

# MEETING WITH SPACE JOBS: DO YOU WANT TO FOLLOW A SPACE CAREER?

*Activity developed by teachers*

A lesson plan

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## BRIEF DESCRIPTION

Students will familiarise themselves with space missions, and the opportunities and potential of careers in the space sector. Students will understand the benefits generated by space sciences and technologies. In addition, students will understand that studying sciences at school allows one to develop skills that are extremely valuable to pursue a space career. Students discover about the great relevance of space sciences in our everyday lives.

**Category**  
Space

**Type of activity**  
Lesson plan

**Education level:**  
Middle school

**Age range**  
10-16

**Time**  
5 hours

**Supervised for safety:**  
No

**Cost:**  
Low (<5€)

**Group size:**  
Group

**Location**  
Indoor (small, e.g., classroom)

**Core Skills**

Asking questions  
Planning and carrying out investigations  
Constructing explanations  
Engaging in argument from evidence  
Communicating information

**Type of learning**  
Fun learning

## KEYWORDS

Space; space career; space sciences; spin-off; gender balance.

## GOALS

- To make connections between objects related to space and our everyday lives.
- To identify students' interests and hopes for the future.
- To promote space careers as a motivation for learning and studying STEM (Science, Technology, Engineering and Maths) at school.
- To exploit the importance of skills that are relevant to follow space careers.
- To explore and to research about possible future space careers.
- To investigate space science topics and phenomena which relate to space careers.
- To identify the importance of space careers in our daily lives.

## LEARNING OBJECTIVES

Students will be able:

- To describe physical phenomena related to space;
- To recognize and describe some important objects related to space activities and their importance in our daily lives;
- To identify and explore skills that are important in the pursuit of a career related to space;
- To identify current and future space careers, and their importance to humankind;
- To find the science behind some space related jobs.

## EVALUATION

- Check that all objectives are reached.
- Ask the student to identify some space careers.
- Ask the student to write a small essay describing a job related to space, indicating what are the required skills and its importance for humankind.

## MATERIAL

- Computers with Internet access

In case there is no access to the Internet, each group of three or four students will need the following:

- Large sheets of paper
- Coloured markers.

Each student will need the following:

- Pencils
- Paper

## FULL ACTIVITY DESCRIPTION

Give a short introduction to the theme of space careers, remembering your students they will spend their lives in the 21<sup>st</sup> century, and that the future always offers unpredictable opportunities.

We already have a space station (the ISS) orbiting our planet, permanently occupied with scientists and astronauts, and more are expected to come; space probes will explore new planets, natural satellites and asteroids; there will be manned missions to our Moon and/or to other planets, such as Mars...

These are only examples of the scientific and technological accomplishments happening in the exciting future ahead of us, and that humankind currently dreams of.

### First phase: orientation/background Information

Present to students a list of objects that are used in their everyday lives and that are developed thanks to the space science technologies. A possible list might, for example, include:

- A lubricant;
- Sunglasses;
- A helmet;
- Headphones;
- A cordless vacuum cleaner;
- A pillow;
- An electric toothbrush;
- A digital wristwatch;
- An infrared thermometer;

- A water filter;
- A bulletproof life vest;
- An artificial heart;
- LEDs;
- Some baby food;
- A mobile phone;
- A laptop;
- ...

Ask them (without giving them that information) what objects are related to space sciences' research and/or space exploration.

*"Can you select objects from this list that are related to space sciences?"*

As they brainstorm, write or highlight their selections on the board. Students might be surprised. Most of them could never have imagined that things we use in our daily lives are originated from research in the field of space sciences.

In order to start a discussing about how important are space missions and about the diversity of space jobs, give students more resources about technologies and products coming from space sciences, and ask them to reconsider their previous choices.

*"Take a look at the following resources."*

[spinoff.nasa.gov/Spinoff2008/tech\\_benefits.html](http://spinoff.nasa.gov/Spinoff2008/tech_benefits.html)  
[zidbits.com/2010/11/top-ten-nasa-spinoffs](http://zidbits.com/2010/11/top-ten-nasa-spinoffs)  
[www.nasa.gov/centers/kennedy/news/facts/nasaspinoff.html](http://www.nasa.gov/centers/kennedy/news/facts/nasaspinoff.html)

*"Also watch the following videos."*

[www.youtube.com/watch?v=Rt2cMNNqMCo](http://www.youtube.com/watch?v=Rt2cMNNqMCo)

*"Would you now reconsider your previous choices?"*  
*"What objects do you think are connected to space sciences?"*

Ask students to give you some of their answers and write them on the board. Encourage students to discuss, while supporting them. Highlight the importance of the objects developed thanks to space sciences in our daily lives.

Ask students to open a Padlet or a text editor to share their ideas, reactions, and comments on the importance of the previously presented objects and space sciences in our lives. You can also ask them to write an article for a newspaper (school or

local), to create a mini-comic in Toondoo (see Figure 1), or to publish their findings in social media.

Suggest them to find pictures and links that illustrate the relation between space sciences and our everyday lives.

*“Create now a mini comic explaining the importance of space sciences in our everyday lives.”*

[www.toondoo.com](http://www.toondoo.com)

OR

*“Write an article for a newspaper introducing the importance of space sciences in our lives. Insert pictures and links to illustrate your points of view.”*



**Figure 1:** Example of a mini-comic created in Toondoo.

### *Tips for a diversified classroom*

It is possible that in this type of exercise, some students hesitate to contribute (they may feel shy or afraid to be criticised). Make sure that you are paying attention to all students, and convey to them that all answers and all ideas are important and valuable. Try to start the discussion by asking two engaging questions. Invite all students to participate, even if you assume that the discussion is more relevant to some students

than others. Provide ample time for your students to respond and discuss among themselves.

### *Ideas for the use of ICT tools*

Students should be encouraged to use a text editor (a simple text editor, Google Docs, LibreOffice Writer, Microsoft Office’s Word, or similar) or a *Padlet*<sup>1</sup> to write and share their ideas. *Toondo*<sup>2</sup> is a great place to easily create a comic.

### *Main Skills involved*

During the orientation phase of the activity, students will mainly develop the following skills:

- **Active listening:** students are giving full attention to what the teacher and colleagues are saying, taking time to understand the different points of view, and asking questions.

1 <https://padlet.com>

2 [www.toondoo.com](http://www.toondoo.com)



- **Speaking:** students share their ideas and opinions, communicating preliminary observations.
- **Using ICT tools to present ideas.**

## Second phase: conceptualization

Students are encouraged to continue the discussion, making hypothesis, and sharing their opinions. There are no wrong or correct answers.

Give students alternative selections of objects and encourage them to continue the activity.

*"You have learnt there are many objects we use in our lives that are coming from space sciences. Can you select one of them and imagine who worked to develop it?"*

*"Select the object you most need in your life."*

*"What object would you like to have developed if you were working in space sciences? What kind of job would that have been?"*

Split students into small research groups of three or four members. Each group chooses one object developed within the framework of space sciences.

Building on the brainstorm started in the previous phase, continue discussing the topic, and encourage your students to raise all ideas related to the object chosen and to imagine its relation to space careers. Remember that even a false hypothesis can contribute greatly to the learning process.



Figure 2: Space Careers Card Game.

After the students have gathered all ideas and hypothesis in relation to their object and space careers, guide them to formulate questions on the topic.

Invite students to play the *Space Careers Card Game*<sup>3</sup> (Figure 2). This will allow them to familiarise themselves with a selection of space-related careers. While playing the game, students will think about additional questions and

hypothesis they can add to their documents.

*"We are now ready to learn more about technicians and scientists who are responsible for space missions and the development of many tools present in our lives. Let's play the Space Careers Card Game!"*

3 [www.space-awareness.org/en/careers/teaching-material/introducing-space-careers](http://www.space-awareness.org/en/careers/teaching-material/introducing-space-careers)

### *Tips for a diversified classroom*

- Encourage everyone to express their views and concerns. A good way to succeed in having all students joining the discussion is by using ICT tools such as *Google Sites*,<sup>4</sup> *MediaWiki*,<sup>5</sup> *Wikidot*,<sup>6</sup> *PBWorks*,<sup>7</sup> or *DokuWiki*.<sup>8</sup>
- Sometimes students may start a hypothesis with a comment similar to “This is probably wrong... This is not the correct connection.”. Offer a special encouragement to these students.

### *Ideas for the use of ICT tools*

A virtual space can be created with all students using one of the tools mentioned in the previous paragraph, and each group can create its own page inside that place. This way, different topics related to space careers can be investigated in one shared area. In addition to post their ideas, the members of the groups can also add resources and make them available to the other groups, for further discussion. This method fosters collaboration and allows to assess students engagement in real time.

### *Main Skills involved*

During the conceptualisation phase, students will mainly develop the following skills:

- **Critical Thinking:** students are using logic and reasoning to identify concepts, relations and connections between products deriving from space sciences and space careers.
- **Contextualisation of science:** students are learning and applying scientific ideas and rules in the framework of space careers.

## Third phase: investigation

During the Investigation phase, you will guide students to understand the connection between research and the hypothesis they have made. Discussion is turned into action, and research is performed in order to respond to student’s questions and hypothesis on the importance of space jobs for our daily lives.

For each selection of objects, you will ask students basic questions related to the characteristic of space careers. To encourage students to search for answers, guide them to explore resources in the Internet and to keep going with the research until all hypotheses gathered during the previous phases have been checked.

Make sure they understand the connection between the research they are embarking and the hypothesis they made, i.e., make sure they understand why they are going through every single step.

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4 [sites.google.com](https://sites.google.com)

5 [www.mediawiki.org](https://www.mediawiki.org)

6 [www.wikidot.com](https://www.wikidot.com)

7 [www.pbworks.com](https://www.pbworks.com)

8 [www.dokuwiki.org](https://www.dokuwiki.org)

During the investigation phase, promote a role playing game with students, where they have to imagine being a scientist, an engineering or a technician.

*"Imagine now you are a scientist, an engineering or a technician supporting a space mission to the ISS. Are you ready to embark this task?"*

Each team/group will select a space job from the following list (you are free to add others, if you like):

- Physical scientists
  - Astronomer/Astrophysicist
  - Geologist
  - Meteorologist
  - Oceanographer
  - Physicist
  - Chemist
- Life Scientists
  - Biologist
  - Medical Doctor
  - Psychologist
  - Nutritionist
- Mathematicians
  - Mathematician
  - Statistician
  - Computer Scientist
- Engineers
  - Aerospace/Astronautics
  - Instrumentation
  - Computer
  - Robotics
  - Materials
  - Safety
  - Biomedical
  - Chemical
- Crew Members of Spacecrafts
  - Pilot Astronaut
  - Mission Specialist





- Payload Specialist
- Technicians
  - Electrical/Electronics
  - Laser
  - Radar
  - Aerospace Model
  - Aircraft
  - Satellite
- Other Fields
  - Quality Assurance Specialist
  - Cook
  - Ground Radio Operator
  - ...
- ...

Ask some questions to stimulate and help them to choose a space related job.

*“Have you ever wondered:*

- *What is the purpose of discovering exoplanets?*
- *Are there other planets like Earth in the Universe?”*
- *Why aren't we able to explore all potentially habitable planets?*
- *If we do find an Earth-like planet, how will we study it?*
- *What if life as we know is not the only kind in the Universe?*
- *If we ever find evidence of life on Mars, such as fossils or evidence of simple life forms under the surface, how important would this discovery be, and how would it affect future space missions?”*

*“Imagine that:*

- *You are an astrophysicist. Classify images from the Mars Reconnaissance Orbiter!<sup>9</sup>*
- *You are an astrobiologist. Find a new house for humans in the outer space!<sup>10</sup>*
- *You are an engineer. Design a new space telescope!<sup>11</sup>*

9 [www.space-awareness.org/en/games/Cerberus](http://www.space-awareness.org/en/games/Cerberus)

10 <http://tools.inspiringscience.eu/delivery/view/index.html?id=253a685eacfb483ba87bf830b6608709&t=p>

11 <http://chrisnorth.github.io/design-a-space-telescope/#>



- *You are a geologist and carry out research investigating phenomena related to the gravitational and magnetic fields of the Earth, its internal structure and composition, its dynamics, generation of magmas, volcanism and rock formation!*
- *You work in a research centre doing data analysis about physical processes and properties of our planet and its surrounding space environment, such as electrical and the magnetic phenomena in the upper layers of our atmosphere!*
- *You are responsible for a research centre for analysing data about fluid dynamics of the oceans and the atmosphere!*
- *You are a cook and the person responsible for the menu of the astronauts during a space mission!<sup>12</sup>*

### *Tips for a diversified classroom*

- Develop a positive atmosphere in the classroom, that promotes excellence. Encourage your students (individually or as groups) to ask for support from you if they have problems during their inquiry. This is also an indirect way to get to know your students, and thus to be able to tackle assumptions you might have about their learning behaviour and capacities based on their gender or cultural background.
- Keep expectations high for all of your students.
- Supervise the teams, while being aware if a student underperforms.
- Encourage the formation of heterogeneous groups, taking into account gender, origins, and level of achievement. You may choose to assign students randomly or ask them to form their own groups.
- Make sure that the leadership positions are not always selected by the same students. Assigning roles (deliberately or randomly) may assist in assuring that all students get a chance to take on different responsibilities (using equipment, recording ideas and results, reporting, etc.).
- Take care of situations in which a student may feel isolated. Working in pairs can be a solution in such cases.
- Make sure that you give both girls and boys opportunities to take leadership.
- Create a cooperative instead of a competitive environment within each group and among groups.

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12 Read some stories about the diet of astronauts and their health while living at space:  
<https://blogs.scientificamerican.com/food-matters/30-under-30> and  
[www.esa.int/esaKIDSen/SEMQ8F1DU8E\\_LifeinSpace\\_0.html](http://www.esa.int/esaKIDSen/SEMQ8F1DU8E_LifeinSpace_0.html).

### *Ideas for the use of ICT tools and other resources*

While using the workspaces mentioned in the conceptualization phase, students can search for more information in the following websites and use the resources available there:

- [www.nasa.gov/centers/langley/news/factsheets/FS-2001-09-68-LaRC.html](http://www.nasa.gov/centers/langley/news/factsheets/FS-2001-09-68-LaRC.html)
- [www.universetoday.com/37079/benefits-of-space-exploration](http://www.universetoday.com/37079/benefits-of-space-exploration)
- <https://spinoff.nasa.gov/index.html>
- <https://spinoff.nasa.gov/Spinoff2018/pdf/Spinoff2018.pdf>
- [www.discoveryeducation.com/teachers/free-lesson-plans/life-in-space-international-space-station.cfm](http://www.discoveryeducation.com/teachers/free-lesson-plans/life-in-space-international-space-station.cfm)
- [www.ncpedia.org/sites/default/files/documents/careerstart/7nasa\\_spinoff.pdf](http://www.ncpedia.org/sites/default/files/documents/careerstart/7nasa_spinoff.pdf)

### *Main Skills involved*

During the investigation phase, students will mainly develop the following skills:

- **Critical thinking:** students are using logic and reasoning to identify the strengths and weaknesses of their investigation plan and its implementation. Propose modifications if needed, and assess the validity of the final results obtained after the interpretation of the data.
- **Judgement and decision making:** students are considering possible pathways for manipulating data, assessing their validity and recognizing errors in the experimentation and data manipulation process. They are also assessing team proposals and opinions.
- **Active listening:** students are developing the ability to pay full attention to the opinion of team members.
- **Reading and comprehension:** students are developing the capacity to follow and understand instructions, as well as relevant theory.
- **Monitoring**
- **Assessing self and team performance and taking corrective actions if needed.**

### *Fourth phase: conclusion*

Guide your students to draw their conclusions and ask them to compare these to their original hypothesis. Conclude on the importance of space missions in our lives, and encourage them to study a space career.

Students can present their conclusions by means of digital stories, posters, or a blog related to space careers.

*"You are now ready to choose a space career to follow. Explain to your colleagues what are the skills needed to do your job, which subjects you have to study, and in which way you can help lives of others by doing your job."*

### *Tips for a diversified classroom*

Give students time to draw their conclusions and make sure that you are paying attention to all of them equally.

### *ICT tools for presentation*

#### Storybird

*Storybird*<sup>13</sup> allows anyone to quickly build visual stories. The website plays the role of the curator from illustrators and animators around the world in order to inspire writers of any age to turn images into fresh stories. More than 5 million stories have been created, making Storybird one of the world's largest storytelling communities. By using this platform, your students will create new stories themselves or with other "budding writers", thus improving their literacy (reading and writing skills) while using their creativity and imagination. You can find several video tutorials on how to use Storybird. Here is an example: [youtu.be/9nHo5KO4EO8](https://youtu.be/9nHo5KO4EO8).

#### Gloster

*Gloster for education*<sup>14</sup> allows teachers and students to access, create and use digital interactive posters ("Glogs") as instructional aids and share them. The website includes a section with a collection of Glogs that are publicly available.<sup>15</sup>

This tool allows one to create an interactive poster that links various resources. Create a glog and share its URL with your students. There are several video tutorials on how to create glogs. See this one, for instance: [youtu.be/ij7KTcl0QEk](https://youtu.be/ij7KTcl0QEk).

### *Main Skills involved*

- **Critical thinking:** students are able to assess their results and to consider alternative explanations.
- **Active listening:** students are paying attention to the opinions of their classmates and take into account the proposals they provide.
- **Reading and comprehension:** students are referring to literature and relevant theory in order to draw conclusions.
- **Speaking:** students are communicating their conclusions to teammates based on their thoughts and on solid arguments.

13 <http://storybird.com>

14 <http://edu.glogster.com>

15 <http://edu.glogster.com/glogpedia>

## Discussion

After students have made connections between objects/tools and space careers, invite them to watch the following video, which brings up the problematic of gender balance in careers related to space.

*"I hope you have enjoyed this activity and have learnt more about space careers. Listen to the following interview and try to identify the main characteristics of the described space careers, and share with us if there is something that surprised you."*

[women.nasa.gov/maynette-smith](https://women.nasa.gov/maynette-smith)

In order to evaluate students' stereotypes about gender balance, encourage them to freely discuss this topic by introducing the question that follows.

*"Do you believe there are space careers that could be done only by men or women?"*

Guide them to make specific observations focused on this problematic. Write the main ideas on the board, and invite students to write an essay about gender balance in space sciences.

## CONNECTION TO SCHOOL CURRICULUM

This activity is strongly related to STEM subjects, such as Mathematics, Statistics, ICT, Physics, Chemistry, Biology, Astronomy, Geology, and others. It also discusses the problematic of gender balance and, thus, strongly relates to Social Sciences and Philosophy.

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This resource was selected and revised by Space Awareness. Space Awareness is funded by the European Commission's Horizon 2020 Programme under grant agreement n° 638653.

