

# Overview of the Astronomy Education Research landscape

Paulo S. Bretones

Departamento de Metodologia de Ensino/UFSCar, Brazil  
Email: [bretones@ufscar.br](mailto:bretones@ufscar.br)

## 1. Introduction

When the landscape of a research area is analyzed, its scientific production is mainly identified by the following publications: theses, conference proceedings and journal papers. To investigate this output the works may be classified and analyzed by the categories: year, country, institution, grade level, topic/content, focus of study in education, type of academic research, theoretical framework. The present work deals with review articles published in Astronomy Education Research (AER), their results and suggestions. Examples of surveys and summary reviews are: [Wall \(1973\)](#); [Bishop \(1977\)](#); [Bailey & Slater \(2004\)](#); [Bailey, Prather & Slater \(2014\)](#); [Slater \(2008\)](#); [Lelliott & Rollnick \(2010\)](#); [Franknoi \(2014\)](#). Some articles also published reviews about students' conceptions of astronomy concepts as [Trumper \(2001\)](#).

About reviews of proceedings, as an example, [Bretones & Megid Neto \(2011\)](#) analyzed 283 papers dealing with astronomy education published in the IAU proceedings from 1988 to 2006. The results show the majority of each category as: country (USA-35.6%); grade level: university education (37.8%) and public outreach (27.6%); focus: non-school-programs (28.3%), curricular programs (26.3%) and teaching materials (18.4%); content: General (83.4%); type of academic research: Reports of Education Experience (R&D, Reports of Practices etc.): (67.5%). 87.6% did not show any theoretical frameworks.

Concerning journals [Lelliott & Rollnick \(2010\)](#) reviewed 103 peer-reviewed journal articles from 1974 to 2008 using a conceptual framework of "big ideas" in astronomy, five of which accounted for over 80% of the studies: conceptions of the Earth, gravity, the day-night cycle, the seasons, and the Earth-Sun-Moon system. Most of the remaining studies were of stars, the solar system, and the concepts of size and distance. About published papers in journals, an example of analysis can be seen in [Bretones, Jafelice & Horvath \(2016\)](#) about the first ten years of the Latin-American Journal of Astronomy Education (RELEA), with 103 articles published in 24 editions (2004 – now) and some discussions about the Teaching of Astronomy in Asian-Pacific Region which published 20 issues featuring 171 articles (1990-2003) and Astronomy Education Review which published 19 issues featuring 255 articles (2001-2013). These surveys show trends and gaps, already discussed in the literature of the area and point towards the less addressed contents and recommendations for further work.

The answers to a questionnaire of IAU CC1 and WG on Theory and Methods in Astronomy Education members about the achievements and challenges of AER are discussed. About the achievements and impacts of AER mentioned in the last decades were: effective techniques for teaching astronomy; construction of a variety of concept knowledge inventories; strategies for alternative conceptions assessment and development of classroom techniques to overcome them; development and evaluation of active learning; creation of journals; publications of theses or dissertations, conference proceedings and journal papers. Among the objectives and challenges of AER for the next decades, our

colleagues mentioned: consolidating the achievements; deeper treatments dealing with epistemological questions; increasing the methodological rigor; development of models to connect new technologies in a variety of contexts and instruments to probe student attitudes; astronomy to improve science education and to link other branches of culture; investigate the roots of astronomy in each nation and respect multiculturalism. Regarding the efforts of the WG, recent surveys of publications from some countries are also shown evidencing the dispersion of AE literature. The role and goals of astronomy teaching should be discussed considering contents, methods, levels, resources and purposes. Given the needs and complexity of education nowadays and the role of astronomy in this context, the potential of education research is also evaluated, considering knowledge, practices, policies and the training of teachers.

An important issue is about the formation of a community in an area where the astronomers are trained as scientists and the need of training of education researchers. About this, the different approach of hard sciences, that advance from their points of arrival differently from the social sciences in which education is inserted that advance from their starting points is pointed out and discussed. Because of this, educational sciences have lack of memory and for their researches, it is necessary to know about what have been done and previous results as mentioned by Charlot (2006). Considering the memories of the publications on astronomy education research and accepted astronomy teaching practice, Franknoi (2014) mentions the importance of a journal for the community.

Finally, collaborations for surveys, literature reviews and the advertisement of such materials, aiming to strengthen the training of researchers and the practitioners as well are also encouraged.

## Acknowledgements

I would like to express my deepest thanks to Jorge E. Horvath for his suggestions. I also thank the IAU and FAPESP for the travel grants and financial support (grant 2018/07912-9, São Paulo Research Foundation (FAPESP)).

## References

- Bailey, J. M., Prather, E. E. & Slater 2014 *T. F. Advances in Space Research*, 34, p. 2136–2144
- Bailey, J. M., & Slater, T. F. 2004 *Astronomy Education Review*, 2, p. 20–45
- Bretones, P. S.; Jafelice, L. C. & Horvath, J. E. 2016, *Journal of Astronomy & Earth Sciences Education*, v. 3, n. 2, p. 111–124
- Bretones, P. S. & Megid Neto, J. 2011, *Astronomy Education Review* v.10, n. 1
- Bishop, J.E. 1977, *Science Education* 61, p. 295–305
- Charlot, B. 2006, *Revista Brasileira de Educação* v. 11 n. 31. p. 7–18
- Fraknoi, A 2014, *Journal of Astronomy & Earth Sciences Education* 1, 37–40
- Lelliott, A. & Rollnick, M. 2010, *International Journal of Science Education*, 32, 1771
- Slater, T. F. 2008, *Astronomy Education Review* 7, 1
- Trumper, R. 2001, *International Journal of Science Education* v. 23, n. 11, p. 1111–1123
- Wall, C. A. 1973, *School Science and Mathematics*, 73, p. 653–669