11. Outcomes of Automata for STEM activities with cognitive and physically impaired people

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This case study shows how an **AutoSTEM** activity can be an excellent stimulus to people who have cognitive and physical special needs, stimulating the proximal zone of development of each individual (Vygotsky, 1978), to help them discover their own inner resources and potential and deal with difficulties (C. Morosin Psicomotricità dell'adulto, Cecilia Morosini, Lina Barbieri, Laura Ferrari Carrocci Faber editori 2005i).

Introduction

Automata are fascinating mechanical toys for children, small Kinetic Art sculptures. An Automata is a construct that includes engineering, cultural awareness and artistic expression. Automata are story telling mechanical objects. Automata have fascinated children over the ages and today there are museums just for automata.

AutoSTEM uses a multidisciplinary approaches which introduces STEM concepts and competences in different subject areas

while also including, measurement, transfer of power, mechanics, numbers, creativity and comprehension.

Context, approach, and implementation

Francesca Ferrini (educator, psychomotor and pedagogical counsellor) and the educators of the Arboreto Day Centre carried out this activity. Arboreto is located in Gubbio (PG), Italy. It is a centre for young adults with physical and cognitive difficulties. The workshop lasted 3 hours and 10 people participated. Francesca led the group while educators from the centre helped people with greater difficulties to complete the most difficult manual tasks.

Respecting the centre's policy and in order to avoid any distractions, no photos were taken of the participants.

This case study intends to be a starting point for any educator who works with people with special needs. It demonstrates that the use of manual skills is a great help in strengthening fine motor skills and hand-eye coordination. It also indicates that STEM contents can be spontaneously understood while experiencing them in the building process of an **AutoSTEM** automata. It also shows that the activity is a good stimulation for reasoning processes and for building a connection between different topics, leading participants to gain useful insights. Furthermore, this kind of activity encourages group work, collaboration and verbal sharing of what has been learnt.

Implementation

The workshop was organized in nine steps:

1) Explanation to the participants of what they would be doing
2) Drawing circles using compasses

3) Considering how to divide the circles into 8 equal parts and completing the task
4) Colouring the disks – the students were divided in to 2 groups: one group had freedom to follow their own imagination and the second was instructed to used only use primary colours
5) Construction of the turbine - some participants helped in the construction
6) The disks were cut, holes made in the centre, and they were mounted on the turbine
7) Turning the turbine - a hair dryer was used to make the turbine rotate. The whole group observed
8) Reflecting – the group reasoned and reflected on the mechanism that moves the turbine. They enjoyed observing the colours changing depending on the different combinations made during the colouring step
9) Recording- participants wrote down what they observed: the colour combinations and the resulting colours

Challenges

The participants with more severe physical difficulties were helped to cut out, colour and draw the circles, while people with more severe cognitive difficulties had to be helped in understanding how to divide the circles into 8 equal parts. However, the biggest challenge was for the educators who had to differentiate the work according to the personal skills of each participant. A very important aspect was for the educators to hold back and stimulate the participants so they could use their own passion to do the tasks on their own, This enhanced their self-esteem as they succeeded in the tasks.

Results

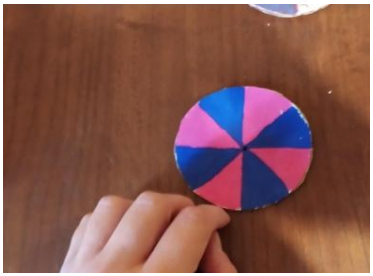
The work produced a number of results:

- The participants have acquired greater confidence in themselves and in their potential. At the beginning of the activity, they thought they would not be able to succeed in this task, but with the mediation of the educators, they were very satisfied and this increased their sense of self-esteem.
- Through observation and reflection, the participants easily discovered the mechanism that moves the turbine.
- The participants were very happy to be able to observe which secondary colours are produced by the primaries, and to discover what colours the various combinations chosen by themselves, generate.
- It was very meaningful when we talked about how colours mix when the disk spins quickly and how important speed is in this process. We also talked about the Newton Disk, which aroused a lot of interest and curiosity from the majority of the group.
- In a simple, practical and fun way, each of them felt like a scientist able to discover and deepen some topics that, before, seemed too difficult for them.

The automata made were the turbine and the spinning disk. In addition, the participants wrote down the colour combinations and the resulting colours.

Discussion

This case study shows that an **AutoSTEM** workshop was not only useful for transmitting sciences through the construction of automata. It also shows how useful they are for working on the proximal zone of development with various types of special needs people.



References

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