



ExoWorld Walk in the Botanical garden of Cluj-Napoca

Ficut-Vicas, D. & Szücs-Csillik, I.

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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 unearthy 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?



The LAZY PERSON'S guide to SAVING the WORLD

End extreme poverty. Fight inequality and injustice. Fix climate change. Whoa. The Sustainable Development Goals are important, world-changing objectives that will require cooperation among governments, international organizations and world leaders. It seems impossible that the average person can make an impact. Should you just give up?

No! Change starts with you. Seriously. Every human on earth—even the most indifferent, laziest person among us—is part of the solution. Fortunately, there are some super easy things we can adopt into our routines that, if we all do it, will make a big difference.

Have a look at just a few of the many things you can do to make an impact!


Click [here](#) for a PDF download of some of the actions.

Level 1	Level 2	Level 3	Level 4
THINGS YOU CAN DO FROM YOUR COUCH			
<ul style="list-style-type: none"> Save electricity by plugging appliances into a power strip and turning them off completely when not in use, including your computer. Shop paper bank statements and pay your bills online or via mobile. Share, don't just like. If you see an interesting social media post about women's rights or climate change, share it so folks in your network see it too. Speak up! Ask your local and national authorities to engage in initiatives that don't harm people or the planet. You can also voice your support for the Paris Agreement and ask your country to ratify it or sign it if it hasn't yet. Turn off the lights. Your TV or computer screen provides a cozy glow, so turn off other lights if you don't need them. Report online bullies. If you notice harassment on a message board or in a chat room, flag that person. Stay informed. Follow your local news and stay in touch with the Global Goals online or on social media at @GlobalGoalsUK. Tell us about your actions to achieve the global goals by using the hashtag #GlobalGoals on social networks. In addition to the above, offset your remaining carbon emissions! You can calculate your carbon footprint and purchase climate credits from Climate Neutral Now. In this way, you help reduce global emissions faster! 			

1 NO POVERTY	2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING	4 QUALITY EDUCATION
5 GENDER EQUALITY	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION	14 LIFE BELOW WATER
15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS	SUSTAINABLE DEVELOPMENT GOALS

Level 1	Level 2	Level 3	Level 4
THINGS YOU CAN DO AT HOME			
<ul style="list-style-type: none"> Air dry. Let your hair and clothes dry naturally instead of running a machine. If you do wash your clothes, make sure the load is full. Take short showers. Bathfubs require gallons more water than a 5-10 minute shower. Eat less meat, poultry, and fish. More resources are used to provide meat than plants. Freeze fresh produce and leftovers if you don't have the chance to eat them before they go bad. You can also do this with take-away or delivered food, if you know you will not eat the eating it the next day. You will save food and money. Compost—composting food scraps can reduce climate impact while also recycling nutrients. Recycling paper, plastic, glass & aluminium keeps landfills from growing. Buy minimally packaged goods. Avoid pre-heating the oven. Unless you need a precise baking temperature, start heating your food right when you turn on the oven. Plug air leaks in windows and doors to increase energy efficiency. Adjust your thermostat, lower in winter, higher in summer. Replace old appliances with energy efficient models and light bulbs. If you have the option, install solar panels in your house. This will also reduce your electricity bill! Get a rug. Carpets and rugs keep your house warm and your thermostat low. Don't wash. If you use a dishwasher, stop now! Choose a better diaper option. Switch to a responsible disposable brand. Shovel snow manually. Avoid the noisy, exhaust exercise. Use cardboard matches. They don't require any... 			

Level 1	Level 2	Level 3	Level 4
THINGS YOU CAN DO AT WORK			
<ul style="list-style-type: none"> If you have a fruit or snack that you don't want, don't throw it out. Give it away to someone who needs and is asking for help. Does everyone at work have access to healthcare? Find out what your rights are to work, fight against inequality. Mentor young people. It's a thoughtful, inspiring and a powerful way to guide someone towards a better future. Women earn 15 to 30 per cent less than men for the same work. Pay inequality persists everywhere. Voice your support for equal pay for equal work. A billion people lack access to basic sanitation services. Lend your voice to talk about the lack of toilets in many communities around the world! Make sure your company uses energy efficient heating and cooling technology, and adjust the thermostat, lower in winter, higher in summer. Stay informed. Read about workers in other countries and business practices. Talk to your colleagues about these issues. Does your company invest in clean and resilient infrastructure? It's the only way to keep workers safe and protect the environment. Raise your voice against any type of discrimination in your office. Everyone is equal regardless of their gender, race, sexual orientation, social background and physical abilities. Bike, walk or take public transport to work. Save the car trips for when you've got a big group. Organize a No Impact Week at work. Learn to live more sustainably for at least a week: un.org/sustainabledevelopment/no-impact Speak up! Ask your company and Government to engage in initiatives that will not harm people or the planet. Voice your support for Paris Agreement! Try to reduce waste, since most waste ends up in our oceans. Examine and change everyday decisions. Can you recycle at your workplace? Is your company buying from merchants engaging in harmful ecological practices? Know your workplace rights to ensure your access to justice. Corporate social responsibility counts! Encourage your company to work with civil society and find ways to help local communities achieve the goals. 			

Level 1	Level 2	Level 3	Level 4
THINGS YOU CAN DO OUTSIDE YOUR HOUSE			
<ul style="list-style-type: none"> Shop local. Supporting neighbourhood businesses keeps people employed and helps prevent trucks from driving for distances. Shop smart—plan meals, use shopping lists and avoid impulse buys. Don't succumb to marketing tricks that lead you to buy more food than you need, particularly for perishable items. Though these may be less expensive per ounce, they can be more expensive overall if much of that food is discarded. Buy Funny Fruit—many fruits and vegetables are thrown out because their size, shape, or color are not "right". Buying these perfectly good looking fruit, at the farmer's market or elsewhere, allows food that might otherwise go to waste. When you go to a restaurant and are ordering seafood always ask: "Do you serve sustainable seafood?" Let your favourite businesses know that ocean-friendly seafood is on your shopping list. 			

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?

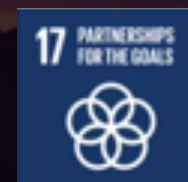
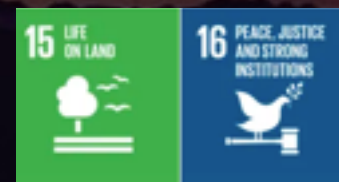
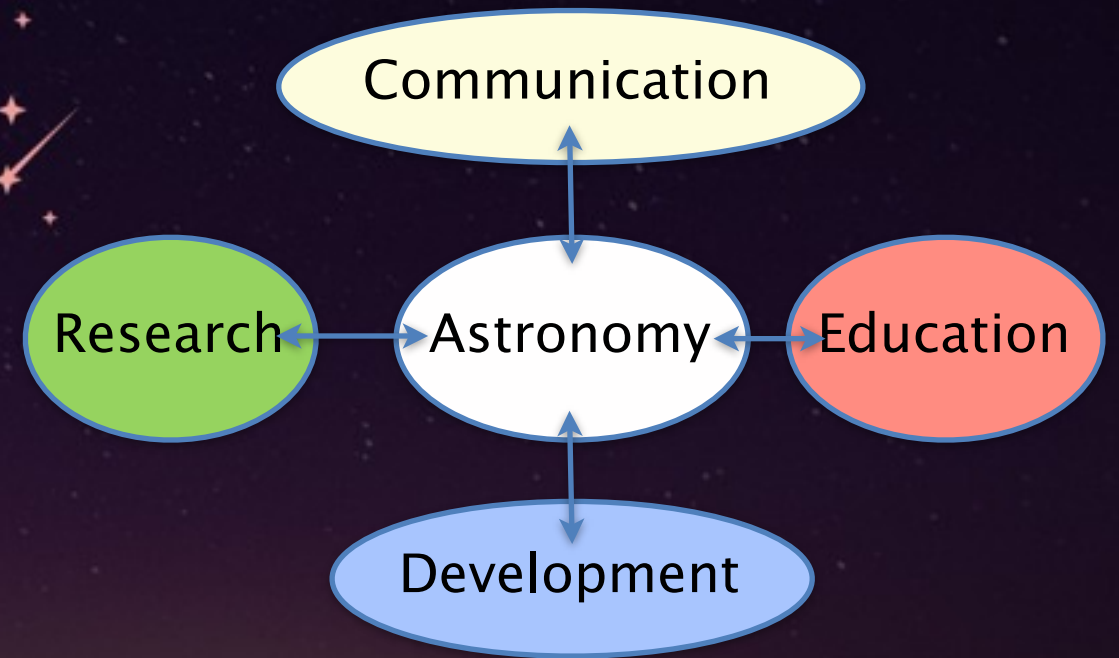
How does Astronomy “blend in” into Sustainable Development?

★Through interdisciplinary connections with other fields

★Through knowledge transfer

★Through self-sustainability

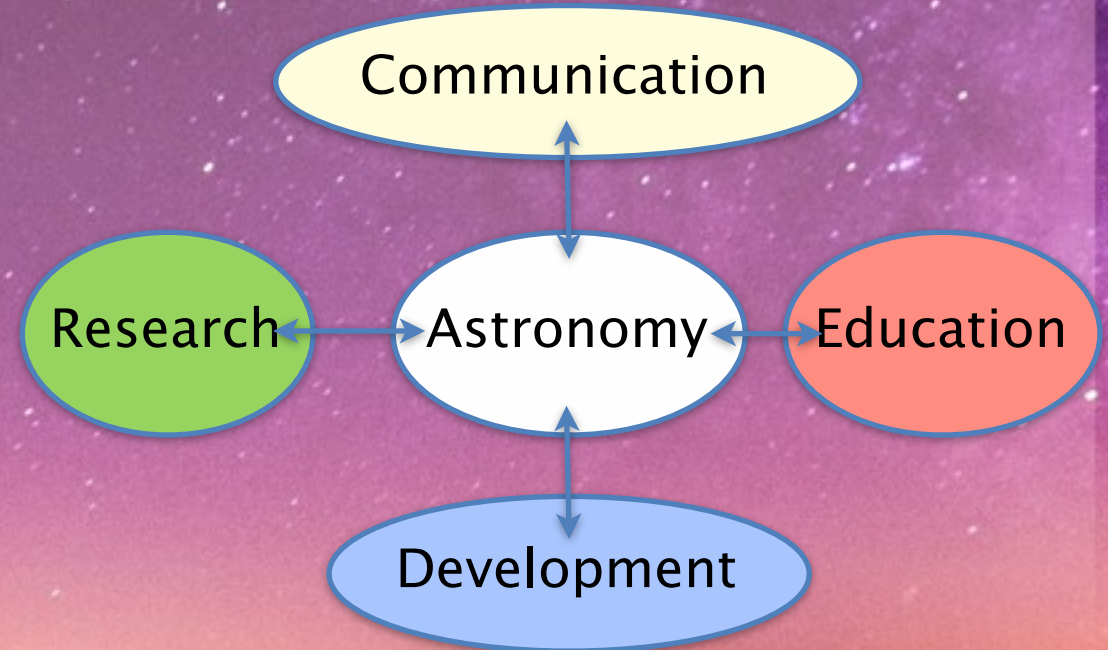
★Through “meeting half way” with the needs of humanity



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 techniques for teaching astronomy
- construction 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,

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.

(Image source: Composite of

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 Astrobiology 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 interactive 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 soon.



ExoWorld Walk Project

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

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?
Fossils, 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...Ingre
dients for life?
There is no planet B

Map





ExoWorld Walk Project

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

ExoWalk 0
Overview

Map of the Botanical Garden with the proposed walk path.

1. **NEED FROM BASIC ELEMENTS** (essential) Earth is unique. This is unique. There is no planet B.

2. **NEED FROM NECESSARY CONDITIONS** when did life appear? Fossils, microfossils, biogeography, life evolution.

3. **NEED FROM THE RIGHT ENERGY** diversity and diversity of organisms. Evolutionary processes and patterns. Why or what is LUCA?

4. **NEED FROM INTERACTING ELEMENTS** How was the formation of the

Station 1 - Entrance. Interactive teaching - Playing with cubes
Question: Who is alive? Choose life!

Answer:
Cube 1, 4 sides: 11. Tree, 12. Table, 13. Garden shoe, 14. Basketball basket!

Cube 2, 4 sides: 21. Butterfly, 22. Glass, 23. Rake, 24. Gardener's house

Cube 3, 4 sides: 31. Gardener, 32. Wheelbarrow, 33. Pen, 34. Gardener's car

ExoWalk 1
Unicity

"We are used to looking things in: "I am a human being just like any other human being", but yet although there are billions of human beings they are all different." This is a rose just like any other rose". Yet, look around and show me two roses exactly the same. Similarly in the Universe, there may be millions of Earth-like planets, but none is exactly the same as Earth.

What about our Earth? Is it the only blue planet in terms of earthly life? Are there other Earth-like planets? Is the Earth unique? What you think? (see Jean-Pierre Sillig publications).

Station 2 - Sundial. Interactive teaching - Playing with cubes
Question: What is unique?

Answer:
Cube 1, 4 sides: 11. Earth, 12. 2 Rubber Boots, 13. 2 garden hats, 14. 2 pencils

Cube 2, 4 sides: 21. Rose Bogdani, 22. 3 cardboard boxes, 23. 2 garden basket, 24. 7 cubes

Cube 3, 4 sides: 31. Garden's Sundial, 32. 3 hoes, 33. 3 garden gloves, 34. 4 brooms

ExoWalk 2
Traces of life
Fossils, Microfossils, Biosignature

This Japanese garden is an ensemble of emblematic elements which give them a sense of a mini Universe. Here one can find the basic elements from which the Universe was formed: fire - the burning symbol of stone or iron, earth - in the form of stone and water, air, plants and animals in their natural forms.

What are basic elements? The water? Energy and chemical element? Water with ingredients, metal, stone, earth, fresh plant air, heat of the sun, wood...

Stone, wood, water is emblematic? What is the oldest trace of life? When did life appear? Fossils, microfossils, life signatures, life evolution... (see Pierre Comin publications).

Station 3 - Japanese Garden. Interactive teaching - Playing with cubes
Question: What are the basic elements of nature?

Answer:
Cube 1, 4 sides: 11. Water, 12. Eggs, 13. Flour, 14. Potatoes

Cube 2, 4 sides: 21. Wood, 22. Books, 23. Bucket, 24. Shovel

Cube 3, 4 sides: 31. Fire, 32. Birthday cake, 33. Car, 34. Garden shears

Cube 4, 4 sides: 41. Earth, 42. Tile, 43. Asphalt road, 44. Mineral fertilizer

Cube 5, 4 sides: 51. Metal, 52. Fork, 53. Ax, 54. Nail

ExoWalk 3
Micro - Macro
Evolutionary processes and Patterns

The Water Tower's part of the Botanical Garden from Cluj-Napoca is really unique. Is that so? If we climb in the tower, we can see part of the city and if we look down we see the small pools with water lilies. And if we look around there are huge trees, which have grown since the garden existed. Let's take a closer look at these pools. What do you see in them? Only plants or snails, fish, algae, microbes? What is the population of such a basin?

Station 4 - Water Tower. Interactive teaching - Playing with cubes
Question: What is MACRO? What is ...?

Answer:
Cube 1, 4 sides: 11. Bacteria, 12. Beans, 13. Water Lily, 14. Asteroid

Cube 2, 4 sides: 21. Mushrooms, 22. Mountain, 23. Cave, 24. Galaxy

Cube 3, 4 sides: 31. Algae, 32. Watering can, 33. Tomato, 34. Quasar

ExoWalk 5
Ingredients for Life

What is the habitability of a planet? In the greenhouse, are good living conditions for plants. Is that the case everywhere? Not really. Outside the Earth's atmosphere, is there life like ours?

What are extremophiles? Are these microbes on exoplanets as well? How far has the research gone?

The Earth from the composition of the atmosphere to the properties of the soil has evolved in time to become the cradle of life. Our handprints onto our planet contribute to the future evolution of our planet which can be both favourable or unfavourable to life's evolution.

Station 5 - Greenhouses. Interactive teaching - Playing with cubes
Question: What are the ingredients for life? What do you need to prepare life?

Answer:
Cube 1, 4 sides: 11. Sun, 12. Cook, 13. Spoon, 14. Pot

Cube 2, 4 sides: 21. Ocean, 22. Hat, 23. Soybean, 24. TV

Cube 3, 4 sides: 31. Chemical Elements, 32. Breakfast, 33. Gloves, 34. Garden's bank

Cube 4, 4 sides: 41. Stable Solar System, 42. Tile, 43. Soccer field, 44. Bell

ExoWalk 4
Formation
Solar System vs. Exoplanetary System

The "formation" of the Solar System and exoplanetary systems is a complex process that involves the collapse of a molecular cloud, the formation of a protostar, and the subsequent accretion of gas and dust. The resulting system consists of a central star and a disk of protoplanetary material. The formation of planets and other celestial bodies is a result of the interaction of these bodies with the disk and each other.

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Station 6 - Vegetable Garden. Interactive teaching - Playing with cubes
Question: What is outside the Earth?

Answer:
Cube 1, 4 sides: 11. Saturn, 12. Flower, 13. Pigeon, 14. The little gardener

Cube 2, 4 sides: 21. Comet, 22. Tree, 23. Gardener with flowers, 24. Squid

Cube 3, 4 sides: 31. Sun, 32. Banana, 33. Frog, 34. Bee



ExoWorld Walk Project

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

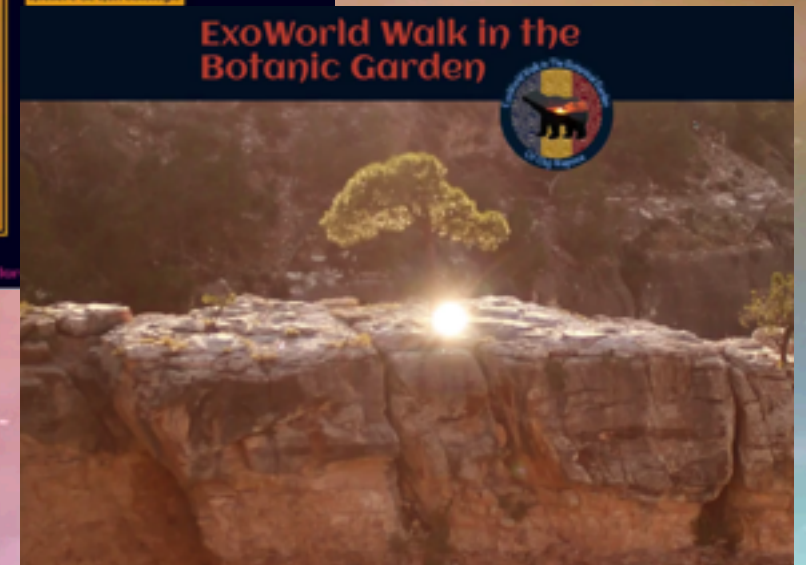
Organizare ExoWorld Walk website:

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 in the Botanic Garden

Despre ExoLumi în plimbare prin Grădina Botanică Cluj-Napoca

"In the beginning there were only probabilities. The universe could only come into existence if someone observed it. It does not matter that the observers turned up several billion years later. The universe exists because we are aware of it." (Sir Martin Rees)

Română

English

"La început erau doar probabilități. Universul putea exista în existență doar dacă exista cineva să-l observe. Nu contează că observatorii au apărut câteva miliarde de ani mai târziu. Existența există pentru că noi suntem conștienți de existența lui." (Sir Martin Rees)

ExoWalk

Acasă | Despre proiect | Galeria Expo | Astrobio pt. Tuti | BLOG

Atelierele de Astrobiologie din Grădina Botanică vor avea loc în lunile. Mai multe detalii curând!!!!

Dacă plimbarea prin grădina botanică și expoziția de postere v-a pus pe gânduri, dacă site-ul nostru v-a stârniț și mai mult pofta de a cunoaște mai multe despre astrobiologia vă invităm cu mic cu mare la o serie de 6 Ateliere de Astrobiologie (ADA) pentru a aprofunda tematica posterelor proiectului nostru. Atelierele au o durată de 60 de minute și se vor desfășura săptămânal în lunile Iunie-Iulie. Participarea este gratuită dar necesită o programare prealabilă.

Acasă | Despre proiect | Galeria Expo | Astrobio pt. Tuti | BLOG

Linkul pentru înscrierea în campionat și prima provocare vor apărea pe această pagină în curând!!!!

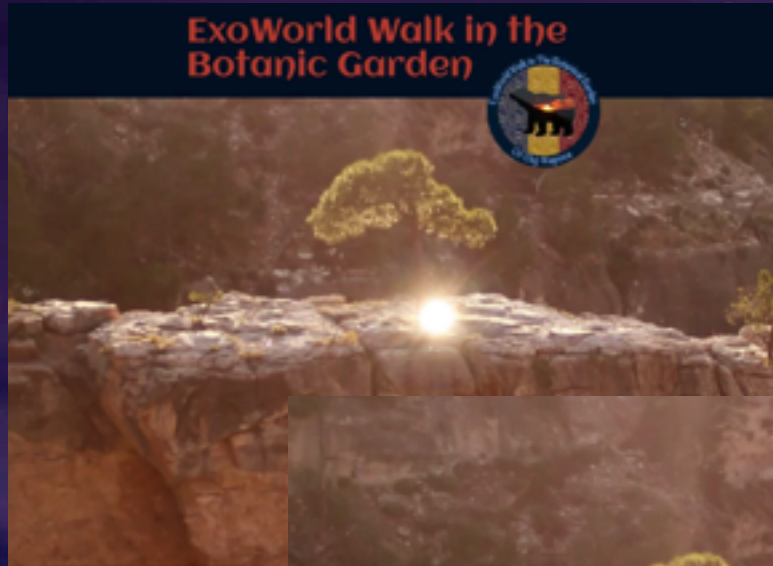
Campionatul AstroBio este un concurs online care se va desfășura prin intermediul websiteului ExoWalk. Pe această pagină a site-ului nostru vor fi postate periodic noi provocări și fiecare provocare poate aduce participantului puncte și o înșignă virtuală. Pe toată perioada concursului, pe această pagină vom afișa topul primelor zece punctaje folosind nickname-uri pentru desemnarea participanților afișați. Pentru a participa la concurs este nevoie de o înscriere prealabilă în care fiecare participant își poate alege nickname-ul său. Participanții se pot înscrie oricând în concurs până la data lansării ultimei provocări.

Contact



ExoWorld Walk Project

A few snapshots of our ExoWorld Walk website



Despre ExoLumi în plimbare prin Grădina Botanică Cluj-Napoca

"In the beginning there were only probabilities. The universe could only come into existence if someone observed it. It does not matter that the observers turned up several billion years later. The universe exists because we are aware of it." (Sir Martin Rees)

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"La început erau doar probabilități. Universul putea exista în esență doar dacă exista cineva să-l observe. Nu contează că observatorii au apărut câteva miliarde de ani mai târziu. Universul există pentru că noi suntem conștienți de existența lui." (Sir Martin Rees)

English

ExoWalk

Home About the project Gallery Learn More on Astrobiology Contact

Announcements:

1. Learn More on Astrobiology
[Learn](#)
2. Explore our site and check out our project's Gallery
[To the Gallery](#)
3. Leave a message on our Wall
[Leave a Message](#)

Our project proposes to the greater public Botanic Garden in the shape of the Constellation. The walk path has highlighted on the map with interconnect. The theme of our exhibition is astro

ExoWalk

Home About the project Gallery Learn More on Astrobiology Contact

The walk path "ExoWorld Walk in the Botanic Garden of Cluj-Napoca" starts at the main building in the Botanic Garden, on [street Republicii, No. 42, code 400015, Cluj-Napoca, Romania](#). There, we placed an overview poster of the whole project. For a map with directions to the Botanic Garden and other details please consult:

<http://gradinabotanica.ubbcluj.ro/en/contact-us/>

For any kind of information, comments or suggestions regarding the project ExoWalk "ExoWorld Walk in the Botanic Garden of Cluj-Napoca", please contact us at:

ExoWorld@ExoWalk.ro



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

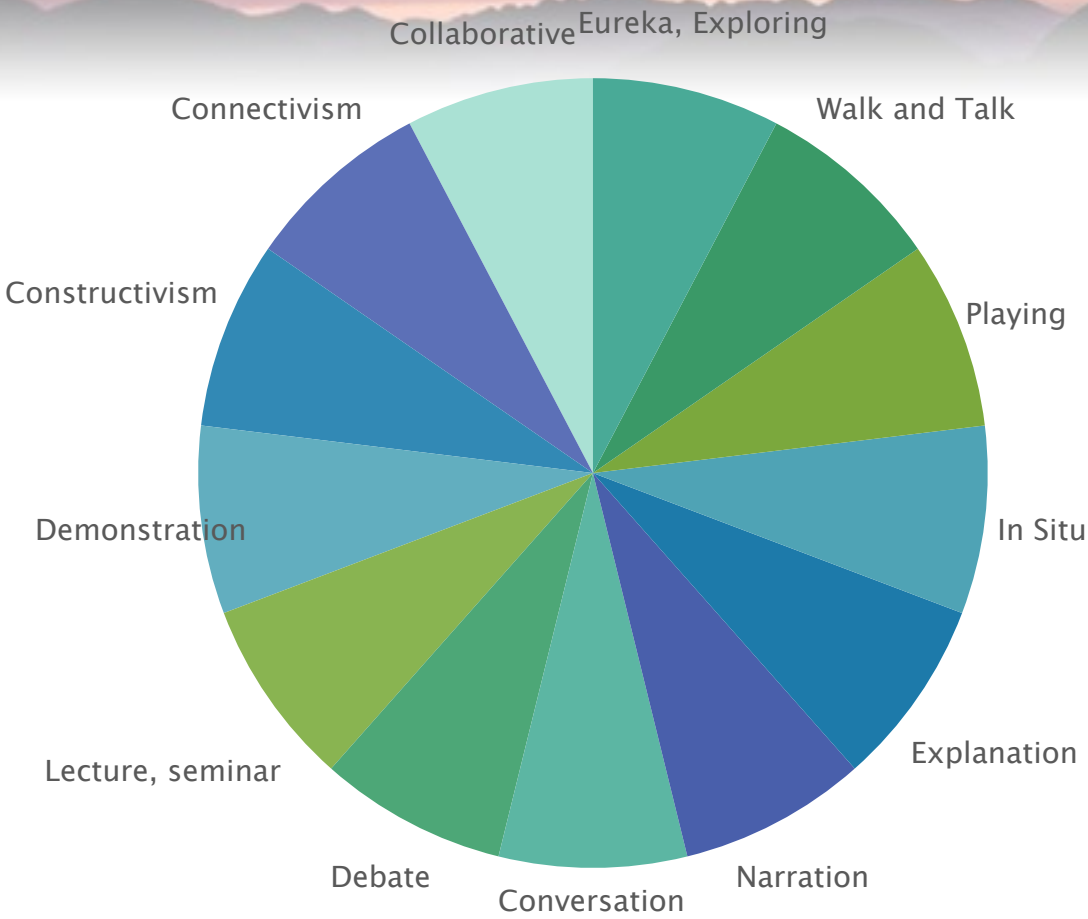
Astronomy Education Research (AER) Component of the ExoWorld Walk Project

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



THE EDUCATION
METHODOLOGIES
USED BY
„EXOWORLD WALK”

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

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

Formation Solar System vs. Exoplanetary System

Star formation is the mechanism which controls the structure and evolution of galaxies, the buildup of heavy elements in the Universe, which is responsible for the creation of planetary environments in which life is possible. We know that huge clouds collapse under force of gravity to form stars.

Planets are formed around a new star by condensing in a disc of molecular gas and dust, embedded within a larger molecular cloud. Condensation increases until they become giant planets, which are heated, then cleanse their orbits in the disc and possibly bend it. Remaining gas in the disc finally disappears, leaving planets, a disc of dust and debris. Planets born from the instability of protoplanetary disks.

1. Pebbles/Planetesimals formation and accretion
They are the building blocks of planets.

Embryos, protoplanets
Moon-sized or larger

2. Orbital migration
Planetary migration occurs when a protoplanet in orbit around a star interacts with a disk of gas or planetesimals, resulting in the alteration of its orbital parameters.

3. Giant impacts, gas accretion, giant planet scattering
The planets scattered the majority of the small icy bodies inward, while moving outward themselves. These planetesimals then scattered off the next planet they encountered in a similar manner, moving the planets' orbits outward while they moved inward. This process continued until the

Protoplanetary disks
evolution

1. Prokaryotes formation
They are organisms whose cell(s) are characterized by the absence of a nucleus or any other membrane-bound organelles. They fed on carbon compounds that were accumulating in Earth's early oceans. They contributed to the development of an oxygen-rich atmosphere early in Earth's history.

2. Oxygen-metabolizing organisms' formation
Other organisms evolved that used the Sun's energy, along with compounds such as sulfides, to generate their own energy. Cyanobacteria started to utilize water during photosynthesis, releasing oxygen as a by-product. Over time, enough oxygen accumulated in Earth's atmosphere to allow for the evolution of oxygen-metabolizing organisms.

3. Complex organisms began to evolve
The eukaryotic cells, of which humans are made, evolved from bacteria about two billion years ago. One theory is that eukaryotic cells evolved via a symbiotic

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- The curricula of most degree programs in natural sciences and engineering predominantly involve classroom lectures, practice 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 KNOW, 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.



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

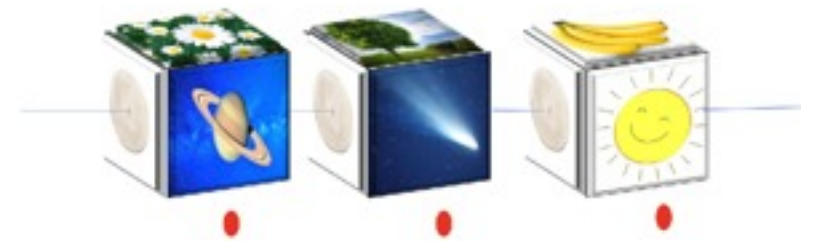
LETS
PLAY

„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



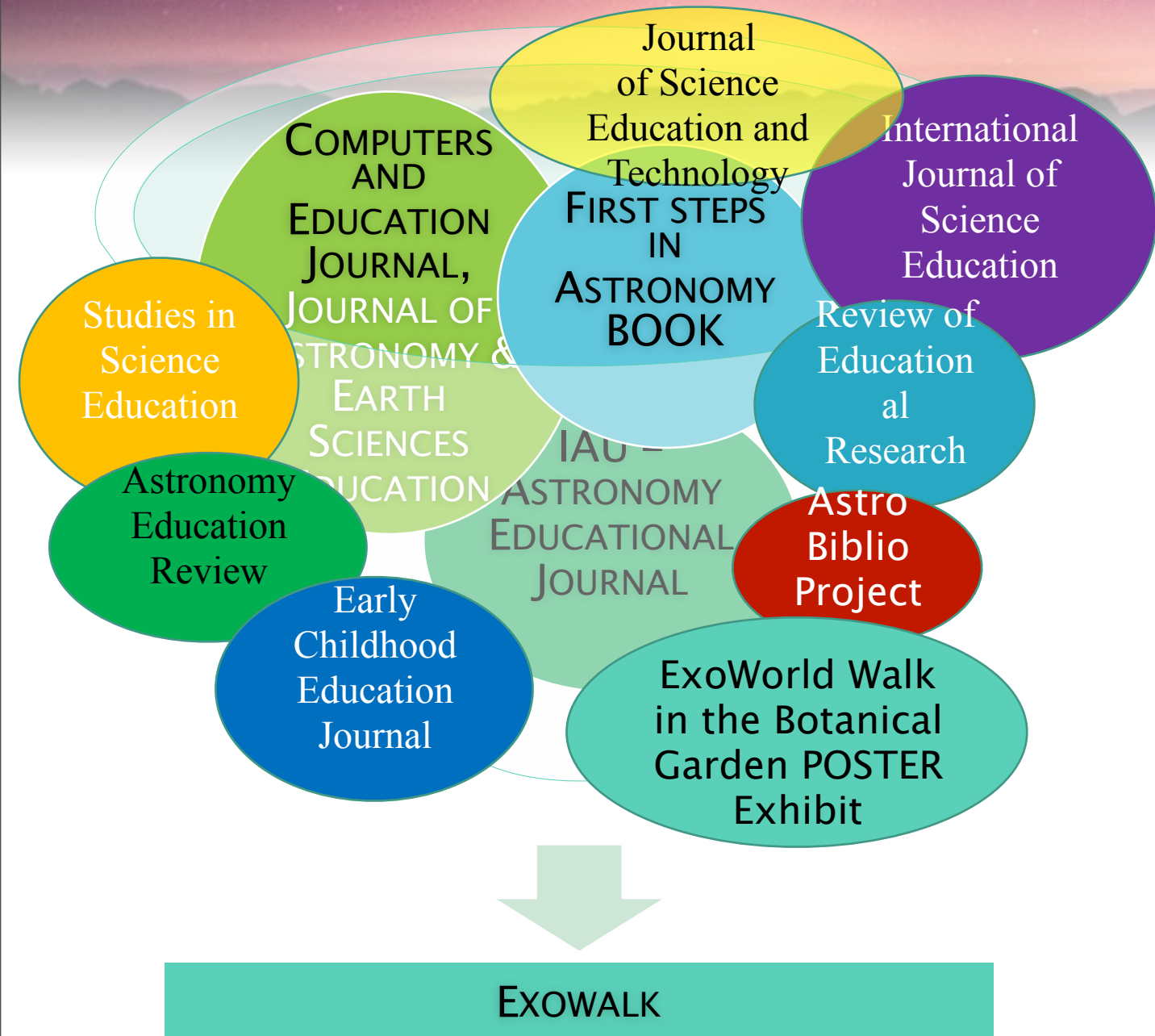
MOTIVATION, CURIOUSITY



COLLABORATION



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← 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.

A graphic of a starburst with several bright stars and streaks, resembling a meteor shower or a cluster of stars, positioned in the upper center of the image.

Thank you!