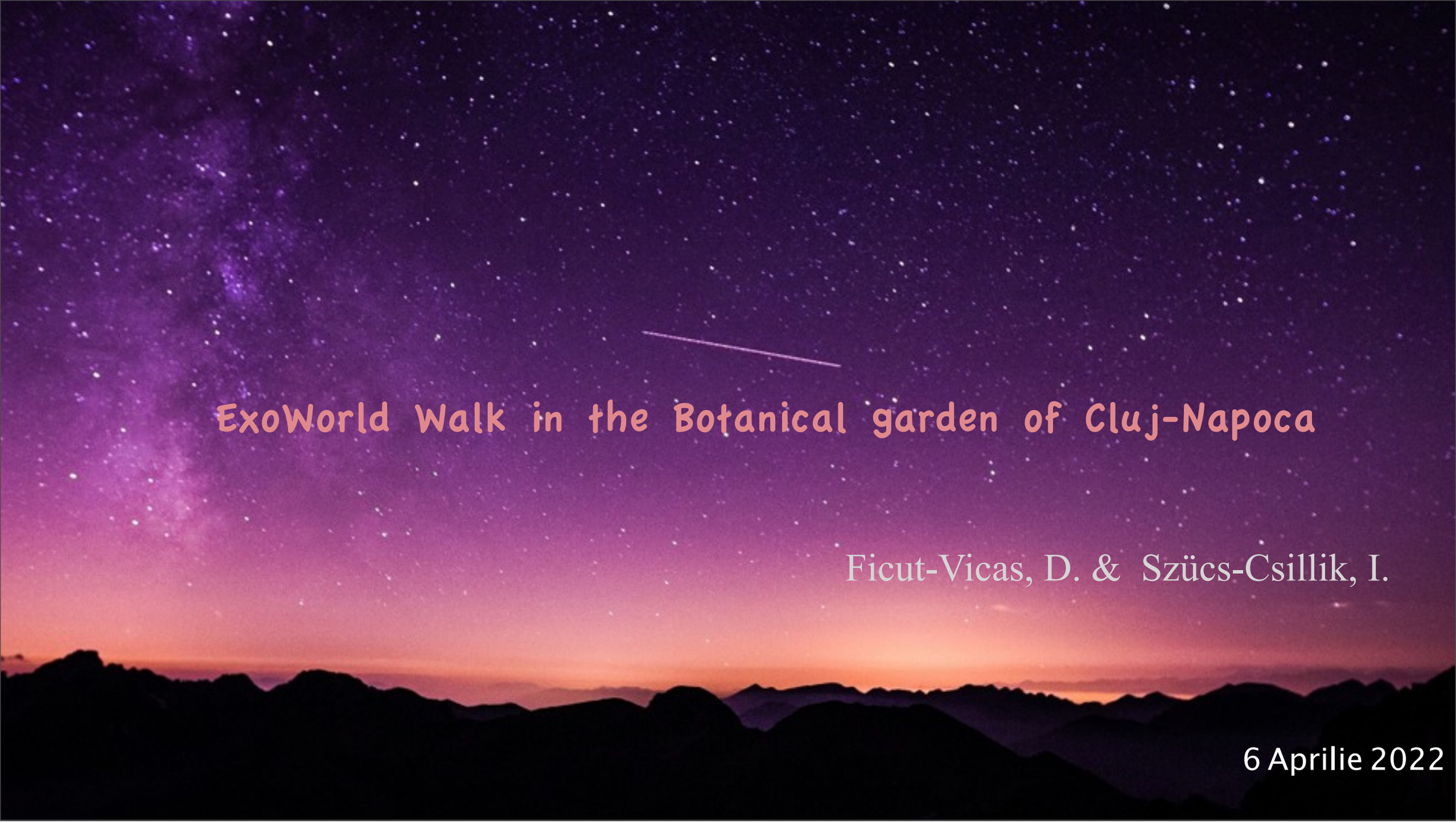

ExoWorld Walk in the Botanical garden of Cluj-Napoca
Ficut-Vicas, D. & Szücs-Csillik, I.
6 Aprilie 2022

Presentation Overview

1. Astronomy more than a science
2. Astronomy and its multiple dimensions
3. Astronomy Education Research
4. ExoWorld Walk Project Presentation
5. Astronomy Education Research (AER) within the ExoWorld Walk project
6. Conclusions & Future Work

Astronomy more than just a science

Astronomy “the crown of all sciences” (N. Coculescu), as all sciences extend into astronomy once they dwell upon unearthly things.

Legatura dintre Astronomie și Agricultură

Astronomy is one of the oldest sciences in the world and it has been the heart of many revolutions of thought.

Astronomy is an inspiration

Astronomy has pushed engineering and technology to the limit and beyond in the quest to collect information from as many photons as possible.

Astronomy makes this world better.

WHO should take action to implement SDGs?

Governments and policy Makers

NGOs and other non-profit organisations

Engineering and Industry sectors

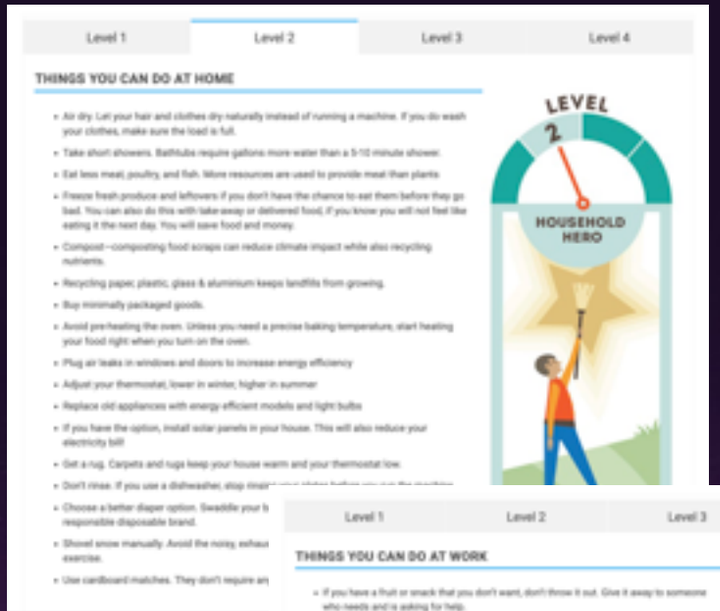
Research sector

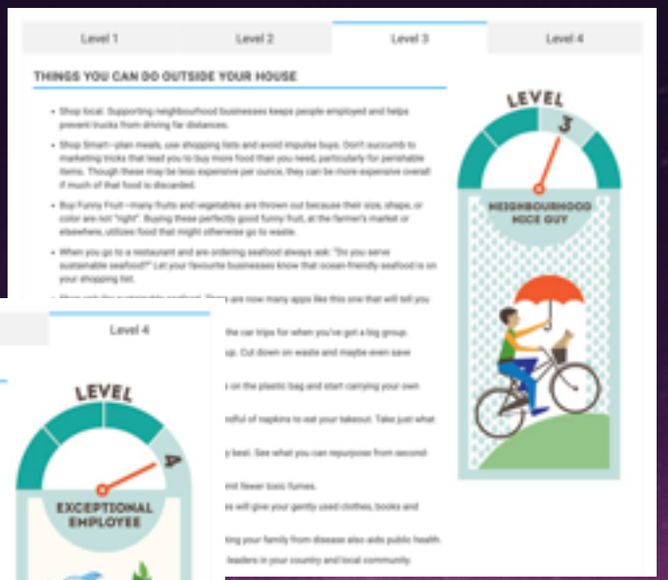
Private sector

You, Me, Everybody

Explore the Interactive Map of SDGs at: https://dashboards.sdgindex.org/map

Why should we take action to implement the SDGs?





Source : https://www.un.org/sustainabledevelopment/takeaction/

Implementing SDGs is not about changing your career is about SUPERPOWERS

If given the choice, I bet all of us would like to be SUPERHEROES.

What is your super power?

Put in balance what you are good at, what you are passionate about and how to employ Your talent for a better world.

Now What is your super power?

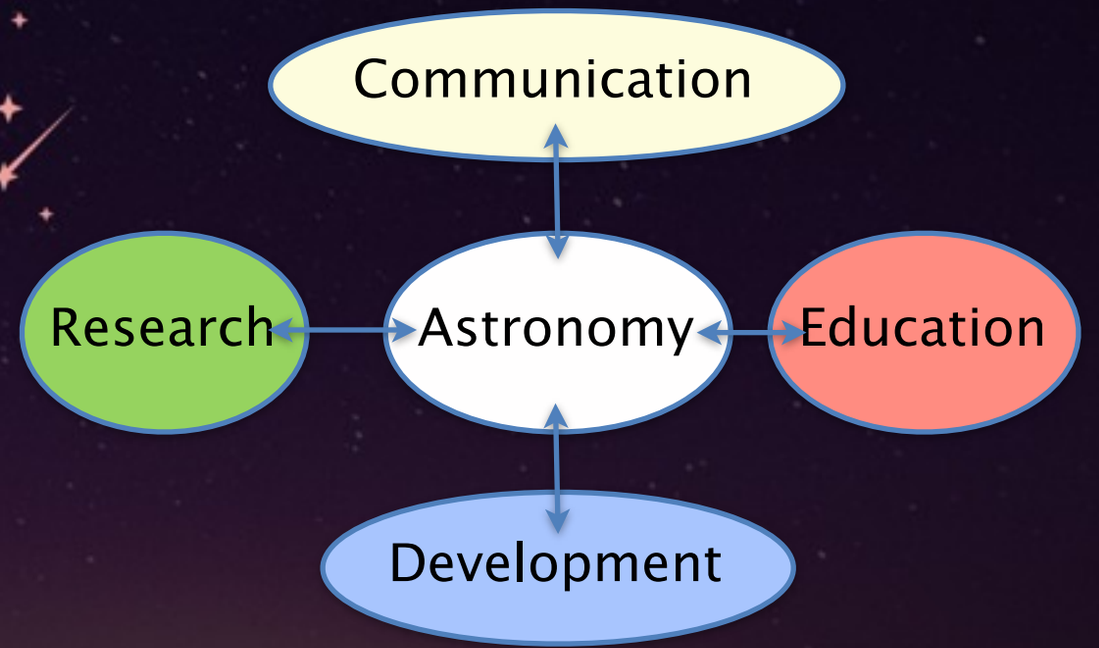
How does Astronomy "blend in" into Sustainable Development?

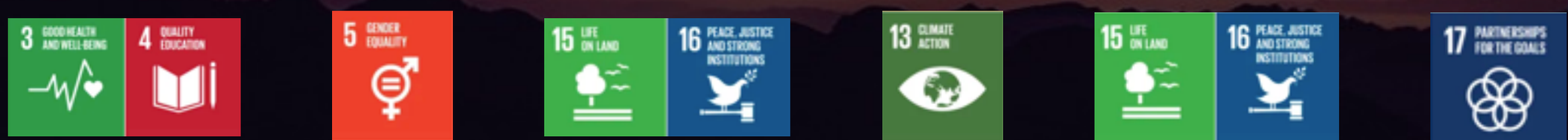
★**Through interdisciplinary connections with other fields**

★**Through knowledge transfer**

★**Through self-sustainability**

★**Through "meeting half way" with the needs of humanity**

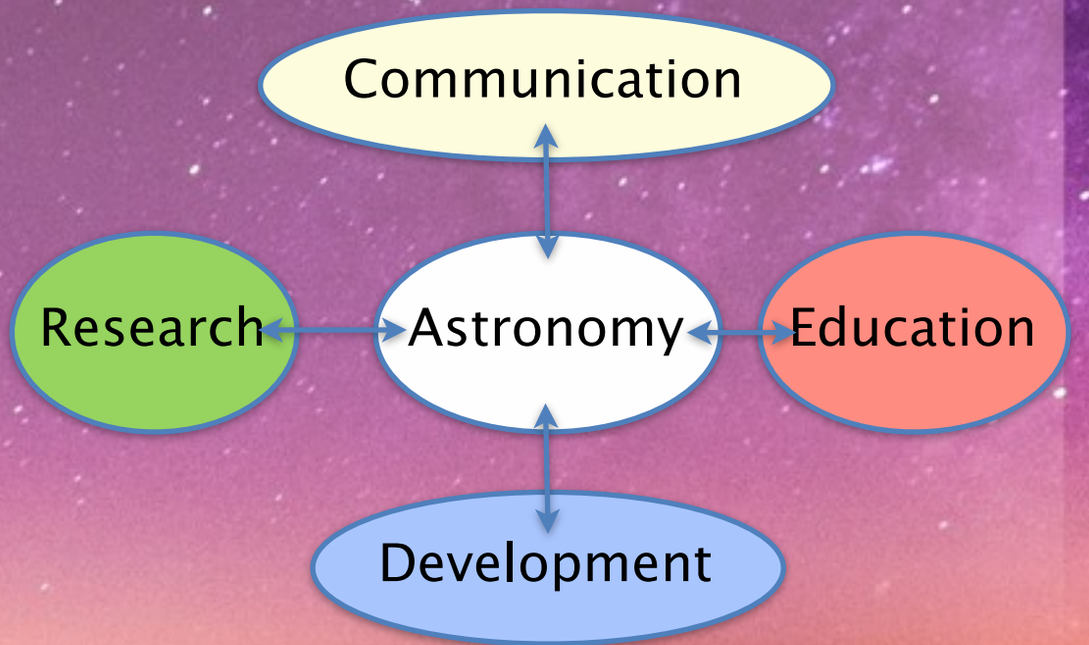




Astronomy and its multiple dimensions

D1. Astronomy Research
D2. Astronomy Communication
D3. Astronomy Education
D4. Astronomy Development

"The IAU is the international astronomical organisation that brings together more than 12 000 active professional astronomers from more than 100 countries worldwide. Its mission is to promote and safeguard astronomy in all its aspects, including research, communication, education and development, through international cooperation."



Astronomy and its multiple dimensions

PROGRAM III: STUDIES OF HISTORY AND ASTRONOMY EDUCATION

Project III.1: History studies and astronomical education in Romanian and European context

Study of Early Romanian Contributions to Astronomy
Archeo-astronomy studies
Studies on astronomy teaching methodology

Communication: a responsibility of all scientists

Interacting with journalists can help scientists communicate their research Copyright: David Dickson

The scientific community should commit to communication as an integral part of a researcher's professional role.

What responsibility does a scientist have to society?

Until recently, replies to this question generally fell into two categories. Those in the 'traditional' camp argued that a scientist served society best by simply carrying out high-quality research, leaving others to judge how it should be used.

Astronomy Education Research (AER)

Achievements of AER in the last decades:

- effective tecqniques for teaching astronomy
- constrction of a variety of concept knowledge inventories
- strategies for alternative conceptual assessment and development of classroom techniques to overcome them
- development and evaluation of active learning
- creation of journals

(Bretones et al. 2019)

Astronomy Education Research (AER)

Challenges and objectives of AER :

- consolidate the achievements
- deeper treatments dealing with epistemological questions
- increase the methodological rigor
- development of methods to connect new technologies in different contexts
- instruments to probe students attitudes
- astronomy to improve science education
- astronomy for multiculturalism

(Bretones et al. 2019)

ExoWorld Walk Project

ExoWorld Walk Project touches on all the 4 dimensions of astronomy and contributes to SDG4, SDG13 and SDG17

ExoWorld Walk

Project Coordinators: Ficut-Vicas,

(Image source: Composite of

The Idea

Sometimes a simple change of perspective inspires deeper understanding! We propose for the visitors of the Botanic Garden of Cluj-Napoca to take a different path and look at the same plants and make new connections between Nature and the Universe, between astronomy and biology and reflect upon the miracle of life. Then, explore further the new concepts gained through a webpage and a workshop and test their abilities and understanding in an online competition.

ExoWorld Walk Project

Project Partners:

Astronomical Observatory Cluj-nApoca of the Cluj-Napoca Branch of the Romanian Academy

Botanic Garden of Cluj-Napoca administered by Babes-Bolyai University

Astronomical Institute of the Romanian Academy

Main Goals

1. Teaching the public that our Earth is special and unique and "There is no planet B".

2. Promoting scientific career diversity by showcasing Astrobiology as the crossroads between many scientific disciplines.

3. Encouraging interdisciplinary bridges between sciences, between the world of astronomy and the world of biology and collaborations between the Astronomical Observatory and the Botanic Garden of Cluj-Napoca .

ExoWorld Walk Project

What has the project set out to do?

1. Creating an Astrobiolgy concept map for the Romanian public by defining a new walk path in the Botanic Garden of Cluj-Napoca. At each intermediary point along the walk path we will place an interactiv poster that invites the viewer to reflect upon five important themes. The project and the walk path will be presented in a poster placed at the entrance of the botanic garden.
2. Creating a dedicated project website
3. Organizing a public workshop which will have the form of 5 to 6 weekly two hours meetings with the public in the botanic garden.
4. Organizing an online competition.

ExoWorld Walk Project

What have we done with the project so far?

1. We designed for the public a new walk path in the Botanic Garden of Cluj-Napoca with the shape of the Big Dipper Constellation.
2. We drafted the posters that will be exhibited along the walk path. We are now discussing final details of the posters .
3. We designed interactive components to our posters for accessibility and educational purposes.
4. We created a dedicated project website which shall be launched this week : www.Exoworldwalk.ro
5. We created the infrastructure of our online competition embeded in our website.
6. We embeded project monitoring & evaluation measures into our website.
7. We have started organizing the “first Walk” as we expect the Poster Exhibition to be up and running sooon.

ExoWorld Walk Project

1. FIRST STOP (ROSE GARDEN, SUNDIAL)
Earth is unique, life is unique.
There is no planet B
——

2. SECOND STOP (JAPANESE GARDEN)
When did life appear?
Fossilis, microfossils, biosignature, life evolution
------

3. THIRD STOP (THE WATER TOWER)
Unicity and diversity of organism
Evolutionary processes and patterns
Who or what is LUCA?
——

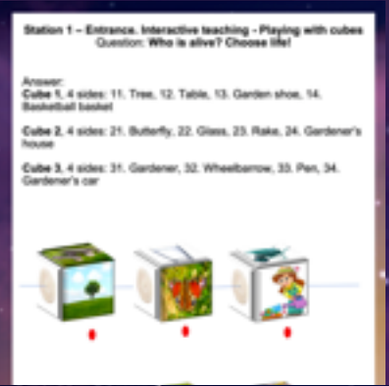
4. FOURTH STOP (VEGETABLE GARDEN)
How was the formation of the planetary systems (solar system versus exoplanetary system)?
----

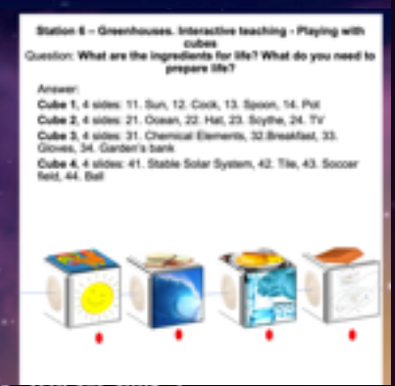
5. FIFTH STOP (GREENHOUSE)
Water+chemistry+energy...Ingredients for life?
There is no planet B
——

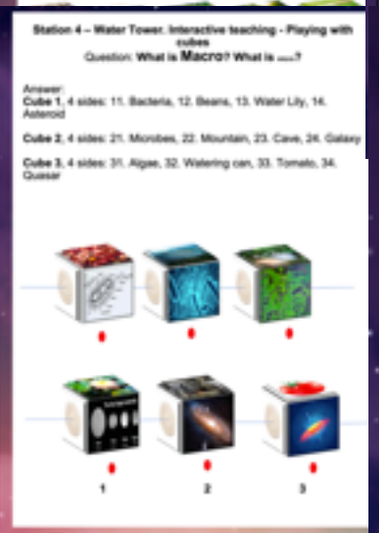
Do you want to know more on the ExoWorld Walk path?

ExoWorld Walk Project

Do you want to know more on our ExoWorld Walk poster exhibition?





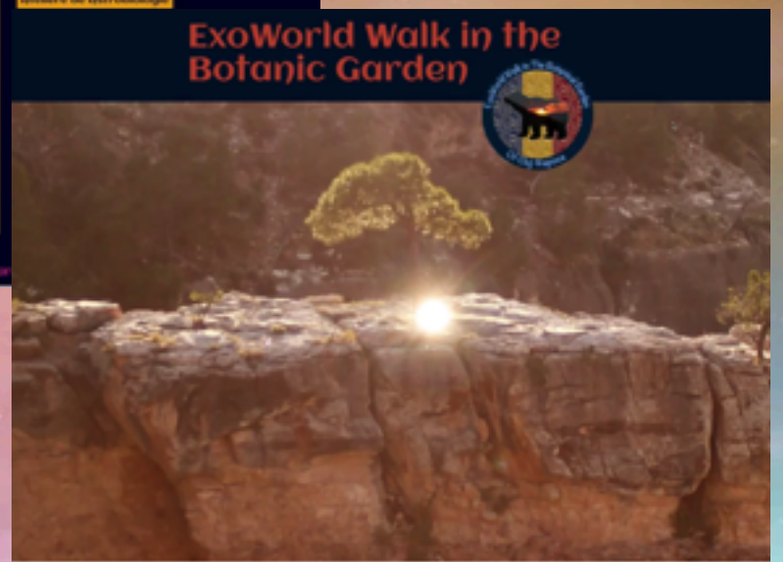


ExoWorld Walk Project

Do you want to know more on our ExoWorld Walk website?

Organizare ExoWorld Walk website:

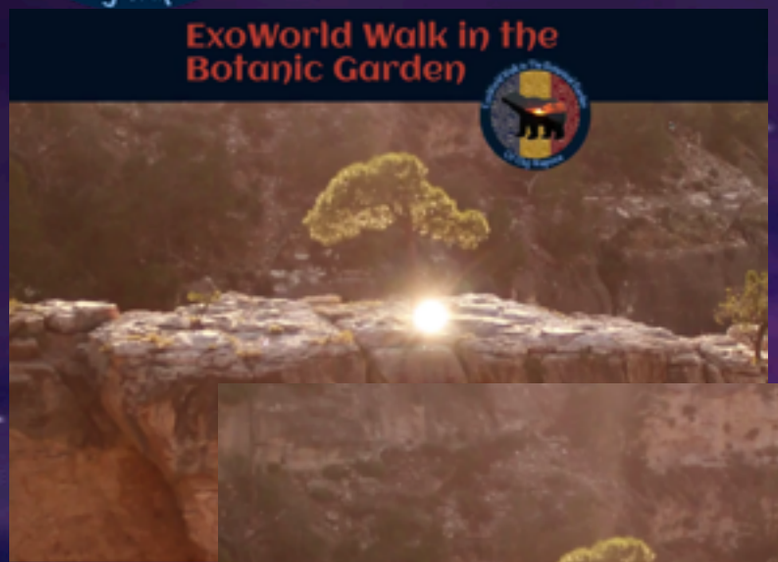
About the project Section
Educational Section
Interaction with the Public Section
Gaming Section



The site is in english and romanian although certain features are only available in Romanian

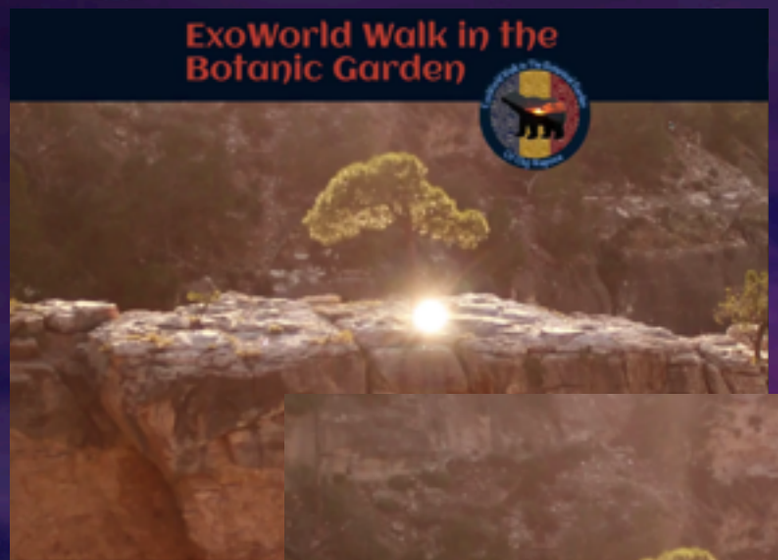
ExoWorld Walk Project

A few snapshots of our ExoWorld Walk website



ExoWorld Walk Project

A few snapshots of our ExoWorld Walk website



ExoWorld Walk Project

ExoWorld Walk Interactions with the public

Forms of Interactions with the public

- through the Social Wall
- through the Blog
- through the challenges on the website and in the workshops
- through the online competition
- through the selfie with an ExoWorld Walk poster competition
- through the public workshop
- through the poster exhibition

Main Goals

1. Teaching the public that our Earth is special and unique and "There is no planet B".
2. Promoting scientific career diversity by showcasing Astrobiology as the crossroads between many scientific disciplines.
3. Encouraging interdisciplinary bridges between sciences, between the world of astronomy and the world of biology and collaborations between the Astronomical Observatory and the Botanic Garden of Cluj-Napoca .

ExoWorld Walk Project

ExoWorld Walk Monitoring, Evaluation and Impact

The multiple interactions with the public embeded in our website or our proposed activities have multiple purposes:

1. To give the public an enjoyable experience whilst learning new concepts in Astrobiology.
2. To responsibly encourage avenues between research and education
3. To motivate the public towards STEM Education and Careers.
4. To understand the misconceptions within the public and see what educational teaching–learning strategies work best.
5. To continuously evaluate our interventions and improve our results.

The AER component of the ExoWorld Walk Project

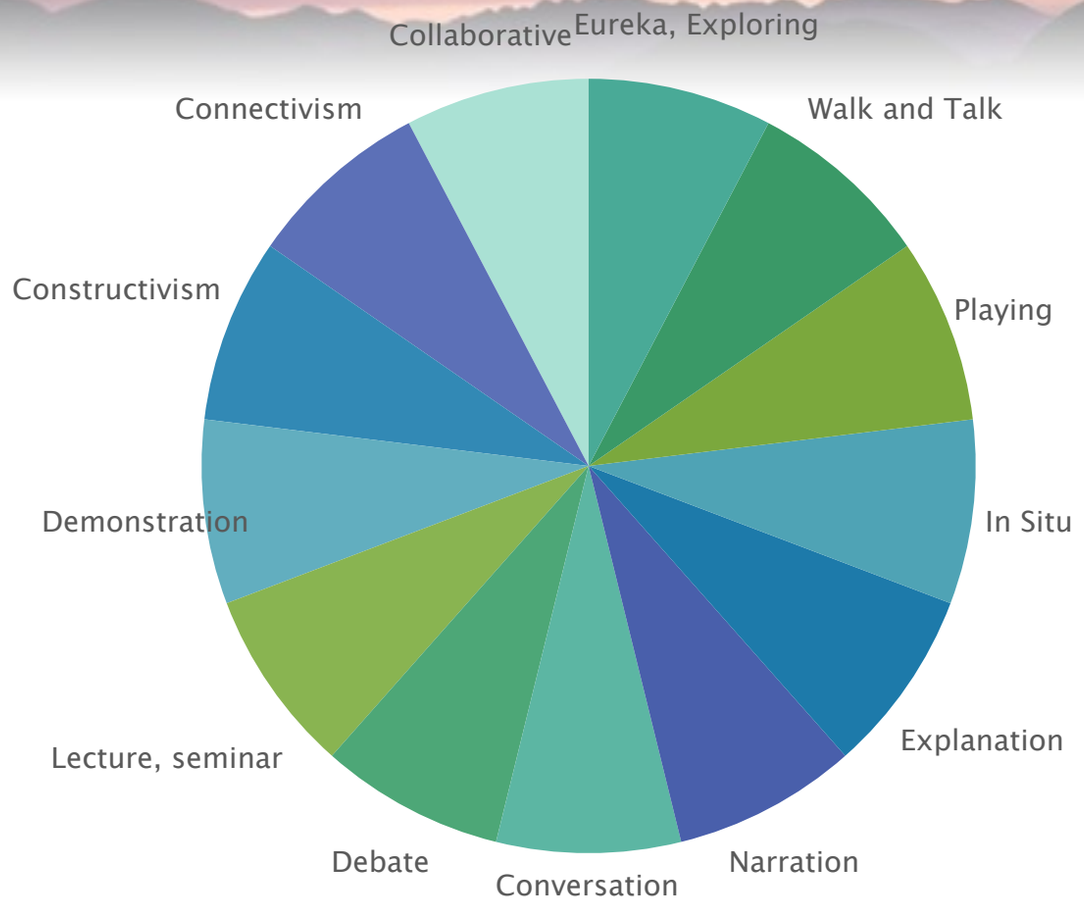
Studies of the Astronomy Education methodology, Teaching – Learning strategies used in the ExoWorld Walk Project

Astronomy Education Research (AER) Component of the ExoWorld Walk Project

MAIN IDEA
PROPER EDUCATION IN ASTRONOMY IS IMPORTANT FOR THE DEVELOPMENT OF ASTRONOMY IN ROMANIA.

- If an astronomer (researcher, Amator Astronomer) is asked to give a presentation or a workshop about astronomy, how will he/she ensure that a well diversed mass of participants do not simply receive information but rather receive astronomy education?
- In a country where astronomy is not a scientific discipline astronomy education counts on every astronomy related educational intervention no matter how small. AER helps us valorize these interventions.
- If you think back, what knowledge content stayed with you over the years from when you were in school? Why that content?
- Was it the content you used the most? Was it the content presented in a certain kind of way that answered your needs? Was is the content that was just presented to you or the one you took an active part in learning?

Astronomy Education Research (AER) Component of the ExoWorld Walk Project



Eureka, Exploring
Walk and Talk
Playing
In Situ
Explanation
Narration
Conversation
Debate
Lecture, seminar
Demonstration
Constructivism
Connectivism
Collaborative

THE EDUCATION METHODOLOGIES USED BY „EXOWORLD WALK”

Astronomy Education Research (AER) Component of the ExoWorld Walk Project

„EUREKA" METHOD

USING THE POWER OF "DISCOVERY LEARNING," THE EUREKA METHOD OF TEACHING ONE CAN CREATE THE CONDITIONS FOR DISCOVERING KNOWLEDGE ABOUT A SUBJECT THROUGH HANDS-ON ACTIVITIES. RESEARCH SHOWS THAT THIS TYPE OF LEARNING LASTS LONGER!

THE RESULT? "THE PARTICIPANTS DEVELOP BETTER CRITICAL THINKING SKILLS AND SCIENTIFIC LITERACY BECAUSE IT WAS SOMETHING THEY DISCOVERED ALL ON THEIR OWN."

"I COULD TALK ABOUT A CONCEPT UNTIL I'M BLUE IN THE FACE. BUT UNTIL YOU EXPERIENCE IT, YOU'RE NOT REALLY GOING TO TRULY UNDERSTAND."

ExoWorld Walk Example:

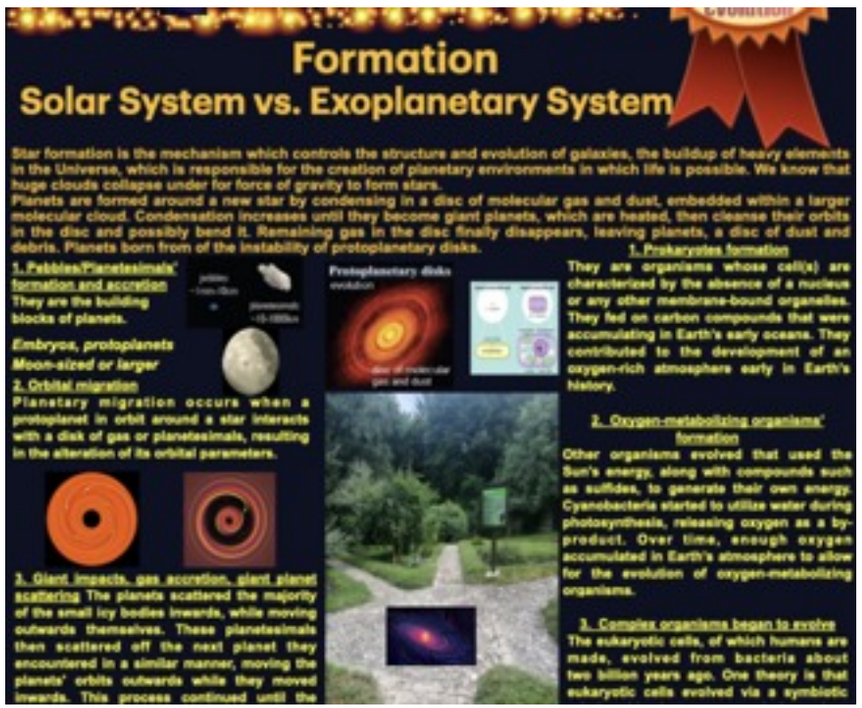
Why is the sky blue if sunlight is colorless?
The sky is blue due to the scattering of light by tiny particles in the atmosphere.

Astronomy Education Research (AER) Component of the ExoWorld Walk Project

„WALK AND TALK" METHOD

- **THINKING. TALKING. WALKING.**
- THESE BASIC HUMAN FUNCTIONS ARE INEXTRICABLY LINKED TO EACH OTHER THROUGHOUT HISTORY.
- IT'S A FUNDAMENTAL **HUMAN EXPERIENCE** THAT WE NEED TO **MOVE, TRAVEL, AND BECOME INSPIRED** TO DISCOVER NEW THINGS.
- FACT IS THAT WALKING GREATLY ENHANCES CREATIVE THINKING.
- THE ANCIENT GREEK PHILOSOPHERS WERE PARTICULARLY ENAMOURED WITH WALKING WHILE TALKING, TEACHING AND COLLABORATING. INDEED, RAPHAEL'S FRESCO "**THE SCHOOL OF ATHENS**" DEPICTS **ARISTOTLE** AND **PLATO** WALKING WHILE DISCUSSING HOT TOPICS OF THE DAY WITH THEIR FOLLOWERS, HOLDING THEIR BOOKS WHICH UNDOUBTEDLY CONTAIN THE VERY FIRST MEETING NOTES.

ExoWorld Walk Example



Astronomy Education Research (AER) Component of the ExoWorld Walk Project

- The curricula of most degree programs in natural sciences and engineering predominantly involve classroom lectures, practic for solving exercises, seminars with student presentations and, rarely, excursions or actual fieldwork.
- „IN SITU" METHOD

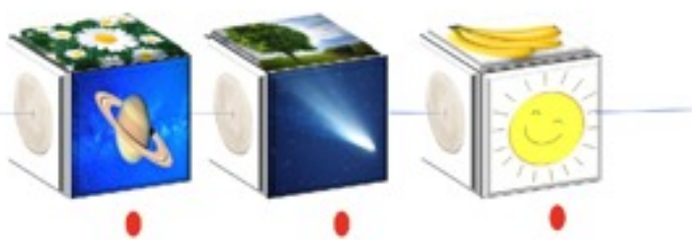
We teach at the place which is being studied, hence "in situ".

- AS WE KNOWN, ONE OF THE MOST IMPORTANT ROLES OF BOTANICAL GARDENS IS TO PROMOTE LEARNING AND ENGAGEMENT RELATED TO THE VALUE OF PLANTS AND THE NEED TO CONSERVE BIOLOGICAL DIVERSITY. CLIMATE CHANGE, ASTROBIOLOGY IS A CRITICAL PART OF THAT LEARNING AND ENGAGEMENT, GIVEN ITS INFLUENCE ON PLANT ECOLOGY AND CONSERVATION AND ON THE OPERATIONS OF BOTANICAL GARDENS.
- BOTANICAL GARDENS ENGAGE VISITORS IN FREE-CHOICE LEARNING AND HOST STUDENT GROUPS DURING FIELD TRIPS.
- EVIDENCE SHOWS THAT BOTANICAL GARDENS HAVE POSITIVE IMPACTS ON KNOWLEDGE AND ENVIRONMENTAL ATTITUDES IN STUDENT GROUPS AND VISITORS, INCLUDING ON TOPICS SPECIFICALLY RELATED TO PLANTS, CLIMATE CHANGE, ASTROBIOLOGY, ETC.

„PLAYING" METHOD

- In this method of learning, playing acts as the driving force as the entire learning method revolves around activity-based learning. It encourages expression and creative skills among children.
- Children's always tend to get excited if certain fun element and play is involved in it. With this particular method, the child can give wings to their imagination ability. It enables the child to improve various skills like motor, creative, imaginative, aesthetic, cognitive, linguistic etc.
- UPS, Just Children Like to Play? no-no-no… ADULTS also…

ExoWorld Walk Example:



Astronomy Education Research (AER) Component of the ExoWorld Walk Project

„CONNECTING" METHOD

What is Connectivism Learning Theory?

- Connectivism is a relatively new learning theory that suggests students should combine thoughts, theories, and general information in a useful manner.
- It accepts that technology is a major part of the learning process and that our constant connectedness gives us opportunities to make choices about our learning.
- It also promotes group collaboration and discussion, allowing for different viewpoints and perspectives when it comes to decision-making, problem-solving, and making sense of information.
- Connectivism promotes learning that happens outside of an individual, such as through social media, online networks, blogs, or information databases

ExoWorld Walk Example:

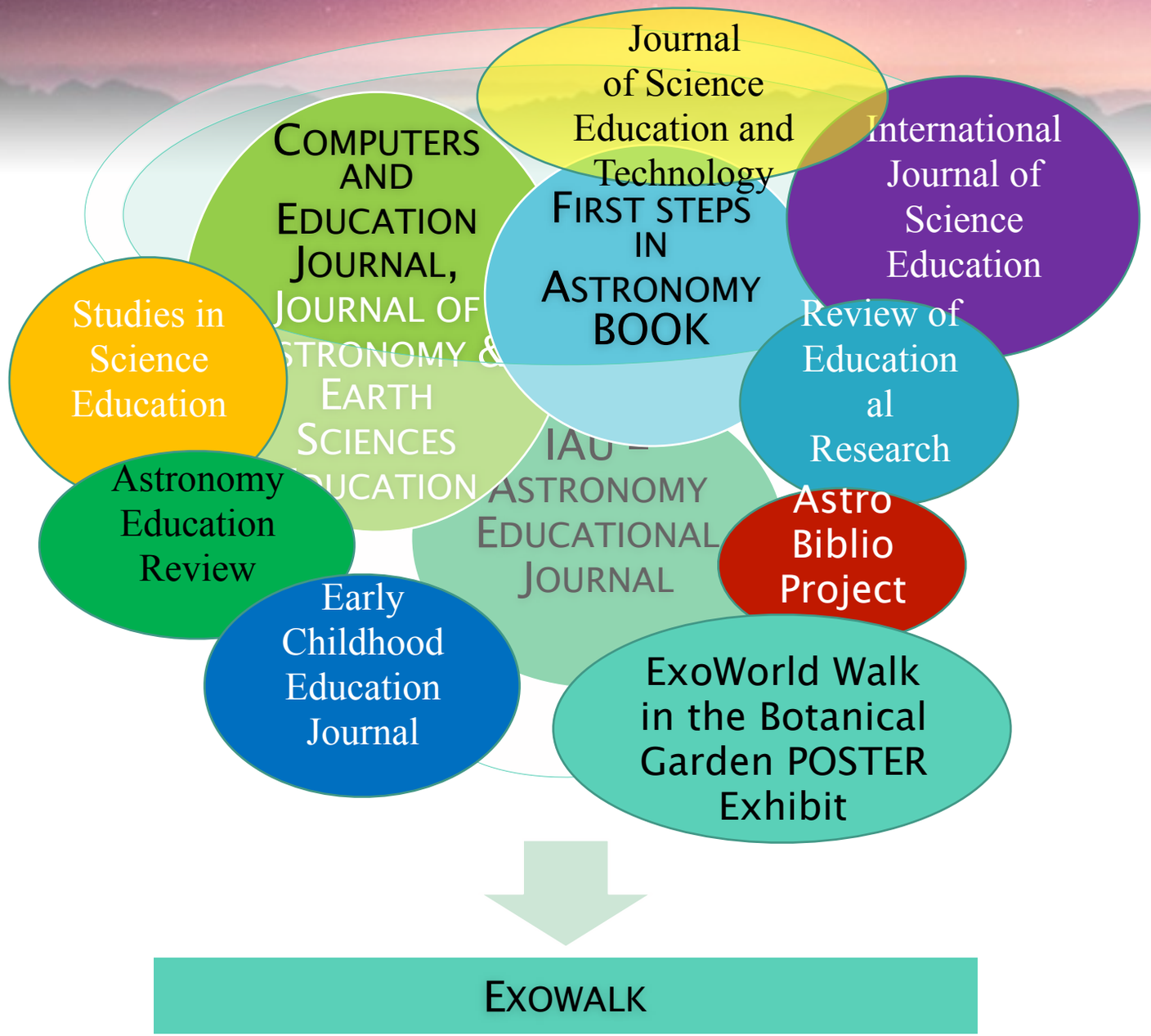
Astronomy Education Research (AER)
Component of the ExoWorld Walk Project

BENEFICIAL EFFECTS OF ASTROBIOLOGY – ASTRONOMY (SCIENCE) EDUCATION

- EDUCATION
- COMMUNICATION, INFORMATION
- MOTIVATION, CURRIOSITY
- COLLABORATION




Astronomy Education Research (AER) Component of the ExoWorld Walk Project



← **Instead of Bibliography**

Astronomy Education Research is guided by the same research publication standards (peer review) as Astronomy Research.

Recently the IAU OAE signed a collaboration with the ads which allows the indexation of Educational resources (lesson plans, materials, etc).

Conclusions

1. ExoWorld Walk project touches on all the dimensions of astronomy:

   Communication: " Life in the Universe","There is no planet B", etc.

   Education: Knowledge concepts from Astrobiology

   Development: Career Diversity for all

   Research: Teaching_learning strategies adapted for astrobiology content

2. ExoWorld Walk project contributes to SDG4: High Quality Education, SDG13: Climate Change and SDG17: Partnerships for achieving SDG Goals
3. ExoWorld Walk project is a way of celebrating the Year 2022 as the International year for Fundamental Sciences for Sustainable Development
4. ExoWorld Walk is a case study of interdisciplinarity within science and their benefits
5. ExoWorld Walk is research through diverse interactions with the public.

Future Work

1. Extending the project in two dimensions:

    1.1 Using the exhibition as an inspiration for a virtual exhibition that can be made available to schools and planetariums.

    1.2 Enlarging the area of the exhibition and considering multiple site exhibitions.

2. Maintaining & Updating Website

    2.1 Maintaining the ExoWorld Walk website as an educational resource in the romanian language on Astrobiology

    2.2 Creating new educational content for the website and continuing with the online competition.

Thank you!