

## 9. Using Automata in an after-school Science Club

Joel Josephson

### 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 at the same time, including, measurement, transfer of power, mechanics, numbers, creativity and comprehension.

This case study details how **AutoSTEM** activities were implemented in a 1-hour Science club over the course of 4 sessions.

### Context

Joel Josephson (Kindersite) and Ms Bettany (general primary school teacher) at the Firs School, Chester, UK, carried out the activity.

The Firs is an independent primary school for boys and girls aged 2-11. The activity was carried out with 10 – 12 boys and girls aged 9 to 11 years.

### Case

This case study looks at using **AutoSTEM** resources in an informal, context were direct learning is not the primary objective, but peripheral.

The concept of the Science Club is to introduce science areas to the upper primary children in the school in an informal and enjoyable setting and build interest and engagement with science subjects.








## Approach and implementation

The workshop was organized by introducing the **AutoSTEM** project to the head teacher and her assistant. An introduction to the teachers of the school was then arranged during a regular teacher meeting. At that meeting, Josephson introduced the project and a short workshop was completed where each teacher built the JellyBird.






A meeting was arranged with the teacher who would be conducting the Science Club (Ms Bettany) who is a general primary teacher with over 20 years experience of teaching. At the meeting, a number of different **AutoSTEM** automata were shown to the teacher and an agenda was decided on of which automata would be completed each week.

Over the course of the 4 weekly meetings the desired methodology used was:

-  Setup of materials and tools in the classroom prior to the children's arrival
-  Reflection on previous week
-  Short introduction to the task of the day
-  How they wished to work individually or in groups
-  Building of the automata
-  Using the automata
-  Roundup and reflection

The planned methodology was adapted during the course of the club in reaction to actual events and feedback.

The automata made were:

-  The Balloon car
-  The Dancing doll
-  The Drawbridge

The children were 10 x 9 to 11 year olds, boys and girls.

Josephson also led a discussion on the physics involved in using the car. The cars are driven by blowing air in to a balloon attached to the car and the release of the air caused by the tension in the rubber balloon creates the propulsion. The discussion centred on where the energy came from and the chains in the transformation of energy to have reached the balloon. In addition, other **AutoSTEM** automata were shown to the children so they could understand other aspects of the physics that they are based upon.

## Challenges

It was found during the first club meeting that there was not enough time to complete all the steps envisaged in the initial plan and the necessity for more scaffolding and allowances for mistakes made by the children meant that the initial target of a completed and working Balloon car by the end of Club meeting

one with feedback and reflection, could not be achieved. It was decided to remake the Balloon cars with adaptations learnt from week 1.



Challenges included insufficient scrutiny of the children leading to mistakes especially in the placement of the holes for the axles and straw. There was also not enough time for the children to play with their Balloon cars and engage in a discussion of their work.

The second session was also preceded by a discussion of how the children felt that they could improve their cars.





This challenge was overcome by recommending the Balloon car in to the 2<sup>nd</sup> weekly session.

The Dancing doll automata that was developed in the 3<sup>rd</sup> week faced similar challenges.

The Drawbridge in session 4.

## Successes

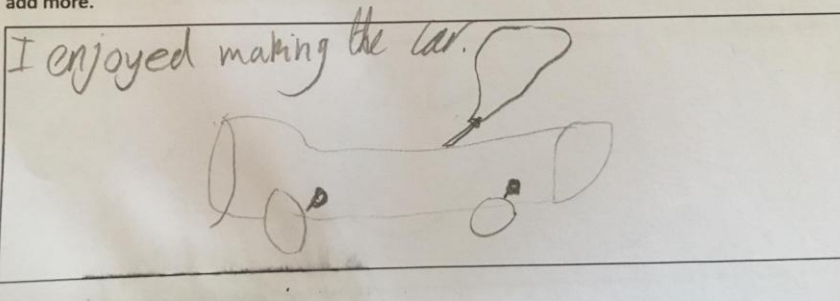
The work produced positive results:

-  All participants managed to make a working automata that they were proud to share
-  They gained an introductory understanding of how energy is conserved and transferred.
-  They worked together and helped each other complete their tasks. The participants gained confidence in their ability to complete the tasks they were satisfied and this increased their sense of self-esteem.
-  They built an understanding through the discussions and reflections of how they car's move and stop

Comments from the children include:

### Question 5:

Explain what you liked or didn't like, please? You can continue on the back of the page if you want to add more.



## Outcome

The children very much enjoyed the challenge and making things that worked.

The workshops teachers felt the time was much too constricted and reduced the impact due to not being able to carry out enough reflection and challenge their thinking and reflecting skills.

## Evaluation

This case study indicates that **AutoSTEM** Workshop activities can be adapted to alternate formulas but requires more preparation in to the methodologies to be employed, with a less ambitious agenda and more pre and post work around the actual construction.

In addition as the workshop was with older children than specifically targeted the potential to go much further in to the mechanics and physics involved are very clear and indicates that workshops can be held with older groups of children and used as a starting point for practical science instruction and experimentation with a toy that is relevant and interesting to children that have placed a stake within as they constructed the toy.

### The children's questionnaires

The children completed simple questionnaires at the end of the 4 sessions with the following questions and findings:

Q1. Did you enjoy the **AutoSTEM** workshops?

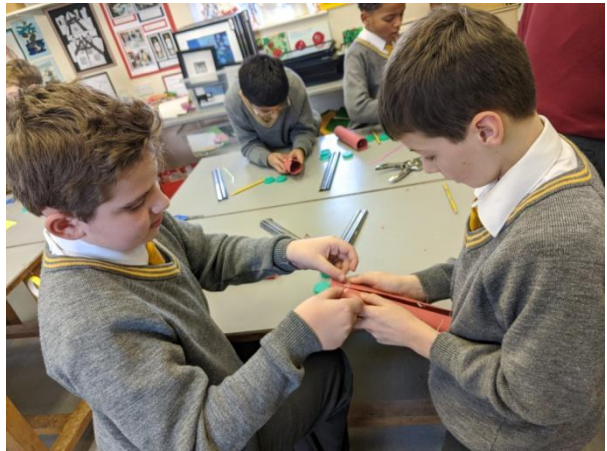
75% responded that they *Enjoyed a lot*, or *Enjoyed*

Q2. Was it easy or hard to make the Automata?

42% said it was *Very easy* or *Easy* but 17% said it was *Hard*

Q3. Did you learn anything new?

67% said that they *learnt loads* or *Learnt a bit* and 33% said that *Some new but some I knew*



already

Q4. Would you like to do more learning with automata?

83% stated that they would like to do more learning using automata.

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### Analysis of results:

An analysis of results at this level and sample size can only be indicative but appears to indicate that even though the children were older than the targeted group of the project and in a semi-formal setting, they still gained from the project pedagogically, and with engagement and enjoyment. The indication that the children would like to go further with this direction is encouraging and indicates that a future project for older children may be indicated.

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### Comments from the children:

Enjoyed making the car

Cool Fun Easy

My favourite was the cogs challenge

I liked the spinning doll

I quite like it

I think you should make more time. I liked the fun of making stuff

I enjoyed making the car but the ballerina was too hard but I do like my teachers

I liked everything

I liked playing with it

It was really fun



I liked the experimentation

I liked making the car and really enjoyed stuff



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## Evaluation from the teacher:


What went well?

-  The pupils enjoyed making things and testing if they worked
-  Good opportunities for collaborative work

What could be improved?

-  Perhaps the pupils could have been involved in the prep rather than being handed a readymade kit requiring not enough thinking and effort.
-  More sessions needed. If we had more than 4 or 5 sessions then there would have been time for pupils to prep materials and more importantly to reflect on what worked and what did not with the opportunity to better their designs and tinker with the product to improve its working, therefore challenging their thinking and reflecting skills.

What the children gained from it:

-  Enjoyment, but with more sessions, they could have developed their thinking, discussed the successes and failures and improved on initial attempts.