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A robot arm

Space technology

time

50 minutes

learning outcomes

To:

- know that an astronaut uses robot arms to carry out repairs outside the space station
- discover that the longer a robot arm is, the more difficult it is to pick something up
- discover that a robot arm needs hinges to work

end product

- a robot arm

materials needed

- 96 ice lolly sticks
- 24 erasers
- 12 sets of chopsticks
- 12 tweezers
- 12 containers
- 12 table tennis balls
- scissors
- split pins
- heavy duty hole punch

Preparation

For the activity **Make a robot arm** prepare 12 containers, filling them with the items listed below: eight ice lolly sticks, a pair of scissors, split pins, and two erasers.



Picking things up 10 min.

Organise the children into pairs. Give each pair a set of chopsticks. Explain that they are going to use the chopsticks to lengthen their arms, so they must hold the chopsticks by the very end and stretch their arms as long as possible. Encourage them to try to pick up a table tennis ball and an eraser with the chopsticks. Ask them if they were able to do this or not. Why / why not?

What went wrong? Was it harder to pick up the eraser or the table tennis ball?

Explain that sometimes astronauts have to pick up something that is a long way away. Instead of chopsticks, they use robot arms to make their arms longer. Look at the photographs on the discussion sheet showing the real robot arm holding the astronaut. What is the robot arm being used for? They are using it to carry out repairs outside the space station. They can't just walk outside to do this. Explain that an astronaut has to operate the robot arm very accurately.



The children make a robot arm to be able to pick things up from a distance.



Make a robot arm 30 min.

Review the first activity from this lesson: **Picking things up**. What made it difficult to pick something up? Make suggestions together for some criteria for the robot arm they are going to make. They must at least fulfil the following conditions:

- the hand must be able to pick up an object (smooth and rough)
- the robot arm must act like an extension of your own arm
- the robot arm must be long

Organise the children into pairs. The children use the items in the containers to design their own robot arm. Explain that their designs must be approved by their teacher before they start to build their robot arm. Give each pair a container with the materials they will need, so they can see what they can use in their design for their robot arm. The children complete Task 1 on the worksheet. After this the children make the robot arm.



Encourage the children to test the robot arm by picking up the table tennis ball and the eraser. Does the arm work? Why not? How could it be improved?



Working with the robot arm 10 min.

How could you make the robot arm work better? What happens if you make it longer? Or shorter? Is it easier to work with a long or a short robot arm? Encourage the children to try out various exercises with their robot arm. Now they should complete Task 2 on the worksheet.

Discuss the answers. If the robot arm is longer you need more strength to pick something up, because the arm itself is heavier and because the object is further away. A shorter robot arm is easier to use. If you undo one or more of the hinges, the robot arm doesn't work any more, just like the activity using chopsticks at the beginning of this lesson.



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discussion sheet







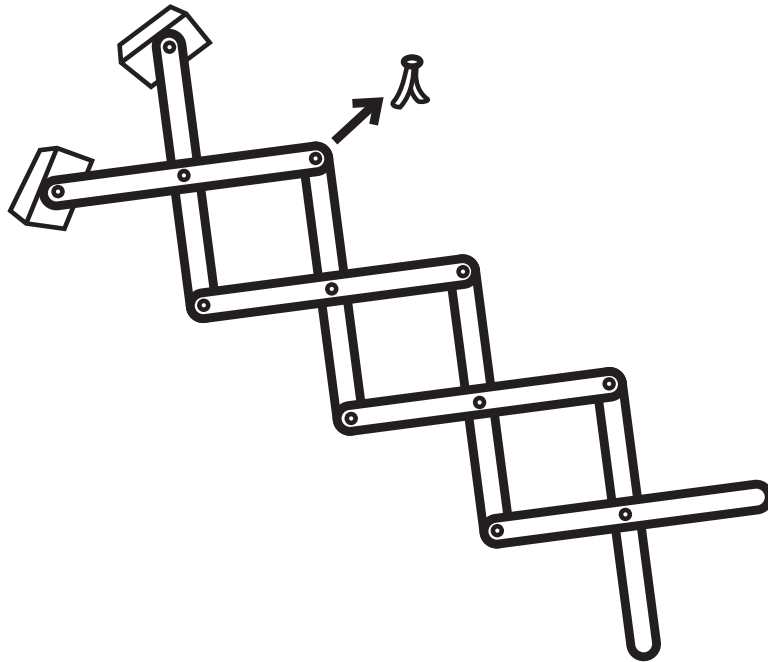
A robot arm

1 *Make a robot arm*



- | | |
|---|---|
| 1 | Ask your teacher for a container with the things you need. |
| 2 | Examine the items in the container. What can you use to make your robot arm? |
| 3 | Make a design for a robot arm. |
| | You can see an example on the next page. |
| | Your robot arm must be able to do the following: |
| | <ul style="list-style-type: none">• the hand must be able to pick up an object• the robot arm must act like an extension of your own arm |
| | See instructions 4 to 9 to see how you can make a robot arm. |

draw
the
design
for your
robot
arm
HERE



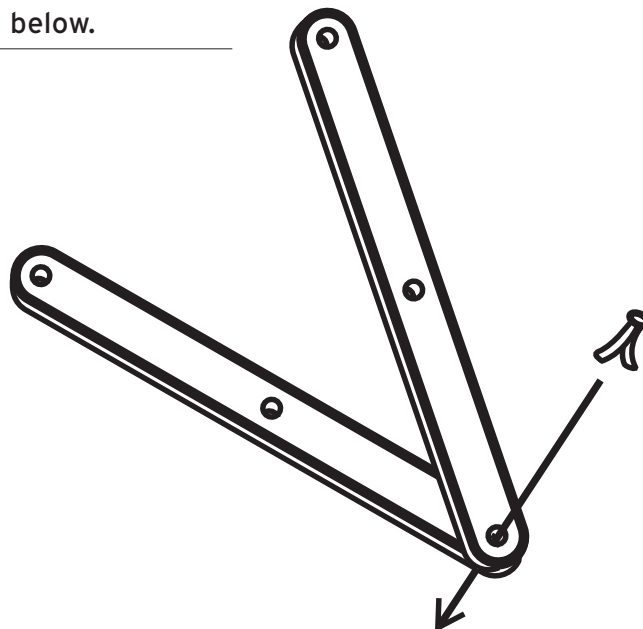
b What items from the container do you need to make your design?



c Does your design meet the requirements? **yes / no**

CIRCLE the correct answer



4 Use the teacher's hole punch to make three holes in each ice lolly stick, as shown in the drawing below.



	5 Use a split pin to join two ice lolly sticks in the centre, forming a cross.
	6 Repeat steps 4 and 5 for the other sticks.
	7 Now you need to join all the crosses together. Take a good look at the drawing at the top of the previous page to see how to do this.
	8 Cut a slit in the side of the two erasers.
	9 Push the ends of the gripper into the slits in the erasers.
	10 Try using your robot arm to pick up an eraser from the table. Did this work? yes / no
	11 Now try to pick up a table tennis ball. Did this work? yes / no
2	<i>Working with the robot arm</i>
a	Try to make your robot arm even longer. Does it work better?
	
b	Does the robot arm work better if you make it shorter?

CIRCLE the correct answer

CIRCLE the correct answer

write your answer HERE

write your answer HERE

c

What else could you use - instead of erasers - for the grippers?

write your
answer
HERE

d

Remove some of the split pins. Does the robot arm still work?

write your
answer
HERE