

Experiments for astronomy teaching: One Decade Review of works presented on the SNEF

J. Oliveira^{1,2} & P. Rodrigues²

¹ Laboratório Nacional de Astrofísica, Itajubá-MG, Brasil, e-mail: joliveira@lna.br, jandersonfba.unifei@gmail.com

² Universidade Federal de Itajubá, Itajubá-MG, Brasil, e-mail: palomaraap@unifei.edu.br

Abstract. In this work, a survey was carried out in researches that present experimental practice as a tool for teaching astronomy in schools, through a bibliographical review of the works published between 2011 to 2015 editions at the Simpósio Nacional de Ensino de Física (SNEF). Among the main results obtained, it was verified that there was no significant increase in the number of proposals that bring the experimental practice as a teaching method. In most cases, experimental practice was used as a demonstration tool for a specific concept. In addition, it was verified that there are studies that seek to develop proposals that allow the inclusion of students with visual and hearing disabilities.

Resumo. Neste trabalho, foi realizado um levantamento em pesquisas que apresentam a prática experimental como ferramenta de ensino da astronomia nas escolas, através de uma revisão bibliográfica dos trabalhos publicados entre as edições de 2011 a 2015 do Simpósio Nacional de Ensino de Física (SNEF). Entre os principais resultados obtidos, verificou-se que não houve aumento significativo no número de propostas que trazem a prática experimental como método de ensino. Na maioria dos casos, a prática experimental foi usada como uma ferramenta de demonstração para um conceito específico. Além disso, verificou-se que existem estudos que buscam desenvolver propostas que possibilitem a inclusão de alunos com deficiência visual e auditiva.

Keywords. Teaching of Astronomy – Publications – Bibliography

1. Introduction

In the last decades, there has been a considerable increase in the academic work on the teaching of astronomy (Langhi & Nardi 2014). However, this increase does not imply that astronomy teaching has become better or more efficient, but it does demonstrate that this theme has gained ground in science education research. This aspect can be explained by the incentive of the teaching of astronomy contents present in official documents, such as in the Parâmetros Curriculares Nacionais (PCN) (Brasil 1997), and PCN+ proposals (Brasil 2002).

Despite the efforts of researchers in this area to propose possible solutions to the problems of astronomy teaching, there is still a gap between the results obtained and the effectiveness in the classroom of these proposals for improvement. Among these proposals, one has the use of practical activities to work on a particular astronomy theme.

2. Main Goals

In this work we have realized a survey of the types of proposals that bring the experimental practice as instrument for the teaching of astronomy. In addition, the objective is to verify the nature of the proposals of the experimental activities in relation to the methodology used. Therefore, it was decided to carry out a bibliographic review in articles published in the years 2011, 2013 and 2015 at the Simpósio Nacional de Ensino de Física (SNEF).

3. Methodology

To simplify the presentation of the methodology, we elaborated a diagram that shows the steps made during this study, in Figure 1 we present this diagram.

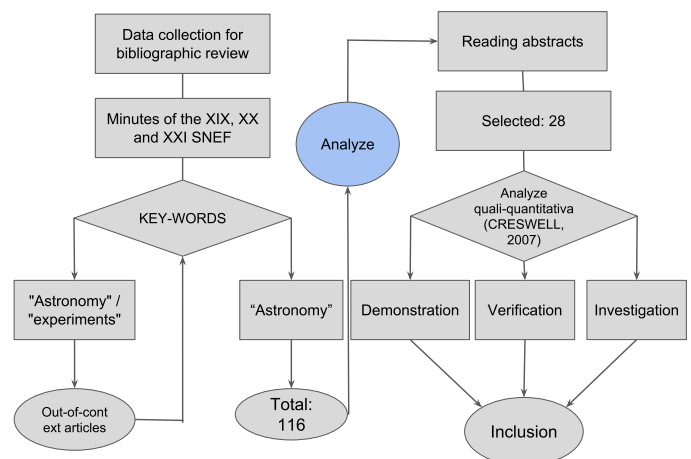


FIGURE 1: Here we present the methodology by means of a diagram.

4. Results and Analysis

Table 1 shows the number of papers selected for each of the analyzed editions of the SNEF. In Figure 1 we have the analysis of how these experiments are being proposed and what type of approach is being used, where it was evaluated according to the definitions proposed by the authors Araújo & Abib (2003). These are the modality of demonstration, that of verification and that of investigation.

When analyzing the graph of Fig.3, we can see a greater occurrence of proposals with experimental approaches of the demonstrative type, which can be explained by the fact that this type of approach has a more simplified methodology, since its main characteristic is to illustrate a certain physical phenomenon

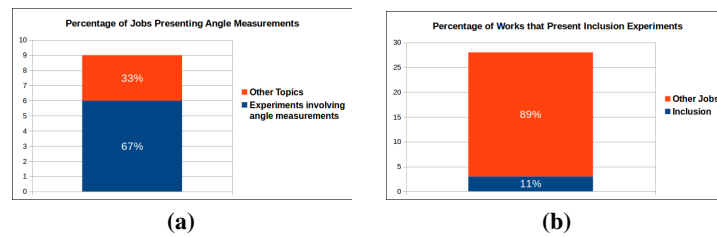


FIGURE 2: Fig.2a shows the graph of the distribution of the verification activities that propose as a proposal the measurements of the angles of stars, in relation to the total number of works found with this type of approach. In Fig.2b we have the relation of the proposals with inclusion activities.

Table 1: Distribution of analyzed articles

EDITION (year)	WORKS ON ASTRONOMY	WITH EXPERIMENTAL ACTIVITIES	PERCENTAGE (%)
XIX (2011)	33	09	27
XX (2013)	39	09	23
XXI (2015)	44	10	22

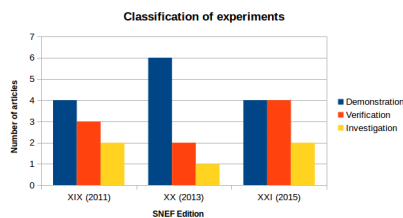


FIGURE 3: Graph of the classification of the experiments

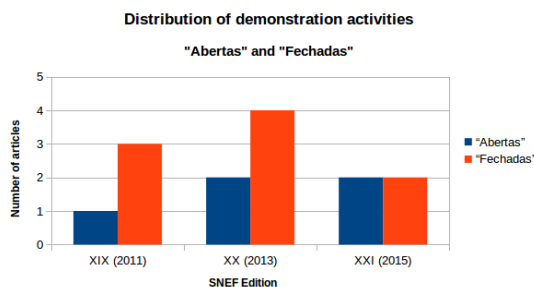


FIGURE 4: Graph of the distribution of demonstration activities.

that intends to be studied (Araújo & Abib 2003). However, this type of approach can contribute more significantly to the teaching-learning process of individuals, provided that a strategy is adopted that allows students to hypothesize about the phenomena that are being demonstrated. To do so, these proposals should present a greater openness to discussions, being this type of proposal defined as "Demonstrações do Tipo Fechadas" by the researchers Araújo & Abib (2003).

However, when analyzing the methodology proposed in these activities, it was verified that the majority presents a strategy of experimental activity focused on the simple observation of the phenomenon (Fig.4). In which most of the proposed activities were the use or preparation of a model of the solar system. For the researchers Araújo & Abib (2003) this type of activity is classified as "Demonstrações do Tipo Fechadas".

In relation to the verification activities, which has as main characteristic the search for the verification or validation of a

physical law, or even the limits of validity of such law (Araújo & Abib 2003), it was verified that the analyzed proposals have approaches that allow to the students only a verification of the phenomenon that was being studied. So the topic covered in most of the proposals was the measurement of angles in the celestial sphere of some stars, such as the Moon and the Sun (Fig.2a). So, only 3 articles were found that presented different themes, with the following topics: the measurement of the polarization of light; electromagnetic spectrum verification; verification of the local value of gravitational acceleration.

In relation to the proposals that address experiments aimed at the inclusion of people with disabilities, only 3 proposals were found in all the analyzed editions of the SNEF. It is worth mentioning that these 3 proposals were also evaluated in terms of the type of approach presented and were recorded in the previous analyzes related to demonstration, verification and investigation activities.

5. Conclusion

In this work, it was verified how the experimental activities for the teaching of astronomy are being used. A decrease in the proportion of articles of this nature was observed in relation to the total number of works found (Table 1), which may be indicative of a reduction in the interest of the authors in the use of experimental practices for the teaching of astronomy. It was also verified the preference in the use of the demonstrative approach. However, practical activities may offer more to students than the mere observation of a phenomenon, where other types of approaches must be explored that can contribute more significantly to the process of teaching and learning of students.

Acknowledgements. This work was funded by the Laboratório Nacional de Astrofísica. We also thank the Universidade Federal de Itajubá for giving us the opportunity to carry out this work.

References

- Araújo, M. S. T., & Abib, M. L. V. S. 2003, *Revista Brasileira de Ensino de Física*, Vol. 25, No. 2, p. 176.
- Brasil. Secretaria de Educação Média e Tecnologia. *Parâmetros Curriculares Nacionais: ciências naturais*. Brasília: MEC/SEMTEC, 1997.
- Brasil. Secretaria de Educação Básica. *PCN+ Ensino Médio: orientações educacionais complementares aos Parâmetros Curriculares Nacionais para o Ensino Médio – Ciências da Natureza, Matemática, e suas Tecnologias*. Brasília: MEC/Semtec. 2002.
- Creswell, J. W., 2007 *Projeto de pesquisa: métodos qualitativo, quantitativo e misto*. Porto Alegre: Artmed, 211.
- Langhi, R., & Nardi, R. 2014, *Revista Brasileira de Pesquisa em Educação em Ciências*, Vol. 14, p. 41