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Dancing Doll for AutoSTEM

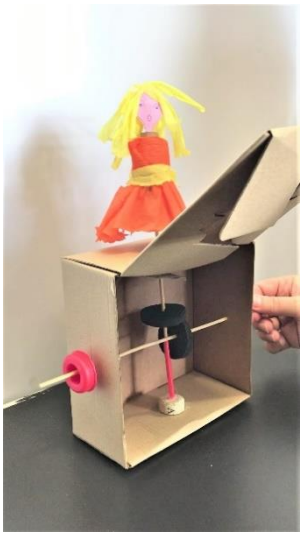
Construction instructions and pedagogical guidelines

This guide includes the following parts:

- What is Dancing Doll
- How the Dancing Doll can be used to learn STEM areas
- Variations of the Dancing Doll
- How to construct Dancing Doll
- Templates

What is the Dancing Doll

The Dancing doll is a paper doll that fits on the top of a box. It turns around when a hand crank is activated. Inside the box there is a mechanism that makes the motion.



Figures 1 & 2. An example of Dancing doll and the mechanism

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Using the Dancing Doll for STEM

The following are ideas how to introduce STEM concepts when constructing the Dancing Doll. The teacher can adapt these suggestions to their own class and context and plan their own activity (Plan template).

Target group

The Dancing Doll example described here is designed for children from 4 to 7 years old. Teachers can adapt the proposal to other ages.

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

Learning goals

When constructing the Dancing Doll several learning goals can be achieved:

- To learn about physics and mechanisms, in particular, mechanical energy and transferring energy from the manual turning of a handle into making the doll move.
- 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.

Guide how to introduce STEM concepts during construction

The starting point is the Dancing Doll, how it functions and how to construct it.

Observing

The first thing the teacher does is show a model of the Dancing Doll turning around. The teacher can ask, why did it move? Here is a link to a video example, that can be used.
https://www.youtube.com/watch?v=_1tldIdgBPo

Exploring and learning about physics and mechanisms.

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

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Teachers can talk about the friction drive in a very simple way. Using friction transfers a force from one wheel to another, hence the name friction drive. A very simple way to do this is to allow the edge of one circular disk to rub on the under surface of another disk.

Starting to construct the doll and learning mathematics and biology

Continuing with 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. This is a link to a description of a cone
https://mathblog.com/reference/geometry/cone/
What does the body look like? The body is a cone.
What does the face look like? Children can paint eyes, nose and mouth, as well as hair.
Once the two parts are completed, it is time to put them together! Here it comes the moment to glue the two parts of the Dancing Doll. Children can also discuss and offer ideas how the would make arms for the dancing doll, they can talk about what shapes the arms are. In this scope, the construction and use of the Dancing doll also opens up the possibility to talk about parts of the human body.

Constructing the mechanism to develop engineering competences

Continuing with ideas that can be used for observing and learning about shapes and numbers, and also about a friction drive.
Children can then explore examples of this motion and start to explore materials needed to construct it.
The teacher continues talking with the children about the box and the pieces and materials to construct the mechanism.
Children construct the mechanism following the method described in How to construct Dancing Doll.

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Variations on the Dancing Doll and adding scenarios and narratives

Other themes and characters can be used instead of Dancing Doll. It can be a carrousel, e.g. a carrousel of numbers, a planet, another doll, e.g. typical from children's country, smiling vs sad face or whatever teachers and children can imagine.

Different **scenarios** can be developed for the Dancing Doll. The scenario can be used at the beginning of the activity or the end.
For example, a circus can be used to contextualize the activity. Other characters can be added? What do they do? Which mechanisms can be used?

Narratives and stories can also be used.

Save the word!

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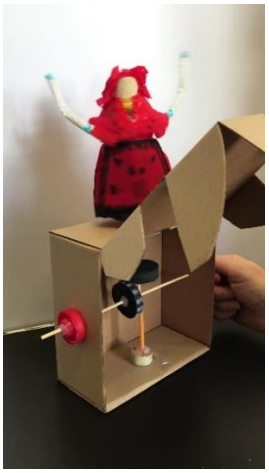
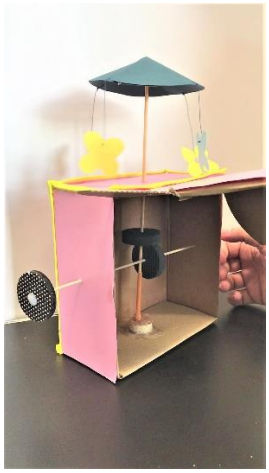


Portuguese Dancing Doll – Viana do Castelo

Adriana Pedrosa Cátia Simões
Madalena Araújo Rita Costa



Carrousel

Anália Santos
Inês Machado
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Carrousel of numbers

Anália Santos
Inês Machado
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Figures 3,4, 5 and 6. Examples of other automata using a rotation mechanism

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How to construct Dancing Doll

To make the actual Dancing Doll part (or any other character) a wide variety of material can be used including: coloured sheets, foam rubber (pieces or sheets), cardboard, wooden sticks, straws, coloured ribbons, fabrics, crepe paper, coloured paper, newspapers, recycled or natural materials, in fact, anything the teacher and children can think of. We provide a template (see link) that has a template for a dress and a head.

Parts and tools required

- Template for the cone. (see Appendix 1 below and link).
- A box for the mechanism. (a shoe box or similar small box will do).
- Gears that can be made from bottle tops, cardboard or foam/rubber mats (for example ones used for camping or gym).
- Long sticks of wood (skewers) The ones used for cooking are perfect as the children can cut them easily.
- Drinking straws
- Scissors
- Glue stick and/or hot glue gun
- Colouring pen or pencils
- Coloured cardboard

Since the materials that can be used are very wide and easy to find, the teacher can ask the students to find objects that might otherwise be thrown 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 video https://www.youtube.com/watch?v=Lvvxnfe2wTw before starting to make your Dancing doll.

1. Create the Doll from the template shapes in the linked template
    a. Cut out the shapes, and make a cone around the skewer and stick it, and then stick the circle as a head
2. Open the box and make the mechanism.

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a. Make a mark in the centre of either end of the box and make holes just big enough to take a skewer. The centre of the two end sides and the top of the box is found by placing 2 diagonal lines across the end with a pencil and ruler.
b. Cut out of your foam/cardboard in to 2 round shapes or take bottle tops (these will be your gears)
c. After making a hole in one gear thread a skewer through the gear. The skewer must be long enough to fit through both sides of the box.
d. Push the skewer through the 2 sides of the box. You might need to take the gear off and push the skewer through one side, then insert the gear before pushing through the second side.

3. Make a hole in the top of the box large enough to take a straw (see point 4a)
4. Stick a 5 cm piece of straw through the hole you have made in the top of the box and glue it in to place
5. Push the second skewer with the doll though the straw and then add the second gear to the bottom of it.
6. You can add a handle on the end of the horizontal stick using a bottle cap.

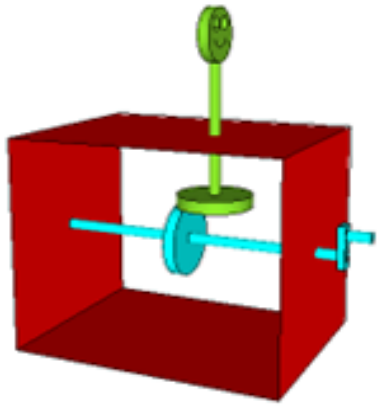

Figure 7. The mechanism

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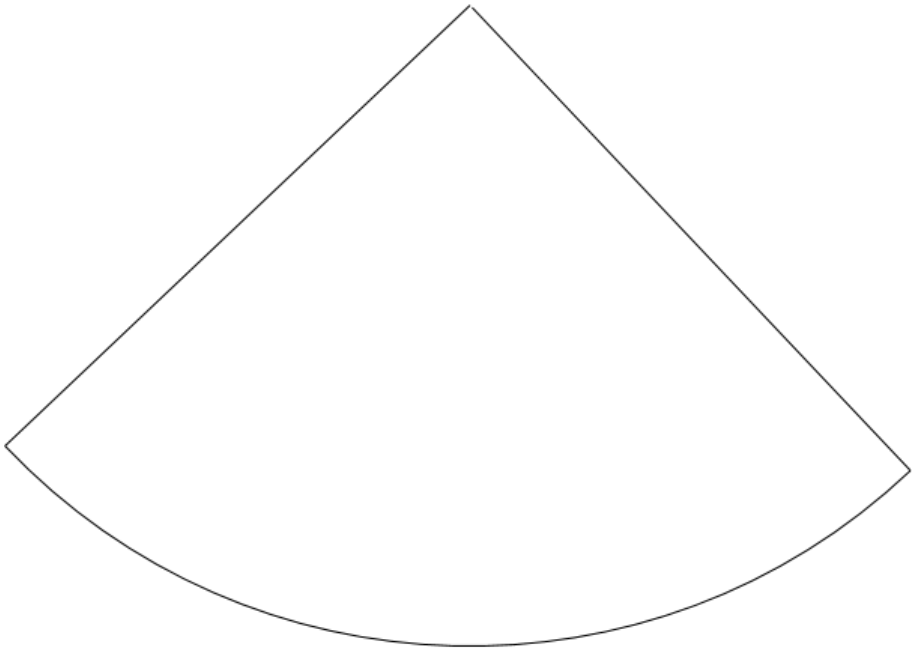
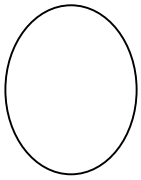
Appendix 1

Templates Components of the Dancing Doll – a cone and head





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