

**REMOTE TECHNICAL VISITS: A POSSIBLE APPROACH TO THE ENVIRONMENTAL TOPIC IN TEACHING UNITS****VISITAS TÉCNICAS REMOTAS: UMA POSSIBILIDADE DE ABORDAGEM DA TEMÁTICA AMBIENTAL DENTRO DE UNIDADES DE ENSINO**

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**Abstract**

The COVID-19 pandemic and the distancing measures required adaptations in the entire teaching structure. In this context, the objective of this article is to report remote visits carried out for students attending High School courses integrated to the Technical and Higher Education levels about environmental topics. The visits to five companies/organizations took place by means of a project prepared by undergraduate students attending the FMU Environmental and Sanitary Engineering course, aiming to provide them with a virtual presentation of their processes in the environmental area. The participants in the visits were 231 students from High School courses integrated to the Technical level from two public schools and 152 attending courses integrated to Higher Education at a private institution. Thus, in a dynamic way, it was possible to show socio environmental activities developed by the companies/organizations, regarding different theoretical-practical aspects inherent to sustainability, such as waste management, ecological sanitation, vegetable gardens in small spaces, aquaponics systems and the importance of stingless

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bees, among others. It is considered that the Remote Visits Project is within a scenario marked by the expansion of educational procedures, enriching both the academic experiences of the students directly involved in the Project and those of the other students participating in the visits, due to the reflections and learning processes provided by the immersion in applied sustainability models, thus promoting interdisciplinary knowledge, sensitization and diverse information pertinent to the environmental issues addressed in the visits.

**Keywords:** Education at a Distance. Information Technology. Pandemics.

## Resumo

A pandemia da Covid-19 e medidas de distanciamento demandaram adaptações em toda estrutura de ensino. Neste contexto, o objetivo deste artigo é relatar visitas remotas realizadas para estudantes do ensino médio integrado ao técnico e superior sobre temáticas ambientais. Visitas a cinco empresas/organizações ocorreram por meio de um projeto elaborado por graduando(as) de Engenharia Ambiental e Sanitária da FMU, visando proporcionar aos estudantes a apresentação virtual de seus processos na área ambiental. Participaram das visitas 231 estudantes do ensino médio integrado ao técnico, de duas escolas públicas, e 152 do ensino superior de uma instituição privada. Assim, de forma dinâmica, foi possível a demonstração de atividades socioambientais desenvolvidas pelas empresas/organizações, quanto a diferentes aspectos teórico-práticos da sustentabilidade, como gerenciamento de resíduos, saneamento ecológico, hortas em pequenos espaços, sistemas de aquaponia, a importância das abelhas sem ferrão, dentre outros. Considera-se que o Projeto Visitas Remotas insere-se em um cenário de ampliação de procedimentos educacionais, enriquecendo tanto a vivência acadêmica dos estudantes envolvidos diretamente no Projeto, quanto dos demais estudantes participantes das visitas, pelas reflexões e processos de aprendizagem proporcionadas pela imersão em modelos aplicados de sustentabilidade, promovendo, assim, conhecimento interdisciplinar, sensibilização e informações pertinentes às questões ambientais abordadas nas visitas.

**Palavras-chave:** Educação à distância. Pandemias. Tecnologia da Informação.

## 1. INTRODUCTION

The COVID-19 pandemic evidenced a wide range of negative effects on the National Education Systems, at different education levels and in different countries (MAHAGAMAGE; MARASINGHE, 2023). This situation also revealed a vicious circle of inequalities, oftentimes associated with regional, national and global social problems (SENHORAS, 2020).

Based on this assumption, Monteiro (2020) indicates the need to review the educational models, as their weakness was even more exposed, given the current health crisis scenario imposed by the Coronavirus pandemic. There was a need for standardization instituted by the Ministry of Education (MEC) through ordinance No. 343 of March 17th, 2020 (BRASIL, 2020a). This Ordinance allowed substituting in-person classes in the country's teaching institutions by methods that held information and communication means and technologies.

The regulation included in the Hybrid Teaching proposal in Brazil was launched with the advent of MEC Ordinance No. 2,253 of October 18th, 2001, which authorized Higher Education courses to use remote methods in 20% of their hour loads (BRASIL, 2001). In 2019, this was updated by Ordinance No. 2,117 of December 6th, (regulating use of the Education at a Distance (EaD) modality in up to 40% of the total hour load in undergraduate courses (BRASIL, 2019). In



turn, in Elementary and High Schools, discussion and implementation of hybrid teaching were only initiated due to the requirements imposed by the pandemic (CIEB, 2020).

The original definition of Hybrid Teaching, by Bacich et al. (2015), is described as follows: “[...] a formal education program in which a student learns through an online teaching means, with some element of student control over the study time, place, mode and/or pace, and through in-person learning, at the school”.

The same authors mention that hybrid teaching is a pedagogical set that mixes face-to-face activities and those carried out through digital Information and Communication Technologies. There are different strategies to combine these activities, which consist in focusing on the student's learning process and not on the rapid transmission of information, traditionally carried out by teachers. The classroom becomes a place of active learning, in which the students are faced with different situations, entering into contact with environments that present projects, discussions and laboratory activities, among others, with the support of the teacher and their peers.

However, access to technology is an indispensable factor to implement hybrid teaching. Students and teachers need to be able to handle, interact and produce content in the virtual environment by means of already existing Information and Communication Technologies (ICTs), so that all instances of online interactivity are assertive. It is important that the students are familiar with the new technologies, that they feel the need to use them and that they have easy access to them, as most pupils belong to different social classes (BARBIERIA et al., 2021)..

The special needs regarding adaptation of the ICTs for deaf and blind students should also be considered, as well as for those with mental disorders or communication, learning or social relationship difficulties (CASTRO et al., 2015; VILELA et al., 2021, ESPER et al., 2022).

In terms of the school activities during the pandemic, this problem became evident due to the difficulty accessing the online education platforms, especially as a result of the absence of good quality Internet connections and devices in the homes of students in situations of greater social vulnerability. A research study conducted in 2019 by the Brazilian Institute of Geography and Statistics indicated that 4.3 million students still lacked Internet access in 2018. Of these, 4.1 million were from the public teaching network (IBGE, 2021).

It is remarkable that the pandemic revealed profound social inequalities in the education system (BARTHOLO et al., 2023; GOMES; SOUZA, 2023). This is due to the fact that, although encouraging the use of new technologies in the MEC Basic National Common Curricular Guidelines (BNCCGs) and in the states' curricula, there is limited support in public schools for the technologies to be used effectively (BARBIERIA et al., 2021). Most of the Brazilian states adopted digital means to exchange materials and diverse information with their students (BRASIL, 2017)

The Ministry of Education conceptualizes the BNCCGs as a regulatory document, informing the essential themes to be worked on in each curricular phase, involving childhood education, as well as elementary and secondary level education, in order to ensure full development and guarantee teaching quality in public institutions (BRASIL, 2017).

One of the topics that cannot be overlooked during this critical pandemic period is Environmental Education (EE), herein understood as an indispensable movement for a transition to more sustainable societies, by means of critical reflections, dialog and social and collaborative learning, as well as through the elaboration of collective action-targeted utopias (MONTEIRO; SORRENTINO, 2020). Thus, in the school context, Environmental Education had to be reinvented and resignified by means of innovating methodologies and accessible resources (DE CASTRO FILHO; ALBUQUERQUE, 2021).

“Even with the effects of the pandemic, we cannot ignore the environmental problems that perpetuate themselves at the national and global levels and which increasingly demand mitigating

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strategies and formation of opinion and values, with the school playing a fundamental role in this process. In this sense, the universe of EE (Environmental Education) is increasingly expanding as anthropogenic and natural interactions intensify, in order to raise awareness and provide a change of attitude towards a reality focused on the conservation of natural assets” (DE CASTRO FILHO; ALBUQUERQUE, 2021).

One of the methodologies widely applied in the Environmental Education area are technical visits, which, due to their investigative and pedagogical role, assists students in understanding various themes such as public policies, environmental and cultural assets, social conflicts and socioenvironmental preservation, among others, according to the context and realities proposed (FREDERICO et al., 2023). It proves to be a teaching-learning instrument conducive to providing interactivity and awakening the students' interest regarding their involvement during performance of the activities, thus being able to experience other scenarios, with different experiences and new interpretations for their training (ALMEIDA; SANTOS, 2018).

Also according to the aforementioned authors, the theoretical-methodological concepts sustain the idea of dialog produced in the classroom, with elaboration of ideas based on observations, when made in the technical-scientific development reinforced by the Technical Visit method. In this way, technical visits become a tool in the learning resource, highlighting not only the importance of the action itself but also of its planning, which will delimit the contents addressed and then allow for the connection between theory and practice.

Considering the COVID-19 pandemic, the application of hybrid teaching and the need to develop Environmental Education practices during the pandemic, the objective of this article is to report remote visits carried out during the second half of 2020 for students attending high School courses integrated to the Technical and Higher Education levels.

## 2. MATERIAL AND METHOD

### 2.1 Methodological procedures

In order to enrich the training of undergraduate students attending the Environmental and Sanitary Engineering course at the Faculdades Metropolitanas Unidas (FMU) University Center, a Higher Education private institution, five students from the aforementioned Course developed a project to be offered to teaching institutions (initially from the Elementary, High School, Technical and/or Higher Education levels), aimed at presenting socioenvironmental activities within companies/organization and by means of remote technical visits during the COVID-19 pandemic.

Planning and development of the Remote Visits Project took place in three stages:

**Before the visit:** survey of and contact with interested companies/organizations and teaching institutions; forwarding of documents to interested companies/organizations and schools, with a description of the responsibilities between the parties and authorization for image use for disclosing purposes; verification of available dates in the interested companies and schools: and announcement of the project in social networks.

**Remote technical visit:** monitoring and assessment of the visits (detailed above, in the Results item).

**After the visit:** survey of the participants in the visits and writing of due descriptive reports.



For the survey of companies/organizations and to establish partnerships for the visits, the five students attending the FMU Environmental and Sanitary Engineering course made a list of companies/organizations with performance in the environmental area by means of searches in social media, in addition to indications from peers, students and former students who worked in those companies and, thus, had professional networking and experiences targeted at sustainability activities in the business scope.

In order to identify schools interested in participating, the project was announced in the São Paulo Municipal Health Department, in technical schools from the Paula Souza Center and at FMU itself. After identifying the interested companies/organizations and schools, scheduling the visits and signing the documents, materials to announce the Remote Visits Projects in the social networks were prepared in folder format, containing diverse information regarding dates, times, platforms, participating companies or organizations, and names and photographs of those responsible for the presentations.

Chart 1 below presents the companies/organizations and teaching institutions participating in the project, the number of students and the duration of each of the remote technical visits carried out.

**Chart 1:** Companies/Organizations, teaching institutions, participants and duration of the remote technical visits

Companies	Teaching Institute	Participants	Duration (minutes)
Garagem de ônibus	ETESP Escola técnica Estadual de São Paulo	186	86
Associação Reciclazaro	ETEC Paulistano	45	109
SOS Abelhas sem Ferrão	Centro Universitário FMU	22	105
Porte engenharia e Urbanismo	Centro Universitário FMU	70	90
Eclo compostagem	Centro Universitário FMU	60	90

The technical visits were carried out in the remote modality by means of online platforms such as Blackboard, Google Meet and Microsoft Teams, made available by the undergraduate students that organized the Project, through which representatives of the companies presented the internal process corresponding to the activities developed in the sustainability and safety areas.

At the end of each visit, data on the number of participants, contents addressed/shown and duration were surveyed.

### 3. RESULTS AND DISCUSSION

During the remote visits to the companies/organizations, themes and practices were presented, which were aimed at ecological sanitation, planting vegetable gardens in small spaces



and waste management, among other socioenvironmental activities targeted at sustainability, according to each company/organization's niche, as follows:

### 3.1 Remote Technical Visit: Via Sudeste Transporte/Bus Garage

The visit to Via Sudeste Transporte on October 6<sup>th</sup>, 2020, was attended by 186 participants from the São Paulo State Technical School (*Escola Técnica Estadual de São Paulo*, ETESP) located in the Bom Retiro neighborhood, central region of the capital city of São Paulo, with students attending the Administration, Systems Development, Buildings, Electronics, Environment, Industrial Automation, Events, Metrorail Transportation, Inbound Tourism and Human Resources courses (in the High School integrated to the Technical level modality)..

The presentation showed the external space of the bus carrier's garage, focusing on functioning of the waste management processes, presenting various concepts such as reverse tire logistics or the process of treating water from artesian wells for use in various non-drinking activities in the facilities, enabling the discussion of sustainable processes and the importance of Environmental Education in the companies.

Regarding this aspect, Adams and Gehlen (2005) highlight the importance of a number of theoretical-practical pedagogical aspects of this process since, according to a research study conducted by the authors, the Environmental Education that has been developed in companies lacks Education or even Human Sciences professionals, ending up with the development of actions that contribute very little to transforming reality.

Anyhow, the companies' role to cope with current socioenvironmental issues by means of Corporate Social Responsibility is increasingly acknowledged. Regulating bodies and consumers in general start demanding that companies adopt responsible socioenvironmental practices. In addition, a number of studies have already been conducted in this context to verify if adoption of these practices, from the Environmental, Social and Governance (ESG) perspective, exerts any influence on these companies' financial performance (ALBUQUERQUE et al., 2020). Thus, approaches like this, provided by the Remote Visits Project between companies and teaching institutions, are connected to the current demands.

### 3.2 Remote Technical Visit: Associação Reciclázaro

The technical visit to Associação Reciclázaro took place on October 26<sup>th</sup>, 2020, with 45 participants from the Paulistano State Technical School located in the Jardim Paulistano neighborhood, São Paulo, with students from High School courses integrated to the Technical Level attending the Systems Development and Environment academic disciplines, who were able to learn about the actions of the Association, responsible for the Professional Training and Environmental Education Center (*Centro de Formação Profissional e Educação Ambiental*, CEFOPEA), which promotes activities to preserve the environment and assist people in vulnerable situations.

With the additional objective of disseminating Environmental Education, the Association conducts monitored visits, courses and workshops, among other activities. In addition to this, it institutes designated social business projects, such as the Via Verde Gardening Cooperative and the Pão de Moça Bakery.

During the visit, these and other projects were presented: a recycling cooperative where, in addition to solid waste management, there is an ecological sanitation system made using the banana tree circle method; an aquaponics farm; an agroforestry system projects; rainwater collection; butterfly houses; vertical and elevated vegetable gardens, adapted for insertion in small spaces and aiming at urban agriculture; bioconstruction of green roofs; and an organic waste



treatment plant, such as worm farming, composting and biodigester, with subsequent generation of biogas and biofertilizers.

The visit made it possible to introduce sustainable systems and tools to the students in a didactic way, showing the positive effects of these measures, many of them easy to implement and, therefore, accessible to the students themselves, such as vertical vegetable gardens, home composting and rainwater collection.

Frederico et al. (2023) also consider the potential of technical visits when associated with EE for the training of people co-accountable for their practices, capable of understanding their role and participation regarding sustainability.

### 3.3 Remote Technical Visit: SOS Abelhas Sem-Ferrão

This technical visit took place on October 31<sup>st</sup>, 2020, was attended by 22 participants, including undergraduates from FMU, and was also open to other stakeholders, to accompany the presentation of the SOS Abelhas Sem Ferrão organization, an entity devoted to conservation of Brazilian native bees.

The creation of an aquaponics system for irrigation of different species of seedlings was presented, addressed regarding their medicinal, nutritional and edible functions, this latter item referring to the so-called Unconventional Food Plants (*Plantas Alimentícias Não Convencionais*, PANCs), which fall within the context of not being consumed as they should because of popular ignorance, even denoting countless species existing in Brazil.

Subsequently, the stingless bee boxes were presented, discussing the legalized capture technique, which, in accordance with CONAMA Resolution 496/20 (BRASIL, 2020b), is exercised through the use of the “bait nest”.

In addition, the presentation addressed the characteristics and organizations of bees, insects that produce their subsistence resources only in essential amounts for consumption, in addition to controlling the birth rate according to food availability.

Through this visit, the students had the opportunity to learn about the importance of stingless bees in the ecosystem, among other aspects such as pollinators and environmental pollution bioindicators.

From a critical perspective, the role of Environmental Education for biodiversity preservation is undeniable (SILVA; RUFFINO, 2016), as well as of the approach to topics of this nature, whenever possible, in association with the everyday life demands, close to the participants' reality (QUEIROZ, 2020). It was possible to notice such concern in this remote visit, for example, when highlighting that stingless bees can be air quality indicators.

In addition, Palmieri and Massabni (2020) recall that activities targeted at Environmental Education, which bring students closer to the natural environment, offer important contributions to school education and to teachers' work.

### 3.4 Remote Technical Visit: Porte Engenharia e Urbanismo

According to the official website, the Porte Engenharia e Urbanismo company works in the area of civil construction and development of residential and commercial projects throughout the state of São Paulo.

The technical visit for the undergraduates attending the FMU Architecture and Urbanism, Engineering and Environmental Management courses took place on November 19<sup>th</sup>, 2020, with 70 participants, and presented the creation of the Platina enterprise, focusing on the management of construction solid waste.

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Initially, there was an explanation about the documentation required for the Civil Construction Waste Management Plan (*Plano de Gerenciamento de Resíduos de Construção Civil*, PGRCC) and the Environmental Interest Waste Movement Certificate (*Certificado de Movimentação de Resíduos de Interesse Ambiental*, CADRI). During the visit, CONAMA Resolution 307/02 was discussed, which establishes the classification of these types of waste. In addition to that, an explanation about how control and monitoring of waste transportation is carried out was offered, as well as the importance of encouraging employees in relation to the selective collection practices.

There was also a demonstration of how to separate waste in buckets and packaging in specific bays for metal, wood, scrap, plastic, paper, cardboard and hazardous waste, such as light bulbs and paints, being stored together with an environmental mitigation kit for containment in case of leaks. This consists of an absorbent blanket, absorbent pillow, absorbent cord, peat and/or sand, shovel, PPE (protective glasses, PVC gloves and PFF2 mask).

The visit played an essential role in the undergraduates' academic experience, considering that it presented adequate forms of civil construction waste management, in accordance with the current legislation set forth in the National Solid Waste Policy. Alternative practices were also presented for ambient lighting, with the use of pet bottles reused in stalls, combining energy saving.

Reflections on topics such as proper waste management and energy efficiency are in line with the requirements to cope with climatic emergency since, according to Besen and Grandisoli (2015), profound changes are necessary in the production, consumption and disposal means adopted by our society.

### 3.5 Remote Technical Visit: Eclo Compostagem

The visit took place on November 27<sup>th</sup> with 60 FMU undergraduate students. The Eclo Compostagem company, located in the city of Juiz de Fora (MG), carries out urban organic composting activities, focusing on individuals and companies, collecting the waste generated in homes or in the business sphere. In addition to organic waste, the institution collects napkins, straw, sawdust, chopsticks, toilet paper rolls, plates and paper bags to use in the procedure.

Collection is carried out using a biodegradable bag developed from cassava and corn, which is discarded with the waste to be composted, and a recycled bucket purchased from a recyclable collectors' association. These materials are forwarded to the customers for waste storage, being sent to the headquarters weekly or fortnightly, according to the plan chosen by each user.

During the visit, the problems resulting from inappropriate organic waste disposal were addressed, where various problems occur in their decomposition process, such as formation of a liquid called leachate, causing contamination of soil and water resources; release of greenhouse gases; disease vectors threatening public health; and instability of the massif, with accidents occurring in landfills.

The visit encouraged adherence to the composting techniques, in order to reduce the volume of organic waste sent to landfills, stimulating possible awareness about the problems raised among the listeners.

A study conducted by Pereira and Fiore (2022) also highlights the importance of composting practices, whether at a small or large scale, considering that organic waste corresponds to nearly 30% to 50% of all urban waste. The authors investigated factors that lead people to separate (or not) this type of waste, with results that range from physical infrastructure and convenience or economic aspects to schooling levels, habits, social influence and pro-environmental behaviors.

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These results reinforce the relevance of providing the students with reflections and practices about successful experiences around this theme, as proposed by the Remote Visits Project.

In addition, due to the topics addressed and the sustainable practices shared, it is believed that this Project may contribute to increasing the students' practical knowledge, which is in line with the need indicated by Aguiar et al. (2010) when considering that many schools lack methodologies of this nature, that is, which ease the approach between companies/organizations and students.

In this same direction, De Castro Filho and Albuquerque (2021) assert that the sustainability concepts and practices end up being addressed and worked on merely in a theoretical way, as foreseen in the courses' curricula. In addition to that, due to the pandemic context and the need for social isolation and restrictions imposed by the state and municipal governments, there were greater difficulties or even prohibitions to develop these activities at the school institutions or in-person visits to the places that implement these environmental actions.

Another aspect to be noted refers to the difficulties accessing Internet, especially in public schools, as many of the institutions contacted to take part in the Project reported that their students did not have good quality Internet connections and devices at their homes, as also reported by Cunha et al. (2021), IBGE (2021) and Barbieria et al. (2021).

Among the limitations of this Project we can also mention aspects related to use of the technological resources since, when contacting the schools, some of them expressed their interest in participating but required using their own remote teaching platform to carry out the visits, which led to access difficulties for the Project organizers and precluded those visits.

#### 4. FINAL CONSIDERATIONS

The hybrid teaching model contributes innovations, causing the need to use technologies combined with the traditional method. In view of the social isolation imposed by the COVID-19 pandemic and the sudden change in the teaching-learning methods, adequate and diversified use of these technological tools becomes extremely important to stimulate the educational process.

Such being the case, elaboration and development of the Remote Visits Project provided a total of five remote technical visits, conducted in the second half of 2020 by two public technical schools and a private Higher Education Institution, with the participation of 383 students: 231 and 152 from High School courses integrated to the Technical and Higher Education levels, respectively.

It is also considered that the Project is within a scenario marked by the expansion of educational procedures, enriching both the academic experiences of the students directly involved in the Project and those of the other students participating in the visits, due to the reflections and learning processes provided by the immersion in sustainability models applied within companies and organizations, thus promoting interdisciplinary knowledge, sensitization and diverse information pertinent to the environmental issues addressed in the visits.

The method presented and carried out by the Project showed great application potential even after the pandemic, considering that the education system is undergoing an adjustment, the so-called New High School and Elementary School, where hybrid teaching should be gradually implemented, as stated in the BNCCGs.

From these implementations, reconciling the theoretical curriculum with practical demonstrations can generate greater learning for the students and enrich the various academic disciplines presented by the teachers in the classroom, in addition to creating networking with schools or teachers who decided to adopt the practices indicated by this Project.

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However, lack of access to good quality Internet and electronic devices among many students, especially those in worse situations of social vulnerability, is acknowledged as a major challenge of projects like this, hindering access to the hybrid activities.

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