How do we know that? Space science

A project for early education

About the activity

Children are curious by nature. Most grownups have probably become frustrated by the never-ending question "*WHY?"*

This activity encourages the children to keep asking, to be curious and wonder. To find their answers, they must be able to ask *"why?"* If humans didn't wonder, maybe we wouldn't have found any answers. Who knows, maybe we would still live in caves and hit our food over the head with a wooden club.

We want the children to ask "why?" and "how do you know?", and we want to encourage the adults to ask the same questions to the children. A project about space is the perfect backdrop to talk about how we can find out about things.

The activities in this recourse are just suggestions for things to wonder about. Maybe the children have other ideas, and that might lead you down another track. As long as the children (and adults) are curious and wants to find out, the goal is reached. Don't be afraid of telling the children you don't know the answer to their question but suggest you can try to find out together.

Wonder is the beginning of wisdom. Socrates

Curriculum (Norwegian Rammeplan for early education)

The primary goal of the kindergarten is to promote learning. In the kindergarten, the children will experience a stimulating environment that supports their desire to play, explore, learn and master (...).

The children's curiosity, creativity and desire for knowledge should be recognized, stimulated, and create a foundation for their learning processes.

The children should examine, discover, and understand relationships, expand their perspectives, and gain new insights.

The children will	The staff will
• Experience, explore and experiment with natural phenomena and physical laws • Construct from different materials and explore the possibilities of tools and technology • Examine and experience how to solve mathematical problems and experiencing a joy of using mathematics • Experience and explore nature and diversity of nature	• Observe, analyze, support, participate and enrich the game on the children's premises • Be aware and evaluate their own role and participation in children's play • Visualize natural phenomena and reflect together with the children about relationships in nature • Give the children time and opportunity to ask questions, reflect on and make their own explanations for matters, and to participate in conversations about what they have experienced

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About space Science

Space is an enormous topic, and we will not even try to cover it all. If there are things you want to know about, contact ASE, or your local space educational office.

Space is big, and there are a lot of things scientists don't understand. The children you meet in your educational institution might some day become scientists and help find new answers.

The Big Bang

Most people have heard about the Big Bang and visualize some giant explosion. Before this, there was nothing. And this phenomenon happened from nothing. Scientists believe that the Big Bang happened about 14 billion years ago. The most exciting thing about the Big Bang, is that it is sort of still happening. The universe started growing, and it has been growing ever since. Scientists have found this out by using the doppler effect.

The Doppler effect

The Doppler effect is a phenomenon that allows us to decide whether something is moving towards us or away from us. As an example, we can imagine standing by a road and a car is coming towards us. The soundwaves from the car will have a high frequency (the waves are close together). When the car passes us and is going away from us, the waves are further apart, and the sound gets a lower frequency.

This is also the case with other types of waves, like light. When we study space, this is the difference we look for to decide whether the stars are moving towards us or away from us. Low frequencies emit blue light, and high frequencies emits red light.

Science at ISS

The international space station is a science station in space. What makes it interesting is that everything there is at zero gravity, and things act a little different. The human body is constantly studied at ISS. We know that the muscles and skeleton are weakened when gravity is absent, so the astronauts onboard the ISS must do a lot of exercise to stay healthy. There is still a lot of things we don't know about how our body is affected by space. If your children want to train like astronauts, you can find a fun program for that here https://www.stem.org.uk/missionx

Another thing scientists are interested in finding out, is how plants act in space. On future space missions the astronauts will be dependent on growing a lot of their own food. A journey to Mars might take about 9 months, and after that they will have to live on the red planet for at least two years, perhaps the rest of their lives. It will be impossible to bring enough food for such a journey. But how do plants actually grow in zero gravity? This is what they are working on finding out on the ISS.

Read more about science on ISS here
https://www.nasa.gov/mission_pages/station/research/index.html

Satellites og telescopes

Space is incredibly big, especially when we add the fact it is constantly growing. How do scientists find out so much about stars, planets, and galaxies so far away?

Hundreds of years ago, Galileo Galilei built the first telescope, so they could study the stars. Since then, there has been made a lot of improvements, and for each time we can see just a little further into space. Today, we even have gigantic telescopes in space to see even better. If we look through a telescope from earth, we must look through the atmosphere, and that literately clouds our vision.

With satellites, telescopes, cameras and other instruments in space the scientists have gathered a lot of information about what is happening out there. Did you know we have sent a spacecraft that is leaving our solar system? This is Voyager https://eyes.jpl.nasa.gov/eyes-on-voyager.html

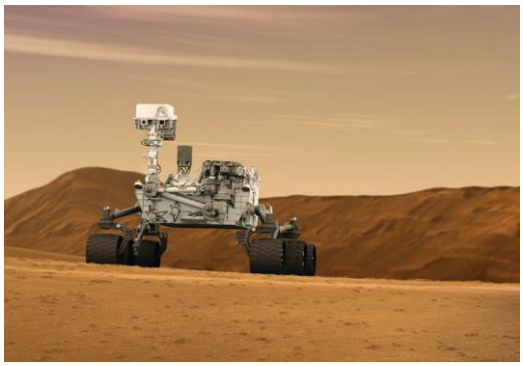
Life on other planets

Scientists also use telescopes to look for life on other planets. First, they look for solar systems with planets just the right distance from their star (their sun) in the center. Some planets' orbits are too close to the star, that will be too hot. Some orbits are too far, and that will be too cold. "Just right" will be the planets that are in between, where we imagine there might be liquid water. When they find such planets, they take pictures with special lenses to find out what chemicals might exist there. They are very interested to find oxygen, nitrogen, and carbon on these planets. If these chemicals are present, there might be an indication that there *might* be life there.

Of course, this is an indication. It does not tell us that there are people, or little green men on these planets, but there might be microscopic life, that looks like life on Earth millions of years ago. But who knows? Maybe there are others out there?

Mars

Scientists have always been especially interested in Mars. They think Mars might have looked like Earth once. For over 50 years we have been looking for signs of life on the red planet, and the search is still on.



Picture 1: Curiosity/NASA

In 1965 we received the first images from the planet Mars when a space probe flew by the planet. In 1976 the first Mars lander arrived. Since then, there has been more lander son Mars. There are little vehicles driving around on the surface called rovers. These are little laboratories that take pictures and analyse samples of dirt and rock and send the results back to Earth.

Activity 1 Plants and light

Scientists are trying to find out how plants grow in space, so that astronauts in the future can grow their own food, both in the spacecrafts and on other planets.

What are vital things for plants to grow? Yes! Water and light. What will happen if the plants do not get that?

You will need

- minimum 2 plants, preferably legume
- somewhere for the plant to grow in sunlight
- somewhere for the plant to grow in darkness (or a box to cover it with)

Talk to the children about what plants need to grow. What happens if these conditions are not met?

Place one (or more) plants on a nice a sunlit place. Make sure to water and prune. This is a great job for the children.

Place the other plant on a dark place, or under a box. Make sure to water and prune this plant as well.

Allow the children to observe the plants. What happens? Do they grow differently? Are there any differences? (Color or size?)

At the end of this project the children will hopefully be able to reflect on the differences in the plants and what has caused these differences. Discuss how the astronauts can work to solve such issues.

A quick alternative

For a quicker solution of this experiment, it is possible to grow your own cress. Cress sprout in a matter of days and the children will see the differences in a shorter amount of time. Place one plant in the sun and one in darkness. Make sure both are watered.

Activity 2 Space is expanding

Many children are wondering how big space is. “Infinite» is a common answer. This is sort of true, but the actual truth is that space is expanding. It is getting bigger and bigger. Today it is a little bigger than yesterday, and tomorrow it will be even bigger.

We know this because of the doppler effect. We can see the stars moving apart.

Image: Generative AI

To show how this works, we can use a balloon. Draw some stars on the balloon and start blowing it up. What happens to the stars? We can see how they are moving away from each other. This is exactly what happens to the universe.

Activity 3 Build a Mars rover

Mars is the only planet we know entirely inhabited by robots. Isn't that crazy to think about?

People have sent many robots to Mars to search for life. Scientists don't think we will find little green men there, but maybe there are tiny bacteria living far under the ice? That is what we are looking for. The tiny robot cars, the rovers, are driving around on the surface of Mars taking pictures and samples.

You can find more information about what is going on, on Mars right now https://goo.gl/uRJeVV

You will need

- Different packaging: Milk cartons, yoghurt cups, egg cartons, plastic packaging, straws etc.
- Paint

Look at images of Mars rovers with the children. Perhaps you can guess what the different parts are, and what the rover is doing.

Let the children use the materials and make a rover. They can build their own, or together with others.

Remember to ask questions to make the children reflect on what they are doing. Ask them to explain about their rover, the different parts and what the rover will be doing when it arrives on Mars. Which instruments does it have and what will it explore? Does it have a camera? These questions might help your space project move forward.

Bilde: lekolar

Activity4 Gravitation and air resistance

What happens when we jump up in the air? We fall back down. Can we jump so high that we don't come back down? I guess not. Not even if we are standing on the highest mountain in the world.

But what happens if an astronaut who are outside the spaceship jumps? Ouch! He, or she, will disappear into space. I hope he is tied to a rope.

Here on Earth, we have gravity. That is the force that holds us to the ground, and makes people in Europe, and people in Australia feel the same way. No one are standing upside-down. The gravitational force is actually keeping our whole planet together. All the planets have a gravitational force. Even the sun has a gravitational force. That is what makes the planets orbit the sun. The bigger the planet or the star is, the bigger the gravity force. If we tried to stand on a large planet, like Jupiter, we would be flattened like a pancake because the gravitational force is so big, and it is pulling us down to the ground.

But in space there is no gravity. Astronauts living on the ISS, or on a spaceship, are floating around in the air. Everything that is not fastened, is floating around.

In this activity the children can play with gravity and wonder why things are falling down.

Suggested equipment

- Balls
- Water and cups
- Little figurines
- Plastic bags
- String
- Globe or inflatable globe

Suggested activities:

1. Hold a ball up in the air. Ask the children what will happen when you let go. Let go of the ball. Why does it fall? Let the children try dropping the ball. Tell the children to jump as high as they can. Why do they always fall back down? Reflect together.

2. Fill a large tray with water. Let the children play with cups in the water. What happens if we make a hole at the bottom of a cup and fill it with water? What if I cover the hole with my finger while I fill the cup, and then let go of the cup? Where does the water go?

3. In this activity the adults will have to decide what the children can do. Some might be able to do everything by themselves, and others might need some help.
   - Cut the plastic bag in squares 20x10 cm.
   - Cut four lengths of string, each 30 cm long. Secure to each corner of the square.
   - Gather the ends of the strings and fasten to the figurine.

   Now you have a parachute. Let the children find places to drop the parachute from. What happens to the parachute? What happens if we throw it up into the air?

   The parachute opens and breaks the fall because air gathers inside the chute. The air is the break. We call this air resistance.

Picture: Apollo 16 landing back on Earth, Credit: NASA

Where do we go now?

Space is a topic that interests most children, and hopefully this activity has triggered their curiosity to explore further.

Allow the interests of the children to decide how to continue the project.

- Will you travel through the solar system? To the sun or the other planets?
- Or will you travel to an entirely different galaxy?
- Can we go to the end of space? How big is space?
- Are you looking for life other places in space?
- Are you space scientists?
- Or space explorers?

Only the imagination sets the limits. Look at the set of resources from Andøya Space Education and create your own project about space.

Gathering time is a great way to allow the children to share their experiences. Make up stories or songs and pull space into the kindergarten. Create a nook where the children can sit and look at books or pictures about space. Maybe you can invite parents and families to an exhibition to see what you are working on?

Such a project is the perfect arena for using educational documentation in the kindergarten. Use assemblies or other gatherings to reflect and discuss what you have learned and what you want to do now.

Teddynaut has his own page where he answers questions about space related topics from children. Check him out.

Dictionary

Research- Research is the activity we do to find out new things and increase our knowledge about something.

Big Bang- "The big bang" that was the beginning of the universe. We don't really know what was there before the big bang.

Doppler effect- the phenomenon that allows us to determine whether something is moving towards us or away from us. Changes in the sound mean that we can hear this difference. The difference in sound comes from the fact that the sound waves behave differently.

ISS- The International Space Station is a craft that orbits Earth. It is a research station manned by astronauts. At the ISS there is no gravity, so much research is being done on how things behave in weightlessness.

Telescope- A telescope is almost like powerful binoculars that can look in space. Some large telescopes are in orbit outside our atmosphere, to allow us to look further into space.

Satellite- A satellite is a celestial body floating around another celestial body. There are both natural and artificial satellites. The moon is a natural satellite. Artificial satellites are crafts humans have built to study space.

Sources

- This resource is created by Andøya Space Education for ESERO Norway.