ELSI SCIENCE OUTREACH EVALUATION FRAMEWORK

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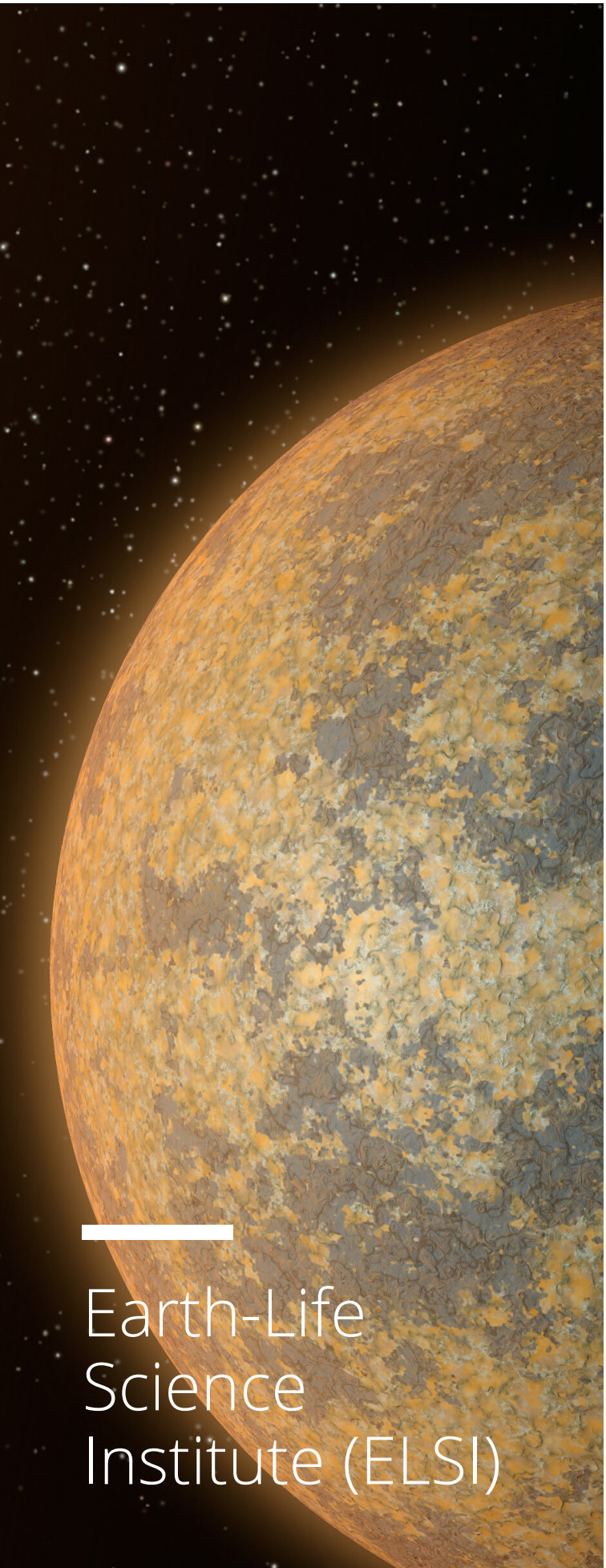


Earth-Life Science Institute (ELSI)

OVERVIEW

The Earth-Life Science Institute (ELSI), Tokyo developed an evaluation framework that helps outreach practitioners, researchers and policymakers measure and understand the impact of their outreach activities. The framework includes several different methods of data collection and analysis that can be used in a variety of outreach activities aimed at students and the public. The framework is intended as a guide that research institutes and universities can simply and easily integrate into their outreach activities. The evaluation methods are based on the Public Outreach Evaluation Strategy by UCL (2009), European Planetary Science outreach toolkit (2018), and the Space Awareness Evaluation Report by Leiden University (2016). The evaluation analysis is based on the Generic Learning Outcomes (GLOs) framework.

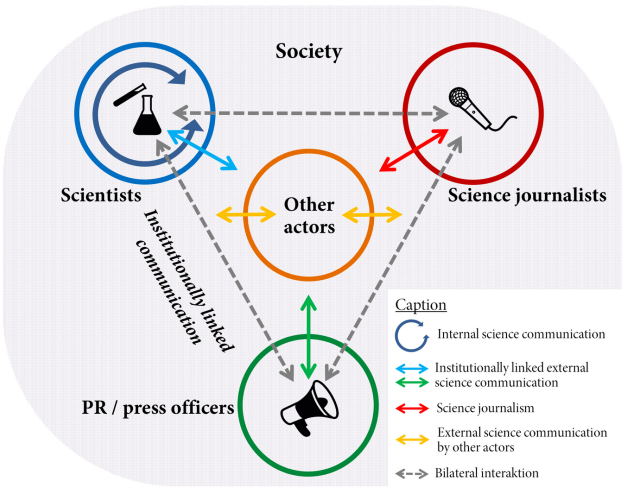


Figure 1: Overview of the field and the actors of science communication framework.

Coordinated evaluation ensures that the project resources and activities are relevant and applicable to the various target audiences. This will create a sustainable legacy for science outreach that will help to determine the societal impact and reach. In particular, there are three main areas of focus:

- Students' pre and post decision making relating to scientific career choices, which determines a baseline of existing attitudes.
- Formative evaluation and piloting of materials will allow improvement.
- Summative evaluation will provide clear indications regarding the overall impact.

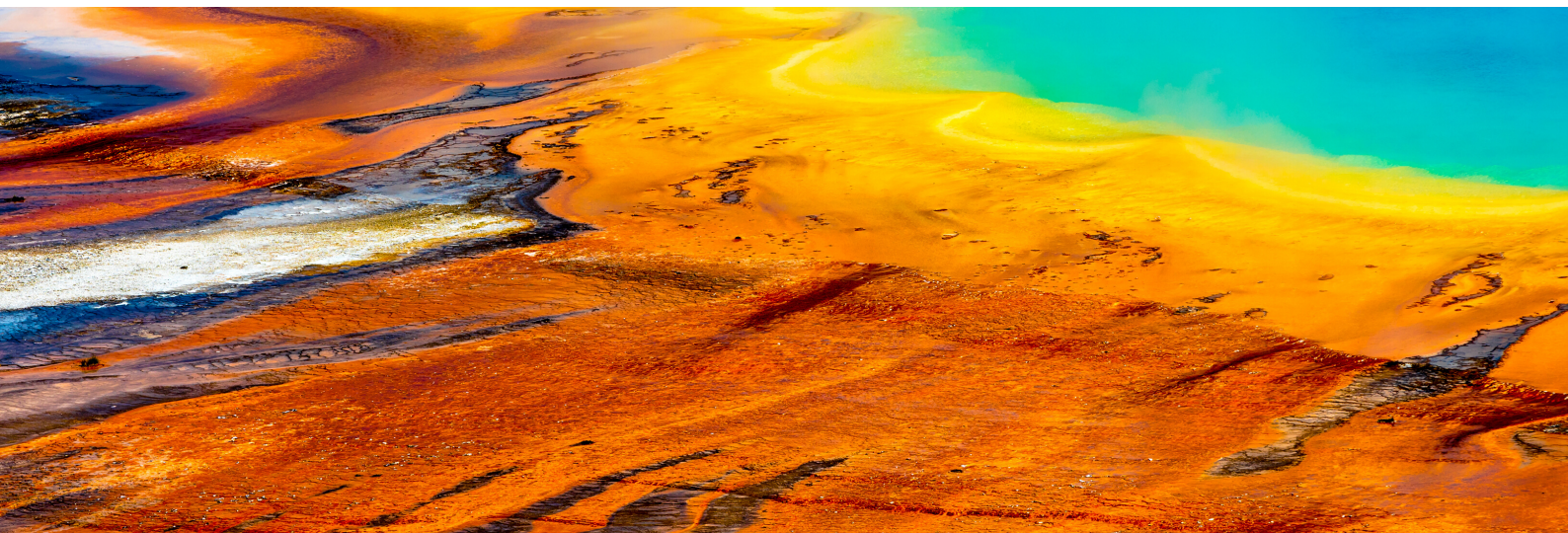
It should be noted that this work is 'on-going' and will be updated constantly with revisions and improvements. All the surveys and evaluation procedures are conducted according to appropriate ethical guidelines on data collection and usage.

2.0 Importance of evaluation

Evaluation is a systematic process designed to help you better understand – and improve – your participants' experience of your outreach activities. It involves collecting information (for example feedback, observations or quiz results) and reflecting on what worked well, what could be improved, and what changed for the people involved as a result of their participation. Measuring the number of participants is a common way to start evaluating outreach efforts; however, it does not explain the quality of the experience, learning outcomes and inspiration to pursue the subject matter.

3.0 Evaluation aims

There are four key aims in relation to the evaluation framework: 1) To use formative evaluation to shape the outreach activities, ensuring they meet the outreach objectives and the audiences' needs, with a spirit of continuous improvement. 2) To report and measure the impact of the outreach activity in a way that is consistent across all activities and pays particular attention to any differences associated with intended career choice and gender. 3) To provide evidence of the outreach activity success and areas for improvement, and help communicate these findings to policymakers, funders and others working in science education and engagement. 4) To establish a baseline dataset regarding existing attitudes and opinions towards science, as well as developing an approach for determining longitudinal impacts of science outreach.



4.0 Analysing the evaluation outcome

In order to understand the evaluation data and analyse them, the framework will draw from the Generic Learning Outcomes (GLOs) framework. GLOs measures the individual and collective perception of learning by reflecting on a broad view of learning effects. The GLOs are organised in five different categories, or themes, that reflect different aspects of learning that are equally important and often overlap. In a particular setting (public lecture, school lecture, lab activity, exhibition engagement, workshops, etc.) you might focus more on one or two of these learning aspects.

1. Knowledge and Understanding – includes learning facts or information and the deepening of understanding, for instance how things relate to each other.

2. Skills – includes know-how, knowing how to do something and the development of skills in order to be able to do new things. It encompasses intellectual skills, social skills, communication skills, physical skills and information management skills.

3. Attitudes and Values – includes feelings, perceptions and opinions about ourselves and towards other people or organisation(s). Increased capacity for tolerance and empathy, increased motivation, and attitudes towards an organisation or an experience.

4. Enjoyment, Inspiration, Creativity – includes having fun, feeling happy, being surprised, inspired, and innovative or creative while exploring, experimenting and making things.

5. Activity, Behaviour, Progression – includes what people do, intend to do, or have done and changes in people's behaviour as a result of the learning experience.

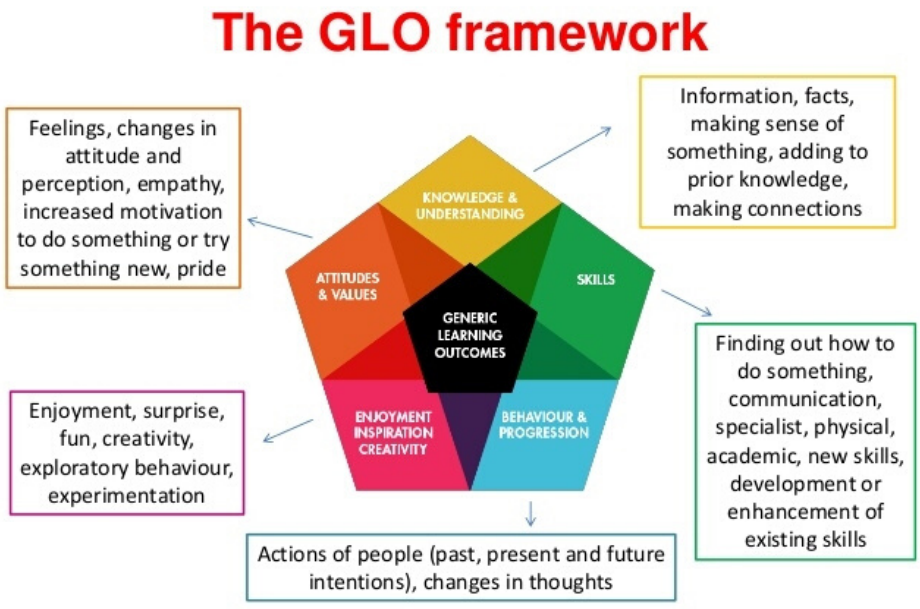


Figure 2: The Generic Learning Outcomes are underpinned by a broad definition of learning which identifies benefits that people gain from interacting with arts and cultural organisations.

5.0 Types of evaluation methodology

While there are many types of evaluation methodologies, this framework focuses on three: targeted surveys, post-event questionnaire, and pre-and-post method. Each methodology determines different outcomes or combinations of outcomes on stimulating interest in and positive attitudes towards science, choosing science as a higher study and for careers, and so on.

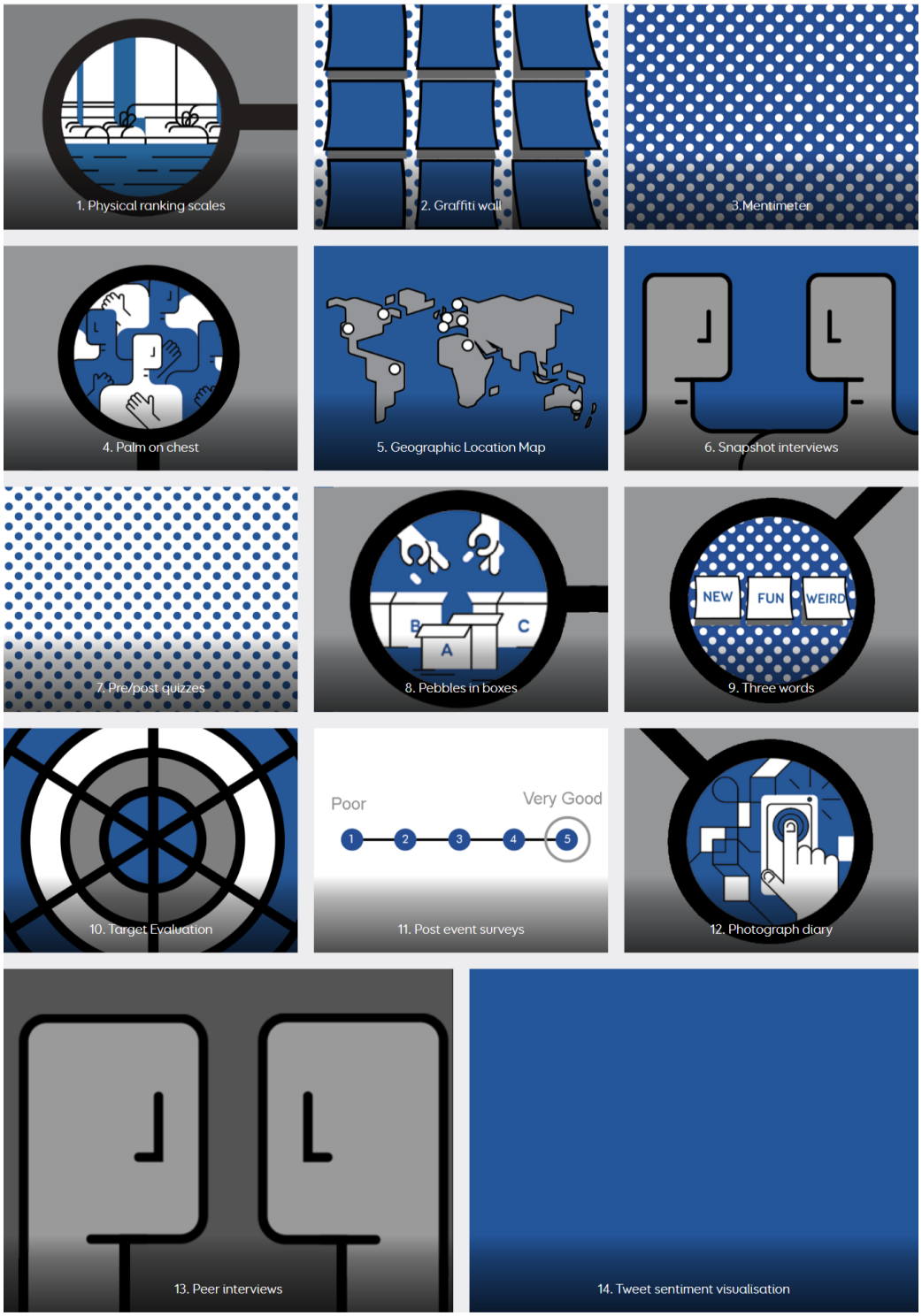


Figure 3: Europlanet Evaluation Toolkit developed by Europlanet 2020 RI includes several different evaluation methods.

5.1 Targeted surveys [1]

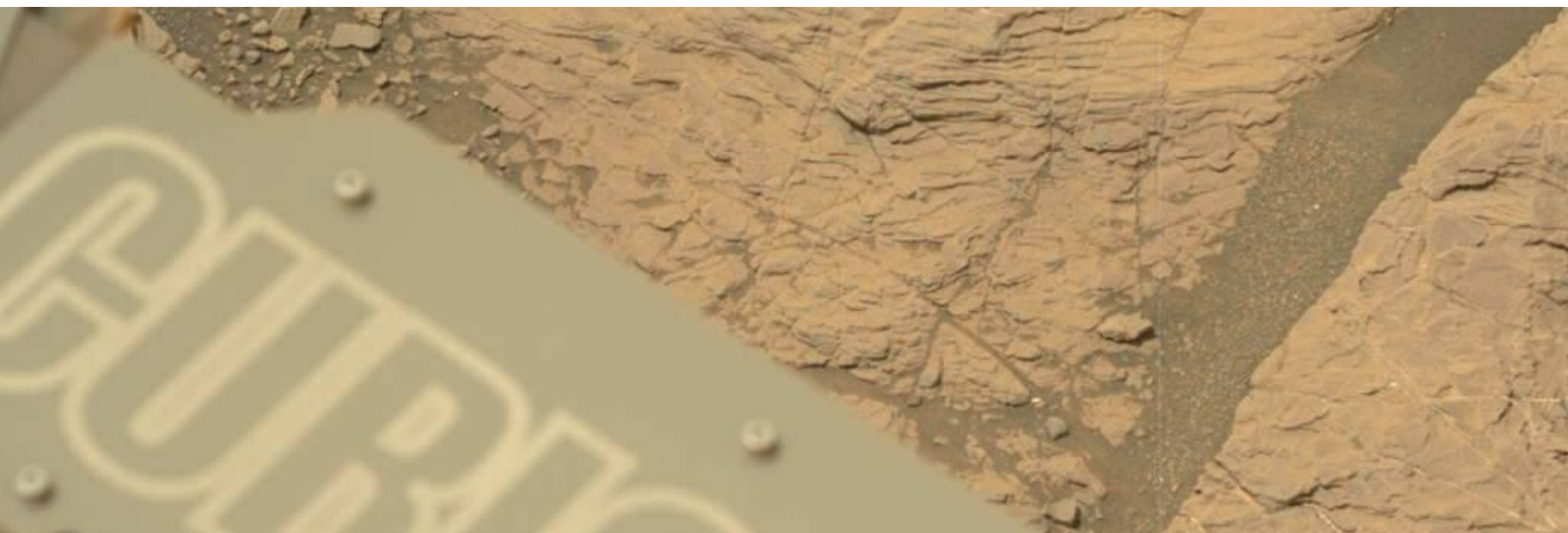
In order to gauge attitudes towards science careers and engagement at larger outreach efforts such as the Super Science High School Fair, a survey was developed. Previous research and frameworks focused on longitudinal workaround attitudes and aspirations were considered when developing the survey: Space-Awe Evaluation Framework (Bultitude. K., DeWitt. J., 2016), ROSE (Relevance of Science Education), and relevant Eurobarometer work. The aim of the survey is to determine a baseline of students' attitudes, influences, and aspiration towards scientific careers. Using 17 questions in 5 categories: 1) Demographic data, 2) Knowledge transfer,3) F uture aspiration, 4) Attitude towards science, and 5) Open-ended, the survey will provide evidence-based findings to communicate to policymakers, researchers, and PIOs. E.g. surveys for students at a science fair, exhibition, symposium attendance.

5.2 Post-event questionnaire [2]

Post-event questionnaires are used immediately after an event to help understand the experience of the audience: what they thought of the experience, what they gained from it, and what they thought could be improved. The questions could be in categories of 1) demographic data to understand the audience participation 2) knowledge transfer to identify if the event provided new information, and 3) open-ended questions to determine areas to improve and adapt. E.g. public lectures, lectures at schools for students.

5.3 Pre-and-post method

This methodology conducts brief surveys that are used before and after an event. The outcome of pre/post surveys helps to identify where the audience has learned the key aspects of the event (knowledge transfer) and to understand the pre and post knowledge of the given topic. It's important to have the same questions for pre/post surveys and the questions can be in the format of multiple-choice, true/false, and multiple responses. This methodology is particularly effective for use with school groups or interested adults participating in lectures, lab tours, interactive workshops, courses, or online content, but can also be used with the general public and lectures/presentations. E.g. lab tours, institute visits, and school visits.



APPENDIX:

[1] Example of the student survey for the WPI Super Science High school Student Fair

(Demographic data)

- Age:
  - 12/13/14/15/16/17/18
- Gender:
  - Male / Female / Other
- Have you attended SSH before?
  - First-time / Second-time / More(Knowledge transfer)
- Have you ever heard of the WPI Programme (World Premier International Research Center Initiative)
  - Yes / No
- Do you know any of the WPI research institutes in Japan?
  - AIMR / Kavli IPMU / iCeMS / IFReC / MANA / I2CNER / IIIS / ELSI / ITbM / IRCN / NanoLSI / ICReDD / ASHBi /

(Future aspiration)

- I want to go to university after high school.
  - Yes / No / Not sure
- I want to go to university in Japan.
  - Yes / No / Not sure
- I want to go to university overseas.
  - Yes / No / Not sure
- I want to study a science stream at the university.
  - Yes / No / Not sure
- I want to do a PhD.
  - Yes / No / Not sure
- I want to be a scientist.
  - Yes / No / Not sure

(Attitude towards science)

- Best scientists are usually men.
  - (Strongly disagree) 1 / 2 / 3 / 4 / 5 (Strongly agree)
- Important scientific discoveries are done by female scientists too.
  - (Strongly disagree) 1 / 2 / 3 / 4 / 5 (Strongly agree)
- Scientific research can help our society in general.
  - (Strongly disagree) 1 / 2 / 3 / 4 / 5 (Strongly agree)
- Scientific research can make MY daily life better.
  - (Strongly disagree) 1 / 2 / 3 / 4 / 5 (Strongly agree)

(Open-ended)

- I'm interested in science because…
- I want to study…

[2] Example of a post-event questionnaire from annual ELSI Public Lecture.

(Demographic data)

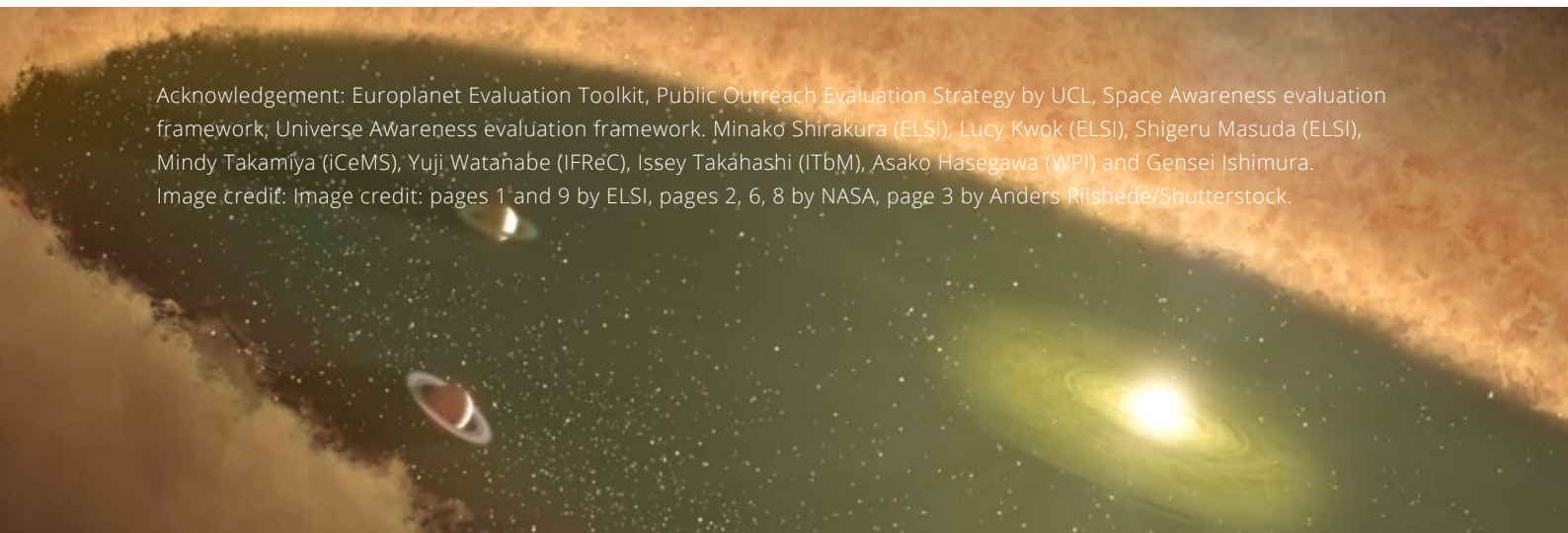
- Age:
  - Under 15 / 16-19 / 20-29 / 30-39 / 40-49 / 50-59 / 60-69 / 70-79 / 80-89 / 90+
- Gender:
  - Male / Female / Other / Prefer not to say
- Have you attended ELSI Public Lecture before?
  - Yes / No
- Have you attended other public science lectures?
  - Yes / No
- Will you attend future ELSI public lectures?
  - Yes / No / Undecided

(Knowledge transfer)

- I enjoyed the lectures:
  - (Not likely) 1 / 2 / 3 / 4 / 5 (Extremely likely)
- I learned new scientific information:
  - (Not likely) 1 / 2 / 3 / 4 / 5 (Extremely likely)
- I would like to find out more about this topic:
  - (Not likely) 1 / 2 / 3 / 4 / 5 (Extremely likely)

(Open-ended)

- What did you like about the event?
- Was the information about the event clear? (about the venue, time, topic, etc)
- What suggestions would you recommend for the next event?



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