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The Acrobat for AutoSTEM

Pedagogical guidelines and construction instructions

This guide includes the following parts:

- How the Acrobat can be used to learn areas of STEM subjects
- How to construct the Acrobat

How the Acrobat can be used to learn STEM areas

What is the Acrobat

The Acrobat is a moving toy made from paper, wooden skewers, corks/plastic discs and split pins, that makes acrobatic movements when the linkages are complete and a rotation movement is made manually.

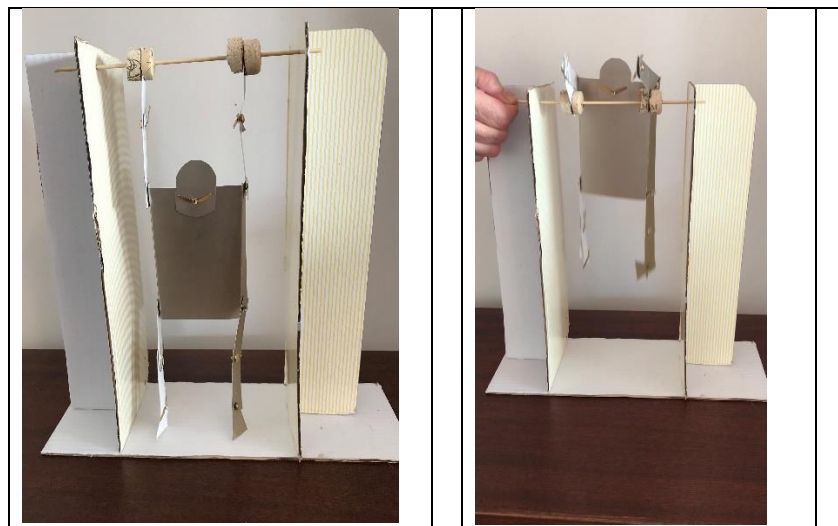


Figure 1 & 2- An example of an Acrobat

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STEM subjects can be introduced when constructing the Acrobat. We detail some ideas below. The teacher can adapt these suggestions to their own class and context and plan their own activity (Plan template).

Target group

The Acrobat example is designed for children from 4 to 7 years old. Teachers can adapt the idea to other ages.

The teacher can decide, depending on her/his knowledge of the children, whether they should work in groups or individually.

Learning goals

When constructing the Acrobat several learning goals can be achieved:

- To learn about physics and mechanisms, in particular, linkages.
- To develop engineering competences of analysis and construction.
- To learn mathematical concepts within the construction and assembly process, including shapes and numbers.
- To learn biology concepts about parts of the human body.
- Other soft-learning goals can be included; problem solving and creativity.

How to introduce STEM concepts during construction

The starting point is the Acrobat, how it functions and is constructed.

Observing

Firstly the teacher shows a model of the Acrobat. The teacher can ask, why did it move? Here is a link to a video example, that shows it in use

Exploring and learning about physics and mechanisms.

Children can observe the Acrobat, and make comments and ask questions about how it functions.

Teachers can talk about the linkages in a very simple way. A linkage is a rigid element with a hinge at each end to connect it to other parts. Linkages are used to join different elements together and to transfer motion to one place to another.



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Starting to construct the Acrobat and learning mathematics and biology

Learning about shapes and numbers.

The teacher talks with the children asking what is needed; the teacher can talk about the different parts, their shapes and placement.

What does the body look like? What do the arms and legs look like?

What does the face look like? Children can draw or paint eyes, nose and a mouth on the acrobat.

Constructing the mechanism to develop engineering competences

Once the different parts are completed, it is time to put them together! Children construct the mechanism following the method described in 'How to construct the Acrobat' below, and explore how linkages function. Paper fasteners can be used to link the different parts of the body, as can be seen in video tutorial. When all the parts are joined together, a wooden skewer can be pushed through each of the hands. The hands should be secured in place to the skewer using four Round pieces (two pieces for each hand).

Variations on the Acrobat and adding scenarios and narratives

Other themes and characters can be used instead of an Acrobat.

Different scenarios can be developed for the Acrobat. The scenario can be used at the beginning of the activity, or the end. For example, a park, a playground or a circus can be used to contextualize the activity. Other characters can be added. For example, the children can draw or paint the acrobat as a clown or a super hero, or an animal, they can explore and be creative. What do they do? What mechanisms can be used?

Narratives and stories can also be used.



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Figure 3. Examples of other automata using linkages and a rotational mechanism

How to construct Acrobat

To make the Acrobat part (or any other character) a variety of materials can be used, including: coloured sheets and paper, cardboard, wooden sticks/skewers, split pins, , newspapers, recycled or natural materials (found materials), in fact, anything the teacher and children can think of. We provide a template (see link) that has a template for a body a head, arms, legs, feet and hands.

Parts and tools required

- Templates for the Acrobat (link).
- Coloured cardboard for the Acrobat
- Pieces of cardboard for the support (cardboard from boxes is most suitable)
- Split pins

Round pieces to secure the hands, Cork, cardboard or foam rubber mats (for example ones used for camping or gym).

- Long sticks of wood (wooden skewers) The ones used for cooking are perfect as the children can cut them easily.
- Scissors
- Colouring pen or pencils

The materials that can be used are very widely available and easy to find. The teacher can ask the students to find materials that might otherwise be thrown

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away (bottle tops, paper...) in this way we can add conservation and reusability in to the teaching of the workshop.

Method

It is best to watch The Acrobat video tutorial before starting to make your own Acrobat.

1. Create the Acrobat from the template shapes in the linked template
 - a. Cut out the shapes
 - b. Fold the shapes on the dotted lines
 - c. Bring the different parts of the Acrobat together by introducing split pins into the circles indicated in the templates. To make the holes for the split pins, a stick can be used or alternately scissors to make small cuts in the paper.
2. The support is built, It should be 30 cm high. You will need 2 pieces of box cardboard for either side. One piece should be a trapezium and the second a triangle. You can see an example in Figure 4. Don't put the wooden skewer through the cardboard support at this stage, we will do it later.



Figure 4 – The support

3. Cut four round pieces from your corks, cardboard or foam so you have a total of four pieces.
4. Push one of the round pieces onto the skewer. Then push the skewer through one hand of the Acrobat, then another round piece to secure the hand in place on the skewers. The hand should be fixed tightly by with the round pieces so that it will rotate when the skewer is turned manually.
5. Repeat the procedure for the other hand, using the same skewer.

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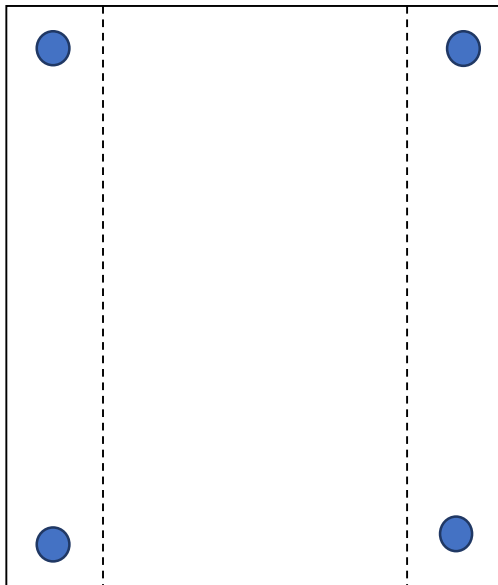
6. Make a hole in each of the vertical supports you made previously in point 2 above and push the skewer through with the Acrobat.
7. The Acrobat is ready to play with.



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Templates

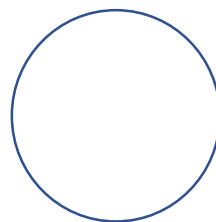
Components of the Acrobat – Rectangles of different sizes for the body, arms and legs. A circle for the head



Body



Feet



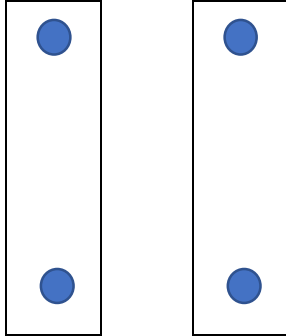
Head

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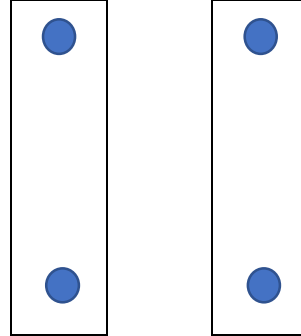
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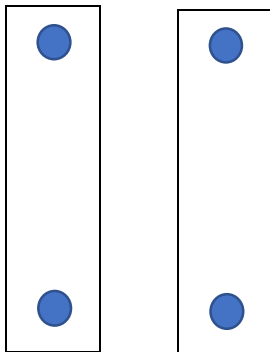
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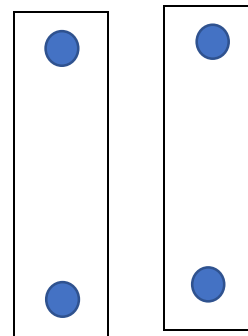
Upper Legs



Lower legs



Arms



Forearms



Hand



Hand