

Scientific initiation within the Federal Institute of Education, Science and Technology of Rio Grande do Sul: a case study of the research, teaching and outreach exhibitions

ABSTRACT

Alex Miranda Santana
alexasantana.en@gmail.com
0000-0001-9021-3883
Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brasil.

Lizandra Brasil Estabel
lizandra.estabel@poa.ifrs.edu.br
0000-0001-9339-2864
Instituto Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brasil.

This study investigates how the scientific research process is developed by students in the technical and university courses, who take part in the Research, Teaching and Outreach Exhibitions of the IFRS Porto Alegre and Viamão Campi. It is a case study that employed observation and interviews to collect data. An analysis of the following factors involving the six participant students was carried out: scientific initiation process, information competence, the relationship with research sources and the mediation of knowledge existing in the relationship between advisors and advisees. Through literature review, transcription of interviews, and content analysis of the answers given to the semi-structured questions, the study presents the impact of the students' participation in the events observed in their social and emotional maturity. The results led to the conclusion that the Federal Institute provides a fruitful environment for the students' scientific initiation through the Research, Teaching and Outreach Exhibitions, with the strong participation of educators as mediators of their students' learning process in the scientific initiation.

KEYWORDS: Scientific research. Mediation. Information competence.

INTRODUCTION

Events known as Science Fairs appeared in Brazil in the 1960s. The first fairs presented works resulting from experiments carried out in the classroom or the assembling of devices used in demonstrations (MANCUSO, 1995). Science Fairs were for a long time seen as events linked to the natural sciences, that is, sciences, biology, physics and chemistry. However, over time this view was broadened, so that these fairs started to be recognized as spaces to promote scientific investigation, which permeates the most diverse areas of knowledge. Science Fairs are considered social, scientific and cultural events that might be held at schools or in community venues, aiming at creating the opportunity of dialogue between peers and the visitors, where the themes researched, knowledge built, methodologies applied, and students' creations are discussed.

A Science fair is a moment when it is possible to involve students in scientific investigation, providing a set of interdisciplinary experiences. It also integrates educators in different activities, and their organization is perfectly justified when their objectives in science teaching are taken into consideration, namely, to develop logic thinking, to use the scientific method, to raise awareness of the universality of scientific laws, to know the scientific environment and explore aptitudes, to prepare students to the job market, and to integrate those individuals in society (PEREIRA, 2000).

As a teaching strategy, science fairs are able to make the student, through their own work, to get involved in a scientific investigation, providing a set of interdisciplinary experiences that complement formal education. As social-scientific project, science fairs might provide students with opportunities to show their work to the community, enabling an interchange of information" (PEREIRA, 2000, p.38).

Also, according to Pereira (2000), science fairs aim to provide a set of situations and experiences that result in:

...incentivizing the scientific activity, favoring the development of interdisciplinary actions, stimulating project planning and execution; motivating students to research and elaborate conclusions based on the results obtained in their experiments; developing the students' ability to elaborate criteria for the understanding of phenomena or facts related to different aspects such as daily life, empirical or scientific; providing the participant students with a significant experience in the socio-scientific field of knowledge dissemination, and integrating school and community (PEREIRA, 2000, p. 20).

Knowledge construction as the individuals' learning process relies on the one side on the development of their cognitive structures and, on the other, on the way they have access to the contents.

Taking that into consideration, the qualitative methodology was chosen to conduct this study. A case study focusing on the problem 'how does the scientific research process is developed by students in the technical and university courses that take part in the IFRS Research, Teaching and Outreach Exhibitions at the Porto Alegre and Viamão Campi, aiming to disseminate scientific production and promoting intra and interinstitutional interchange and sharing of experiences?'. The research main aim is to verify how the scientific investigation process of the participant students occurs, while the specific objectives are: to identify the

process of organization of the Research, Teaching and Outreach exhibitions at the IFRS, Porto Alegre and Viamão Campi; to select students and pupils from that institute or other schools that take part in the exhibitions, who present works in the events; to identify the sources of information chosen by the students to elaborate their works for the exhibitions; to observe the work presentation process in the Research, Teaching and Outreach Exhibitions at IFRS, Porto Alegre and Viamão Campi; to analyze the data obtained through the case study and qualitative research methodologies, and verify how the scientific research is developed by the students and disseminated in the Research, Teaching and Outreach exhibitions at the IFRS, Porto Alegre and Viamão Campi. Science fairs or science exhibitions outstand as events of exchange of teaching, learning and interaction experiences becoming a fruitful environment for scientific initiation.

SCIENTIFIC INITIATION, SCIENCE FAIRS OR SCIENCE EXHIBITIONS AND INFORMATION COMPETENCE

In Brazil, the event known as science ‘fair’ or science ‘exhibition’ can be defined in different ways. The name identifying the event already enables certain understanding, since for a long time people considered science fairs as an activity limited to the knowledge in the ‘sciences’ area, and this was its definition in the school curriculum. In the 1960s and 1970s, teachers of subjects in the sciences area were the first to incorporate the scientific method in their practical activities in the classroom, laboratories, or even in extra class activities. For this reason, the idea that science fairs would only be the product of their activities with their students appeared. However, the term ‘sciences’ can also be understood in a much broader sense, referring to the scientific research carried out in the most diverse fields of knowledge.

The Science exhibition is a space to expose, present and discuss work and technical-scientific projects devised by students, educators, students in scientific initiation scholarships, and even researchers from outside the institution. Currently, the focus is on the importance given to the scientific research promotion by educators of the most varied subjects in the school curriculum, making the education institution a suitable environment for the motivation of investigation. The organization of scientific exhibitions aims at putting theory into practice, provoking the students’ scientific curiosity, motivating them to apply scientific methodology, stimulating them to raise scientific questions based on their own daily life. It is research as part of the teaching and learning processes.

Educating through research implies undertaking investigation as part of the daily teaching activity. Doing research becomes the teaching daily methodological principle. The classroom work is developed around the reconstructive inquiry of existing knowledge, revisiting concepts, going beyond the commonsense knowledge, but encompassing it and enriching it with other types of knowledges brought about by the students, and with the construction of new arguments that will be validated in critical discussion communities such as the science exhibitions, for example. Educating through research leads to learning (DEMO, 1997). The autonomous and participant learning is exercised. It is a way of learning in which everybody is involved in the learning of each one of the participants, and this occurs through the development of their own elaboration ability, characterized by

the ability of developing oral arguments and by the quality of the reporting texts elaborated.

Research is the base of knowledge construction and it is indispensable in the school context, since it enables the individuals to develop their critical thinking and, therefore, become able to transform the context in which they are inserted. However, it implies as pointed out by Morin (2000, p. 14), that “knowledge cannot be considered a ready-made tool, which can be used without examining its nature”. In this sense, educating and learning through research becomes a methodological alternative to knowledge construction, since, this proposal requires taking distance from the “old technicist model of the transmissive pedagogy” (MORAES, 1996, p. 54). According to Demo (1998, p.2) “its essential condition is that the education professional be a researcher, that is, handle research as a scientific and educative principle, and undertake it as a daily attitude”. That author defends in this proposal that “it does not take a ‘research professional’, but rather a professional that ‘educates through research’, and this methodological proposal can be supported by interdisciplinarity as way to reach knowledge.

Education focusing on research entails the act of continuous (de)construction, considers that the investigating spirit must be present (and be the same) throughout the whole education – from pre-school to graduate levels – what differentiates each moment is the search process and the purpose of each of the phases. Such reconstruction requires ability, involves competence to know how to think and question what is known, to learn, and to learn how to re-elaborate knowledges. Education, in the context of educating through research, must be understood as a “process of formation of the human competence with formal and political quality, finding, in innovating knowledge, the main leverage to the ethics intervention” (DEMO, 1996, p. 1). Competence is described by Rios as being able to carry out the duty well. That author warns that

Educators cannot be qualified as competent if they do not have a critical view of why they teach, with which purpose, what the meaning of this teaching is in the social context they are inserted, and which interests it serves (RIOS, 1997, p. 129).

Such competence can be divided into two basic horizons: the technical – specific mastering of the educator’s area, their specialty in the knowledge field; and the political – their role in the broader society context. The technical and political dimensions must be mediated by ethics. This education whose pedagogical proposal is educating through research requires that educators and students handle research as a scientific and education principle and face it as a daily activity. It is centered on the reconstructive questioning “which joins theory and practice, formal and political quality, innovation and ethics” (DEMO, 1996, p. 1). Questioning is defined as the “education of a competent individual, who is critically aware and able to elaborate and execute their own life project within their historical context” (DEMO, 1996, p. 10).

Scientific initiation (SI) as research experience offered to high school and undergraduate students, as participants in investigation activities developed in the Science and Technology Institutions, has a long history in Brazil. As university students, many young people started their professional career as laboratory assistants. Gradually, scientific initiation became a systematic practice. With the

creation of the National Council for the Scientific and Technological Development (CNPq) in 1951, the first scholarships were granted to students, but only in the 1970s the SI grant program was created. Up to that moment, the scholarships were applied for individually. There were grants available, but not an SI institutional policy, but thanks to that initiative, universities started to organize their intra institution programs and then the CNPq created the *Programa Institucional de Bolsas de Iniciação Científica* – PIBIC (Scientific Initiation Grant Institutional Program) in the 1980s. Quotas became available to universities that had their own scientific initiation programs.

The Scientific initiation in high school was inaugurated with the *Programa de Vocação Científica -Provoc* (Scientific Vocation Program) by the Oswaldo Cruz Foundation – Fiocruz, created in 1986. The success of this program, stimulating young people who had not defined their professional choices yet to follow scientific careers, influenced the creation of programs such as the Young Talents, by the *Fundação de Amparo à Pesquisa do Rio de Janeiro* – FAPERJ (Research Support Foundation of Rio de Janeiro) and its later institutionalization by CNPq as a scholarship program. Initially, by providing Junior Scientific Initiation grants, made available to the State *Fundações de Amparo à Pesquisa* - FAP (Research Support Foundations), which then established partnerships with the research institutions. More recently, in 2010, CNPq also launched the *Programa Institucional de Bolsas de Iniciação Científica para o Ensino Médio* - PIBIC-EM (High School Scientific Initiation Grant Institutional Program), with different quotas for teaching and research institutions. Currently, there are several high school scientific initiation programs spread throughout the country, created by both the CNPq and FAP policies, as well as through the private initiative.

The experience of researcher-advisors and high school students confirms the importance of these programs in the young people's professional choice process, by incentivizing them to pursuit careers that involve scientific research, the development of science in schools and its fundamental contribution to projecting the country's future.

Scientific education, mainly in a public institution, is not an individual asset, it has a social character, since it is funded by the society as a whole to meet its needs. In technical institutions, scientific initiation might be an instrument that provokes pedagogical, epistemological and social conception ruptures and, therefore, results in the education of a critical subject. It can also contribute to the formation of scientific attitudes, and inquiry in relation to knowledge. In addition, it might be conceived as a scientific education process, leading students to learn to question, doubt, and deeply express their doubts and those of their peers. This is a view of research that aims at educating and keeps certain distance from the scientific method. Therefore, it assumes that school research must occur simultaneously to the classes, regardless of the education level (OLIVEIRA, 2012, p.22).

In such context, it is necessary to notice that the scientific initiation proposal is not limited to the accumulation of individual experiences. It goes beyond individuals recovering the broader meanings of teaching and learning. In the concrete experience, properly informed and motivated researcher-advisors and students take part enthusiastically in the research daily work and/or at the laboratory. For this reason, Pedro Demo (1993) defines, for example, the challenge of educating in modern times, arguing that there is no research without questioning, there is no autonomy without construction and reconstruction of the

scientific and technological knowledge. In fact, there is only, more than never before, a need to overcome the archaic models of education. The problem cannot be simply reduced to the lack of valuation of education, science and technology as a differential heritage. That author also defends that the most effective way to reach this type of education would be the permanent construction and reconstruction of a critical awareness that would make us able to receptively experience our daily lives.

One characteristic of this process that was gradually noticed is that the researchers were the ones to lead the construction of education practices to mark their positions in the debate around the high school scientific initiation. We should undeniably seek to understand these postures, their way of thinking and acting.

Belluzzo (2001) states that information competence has a fundamental role in information society and in knowledge society,

a continuous process of interaction and internalization of conceptual, attitudinal fundamentals and specific abilities as reference to the understanding of information and its scope, in the pursuit of fluency and the necessary abilities to generate new knowledge and their legal and ethical applicability in the daily life of people and communities throughout their lives (BELLUZZO, 2001).

According to that author, information competence implies mainly the development of a full questioning reasoning ability, from which the person is able to research and elaborate individually, shows abilities to intervene in the reality critically and creatively, using emotional and subjective involvement abilities, which are translated into self-esteem, individual and collective achievement, and finally, know-how abilities that demonstrated correctly the thinking knowledge.

Information competence might be understood as a process in which the individual learns to search, select and evaluate information needed to make decisions and build up knowledge. Educators and students must know to use information sources such as reference works (encyclopedias, atlas, dictionaries, among others), as well as web pages and data bases. It encompasses the knowledge of both how to use computers and access information and how to reflect critically upon the information nature, its technical infrastructure and its impact on the sociocultural-philosophical context. It is necessary to develop abilities to recognize when more information is needed, be able to identify it, locate and use it effectively in the production of new knowledge, integrating understanding and use of technologies with the ability of solving problems responsibly, ethically, and legally.

Information competence must be recognized as prerequisite to the individuals' basic and initial education and their continuous development, so that they are able to be more reflective and investigative and manage to interact truly with the environments of knowledge construction and expression.

Campello (2003), based on a framework elaborated by the American School Library Association, stated that students with information competence access information in an efficient and effective way, evaluate it critically and competently and use information with accuracy and creativity. Students who are able to learn independently show information competence and seek information related to their personal interests persistently, they appreciate literature and other creative forms of information expression and make an effort to reach excellence in the

search for information and knowledge generation. Students who contribute positively to the learning community and society in general show information competence and recognize the importance of information in a democratic society, they demonstrate an ethical behavior in relation to information and information technology and take part in groups actively to search and generate information.

Researchers with information competence learned to learn in a continuous and autonomous way, since they define their information needs and how to seek and access effectively the necessary information. They evaluate the information accessed in relation to its pertinence and relevance and organize this information transforming it into knowledge.

Researchers that guide are educators, critical interlocutors, individuals legitimized to conduct the advisory process (SEVERINO, 2003), which peak in the elaboration of a study and its results. They have an open dialogue with their advisees, acting as mediators, exchanging experiences, so that new knowledge can be constructed, applying methodologies and making the learning process effective.

INFORMATION AND RESEARCH SOURCES TO ELABORATE SCIENTIFIC WORK

Research sources are the set of materials and information used to support a research project, stimulate creation and new ideas, as well as build up the theoretical background for the elaboration of the final work. There are several types of sources, which can be read only for consultation, while references are the actual sources that were surveyed and cited in the scientific work. The concept of information sources is, according to Cunha (2001, p. VIII), quite broad, since “they might include manuscripts and printed publications, as well as objects such as mineral samples, pieces of art or from museums”. They are classified as primary, secondary, and tertiary sources. Primary sources are made up of new information or new interpretation of ideas. They cannot be changed by opinions or selections. Secondary sources, according to Cunha (2001, p. IX) “include information on primary documents and are arranged according to a definite plan: they are, in fact, organizers of primary sources and guide the reader to them”. Data bases and library catalogues are examples of secondary sources. Tertiary sources are bibliographies, directories, and literature reviews and, also according to Cunha,

their main function is to help the reader to search primary and secondary sources, while, most of them, do not present any knowledge or topic as a whole, that is, they only signal the location of or indicate primary or secondary documents, in addition to factual information [...] (CUNHA, 2001, p. IX).

More sources are usually consulted than those found in the references. A scientific work is not developed only based on one source or a limited number of sources and a thorough selection process is fundamental to prevent the use of questionable sources, which might hamper the quality of the research or result in misinformation. A good quality selection of sources is the basis for a good theoretical background related to the theme researched.

According to Moro and Estabel

Students should acquire the competence to carried out surveys in different sources (personal, bibliographic, technological) to locate the topics searched independently, which identify the main ideas of texts, and be able to

understand and interpret them, correlate topics, elaborate summaries and conclusions based on the texts read, and reference the sources surveyed. In addition, they should be able to use quotes in the work reported, identifying the sources' authors and respecting authorship to avoid plagiarism (MORO; ESTABEL, 2004, p. 8-9).

With the easier access to information through the use of technologies such as the internet, information recovery became faster and gained higher quality, whenever proper search criteria and strategies are employed. Large data bases have already evolved to make more and more documents available online, mainly those with education contents.

Araújo (2001) points out that "information can be conceptualized as a social practice that involves actions of meaning attribution and communication". Thus, the meanings ascribed to certain information are linked to each individual's intellectual capability, their learning and education degree tend to define the understanding and transformation degree that they can apply to certain information. The information supplied to individuals entails knowledge improvement, either applied to the several subjects studied in their classrooms, for example, or influencing their lives as subjects in society that seek their rights and know their duties, or even, this information might contribute to the development of new techniques to solve society problems such as health and education.

EDUCATORS AND THE MEDIATION OF THE SCIENTIFIC INITIATION PROCESS

Great part of the individuals' relations with their surroundings does not occur directly. To drink water, for example, we use a glass. To reach an object located in a high place, we climb a ladder. When a child is about to stick their finger inside a socket, they might change their idea following the mother's warning – or for remembering a previous experience of an electric shock. In all these cases, and intermediary element is interposed between the human being and the world. In his work, Vygotski (1896-1934) dedicated some space to study existing filters between the organism and the environment. With the notion of mediation, or mediated learning, he demonstrated their importance for the development of the so-called higher mental processes, namely, planning actions, predicting consequences to make a decision, and imagining objects, among others.

Vygotski's social interactionist theory, according to Gaspar (1993) brings about instruments and input for the understanding and analysis of the teaching and learning process that is developed in non-formal or informal teaching environments. Vygotski sought understanding of the mechanisms through which culture becomes integral part of each human being's nature, and became an exponent of the historical cultural psychological approach, which sees the individual socially inserted in a historically built environment. As a culture disseminator, the environment becomes a source of knowledge. In this theory, social interactions are emphasized in relation to the occurrence of a teaching and learning process in Science fairs, which enable this interaction as a collective space of knowledge construction.

According to Vygotski, higher mental processes such as thought and language, are originated in social processes, therefore, the human being's cognitive

development cannot be understood without referring to their social context. According to his theory, such development is a conversion between social relations and mental structures. Gaspar (1993) understood that this theory defends that the human being's mental development occurs from the inter to the intrapsychic environment, that is, from the social interaction to the individual's interior, basically as a function of speech interiorization. The theory considers the zone of proximal development (ZPD) concept, which corresponds to the difference between the actual developmental level (ADL) and the level of potential development that can be achieved with the help of a more qualified individual. This social interaction is indispensable to the teaching and learning process.

Concerning cognitive development, it refers to the way spontaneous or scientific concepts are developed, according to Vygotski, such concepts are developed in opposed directions, from the highest to the lowest level of complexity, therefore, visiting science exhibitions might optimize the visitors' knowledge advancement, leading them to grasp scientific concepts. According to Vygotski's theory, the scientific concept formal subject transforms gradually the structure of the students' spontaneous concepts and helps them organize these concepts into a system; this promotes students to a higher level of development (VYGOTSKI, 1987).

The educator's role is to mediate the students' knowledge transformation process. A mediated learning is the construction of knowledge carried out through an intermediary link between the student and the environment. Vygotski (1991) also explained that there are two types of mediating elements, namely, instruments and signs, that is, mental representations that substitute real world objects. According to him, the development of these representations occurs, mainly, through the interactions that lead to learning.

Based on this principle, a presentation in a science fair contributes to the cognitive development, acting as a complement of the classroom teaching. At school, educators can revise and expand the content initially approached in studies in preparation for the exhibitions, supplying complementary theoretical instruments for the understanding of new concepts.

Since different students have different abilities and learning styles, each individual has their own pace of progress. Vygotski's historical-cultural theory emphasizes the relevance of the social interaction role. In his opinion, this interaction is one of the greatest factors in students' development. In such approach, knowledge is built socially through effective actions such as the organization of the school work in collective bases (partnerships between students, librarians and educators, for example), thus, the educator is a mediator between the students and the knowledge objects. Students are considered reasoning beings who are able to constitute and develop critical thought. (VYGOTSKI, 1991). Educators are then responsible for providing access to information, guiding its use and contributing to students' the critical thinking process development.

The ZPD concept originally formulated by Vygotski is described, in its most disseminated explanation, as the distance between the actual developmental level (ADL), determined by the students' ability to solve tasks independently, and the level of potential development, determined by their possible performance, with the help of knowledgeable adults or more advanced or more experienced peers.

Thus, the level of potential development is everything that students can only understand with the help of someone that already masters that theme, but a little further, they will certainly understand it by themselves.

The proximal or possible development of a person is the one in which this individual develops by being in a teaching environment with favorable conditions and context to their learning. To create such an environment, the educator must favor students' interaction. For those students who can accomplish a more complex task with somebody else's help, in certain situations, it might be easier to understand the explanation given by a more experienced peer than that given by the educator. For this reason, exchange of knowledge between peers is interesting and must be encouraged.

A practical example that illustrates this exchange is when groups are formed for groupwork in the classroom. According to the individuals' knowledge and the abilities being developed in the activity, the educator might organize the groups or pairs by joining a more experienced student to another that presents more difficulties, so that one can help the other in the activity proposed. In this way, the ones that have already learned have the chance of perfecting their abilities and those who have difficulties will feel challenged to overcome their limitations. It seems relevant to highlight that in certain situations one is more experienced and the other presents difficulties, while in another moment, these roles might be inverted, depending on the competences and abilities developed by individual students. Science exhibitions provide an environment where students and young researchers are constantly exposed to information from the different phases of education and areas of knowledge, either in their exchanges with more advanced peers or with their advising educators. They also put these students in contact with the work of other students and researchers that belong to other institutions, with different approaches to the same themes. The whole situation of an exhibition creates a fruitful environment of closeness between the actual and proximal levels of development. These exhibitions, mediated and guided by educators, expand knowledge already built up by the students and challenge them to understand knowledge developed by their peers and presented in the event, which also challenges them to improve their social abilities.

FEDERAL INSTITUTE OF RIO GRANDE - IFRS AND THE SCIENCE EXHIBITION

IFRS is a public and free education federal institution. Its structure includes 17 campi spread throughout the capital and interior of the state to promote excellence professional and technological education. The rectorate main office is in Bento Gonçalves.

This federal public education institution's mission is to offer professional and technological education, aiming to strengthen the productive, social and cultural means of the communities where it is located. The institute offers initial education and continuous development through short courses, high school technical courses, undergraduate courses and graduate courses at the level of specialization and master's degrees. Currently, IFRS has around 20 thousand students enrolled in over 250 different technical, undergraduate and graduate courses in different modalities and the Youth and Adult Education program (PROEJA). Its staff includes 1,020 educators and 950 technical-administrative personnel.

One of the objectives of federal institutes (FI) is to define policies that cater for regional needs and demands. In this sense, the IFRS presents one of the most significant characteristics that enriches its action, namely, diversity. The campi act in distinct areas such as agriculture and cattle raising, services, industry, winemaking, tourism, and fashion, among others.

It proposes to value education at all levels, contributing to the development of teaching, research and outreach and to the more expressive creation of possibilities of access to free and quality education. At the same time, it caters for local demands, with special attention to the more deprived social classes, which need opportunities of education and promotion of their insertion in the productive world. (IFRS, 2019).

IFRS promotes annually the technical exhibition in all campi, which is a space for exhibitions, presentation and discussion of technical-scientific works and projects elaborated by the federal institute students and workers, members of other FI, elementary and high school students from the municipal, state and private education system, higher education institutions, as well as other organizations that develop teaching, research and outreach projects.

In the context of this study, two exhibitions held by the IFRS were investigated: i) the Research, Teaching and Outreach III Exhibition in the campus Viamão, and the IFRS Research, Teaching and Outreach 19th Exhibition - Campus Porto Alegre – also known as 19th MostraPoA.

The Research, Teaching and Outreach III Exhibition in the Federal Institute of Rio Grande do Sul, Campus Viamão (Figure 1), held on 18, 19 and 20 October 2018, was an event integrating scientific, technological and cultural events, and presented the central theme “Science Reducing Inequalities”.

Figure 1 – Research, Teaching and Outreach III Exhibition, Campus Viamão



Source: IFRS-Campus Viamão (2018).

The presenters in that event included students that were regularly enrolled with the IFRS or other public or private education institutions, IFRS or other private or public education institutions former students, who took part in outreach projects offered by the IFRS. Another group of presenters included citizens linked to non-governmental institutions or organizations in Viamão or its metropolitan region, who developed research or outreach projects involving the local community.

The IFRS Research, Teaching and Outreach 19th Exhibition - Campus Porto Alegre, or 19th MostraPoA (Figure 2), was held on 24th and 25th October 2018. This

event general aim was to contribute to the diffusion of knowledge produced at the research, teaching and outreach dimensions, in the environment of technical and higher education institutions.

Figure 2 – IFRS 19th MostraPoA - Campus Porto Alegre



Source: IFRS-Campus Porto Alegre (2018).

The works accepted were research, teaching and outreach reports by students in the technical and higher education courses of all areas and education institutions. The authors had to be students enrolled with institutions that offered technical or higher education courses in 2018, or those who had concluded their courses in 2017.

METHODOLOGY

According to Ludke and André (1986, p. 2), research is the effort to elaborate knowledge on aspects of one's reality exposing problems and seeking solutions for them. This research was carried out following a qualitative approach, through a case study with an exploratory and descriptive character. Gil (2002, p. 41) explains that exploratory research aims to create more familiarity with the problem, in order to clarify it. A case study, according to Yin (2015, p. 2) investigates a contemporary phenomenon in its real-world context, mainly when the borders between the phenomenon and the context might not be clearly evident. In qualitative research, the researcher is the primary element in data collection and undertakes the role of observer and explorer to reach existing problems, describe them and establish actions.

This study data collection was carried out through observation of events, analysis of official documents of the exhibitions, made available by the federal institute, and the application of interviews to the subjects during the presentation of their works. The interview followed a semi-structured script with guiding questions, which were later on transcribed and whose answers were analyzed based on the theoretical background.

The subjects in this research were selected from their participation in the exhibitions and were students and scholarship holders in the technical and undergraduate courses that developed research and/or outreach activities in the institutions they were linked to. The participants included both sexes and different age groups, who presented research works in the research, teaching and outreach exhibitions at the Porto Alegre and Viamão campi. Three participants from the

campus Viamão and three from the campus Porto Alegre were interviewed. This work neither made distinction between the campus or school that the students came from nor selected prized works, since the Viamão campus did not have this procedure in their exhibition. The participants were interviewed after the presentation of their works, and all received and signed a copy of the Free and Informed Consent Form. The students and scholarship holders interviewed are hereinafter named 'Subjects' and are presented in Chart 1 below.

Chart 1 – Research subjects

Subject	Initials	Age	Sex	Course and campus of origin	Campus
1	MGS	27 years old	male	Agroecology and Organic Production Outreach Project – Viamão	Viamão
2	ADH	34 years old	female	Management Process Technologist – Porto Alegre	Porto Alegre
3	EMSA	56 years old	female	Management Process Technologist - Viamão	Viamão
4	LUF	18 years old	female	Administration technician – Canoas	Porto Alegre
5	GOF	18 years old	male	Computing technician – IFSC - Sombrio/SC	Viamão
6	LAA	18 years old	female	Computing technician integrated to high school - Restinga	Porto Alegre

Source: Santana (2020).

The data collection was carried out through the semi-structured interview guided by points of interest, where, according to Ludke and André, there is not imposition of a strict order of questions and the interviewees talk about the theme proposed with the information they have and that is the focus of the research.

The great advantage of interview over other techniques is that it allows the immediate and current capture of the desired information, practically with any type of informant and on the most varied topics. A well applied interview might allow the treatment of strictly and personal topics, as well as themes of a complex nature and clearly individual choices. It might allow the deepening of issues raised by other data collection techniques of more superficial character such as the questionnaire (LUDKE; ANDRÉ, 1986, p. 34).

The interviews were recorded and fully transcribed, and the whole material transcribed from all interviews was used in the study. The data collected from the answers was organized according to the questions answered to make the data analysis possible.

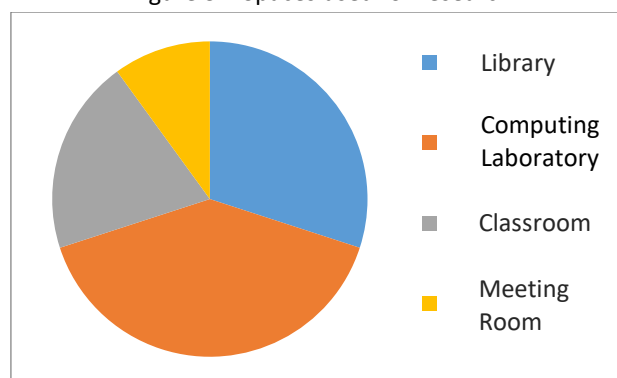
Along with the interviews, the presentations were verified in loco, mainly those focusing on the theme science education. The regulations and procedures of the events were also analyzed, verifying the requirements to register works for participation.

RESULTS: PRESENTATION AND DISCUSSION

The Research, Teaching and Outreach Exhibitions held at the IFRS, Porto Alegre and Viamão Campi, are events that aim to promote students' and the school community's involvement in scientific production and offer a space of dialogue for the exchange of academic and life experiences. The events observed in this study occurred in 2018 and gathered students and educators from several FI Campi, including some from outside the state of Rio Grande do Sul, and from other institutions. It was interesting and satisfactory to realize throughout the development of this study that the students interviewed are aware that the results of the events go beyond the presentation of works and performance evaluation, and they many times reported mainly the partnership developed with their peers and advisors.

The students selected for this study presented their works orally and in posters. After their presentations, they were interviewed about the scientific research process developed to elaborate their works. All the subjects interviewed stated that they felt good for being able to make autonomous choices and develop their activities during the research, including the choice of sources surveyed. Even if some texts were recommended by their advisors, the students showed autonomy to seek their own sources, scientific papers, books and specific informative material, which were mainly selected from digital sources. They also used the space of the library (Figure 3) as a source of research material collection, when mentioning their access to digital sources. They also believe that the library could be better used, due to its relevant role in the intermediation of the access to information wherever it is, either on its bookshelves or on the Internet, as well as regarding the guidance to this access, use and production of information and scientific research.

Figure 3 – Spaces used for research



Source: Santana (2020).

The work presentations observed were significant, since they evidenced the students' preparation for the exhibition. Although they were all quite nervous, they presented their themes properly and showing knowledge. They also supplied complementary information about the theme when asked. An important point is that they all showed mastery of the content and confidence when presenting it. They were happy that people were interested in their speeches, not only family members, school colleagues, and the institution educators, but also students and educators from other institutions and community members. This feeling revealed

by the participants evidences their success at different points of their trajectory up to the moment of the event. The most evident personal achievement mentioned during the interviews was having lost their fear of speaking in public, which was reported by more than one participant as an initial difficulty that if not totally overcome during the research process, was at least well elaborated, so that it neither created difficulties at any point of their presentations, nor hampered their understanding, as confirmed by the observations carried out for this study.

Regarding the works presented, a similarity analysis was carried out to verify what the guiding axes of the 6 projects presented in the science exhibitions were, in relation to teaching, research and outreach. To perform the similarity analysis, the Iramuteq software (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires), developed by Pierre Ratinaud, was used. As shown in Figure 4, extracted from the Iramuteq, the tree presented depicts the interface of the similarity analysis results, identifying co-occurrence of words and the indication of connection between terms. The thicker lines show greater frequency of terms and their relations in the corpus as a whole, while the peripheral zone shows the terms specifically identified with the content of the work presented.

When incidence was analyzed, the words **teaching**, **how**, and **research** presented greater frequency and from these terms, the occurrence of other words that are also important in scientific initiation is observed, namely, production, project, student, campus, practical and knowledge.

Figure 4 – Similarity tree of the works presented



Source: Santana (2020).

As for the objective of science exhibitions: “to put theory into practice, provoking the students’ scientific curiosity, motivating them to apply scientific methodology, stimulating them to raise scientific questions based on their own daily life. It is research as part of the teaching and learning processes”, we could notice that in addition to the main terms highlighted: teaching and research, the

term **how** (our emphasis) can be related to the procedures and the scientific methodology employed in the works. Also, production, project, student, campus, practical, and knowledge, are inserted in the exhibition objectives, showing coherence and commitment to the purposes of the event, which impacted the elaboration, writing and in the practice of presenting the works.

The students were asked in the interview about several points related to their individual participation in the research projects and about the research process they carried out in preparation for the presentation in the exhibition. They all demonstrated to know the research scientific method. They all knew the research phases although some of them talked about them in an empirical and informal way. It became clear that all of them were advised on how to conduct their research following a methodology, some of the students even reported the phases in their interviews. However, some could not demonstrate full understanding of the scientific methodology, since they were not aware of the proper terminology, even if they had followed those steps.

During the data analysis, which was carried out through a case study, following a qualitative approach, some categories were devised that allowed the observation of several aspects of the students' interaction with the scientific research. Although none of them demonstrated to be insecure in relation to their research process, the preparation to present a work in a science exhibition is the ideal time to develop and build up knowledge about the method. Therefore, we understand that for a better preparation of students as future researchers, their advisor teachers should reinforce the concepts and methodology application during the whole work elaboration process. Such procedure should help the students reach the moment of presentation already understanding the process and how they accomplished their results. The subjects also showed to be careful when choosing their research sources, being concerned with their relevance and reliability. Some of the themes worked did not have a large number of information sources for the research, which made the researchers, both educators and students, use everything that they could find, to provide a theoretical support to their work, and even in the practical application of the project. At that point, the importance of the advisors became evident, since they helped their advisees to find sources, select them and even translate texts from other idioms to be used by their students.

The relationship between educators and students was seen to be very close and beneficial regarding the students' scientific initiation. Those professionals supported the students either through the research guidance, emotional motivation or financially, when they needed to buy materials to develop their projects, for example. Advisor educators were always mentioned as supporters by the students, which could be noticed not only in their words, but also due to the enthusiasm of their reports. An exchange relationship was created, which went beyond the teaching activity, since it became a partnership that influenced positively the subjects' personal development. It helped them develop self-confidence and resourcefulness to present their works properly and demonstrating knowledge.

FINAL CONSIDERATIONS

The Science exhibitions organized by the Federal Institute achieved their objective of offering an entrance door and a first step for students who seek to enter the scientific research academic path. The events involved both the institute community and the general community aiming to disseminate the institutional projects developed by their educators and students. They became a joint action between all sectors of the institution in favor of teaching, research, outreach, innovation, and science dissemination. They covered several areas of knowledge with the works presented and showed the plurality of studies carried out and the freedom to research provided to the students.

This study sought to verify the scientific investigation process developed by students in technical and undergraduate courses that took part in the IFRS Research, Teaching and Outreach Exhibitions, at the Porto Alegre and Viamão Campi. Our results led to the conclusion although some of the students do not take part in the proposal of the project themes, since most subjects started to work in ongoing projects, research has a great role in their studies and practical applications. They learn to research in the FI environments and this knowledge is shared with the community in the application and dissemination of their study results. Students that become young scientists in the classroom and under the guidance of advisors in the Federal Institute of Rio Grande do Sul and in other states, develop scientific knowledge as well as social abilities and gain maturity as autonomous and confident citizens.

The Federal Institute incentivizes science dissemination through their exhibitions and it became clear that even in a very initial phase of the students' education, since most of the participants were quite young, this means a lot and makes difference in their education and in their lives. The exhibitions are a process of scientific literacy, in which fundamental steps are followed, namely, preparation, construction, interaction, access and use of sources, elaboration of the final work, and preparation for the communication of the theme researched. Belluzzo (2007) presented patterns and indicators of information competence: a) Pattern 1 – An information competent person determines the nature and extension of the need for information. b) Pattern 2 – An information competent person accesses the necessary information effectively. c) Pattern 3 – An information competent person evaluates critically the information and its sources. d) Pattern 4 – An information competent person, either individually or as a team member, uses information effectively to achieve an objective/obtain a result. e) Pattern 5 – An information competent person understands the economic, legal and social issues of the information use environment and accesses and uses information ethically and legally. Taking that into consideration, it seems relevant to emphasize that the information literacy is a process that leads the person to reach information competence according to the patterns and indicators listed above. Therefore, educators should develop enabling actions, teach subjects that apply these patterns, and guide their students to reach such patterns that promote the education of young scientists with abilities and competences to work on research and live their lives ethically and exercising their citizenship.

The two events observed were successful in gathering participants, and reached the FI community as well as the community in general, which included educators and students from other schools and universities and people in general.

They appealed to anyone interested in acquiring knowledge and attending the presentations. The Research, Teaching and Outreach exhibitions are events that deserve to be supported and incentivized as important means of scientific dissemination, as well as relevant providers of an environment of interaction, teaching and learning.

A INICIAÇÃO CIENTÍFICA NO ÂMBITO DO INSTITUTO FEDERAL DE EDUCAÇÃO, CIÊNCIA E TECNOLOGIA DO RIO GRANDE DO SUL: UM ESTUDO DE CASO DAS MOSTRAS DE PESQUISA, ENSINO E EXTENSÃO

RESUMO

Esta pesquisa apresenta como problema de investigação como ocorre o processo de pesquisa científica, pelos alunos de Cursos Técnicos e Superiores, participantes das Mostras de Pesquisa, Ensino e Extensão do IFRS nos Campi Porto Alegre e Viamão por meio de estudo de caso que utiliza a observação e a entrevista como instrumento de coleta de dados. Analisa o processo de iniciação científica, a competência informacional, a relação com fontes de pesquisa e a mediação de conhecimento existente na relação entre orientadores e orientandos, dos seis alunos participantes dos eventos selecionados para o estudo. Por meio de revisão de literatura, da transcrição das entrevistas e análise de conteúdo das respostas dadas aos questionamentos semiestruturados, apresenta o impacto da participação dos alunos nos eventos observados em seu aprendizado científico e amadurecimento social e emocional. Conclui que o Instituto Federal proporciona ambiente fecundo para a iniciação científica de seus alunos por meio das Mostras de Pesquisa, Ensino e Extensão, com forte participação de seus professores como mediadores no processo de aprendizado dos estudantes para a iniciação científica.

PALAVRAS-CHAVE: Iniciação científica. Mediação. Competência em informação.

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Mailing address: Lizandra Brasil Estabel - lizandra.estabel@poa.ifrs.edu.br

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