



AstroBVI: An Astronomical educational kit for the Blind and Vision Impaired community in Latin America

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Resumen / AstroBVI es un proyecto de Astronomía inclusiva financiado por la Oficina de la Astronomía para el Desarrollo de la Unión Astronómica Internacional (IAU–OAD). BVI responde a las siglas en inglés de la comunidad formada por personas con discapacidad visual (*Blind and Visually Impaired*), quienes a menudo se ven excluidas de las actividades educativas y de divulgación en relación a áreas de conocimiento visualmente intensivas, como en el caso de la Astronomía. Con este proyecto queremos ayudar a derribar las barreras entre la ciencia y la discapacidad, para llevar la belleza de la Astronomía a un público con discapacidad visual, independientemente de su género, su riqueza y su estatus social. En AstroBVI estamos creando y distribuyendo *kits* educativos compuestos por mapas táctiles de galaxias en 3D acompañados por un manual y material multimedia en Español y Portugués. El proyecto se desarrolla desde el Centro de Astronomía de la Universidad de Antofagasta, en colaboración con un equipo de 20 colaboradores internacionales, incluyendo astrónomos profesionales y especialistas en educación inclusiva.

Abstract / AstroBVI is an inclusion Astronomy project funded by the Office of Astronomy for Development of the International Astronomy Union (IAU–OAD). BVI responds to the Blind and Visually Impaired community, which are often excluded from outreach and educational activities in relation to visually-intensive areas of knowledge such as astronomy. In this project we aim at breaking down the barriers between science and disability, to bring astronomy’s beauty to a visually-impaired public, independently of gender, wealth, and social status. We are creating and distributing educational kits composed of tactile 3D maps of galaxies accompanied by a manual and multimedia material in Spanish and Portuguese. The project core team is based in the Astronomy Center of the University of Antofagasta, with a team of 20 international collaborators, including professional astronomers and specialists on education and inclusion.

Keywords / miscellaneous — galaxies: general

1. Introduction

The World Health Organization (WHO) estimated 285 million people are visually impaired worldwide (2014*). In spite of this large number, Blind and Visually Impaired (BVI) people are often excluded from outreach and educational activities in relation to visually-intensive areas of knowledge such as astronomy.

There are many astronomy educational resources at all levels in the web. However, the great majority are written in English. It is far less common to find resources in the dominant languages of South America, such as Spanish or Portuguese. Even fewer are specifically oriented and designed for the BVI community, where “blindness affects between 1 % and 4 % of the population of Latin American countries” (IAPB**), making it extremely difficult for BVI populations in the target region to get introduced to the wonders of the sky.

In AstroBVI***, we aim to make astronomy in general, and galaxies in particular, more accessible to chil-

dren with visual impairments. We have created an educational kit composed of tactile 3D maps of galaxies accompanied by a manual and multimedia material, to be distributed to many countries in Latin America.

With this kit, we want to complement the few existing astronomical education kits in Spanish (including Portuguese), and also address the challenge on being able to bring knowledge on more complex concepts as galaxies, star formation, and electromagnetic spectrum.

2. The AstroBVI project

AstroBVI is one of the 16 projects selected to receive funding in 2018 by the IAU-Office of Astronomy for Development’s (OAD) sixth annual call for proposals****, within the Task Force-2: Astronomy for Schools and Children.

Our aim is to design, create and share an astronomical educational kit (accompanying with the conception and realization of an international online workshop) that will benefit from the experience learned during past complementary OAD-funded projects, such as “Touch of

*http://www.who.int/gho/publications/world_health_statistics/2014/en/

**<https://www.iapb.org/>

***www.AstroBVI.org

****<https://www.iau.org/news/announcements/detail/ann18003/>

the Universe”^{*} and “Astronomy with all Senses”^{**}, and in collaboration with the “Tactile Universe”^{***} team, which has started to run astronomy outreach activities with the Portsmouth BVI Community, and the Galileo Teachers Training Program (GTTP^{****}).

Chile, considered as the World Capital of Astronomy, benefits from a strong, well-established outreach program. The core team is located in the Center of Astronomy of the University of Antofagasta, in Antofagasta, which is the largest city in Northern Chile. The weather conditions in this region provide a unique quality for astronomical observations. Some of the most important observatories are located in the region, as ALMA and VLT. From this region, in close collaboration with astronomers over the world, we provide a fertile starting ground to grow and extend the understanding of the sky to children, students, and general public with vision difficulties, not only in Chile but also in Latin America. Overall, we aim at reaching no limits in research in astronomy, only the desire to learn, to feed curiosity and scientific thinking, where no child feels limited to do what they are passionate about, and promoting engaging with family, friends, teachers, and other support workers. With this aim, our team is composed of 20 collaborators located worldwide, from professional astronomers and outreach coordinators, to education specialists, on working with people with disabilities and risk for social exclusion.

3. The AstroBVI kit

All we know about galaxies so far is due to the study of the light that comes from them. But how can we bring these concepts to the BVI community?

The AstroBVI educational kit is made up of 3D tactile maps of different galaxies and different wavelengths (colors). In this regard, collaboration with the Tactile Universe team is central to the project. They have developed 3D galaxy maps, in consultation with a BVI group, and started activities to engage the BVI community in the UK. They proved that plastic tactile maps offer good cognition and excellent perception by visually impaired people (Bonne et al., 2018). We draw on their experience and work closely with them to incorporate their resources in our project. What we do is therefore transform images of galaxies from the Digitized Sky Survey (DSS Springob et al., 2007) in fits format into a format that can be read by 3D printers. So we can print galaxies!

The sample of galaxies composing the AstroBVI kit has been selected according to morphology and the experience in previous activities developed by the Tactile Universe team. The AstroBVI kit is therefore composed of tactile images of the following galaxies:

M100: a face-on spiral galaxy, observed in the photometric *B*-band,

^{*}<https://astrokit.uv.es>

^{**}<http://www.astro4dev.org/blog/category/tf3/astronomy-with-all-senses>

^{***}<https://tactileuniverse.org>

^{****}<http://galileoteachers.org>

M109: an inclined spiral barred galaxy, observed in the *B*-band,

M51: a face-on merger galaxy composed of a spiral and an elliptical galaxy, observed in the *R*- and the *B*-band,

M105: an elliptical galaxy, observed in the *R*-band, and

NGC5866: a lenticular galaxy, observed in the *R*-band.

The kit is complemented with the DSS images of the galaxies used to create the tactile maps, colored images of the galaxies, a guide to help to touch each galaxy (text and audio formats), lessons for the AstroBVI teachers, and a video-manual^{*} of the use of the kit. All multimedia material will be hosted in the web of the project (www.astroBVI.org) and available in Spanish and Portuguese. The galaxy models will be also available under a creative commons (CC BY-NC-ND 3.0) license.

The AstroBVI kit was successfully tested in an activity carried out in the University of Antofagasta, in collaboration with the *Programa de Integración Escolar* (PIE^{**}) of the *Corporación Municipal de Desarrollo Social* (CMDS^{***}) of Antofagasta. The AstroBVI kit is also part of “Spining Stars”^{****}, a world exhibition on Accessible Astronomy organized by the IAU (see Fig. 1). AstroBVI participated as part of “Astronomy for All”[†], a cooperation of Chilean astronomical institutions helping to bring astronomy to everyone in an accessible way.

4. The AstroBVI teachers

Our project would be meaningless without the AstroBVI teachers. We made use of the social media (facebook[‡] and twitter[§] accounts), to make a global call for educators working with BVI students (with and without Astronomy knowledge), and astronomers, science communicators, and outreach coordinators developing public activities with the BVI community, or willing to include them in their activities.

We have received more than 120 applications from many Latin American countries, but also from Spain and Nepal (see Fig. 2). At the present time, with the available funding from the IAU-OAD and some external funding from collaborators of the project, we have selected 100 AstroBVI teachers to receive a kit. Since the selected AstroBVI teachers come from different background, we have invited them to participate in an international online workshop in early 2019. In this workshop, the AstroBVI team and collaborators will offer capacity building by training teachers and educators working with the BVI community in the different countries. We are working with the GTTP team to provide GTTP certification. AstroBVI teachers are also invited to join

^{*}<https://youtu.be/fLFJ-KcV7dQ>

^{**}<http://www.cmds.cl/pie/>

^{***}<http://www.cmds.cl/>

^{****}<https://sites.google.com/oao.iau.org/inspiringstars/>

[†]<http://astronomia.udp.cl/>

chilean-accessible-astronomy-on-iau-inspiring-stars-exhibition.org/

[‡]<https://www.facebook.com/AstroBVI/>

[§]<https://twitter.com/AstroBVIproject>



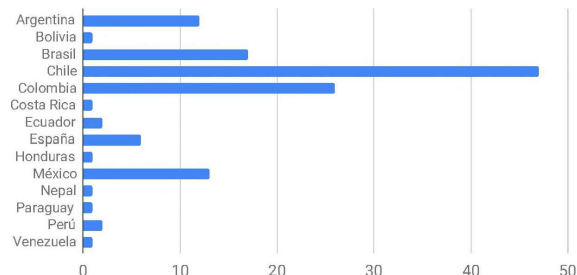
Figure 1: Upper panel: Example of the kit AstroBVI sent to the "Inspiring Stars" IAU exhibition. Lower panel: Image taken during the AstroBVI activity developed at the University of Antofagasta. We tested the AstroBVI lessons on solar system and galaxies, specially designed for BVI students to use the tactile galaxy images, in combination with other low-cost and recycled materials.

a Facebook group*, which we expect to work as a community to share activities and discuss about Astronomy and Inclusion in Latin America in the next years. We also plan to apply for additional external funding so that AstroBVI reaches many more places!

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*<https://www.facebook.com/groups/287760201854708>

¿En qué país te encuentras? / Em que país você está? / In which country are you?



¿Cual es tu nivel de Astronomía? / Qual é o seu nível

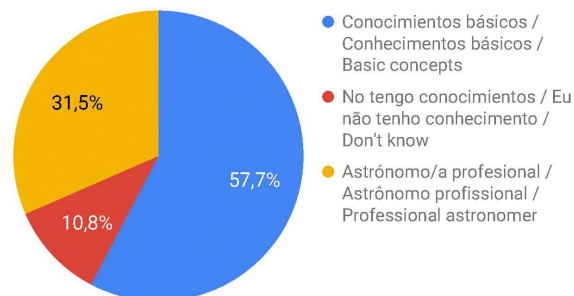


Figure 2: Results of the call for AstroBVI teachers (Spanish and Portuguese languages only). Upper panel: Number of applications per country. Lower panel: Percentage of Astronomy knowledge of the applicants.

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