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Bridging Cultures: the Office of Astronomy for Education Italy Initiatives for Student-centered Education in the Mediterranean

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Abstract

The International Astronomical Union established the Office of Astronomy for Education to support the use of Astronomy to promote STEM education. The Italian Center of OAE – managed by the National Institute for Astrophysics – supports,e OAE in particular by focusing on the Mediterranean Region and on the promotion of sudent-centered practices [1]. Since its establishment, our team has championed a co-design approach involving IAU-endorsed educators. This choice is based on the belief that bottom-up processes are essential for developing meaningful and beneficial activities for diverse communities. This strategy also aims to foster new connections across countries and among individuals. In this talk, we will describe the evolution of our co-design projects. We will start describing our pilot project, MIRTO/STEAM-Med, for co-designing educational resources around the common theme of light. The co-design process was first run remotely, facilitating online peer pairing and mentoring among educators from 12 countries and later during a one-week, in-person workshop in Lampedusa, a highly symbolic location at the heart of the Mediterranean Sea [2]. Finally, all resources have been published in a multilingual booklet and on the open online platform AstroEDU [3], (peer-reviewed resources for astronomy teaching). We will then discuss the following co-design efforts in the OAE framework: FRESCO and Sabir. Both are co-design projects that created innovative educational activities through online meetings for many months, followed by in-person residencies. Sabir is dedicated to inquiry-based learning resources for high school students, and FRESCO to playful and game-based learning activities for children (up to 12 years) within a worldwide community. In Sabir, NAECS from Lebanon, Turkey, Spain and Morocco proposed resources which were collaboratively transformed according to an enquiry perspective and finally published on astroEDU [e.g.4]. In FRESCO, educators from ten participating countries designed from scratch two original board games and a playful children-centred educational path. We will especially focus on evaluation – especially of the process of co-design, which results in a truly collaborative and valid effort leading to valuable shared products, a strong and persistent network and robust empowerment towards innovative education techniques.

Keywords: *Astronomy, co-design, inquiry-based, game-based, playful learning*

1. The OAE: Office of Astronomy for Education

The International Astronomical Union (IAU) is the worldwide astronomical organisation that brings together more than 13,000 active professional astronomers from about 100 countries worldwide. Its mission is to promote and safeguard astronomy in all its aspects, including research, communication, education and development, through international cooperation.
IAU established the Office of Astronomy for Education (OAE) in December 2019. OAE is at the forefront of efforts by the IAU to leverage astronomy for education, specifically in science, technology, engineering and mathematics (STEM). The OAE's mission is to support and coordinate astronomy education by astronomy researchers and educators, aimed at primary or secondary schools worldwide. Its headquarters is located in Heidelberg, but - being Education a highly location-dependent activity - there are Centers and Nodes all around the world, addressing different specificities related to areas and interests. Moreover, the OAE appoints a network of NAECS (National Astronomy Education Coordinators) in more than 99 countries to support the collection and translation

of excellent astronomy education resources, help educators, astronomers and other stakeholders to get started in contributing to astronomy education, and support the creation of reliable and accessible education resources.

2. The OAE Center Italy (I-OAE)

In particular, the Italian Office of Astronomy for Education was the first established Centre (I-OAE) and focuses mainly on three major action areas:

- geographically, it supports and organizes activities in the Mediterranean region, as a meeting point for three continents: Africa, Asia and Europe. Over the millennia, the Mediterranean Sea has been the cradle of some of the oldest civilizations in the world, and a place of meeting, alliance, and dialogue; even though it is a small sea, there is a total of 25 Nations overlooking the Mediterranean Sea: 450 million people live in these countries, and speak different languages. There is no common language. So nowadays, more than ever before, we should focus on dialogue and mutual knowledge.
- in terms of education, it promotes child-centred activities. I-OAE chose to focus on children's education because we have long been researching innovative educational practices, constructionist, playful activities, and active education practices fostering problem-solving and critical thinking. And also because we believe that there is a diffuse need to promote a “scientific citizenship”, toward a knowledge society, fostering cultural diversity through equal, inclusive, and universal access to all knowledge creation (especially education) (see e.g. [5])
- in terms of resources, the Office manages the astroEDU platform (https://astroedu.iau.org/) an open-access, multi-language platform and repository for double (by an Astronomer and by a teacher/educator) peer-reviewed for collecting science education activities that could be used in formal, not formal and informal settings and for different levels.

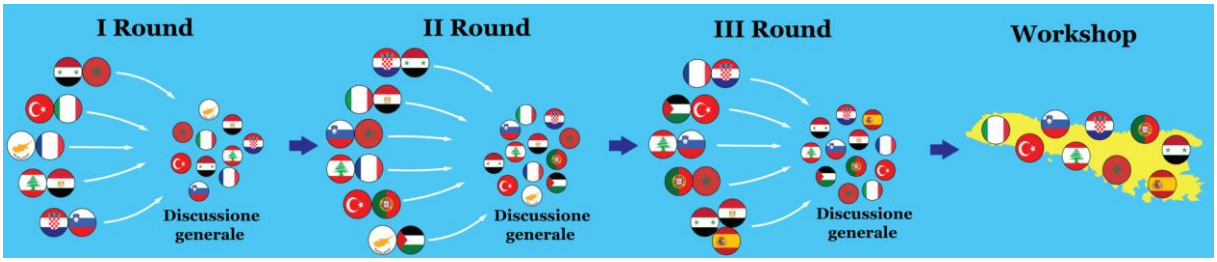
3. The I-OAE Co-design Projects

Before analysing the specific experiences, we would like to outline the idea and the rationale behind the co-design approach we have decided to explore.
In fact, among other projects, the I-OAE developed a series of collaborative processes in the education sector, with an initial focus on the Mediterranean. Representatives from Albania, Cyprus, Croatia, Egypt, France, Greece, Israel, Italy, Morocco, Montenegro, Palestine, Portugal, Slovenia, Syria, Spain and Turkey participated in various stages.
The method adopted is peer co-design, with specific objectives:
- To create a network of people who exchange and share educational practices and ideas
- To create a network of people who take on co-design as a practice (also with teachers and at the local level).
- To produce a learning path for school enriched by different points of view, always keeping in mind the leading actor of learning, i.e. the student.

We did not want to give teachers a set of instructions to use, but the tools to adapt each specific activity to their specific context (whether this regarded the country, or neighbourhood, or the language used in the classroom). We think that something meaningful for children in Italy could be less interesting for children in Africa, as well as for someone living in a city or a village; and the Mediterranean provides quite different environments to compare.
So we started with a call to all NAECs (National Astronomy Education Coordinators) in the Med Area, and a series of online roundtables (MIRTO project) to get to know the participants, the local curricula and the challenges to be faced. This phase has been followed by online meetings to co-design activities around the general theme of *light* (STEAM-Med project) followed by an in-person workshop in the highly symbolic Lampedusa island. (2021/2022 followed by the publication of the booklet of the activities in 2023 [6])
This model (online meetings during several months, followed by an intense in-presence workshop) worked so well that we decided to follow up in 2024-2025 with two projects (Sabir and FResCO projects) that again involved the NAECs in a first online codesign phase, followed by in-presence activities to finalise the resources created.
All the resources have been (or will be, at the end of the project) published in astroEDU, the web repository for peer-reviewed educational materials (cfr. e.g. [7])

3.1 MIRTO, STEAM-Med and the Workshop in Lampedusa

The MIRTO (Mediterranean Informal Round Table Online) project involved countries in the Mediterranean area: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia, and Turkey.
Every week, from December 2021 to February 2022 I-OAE organised a 2-hour online very informal meeting in which National Astronomy Education Coordinators (NAECs) from 4 different countries introduced themselves and their work. In the second part of the meeting, we discussed freely the situation in our countries and the expectations from the OAE office.
After these exploratory steps, our idea was to concentrate on the crossroads between our focuses: the Mediterranean, children's education and astroEDU, and so to create an educational path that could be interesting for children/schools (in the approximate age range 6-12), in the Mediterranean area. It is not a single resource or a single workshop, but rather a set of activities that explore a concept or an idea in astronomy, astronomy, or physics. So the newly formed community of NAECs representatives collectively agreed this subject be "*light*", which is a very broad theme, easily declined in many different ways and adaptable to different contexts, as well as interdisciplinary and linked to Astronomy, our common interest. The final goal was, in fact, to build together a collaborative environment on a permanent basis for multicultural, trans-disciplinary projects, in order to highlight the cultural richness of those areas and promote activities which support astronomy education in the context of a multicultural society, intercultural and interreligious dialogue, environmental issues, and human rights, in line with the UN Sustainable Development Goals.
So, in the STEAM-Med project, each NAEC team selected their own materials and resources, which were discussed, shared and defined iteratively during three rounds of online co-design meetings (see picture).



During each co-design round, the NAECs incorporated suggestions and ideas from the paired country. For the first round, we formed pairs going for similarities; we paired educators with the same language (e.g. Syria Morocco, Lebanon Egypt), or else we paired NAECs who already worked together (Croatia Slovenia). In the second round - on the other hand - we paired NAECs who were apparently not so connected (Syria Turkey, Lebanon France, Morocco Croatia, Portugal Palestine). The Italian team facilitated the work by setting up moments of sharing and reflection and helping to find out the tailoring strategies.
After this online effort, we held an in-person workshop in Lampedusa (Italy): 23 National representatives attended the workshop and 14 Mediterranean countries shared the whole process: Cyprus, Croatia, Egypt, France, Italy, Lebanon, Morocco, Palestine, Portugal, Syria, Slovenia, Spain, Tunisia and Turkey, Montenegro and Greece. Some of the representatives could not attend the workshop for personal or professional reasons. Still, we wish to underline that Palestine's representative could not attend because of the overwhelming difficulty of obtaining a visa.
In-presence activities alternated with open discussion among peers in a truly co-designed experience.
We chose Lampedusa as the first workshop venue, because it is particularly relevant for all Mediterranean countries, being a place where migrants from Africa land, headed to northern Europe: a place of encounter, a symbol of meeting and dialogue and a multicultural historical venue.
A video highlights the whole process, its vision, and its community-building capacity [8]
After the Lampedusa Workshop, we kept working to finalise the products of our efforts, the Stem-Med educational activities, discussing with NAECs the final shape of the documentation for it to serve at best our target communities.
A booklet with a collection of activities and indications for possible educational pathways has been finally published [6]: the booklet is translated into English and Mediterranean languages: Arabic,

French, and Italian (some activities are also available in Turkish, Slovenian, Croatian, Portuguese, Spanish).
The co-designed resources were also published on the astroEDU repository, to reach an even wider (worldwide) audience of educators interested in promoting STEM subjects through Astronomy hands-on activities.
These first projects proved to be a huge success not only in producing shared resources but also in creating a community of practitioners sharing ideas and scopes around the Mediterranean and beyond. So much so that after the first in-person Lampedusa workshop, in the following years similar Mediterranean Regional STEAM Astronomy workshops were held in Morocco (https://aui.ma/mediterranean-regional-steam-astronomy-summer-school) and Turkey (the Mediterranean Regional SHAW-IAU Workshop on ASTronomy for EDucation, MASTED, held in Istanbul https://sites.google.com/view/masted/home?authuser=0) enlarging the community and including participants from other countries (Algeria, Mauritania, India, Pakistan, etc)
Also, in 2024 we expanded our co-design efforts by engaging in two new projects: one (Sabir) aimed at high school education, focussing on an IBL (Inquiry-Based Learning) approach; and the other (FResCo) aimed at primary students, focussing on child-centred methods, particularly Game-based and Playful learning. Both projects foresaw a few months of online meetings (and off-line work) to co-design activities, followed by an in-person residency, a necessary time to focus, build together and finalize the work.

3.2 SABIR

Sabir Project, a co-design project among Mediterranean NAECs, built on our previous co-design experiences in the area. To underline the meaning of this collaboration, the name Sabir indicates the old Mediterranean contact language, which was used as a lingua franca in the Mediterranean Basin from the 11th to the 19th centuries.
Sabir involved partners from six collaborating countries: Italy, Lebanon, Morocco, Slovenia, Spain and Turkey. It aimed at fostering open and critical learning by producing fully co-designed IBL (Inquiry-Based Learning) activities for high school students, provided with a Student's Guide, Teacher's Guide and a common evaluation form. The basic idea was to give birth to a collaborative process among peers with similar scientific competencies and backgrounds, while the diversity among us was mainly due to our experiences and cultures. In this case, we chose not to design activities from scratch, but started from the proposals of each participant NAECs, leveraging on their past experiences.
The general goals of the project were:
1. Sustaining the NAECs network in the Mediterranean;
2. Exchanging best practices;
3. Community building and reinforcement;
4. Co-design implementation process.
Our final goal was to have 4 education activities published on astroEDU translated into English, Italian, French, Spanish, Slovenian and Turkish.
The participating NAECs came from Lebanon, Morocco, Spain and Turkey, whereas the NAEC of Slovenia was invited to join the Office members as an organizer and facilitator, and another member of the Office acted as an evaluator observing the dynamics of the discussions and qualitatively recording the ongoing process.
Following a discussion regarding the definition of IBL and the principles of its design, we gathered ideas and practices related to this theme in order to restructure our framework/scheme for an IBL activity. This helped us in the development of the activities.
We chose to work on the following activities, among those proposed by the NAECs of Lebanon, Morocco, Spain and Turkey:
- Asteroids mining. It's a challenge where the students are asked to develop a scientific plan for mining asteroids and extracting space resources. They must choose their own mission (looking for water or different minerals) and identify the most suitable asteroid through the analysis of orbital and spectral characteristics.
- Exploring Exoplanets: The transit method. Through hands-on activities, students simulate an exoplanet transit using basic materials. They model transit events, experimenting with different parameters of the exoplanets.
- 3,2,1… water rockets. The students construct their own water rockets using everyday materials and launch them, experimenting with the principles of physics and engineering involved, with

special attention to the role of the fins, the trajectory of the rocket, and its initial speed. Which will be the best rocket to save our two astronauts trapped on the ISS?

- Our place in the universe. The students must compare the scientific previsions of the Venus phases according to two different Solar System models: the geocentric model and the heliocentric one. Then they must compare their previsions with the real data and decide "to save or not" Galileo and his friend Copernicus.

The collaborative work was to transform the proposed activities into IBL ones: each NAEC presented the activity, and we discussed all together the main idea, the link to the national curricula, how to engage the students in the scientific challenge, what inquiries the students could choose to conduct, what would be the necessary materials/software/real data to foster an interdisciplinary approach and so on. Each NAEC changed the activities according to the discussion, then, we repeated twice more the whole process of presenting, discussing and proposing further developments, and re-writing the activities.

During this online phase, our qualitative analysis of the discussions showed that - while preparing the educational activities - astronomers/physicists/researchers usually focus on the «contents area» (conceptualization, investigation), wondering: which contents have the students learnt? Which contents have they understood? Which contents will they remember?

In this phase, the facilitator's role was mainly to help the participants focus on the scientific points which could become objects of the inquiry, such as reducing the number of physical parameters to investigate and aligning them to the curricula of the ideal target students. Another effort was to turn the attention from the content to the skills.

During the residency, the NAECs discussed the activities in pairs taking turns so that everyone had the opportunity to present the activity to the others, with the help of a facilitator. In this phase, the main focus was on engaging the students and creating the conditions for them to discuss and express themselves in a comfortable, welcoming, stimulating environment. The facilitator's role was to help the sparring partner NAEC and raise questions, discuss the IBL approach, and pinpoint the most relevant issues to be solved. Additionally, a qualitative evaluation was carried out during this phase, essentially to collect observations on the co-design process. The presenting NAEC collected the suggestions and implemented the activity before the following bilateral meeting. At the end of the week, all the NAECs were requested to write down the final version of the activities.

The four activities are now published (or under publication) on the astroEDU repository (see [4], [9], [10], [11]).

Future developments of this project regard the publication of the teacher's guide and student's guide translated into various languages of the participating NAECs and the extensive evaluation of the effectiveness of the activities themselves especially as viable tools for promoting IBL.

3.3 FRESCO

FRESCO (Florence RESidency and COdesign) is a spin-off of previous co-design initiatives in the Mediterranean, "expanding" worldwide and aimed at developing playful educational resources for children up to 12 years old, with a particular focus on astronomy and astrophysics. The project has two main objectives: (1) expanding a network of practitioners dedicated to STEM and child-centred astronomy education and (2) designing and publishing educational resources, preferably in the astroEdu web platform.

As an outcome of the international call [12] for NAECs (National Astronomy Education Coordinators), 10 teams were selected from Lebanon, Morocco, Greece, Portugal, Nigeria, Syria, Pakistan, Turkey, India, and Egypt. The teams have been working in online collaborative groups, engaging in a co-design process to create meaningful and playful learning activities and open to 'deconstructing' and reworking the proposed activities, according to the input from the co-design group. Seeing the variety and diversity of the proposals we got answering the initial call, we decided to co-design activities from zero. Before the kick-off, two preparatory seminars were held to introduce key concepts in Playful Learning (PL) and Game-Based Learning (GBL) and set up a common understanding of these methodologies. The teams then split into two groups, according to their preferences and the activities they proposed answering the call. They worked online in the PL and GBL groups, with plenary sessions in between.

The PL group is co-designing an educational pathway on "Searching for Life in the Universe - Galactic Habitable Zone" addressing concepts of galaxy structure, habitable zones, and exoplanets. This activity is structured in 4 "stations": educational activities designed as part of the global educational path. Each one could be performed as a single activity too, since they were designed to be self-

consistent. All the activities will be produced in the AstroEdu template, to publish them on this platform. In particular:

- Activity 1 (Tentative title: " Shape and size of Galaxies"). It is an engaging, hands-on playful learning experience designed to introduce students to the fundamental concepts of galaxy types, and astronomical scales. Through a game-like approach, students work collaboratively in small teams to construct visual representations of galaxies by drawing or using art supplies with step-by-step guidance provided by carefully created flashcards.
- Activity 2 (Tentative title:"The Universe as a recycling machine"). This activity introduces students to the concept of nucleosynthesis and how the Universe recycles elements through stellar processes. Using playdough, students will simulate the formation of elements from protons and neutrons, mimicking the cosmic processes that create elements in stars and supernovae.
- Activity 3 (Tentative Title: "The Galactic Habitable Zone"). This activity introduces students to the concept of galactic habitable zone (GHZ). In particular, playing with flash cards, students can discover the different physical phenomena that affect the position and size of the GHZ.
- Activity 4 (Tentative title: "Other habitats beyond Earth"). This activity is designed to discover the science beyond the study of habitable exoplanets. In particular, students will learn to recognize which stars are more likely to be discovered with an exoplanet system, to compare some exoplanet systems with our Solar System and identify the habitable exoplanets.

The GBL group through facilitated iterative design discussions is leading to the refinement of two board games centered on constellations:

- Constellation Explorer, which, through game mechanics, highlights different mythologies and cultural interpretations of constellations (with a card draw mechanism children have to collect constellations based on stories told by different people and place them on the sky map)
- Sky Safari, is a game for getting acquainted with the night sky, in which players will collect observations in a real layout of the sky on the board, using different telescope tokens and going through constellations and various well-known sky objects.

All the intensive online codesign activities culminated in the in-person FRESCO residency that took place in Istanbul (instead of Florence, because this allowed us to join efforts with MASTED, the Med workshop and involve the NAECs in both activities), where participants finalized the first prototypes and revised activities. These were later tested in laboratories at the MASTED Workshop, receiving feedback from educators. Further online meetings followed (and still are ongoing), incorporating insights from the first testing. NAECs will produce new prototypes and refined descriptions for additional local testing with children and teachers before the final materials are published and disseminated, thus producing resources and documentation for schools worldwide.

An in-depth evaluation of the final resources that will be produced and the co-design method will be carried out as part of next year's FRESCO follow-up activities. The evaluation of the final products (PL activities and the games) will involve groups of students experiencing the activities in their classrooms in the different participating countries. As for the method, the FRESCO project involves many people who did not know each other initially and only worked together online for a long time; also it involves a working method (co-design) and a methodological approach (game-based and playful learning) that are not universally acknowledged. During the codesign process, we kept an eye on the fact that the activities we were designing were coherent with a definition of PL and GBL that we collectively agreed upon. The main research questions that drove our evaluation were in fact to understand participants' perceptions and personal experience and their views on the value and effectiveness of such a process; if they were feeling comfortable with it, whether it was changing their perspective in any way and if it was perceived as effective in producing somehow better resources than the ones that could have been developed independently.

To gather evidence on our co-design process, we hence used different tools: surveys on pre-existing knowledge of the process and educational methodologies; cumulative online jam boards to collect disciplinary aspects proposed by participants, previous ideas and preconceptions on methodological aspects, and fundamental values on which to base the educational action; questionnaires: to assess changes in participants' feelings, perceptions, knowledge, and expectations, before, during, and post process; reflective journals. We distributed 4 online questionnaires to the participants with different questions, some repeated (comfortable feelings, inspirations, changes during the process). The main idea was to encourage self-reflection and identify strengths and improvement areas.

Also, we took observations: during all the phases (online and in presence), we recorded the sessions and took notes to evaluate several aspects of the process, such as team dynamics, the flow of the collaboration, decision-making processes, and any possible disagreements among the participants.

Finally, to gather qualitative insights on the participant experiences (in particular, network community building efficacy, collaboration, challenges faced, process efficiency, feasibility, and replicability), we dedicate a final in-person one hour session to a focus group with all the participants.

4. Conclusions

Co-design is a time and effort-consuming practice for both participants and facilitators. With all these co-design projects, we wish to encourage large cooperation in the area, involving local practitioners in online meetings, training courses, and other teaching activities that can be designed together with all the NAECs and the stakeholders of the interested countries. The most important part of these projects is the process itself because we really want to stimulate the Mediterranean and international community, nurture it and generate a space where people from the area can work together in Astronomy Education. Also, the obvious challenges of this project lie in the fact that the geography of the Mediterranean does not correspond to uniformity of language, cultural heritage or religion; different countries may also have political differences, and people may come from various educational backgrounds with diverse values and positions.
As preliminary results of the in-depth evaluation that is still ongoing, the atmosphere in the online meetings always becomes increasingly positive and effective, and the in-person activities always made everything easier, smoothing out some rough edges we encountered along the way. A key challenge that emerged over time is the efficiency of this process, which requires patience and time for results to fully materialize. In the early stages of the co-design process in FRESCO, some participants felt overwhelmed by the variety and richness of the proposals, expressing doubt about the potentiality of the process to produce an outcome. Some participants also shared with us that they had to make several compromises on their initial ideas to create a shared, collaborative product. As we approached the final stages, just before the residency, participants reported that meeting by meeting, the product was becoming more concrete, thanks to the impressive group work and the rich exchange of ideas among all. This collaborative dynamic allowed for the gradual emergence of a shared vision. One participant's diary entry particularly stands out, capturing the general feeling of the group during the closing of the online sessions: "*I'm happy that we are getting somewhere. In the last round, we developed a draft of the final game and felt confident we can really do it. Co-design needs time and patience, but it's a great way to exchange ideas and learn from each other*." This reflection embodies the spirit of co-design: it may be a slow and, at times, uncertain process, but it fosters a collaborative environment where participants can learn, evolve, and ultimately create something meaningful for everyone. A very significant entry of one of the reflective journals states: "*As a matter of fact not only my ideas are changing, my way of thinking, the way I research for certain definitions and topics, the way I discuss with my group members, and the way they and I convince each other. This co-design was a wonderful experience for me to develop and grow. So yes, a change for the better and the more collaborative approach*".
In addition to this openness to the codesign process as professional growth, participants also recognised an intrinsic value to this method as value with respect to the educational design itself: "*Yes of course, there's a considerable change in my initial idea! I improved the initial proposal based on the input from different colleagues and still the second version needs new improvements based on their new input. Thanks to these co-design meetings, I learnt a lot about educational game design*".

REFERENCES

[1] IAU Office of Astronomy for Education, OAE Center Italy - Annual Report 2023, https://doi.org/10.20371/INAF/TechRep/294
[2] https://edu.inaf.it/oae_italia/mirto-steam-med-co-design-process/
[3] https://astroedu.iau.org
[4] https://astroedu.iau.org/en/activities/321-time-for-water-rockets/
[5] Towards knowledge societies: UNESCO World Report 2005 https://unesdoc.unesco.org/ark:/48223/pf0000141843
[6] M. Alassirry, T. Alkhateb, S. Casu, H. Darhmaoui, R. Doran, G.Giobbi, J. Gonçalves, A. Guštin, D. Hržina, T. Jbour, E. Karabal, M. Koçer, H. Madani, C. Mignone, S. Ricciardi, S. Rini, J.P. Saghbini, S. Sandrelli, S. Varano, F. Villa, A. Yelkenci, K. Yelkenci, A. Zanella, A. Zanazzi, M.B Zeid "STEM-MED: a co-design project in the Mediterranean" Booklet of the activities (in English, also available in Italian, French, Arabic) https://edu.inaf.it/wp-content/uploads/2023/06/STEAM_MED_English.pdf

[7] Aysegul Yelkenci (Istanbul Kultur University, Turkish Astronomical Society), Korhan Yelkenci (Istanbul University, Turkish Astronomical Society), Mert Koçer (Kusadasi Ataturk Secondary School) “The Sun in our box” https://astroedu.iau.org/en/activities/the-sun-in-our-box/
[8] https://www.youtube.com/watch?v=Nm7bpsfgkMw&t=165s
[9] Hassane Darhmaoui (Al Akhawayn University), Zakaria Belhaj “Exoplanets in a Box” https://astroedu.iau.org/en/activities/exoplanet-in-a-box/
[10] Aysegul Yelkenci (Istanbul Kultur University, Turkish Astronomical Society), Ceren Can (Istanbul Kultur University), Korhan Yelkenci (Istanbul University, Turkish Astronomical Society) “Asteroid Miners” https://astroedu.iau.org/en/activities/asteroid-miners/
[11] AA.VV https://astroedu.iau.org/en/collections/sabir/
[12] https://edu.inaf.it/oae_italia/fresco/