

Assessment of scientific literacy levels of IPB students

Gabriel William Lopes^a, Vitor Gonçalves^b

^aUniversidade Federal de Mato Grosso, Cuiabá - MT, Brasil, gabrielwlopes0@gmail.com, ^bCIEB, Instituto Politécnico de Bragança, Portugal, vg@ipb.pt.

Abstract

The higher education institutions use scientific and multidisciplinary electronic publication with an anonymous review process and free access to spread technical and scientific knowledge. The Instituto Politécnico de Bragança (IPB) has two electronic journals with the aim of provoking, in young people, the search for wisdom, scientific spirit, respect for authorship and boosting reading and writing skills. This paper presents an exploratory research that evaluated the student's production and publication from IPB by applying a questionnaire about scientific literacy in the first semester of the 2020/2021 academic year. Participated 102 individuals, majority women, with Portuguese nationality, undergraduate students from Higher School of Education of IPB. The analysis revealed that 71 (69,6%) students have difficulties linked to reading and comprehension skills, just as 82 (80,4%) with scientific writing. That aspect may concern a shortage that debate characteristics of scientific reading, interpretation, and publication. Also, 85 (83.3%) students had not yet published any article, which may require scientific literacy for a better understanding of the scientific method. However, it was possible to note several other types of production developed within the scope of school activities, which may come to stimulate scientific literacy.

Keywords: *Scientific literacy, reading, writing, electronic journals.*

Introduction

The current investigation is related to the Internship of Scientific Innovation developed at Instituto Politécnico de Bragança (IPB) between the 2020/2021 academic year. The referred project aims to stimulate students to improve scientific reasoning by constructing and presenting their papers or articles.

This work corresponds to the subproject named “The scientific writing and the journal *adolesCiência*”, an academic journal owned by the Higher School of Education of IPB. It is a scientific and multidisciplinary electronic publication with an anonymous review process and free access. The *adolesCiência* has, as goals, construct a democratic and safe space for debates and reflections amongst high school and college students; and stimulate the learning of writing and comprehension skills while sensitizing for the development of critical thinking and scientific spirit.

There are some fascinating works in this area, for example, in light of the pedagogical processes in primary and secondary cycles (Hilário & Reis, 2009). Other, which analyses the incorporation of new digital technologies of learning (Rangel, Santos, & Ribeiro, 2009). Besides, a paper articulating the curricular discussion at the higher education level (Gonçalves, 2019). Furthermore, targeting adherence to citizenship values (Esperto, 2013). In addition, Linhares & Reis (2011) developed a study that sees teacher's perspective, where they suggested methodologies that could be allied to increase skills in the field of scientific literacy. Therefore, it is verified the relevance of the discussions about how people appropriate scientific knowledge. It can be in a passive way, in which the contents are just absorbed, or in fact, assimilate the scientific awareness in a way to actively intervene in the socio-cultural context they live.

Three aspects justify the relevance of this paper. Firstly, the study produced a mapping related to the know-how of some nuances that permeate the academic life, such as curriculum, scientific production, academic writing, interpretation and understanding of texts. Secondly, this study points out some possible improvements since it dialogues directly with the needs noted by the students. Thirdly, finally, acts for the articulation between other researches on the subject that may emphasize, for example, the scope of practical actions necessary to level up the informational and scientific literacy. Although this is a specific context, is it possible to generalize that some issues are present in higher education more generally.

So, in the light of that information, the study, of exploratory nature, examined the levels of scientific literacy, using the following axes of analysis: scientific writing, comprehension and production or publication on enrolled students of IPB. The data collected through an online questionnaire sent to the personal student's e-mail. It is not unreasonable to highlight it as a remarkable instrument for assessing the local academic-scientific reality. Considering that, in addition to the data and graphs presented, the study directly reports on the set of interconnected personal, relational and social processes that produce an interesting phenomenon - in this case, the construction, by the students, of a coherent, cohesive and scientific text grounded or substantiated.

Scientific Literacy: concept and historical aspects based on a literature review

Scientific Literacy has North American and French origins, having emerged around the end of the last century. Initially, it was related to the process of science alphabetization and learning. However, with the globalization process and the technological advance of the last decades, the concept gained more relevance, especially in the sense of preparing young people in the school process who should deal with future changes, and in the perspective of stimulating scientific awareness to ensure "validation" and "approval" by the civil society (Carvalho, 2009).

In addition, Morais and Kolinsky (2016) warn about the relevance of scientific awareness - which is not an innate thing but developed throughout schooling - as a tool that helps organize the world into specific conceptual categories. Thus, it enables the individual to build knowledge that is concretely grounded, helping to weave a more comprehensive worldview, in psychological growth and acquisition of new skills, as well as in solving tasks that require this format of rationality.

This debate is also transversally related to the concept of scientific culture, being defined by Coelho, Vogt and Morales (2018) as the meeting point between two actors: Science and society. Thus, the representations built by the latter of the practices that the former performs constitute an indispensable and central element of this link that is materialized through scientific dissemination, the main way in which society appropriates the knowledge produced by Science, affecting and being affected dialectically.

The literature also presents other ideas related: Public Understanding of Science, Public Engagement with Science and Technology or Citizen Science (Granado & Malheiros, 2015). Walking along this line of reasoning, Lordelo & Porto (2012) bring to the core of this theme the discussion on scientific communication and the effective social contributions, i.e., how the discourse of science, in its form and content, has been materialized in cohesive actions with reflections on social development. This prerogative is the basis to think about a process of socially committed knowledge construction.

Thus, based on the studies presented, it is verified the relevance of the discussion about how people have appropriated scientific knowledge, which can be in a passive way in a unilateral education model in which the contents are just absorbed; or in fact, assimilate scientific consciousness in order to actively intervene in the socio-cultural context in which they live.

Methodology

The methodological path adopted is based on the theoretical assumptions of Gil (2002) about the structure and systematic establishment in scientific projects. Besides that, ethical aspects were carefully taken into perspective, considering the contributions of Borges, Barros

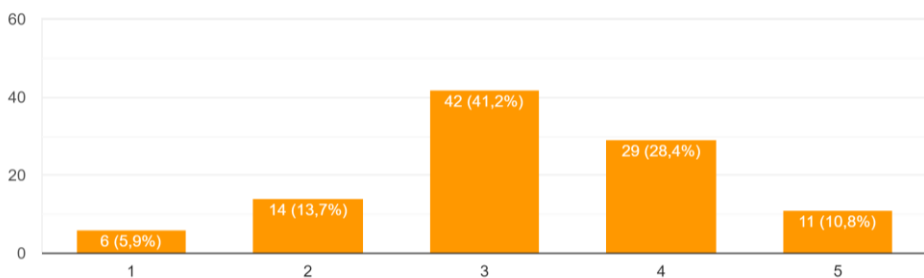
& Leite (2013), who discuss the meanings of principles of ethics in Human and Social Sciences.

In procedural terms, the study applied the instrument Questionnaire about scientific literacy in students at the Instituto Politécnico de Bragança, obtained by Google Forms tools. It was divided into the following areas: i) Free and Informed Consent Term, in which the research was presented, the researchers, its objectives and ensured the conditions of confidentiality and anonymity and the person must mark an option stating that he/she agrees to participate as a volunteer in the study; ii) Literacy of reading, writing and scientific production, arranged in 16 questions that made mention of the object of study; iii) Personal Identification, which contains 09 questions relating to the course, school and other data that may help in the perception of the profile of the participating subjects. The development of the instrument (questionnaire) used to obtain data was based on the studies by Esperto (2013); Gonçalves (2019) and Morais & Kolinsky (2011), which guided the theoretical discussions about the main categories that should be listed in the instrument to assess scientific literacy.

Participated in the research 102 individuals, majority women (73,5%), Portuguese nationality (74,5%), undergraduate students (47,5%) from Higher School of Education of IPB (83,3%). Furthermore, most of the students were in the first (41,2%) or second (44,1%) academic year, belonging to the age group between 21 and 22.

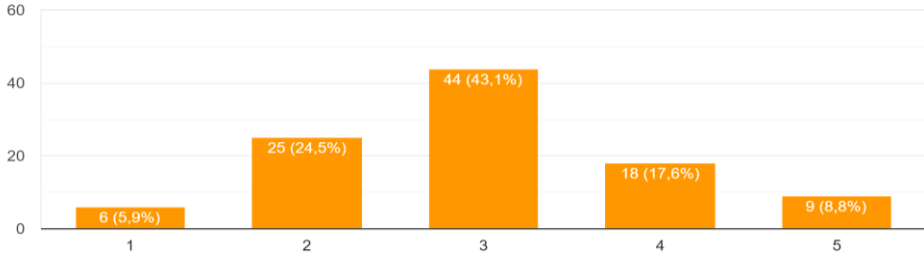
Data analysis and processing

Graphs 1 and 2 denote three relevant facets of the teaching-learning process as they cross by the notion of scientific literacy: reading, understanding, and producing academic-scientific texts. Graph 1 exhibit answers about the difficulty in writing academic papers. The question was examined by applying a Likert Scale ranging from infrequently to very often.



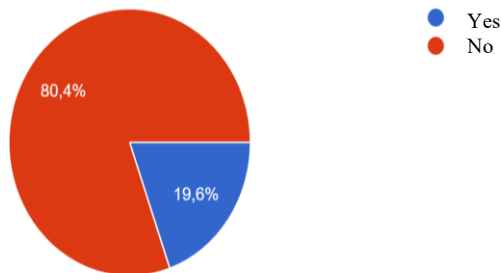
Graph 1 - According to your experience, have you ever had difficulties related to the production of scientific texts?

Graph 2 exposes answers about the difficulty in reading and comprehension of scientific/academic texts. The questions were also made using a Linker Scale ranging from infrequently to very often.



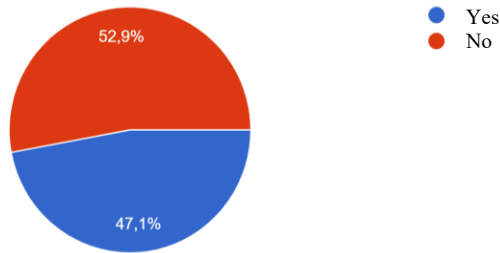
Graph 2 - According to your experience, have you had difficulties reading and comprehending scientific texts?

Both graphs found a very interesting similarity: most of the answers are located in a "midpoint" of the scale. This data provides elements to analyze an aspect already discussed in the literature of the area, which deals with the inseparability between reading, comprehension and scientific production. Based on this assumption, if the student presents some degree of difficulty in one of these points it is natural that the others are also affected since they are intrinsically linked in the process of building scientific knowledge.



Graph 3 - Have you had any course unit-specific about writing and comprehension or even scientific production?

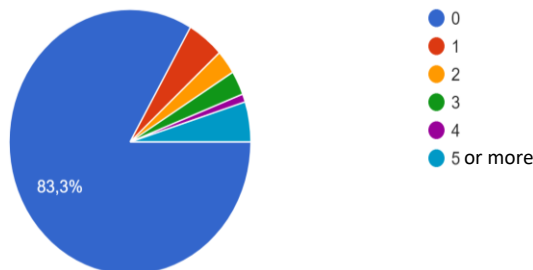
There is a statistical standard very similar when the participants respond about their perception of the presence of course units that dialogue with the development of writing and reading skills required for their area of training and speciality



Graph 4 - Have you participated in workshops or scientific events about scientific writing?

Furthermore, it is also worth noting the low adherence to spaces that discuss transversal themes of scientific literacy in which 80.6%, as shown in Graph 43, have never participated in such training. That can also explain the low supply or dissemination of specific events. The main consequences could be the lack of theoretical and practical of students, which directly reflects in the execution of the tasks requested and, of course, in academic performance in general.

In complementarity, Graph 5 describes the scores relating to the publication of scientific articles, in turn, considered as the most characteristic expressions of the academic field. Following previous results that 83.3% of students have no publications, whilst 4.9% have only one publication; 2.9% of people indicated having two or three published articles; 1% with four and 4.9% five or more.



Graph 5 - Indicate the total number of published scientific articles.

The results showed, for example, that most of the students have already presented some significant difficulty during their training, either on reading, understanding or production of scientific materials. Such data reveals that about half of the participants had no contact with curricular contents which approach these themes.

Final considerations

The present research, of exploratory nature, aimed to evaluate and understand the levels of Scientific Literacy of students of the Polytechnic Institute of Bragança through the application of a virtual questionnaire with questions about reading, writing and scientific production, considering that these are variables that corroborate for the understanding of the theoretical construct object of this study.

The results showed that a large portion of the students has already presented some significant difficulty, either in reading, comprehension or production of scientific papers. This fact is revealed, at the same time, that about half of the participants had no contact with curricular contents that approach these themes. The process of scientific publicization is still very deficient in the group studied, which can be explained by the possible absence of opportunities for this or by the fact that not enough competencies have been developed to help the students for their insertion in the context of scientific journals and periodicals.

Therefore, this study represents to the researcher a mediating element for the evolution of critical thinking, as well, reading and writing skills.

Acknowledgments

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