The Impact of STEM Ambassador Training and Resources
ASTBURY ST MARY'S STEM CLUB

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STEM AMBASSADOR HUB

STEM Ambassador Hub Merseyside & Cheshire

Context and Overview

In September 2018, Hub Merseyside & Cheshire requested, from STEM Learning, a set of ten funded Lego Mindstorm Education EV3 kits. The purpose of the kits was to enable STEM Ambassadors to deliver sessions with young people that would not be possible due to the schools' own lack of available resources. With a focused move towards the delivery of Computer Science in schools, alongside the previously more commonly offered ICT curriculum, the Hub recognised that it would be of benefit for schools to be able to work with STEM Ambassadors with computer science skills.

A group of eighteen STEM Ambassadors attended a full day's training session with the Hub, delivered by **John Pinkney**, a LEGO Education Certified Trainer, who has worked as a subject expert on LEGO MINDSTORMS® Education EV3 and tailored resources to the UK National Curriculum. John supported the attendees in developing their confidence with the kits and exploring the various skills, knowledge and activities for which they could be used. By the end of the session, STEM Ambassadors were able to use the kits and the software effectively and identify ways in which they could use the kits to illustrate aspects of their own job roles

Following the training session, STEM Ambassador, **David Bibby**, contacted the Hub to request the loan of six Lego Mindstorm kits, having agreed to support the staff at Astbury St Mary's Primary School, in running after-school coding activities.

David left college with an HND in Media Production, going on to pursue his dream of being a live sound engineer. After freelancing for a little while, he got a job with a hire company where he developed an interest in video engineering and found his way into a TV studio engineering job at Stockport College. Two years later, whilst working freelance again on a mix of live sound and video post-production jobs, he saw an advert on the BBC's jobs site for a Broadcast Technology Apprenticeship Scheme. He applied and was offered a two-year placement at BBC Manchester. After completing the scheme, he got a full-time job as a Broadcast Engineer in Manchester and now works at MediaCity in a Systems Engineering role, delivering broadcast technology projects.

David explained:

> I have long been interested in programming and scripting, and also in Lego! After attending the Mindstorms training session, I immediately saw the potential for using Mindstorms in schools. I approached my local small village primary school to see if they would like to run anything. It just so happened that they were already considering setting up an after-school coding club so, together, using the resource kits provided by the Hub, we launched the club with 6 weeks of Lego Mindstorms sessions.

David worked with school governor, **Kath Moore**, to complete six separate hour-long after-school sessions at the school using the Hub's Lego Mindstorms kits and the school's laptops. Ten pupils from KS2 attended each week, working on a variety of activities developed by David himself.

> *We started from the very basics of robot construction and programming using Lego Mindstorms EV3 and slowly progressed each week, learning about each of the different sensors in the kit and how to use them through a variety of tasks and challenges. We also introduced different programming concepts throughout but without putting any particular emphasis on the 'computer science' aspect of it. The programming was delivered as an integral part of building a robot and, as such, was easily accessible to the children.*

The first six-week club ran in the second half of the Autumn term between October half-term and Christmas. The activities were so well-received by the children that, as the Hub was able to extend the loan of the Lego kits, David agreed to continue the club in the Spring term for a new cohort of students. As a result, in total, twenty students at the school have benefited from 6 weeks' worth of coding activities that they would otherwise have not had the opportunity to experience.

Impact on young people

The students completed a pre- and post- activity survey before the first club activity and at the end of the six weeks. The data reveals a positive impact on their enjoyment of and engagement in STEM activities, their curriculum confidence and achievement and their awareness of, and aspirations towards, STEM careers.

Following the activities:

- **40%** more students strongly agreed that they would like to do more STEM activities in school.
- **40%** more students strongly agreed that they would like to do more STEM activities outside of school.
- **100%** of students strongly agreed or agreed that STEM Club is exciting.
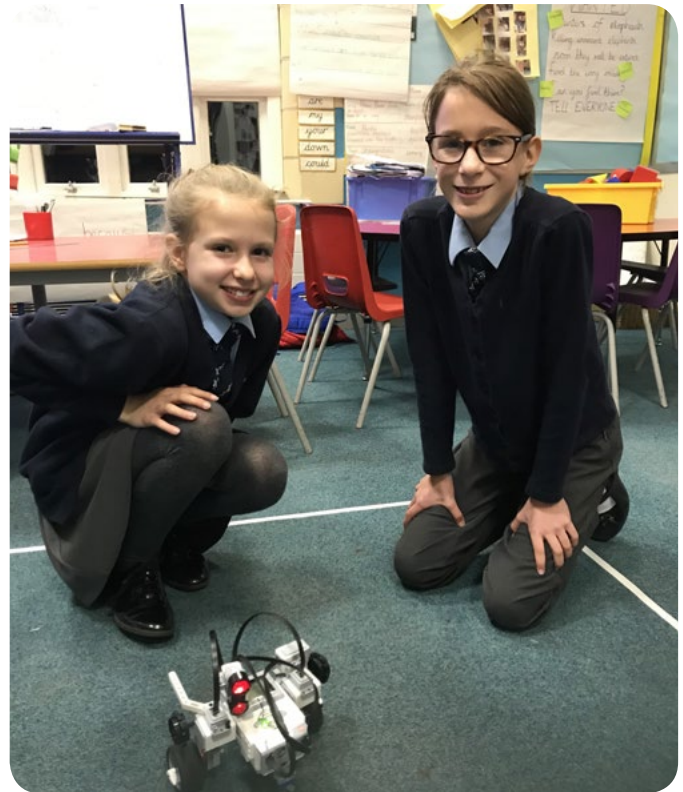
These figures indicate a clear positive improvement in students' attitudes towards STEM activities and their enjoyment and interest in being involvement with them both within a school context and in their own time, which could potentially be a significant factor in their acquisition of science capital. The school also highlighted the STEM Club sessions in their school newsletters, Twitter feed and Facebook page, ensuring that the parent community was informed about the activities and had the opportunity to speak with their children about them.

Governor, **Kath Moore** commented that,

> *They particular seemed to enjoy adding faces and human voices to their robots and adding their sounds into the program loop. They were very keen for Mr Bibby to show them how to record sound!*

In addition to the impact on attitudes and enjoyment, the evaluation data indicated a positive impact on students' curriculum knowledge and their confidence in their own skills and understanding.

Following the activities:

- **100%** of students strongly agreed or agreed that they knew what coding was (30% more than prior to the activities)
- **100%** of students strongly agreed or agreed that they were good at coding (40% more than prior to the activities

Kath highlighted the impact on students' curriculum knowledge and its practical application in real-world contexts.

> *All the children at the club have learned about the logical steps needed to write a program. They showed a really good grasp of loops and could explain their meaning and used words like 'infinity' to explain that the loop could go on forever. The speed at which the children pick up the new commands is very impressive. David explains the new concepts at a good pace and allows the children time to ask questions. The children have produced programs using sensors and we talked about the use of these to stop the robots and how these features are used in everyday equipment like mowers and vacuum cleaners. What they have learned so far will be beneficial when they code in formal lessons at primary school and when they move to secondary school.*

Finally, the data revealed a positive impact on students' awareness of STEM career opportunities and their aspirations to pursue a STEM career.

- **70%** of students strongly agreed or agreed that they knew what jobs people who could code could do (20% more than prior to the activities).
- **40%** of students strongly agreed or agreed that they would like to do a job that used coding (20% more than prior to the activities).

Interestingly, following the activities, there was a much broader spread of responses to the question asking if the students would want to do a job that included coding. Whilst more students agreed strongly that they would be interested, others were clearer that they would not wish to do a job that included coding, despite stating they'd enjoyed the activities. The data suggested that perhaps students had a clearer understanding of what coding was, and the contexts in which it might be used, and therefore felt more able to make an informed decision about whether or not they thought they'd like a job using those particular skills.

Student Evaluation Data

1. I enjoy STEM subjects in school

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	0%	10%	+10%
Disagree	0%	0%	-
Neither	20%	10%	-10%
Agree	20%	30%	+10%
Strongly Agree	60%	50%	-10%

2. I would like to do more STEM activities in school

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	0%	0%	-
Disagree	10%	0%	-10%
Neither	10%	0%	-10%
Agree	50%	30%	-20%
Strongly Agree	30%	70%	+40%

3. I would like to do more STEM activities outside of school

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	0%	0%	-0%
Disagree	10%	10%	-
Neither	30%	0%	-30%
Agree	50%	40%	-10%
Strongly Agree	10%	50%	+40%

4. Taking part in STEM Club is exciting

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	0%	0%	-
Disagree	0%	0%	-
Neither	20%	0%	-20%
Agree	20%	30%	+10%
Strongly Agree	60%	70%	+10%

5. I know what coding is

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	10%	0%	-10%
Disagree	10%	0%	-10%%
Neither	10%	0%	-10%
Agree	30%	60%	+30%
Strongly Agree	40%	40%	-

6. I am good at coding

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	10%	0%	-10%
Disagree	10%	0%	-10%
Neither	20%	0%	-20%
Agree	40%	70%	+30%
Strongly Agree	20%	30%	+10%

7. I know what jobs people who code might do

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	10%	0%	-10%
Disagree	10%	0%	-10%
Neither	30%	30%	-
Agree	40%	20%	-20%
Strongly Agree	10%	50%	+40%

8. I would like to work in a job where I used coding

Rating	Pre Survey	Post Survey	Difference
Strongly Disagree	10%	20%	+10%
Disagree	50%	20%	-30%
Neither	20%	20%	-
Agree	20%	30%	+10%
Strongly Agree	0%	10%	+10%

STEM Ambassador feedback postcards collected from the students also showed the various positive impacts of the activities. Comments from the students revealed that they had developed new curriculum knowledge and understanding. When asked about the best bit of the activity, students made comments such as:

> **Learning about the different things you can use to code a robot.**
>
> **How to use loops and switches.**

The cards also showed that the students had recognised the value of problem-solving skills, determination and resilience, and that they appreciated the experiences they had. Comments included:

> **It was also interesting when it didn't work.**
>
> **Thank you for teaching me.**

Kath also recognised how the activities had supported the students' team-working, problem-solving and communication skills as well as helping to develop their curiosity, resilience and determination, saying,

> *During their second session on loops, the children were given the additional challenge of adding a switch into the loop. They generally worked in pairs and communicated with their partner to decide what they wanted their programs to do and how they could do it. They asked Mr Bibby about loops inside loops and then considered that the robot could do two different things at the same time with more than one loop. If anything doesn't go to plan, they either sort it out themselves or alter their code with a bit of instruction.*

When asked what he hoped the students would gain from the activities he'd planned, David responded:

> *My hope was mostly that the children would have great fun in a relaxed environment without any pressure to perform to any particular level and that almost by accident they would learn about programming!*
>
> *On the whole I think the sessions were really successful! Each week we couldn't persuade the children to leave after the session and the feedback from parents was that their children couldn't wait for the next one! The children started to confidently programme their robots and talk about programming concepts. They regularly surprised me with questions that showed a deep understanding of the concepts we had taught.*

Impact on educators

David's work at Astbury St Mary's has provided experiences to the children he worked with that they wouldn't otherwise have been able to have in a small rural school setting, which is an encouragement to staff at the school. The activities that David has run have been after-school, enrichment activities and, therefore he felt he did not gain much of an insight into the education system or the curriculum. He did feel that he had seen 'some of the challenges experienced by schools, especially small ones regarding resources' and explained how, 'Being able to borrow the Lego Mindstorms kits from the Hub has been a huge benefit to the school I've been working with.'

Governor, Kath Moore, who worked with David at the club used to be a computer programmer herself so was experienced in the skills David was teaching to the children. However, the activities they ran helped to expose other staff to the Mindstorm kits, showed what can be achieved with them and helped introduce possibilities for the school's computing curriculum.

Impact on STEM Ambassadors

Working with the school to develop their STEM Club, in his capacity as a STEM Ambassador volunteer, also had benefits for David who explained:

> *I joined the BBC as an apprentice broadcast engineer 11 years ago. Currently a Senior Systems Engineer at MediaCityUK, I'm now in the position of mentoring apprentices and new recruits. Before I worked at the BBC, I had worked with young people at Stockport College and in an adult education centre in Manchester, so, when I heard about the STEM Ambassador Programme through work last year, it felt like a great way to use my skills to encourage young people in to STEM career paths.*

When asked about the benefits of being part of the Programme and taking part in activities like the one at Astbury St Mary's, David explained that:

> *It is hugely rewarding to see children so enthusiastic about STEM subjects and to see how much they learn. Working particularly with primary-aged children has taught me a lot about how to teach what can be quite challenging subjects and it also feels like I really am inspiring a generation!*

The Lego Mindstorm resources provided by the Hub have also enable him to develop new skills himself, learning about the features of the kits and what can be achieved using them. He was able to confidently develop activities and produce worksheets to deliver effective sessions based around the kits, which have helped inspire the young people he worked with and positively impact their learning of STEM subjects and their attitudes to potential STEM careers. David commented:

> *I think that with the help of the Lego kits, I've been able to make the basics of coding really accessible to primary age children. I hope that by doing that and by offering them the experience that they will be encouraged to pursue experiences and education that they may not have considered before.*

Summary

David's activity illustrates the opportunities that opened up as a direct result of the provision of the Lego Mindstorm kit resources and the funding of the associated STEM Ambassador training, by STEM Learning. Whilst David possessed the knowledge, skills and willingness to be able to put together engaging, exciting activities to support the computer science curriculum and to open students' eyes to the careers available within computing, neither the Hub, the school, nor David himself would have been able to provide the resources required to facilitate such activities. In this particular case, without the financial support from STEM Learning, the positive impacts evidenced in the evaluation data would not have been possible.

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