of livestock should be encouraged in order to make it easier and more effective to work in rural areas.

**Figure 5** – FITOVET ONLINE Home Page (<http://wisci.com.br/fitovet/>).



Source: FITOVET ONLINE Website.

Thus, the Scientific Initiation activities were crucial to maintain the bond between students, professors and the institution. At a time of social isolation, when students and teachers were unable to meet and attend classes, the project made it possible to carry out these activities even in a non-face-to-face way, and to continue their studies contributing to the advancement of science.

It was a unique opportunity to exercise creativity and criticism, since during social isolation, students found themselves faced with routine and repetitive tasks throughout the day, a difficult scenario for everyone, as moments like this demotivate the student. In addition, the execution of the research project during the pandemic created the possibility of articulating various knowledge and substantially expanding the world view and professional and academic training, even in the current conditions of survival.

## 5. Conclusion

The experience of scientific initiation during the pandemic allowed us to observe the student's role in their learning, when formulating research questions and seeking answers through scientific methods. Scientific initiation is more than an activity that is practiced in isolation, it is a critical activity, which is carried out in a group, and that generates discussions, even the professor with the most extensive experience in his career, with each new research activity. acquires new knowledge from the discussion among the members (Pereira, 2016). Thus, in addition to offering a path of knowledge and experience in the academic area and contributing to the student's intellectual formation, scientific initiation enables students to contribute to society.

In particular, in the context of the pandemic, the scientific initiation activity was fundamental, as it challenges the student, given the suspension of face-to-face activities, to continue conducting their research activities even though they are far from the educational institution. Whether in person or remotely, the continuity of research activities proved to be fruitful for students.

In this sense, it is suggested that Scientific Initiation and the guidance of scientific research produced by students from the Instituto Federal do Norte de Minas Gerais - IFNMG - Campus Araçuaí be thought, in these times of social isolation, in new formats, which favors greater teacher involvement, in order to not only maintain, but build links with small research groups, which result in teaching-learning processes that contemplate the fundamental objects for scientific education.

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