The STEM HUB

LOCALLY DELIVERED TARGETED INTERVENTION 2022

CASE STUDY 2
ADOPT A PRIMARY SCHOOL (AaPS)

STEM AMBASSADORS 20 YEARS

Canterbury Christ Church University


The
STEM
HUB

RATIONALE

The AaPS initiative was created to provide STEM Ambassadors with training and resources and, to support schools in challenging circumstances to engage with STEM Ambassadors.

This local intervention was developed from the wider AaPS initiative and aimed to try to improve primary pupils' and their teachers' knowledge about science in everyday life and provide them with contact with people in science-related roles.

The Hub identified that schools who found it challenging to gain the support of STEM Ambassadors were in areas where there were fewer STEM Ambassadors or STEM industries. As many STEM Ambassadors identified that they wished to support primary schools, the issue was ot about the primary age range. This locally targeted initiative also focused on the role of supporting new STEM Ambassadors to learn from more experienced individuals.

INTRODUCTION

The idea of AaPS was developed from the successful Adopt a Secondary School (AaSS) initiative that The Hub had undertaken in 2009/10 where within two years more than 90% of secondary schools had engaged with STEM Ambassadors. With AaSS most of the STEM Ambassadors had a reason to link with the school they adopted, and some companies adopted more than one school. In 2009/10 primary schools were not part of the engagement requirement for the funder.

(AaPS) was created by The Hub because research evidence suggested that 'identity' is formed in primary schools (HMI, 2021). The latest Ofsted Framework used the term cultural capital although not in the way that Bourdieu (1973, 1986) would recognise. Cultural capital is now in all primary school's development plans. The same report suggested that:

- 'The picture is not an improving one for all pupils and may be deteriorating'.
- 'As pupils learn science, they also learn about its uses and significance to society and their own lives'.
- 'Science education also provides the foundation for a range of diverse and valuable careers that are crucial for economic, environmental and social development'.

The AaPS had been developed earlier in 2021 and had recruited well. The schools where STEM Ambassadors lived locally or were in locations with STEM businesses, found few issues with getting STEM Ambassadors to support their requests. One school in a disadvantaged area of Kent had requested support on numerous occasions with no interest from any STEM Ambassadors. The school for the purposes of this report will be called 'New Road'.

Many young people in this area have few opportunities and the SMT of the school identified that with the pandemic and the cost-of-living crisis the numbers of families receiving Free School Meals (FSM) has risen and would likely rise again. The last reported numbers of % eligible for FSM for 'New Road' identified there were 60.6 % of pupils FSM against a Kent average of 24% and national average of 23.1%. The Index of Multiple Deprivation, which is a relative measure of deprivation, is rated as 1 for 'New Road' meaning it is most deprived. The school currently has seven Governor vacancies and no STEM Ambassador population living locally and no large STEM company to support engagement.

The school supported the requirement of one of the intervention proposals to help STEM Ambassadors to gain confidence. It was felt that this was a school that could benefit from working with experienced STEM Ambassadors, buddying up with less experienced STEM Ambassadors and providing support for both the STEM Ambassadors and children's future learning. The benefits of new personnel working with a buddy was found to have a positive relationship to both work engagement and psychological capital (Nigah, Davis, and Hurrell, 2012).

Another of the key points in the proposal was for the pupils and their teachers to express the type of STEM engagement they were interested in (rather than just giving them what The Hub found easiest to secure) and to provide more than one engagement to immerse the school with a rich STEM opportunity. With more than 400 pupils on roll, immersing the whole school was a challenge, particularly with the need to provide buddying opportunities. As science needed to link to what the children know and see (Harlen, 2005) plans were put in place to talk to the children before the 2022 summer holidays.

METHODS

Working with the teachers and pupils of 'New Road' was a privilege but as researchers 'we need to be mindful of boundaries and limitations, in addition to the potential illuminative power of what we do' (West 2016, p. 42). The aim *'to do no harm'* requires understanding of the uncertainties of some of the young people and their teachers lives. There could also be an impact on STEM Ambassadors that are new to the role and the project provides opportunities for all to learn new things. Adopting Macfarlane's (2009) stance that ethics is about the character of the researcher rather than a depersonalised ethical principle helped frame the work and although there is always a tension between the funders' requirements for data and the needs of these vulnerable young people.

The decision taken was to try to protect participants, even if this meant editing an element of the material, but at the same time to try not to conceal aspects which might prevent teachers/STEM Ambassadors in the future having a better understanding. However, making that decision, deleting part of the transcript, and knowing it was the correct thing to do, was challenging (Macfarlane, 2009).

Due to strict safeguarding regulations no mobile phones or recording devices were allowed at any time. All materials provided had to be agreed by the school and the only photographs were ones taken by teachers and then sent to The Hub afterwards.

- 'New Road' was selected as it was a school which had wanted to engage with STEM Ambassadors, who had a high IMD and where there had been no previous engagement.
- A request was placed through the AaPS system for STEM Ambassadors who had not yet supported a school to come and work with both The Hub team and experienced STEM Ambassadors.
- A focus group was created by the school using children from each of the classes to represent the needs of their peers.
- The senior leadership and the science lead were interviewed about what they required and facilitated the opportunities for the director of The Hub to carry out focused groups.
- The science lead led pupils voice and staff feedback sessions in the days following and provided information to The Hub.

Contemporaneous notes were taken and written up as soon as possible after the event to ensure they were factual. STEM Ambassadors and educators who had knowledge of the areas identified by the children were contacted. Ideas were discussed and links made with people with skills. Some of the STEM Ambassadors needed to travel a good distance and others required specialist equipment. The money provided by the intervention was used to support travel and resources.

RESULTS

The interview with the science lead and SMT member gave the background to the school. A tour of the site was conducted and information about the catchment area was elicited. This conversation provided the boundaries for the work and included important issues such as parking, lunch and amenities for STEM Ambassadors. A good deal of the time was spent touring the site identifying the usable space both inside and outside for the activities. The teachers wanted where possible for some activities to be conducted outside. It also enabled The Hub staff to understand the needs of the children.

The conversations with the focus group lasted for more than an hour. The children in the focus group were keen on science and had some ideas of what they wanted, including "Elephants' toothpaste". Much of what they initially requested was mirrored by science shows that had taken place previously with science week funding. These activities often had high visual impact but had not helped the children meet people who had roles in STEM. They did however, motivate the children, end up in their long-term memory although sometimes without the accompanying scientific understanding.

Not all the requests shared by members of the group were agreed by the rest of the children, for example one child asked for the history of maths, why it was invented by whom and when. This like all ideas was noted down and returned to later. One of the teachers had been trained on the moon buggy challenge and the children had enjoyed this, so several pupils requested that moving and making things was part of the day.

Digestion was requested but it was clear that this was something the teachers did every year with bananas, Weetabix and tights. It was good to know that the children received a good practical science curriculum, and that science was a subject that the focus group liked.

Rocks, soils and fossils were requested by one child, to the grumbles and disagreement of the rest of the children but the child countered this by saying: "It could be good if taught well". This led to a discussion of Mary Anning, who was someone the children knew about, but after initially groaning at the idea of rocks it became clear that they were fascinated with rocks, magma and the centre of the earth.

The children were also fascinated with asking: Is it true that questions – such as *is the centre of the world very hot* and is this *where hell is?* Other is it true that questions included will your hair stand on end if you get hit by lightning? Some of the group who considered themselves to be science types added statements of fact comments – such as 15% of the human body is electricity. This provided a good opportunity to explain that not everyone knows everything and the people who would come and work with them would be doing things that related to their jobs. The human body does contain electrical current but the exact amount was not known by the focus group leader.

As it was getting near lunch time the requests were then revisited and a final wish list was drawn up:

- Invertebrates, animals to watch and observe
- Electricity
- Rocks, fossils and sand
- Anatomy
- Space
- Materials
- Rockets- real ones
- Things that moved
- Chemicals

Some of the activities that were requested required specialist STEM Ambassadors for example making a rocket that was 'a real one' took some sourcing and a good deal of risk assessments. (Gunpowder licences are required if larger quantities of black powder are used). All resources that contained any element of risk were purchased by The Hub.

This was to ensure they came from a reputable source and that The Hub could control the quality of equipment used. The rocks and fossils were provided by the geologist.

A timetable *(table 1)* was drawn up and shared with the school. Due to the requests for live rockets, more time was spent on this activity with a range of STEM Ambassadors supporting this throughout the day. Each session lasted 1 hour apart from the making and moving topic which required the children to make the vehicle before testing it and lasted 2 hours.

The school decided that the reception children should not be involved as they were still learning to come into school, and they felt external visitors would be distressing to them.

DISCUSSION

The requests by the children for activities provided information on the science remembered by the children which initially suggested that they were attracted by Wow! science such as "Elephant toothpaste". This is an example of activities-based learning and is debated in Primary science currently because of the Bianchi, Whittaker and Poole (2021) report on science. This report was cited by the Ofsted Science Review (2021) which suggested that while children enjoy practical work that this does not, by itself, foster long-term personal interests in the subject. With such a national debate it was decided that there should be a focus on curricular aims in the planning of the sessions selected by the focus group.

In Years 5 and 6, the rocket activity, setting off rockets was linked with the substantive knowledge of forces for Year 5 and in Year 6 the role of the electrical circuit with the safety buzzer enabling the rockets that misfired to be safely reset.

In Year 2, the mealworms and wax worms provided a good opportunity to observe living things, to identify what was living and the basic survival needs. Some recap curriculum was also offered.

As Year 3 study rocks and the geology sessions gave this unit some good disciplinary and substantive knowledge inputs.

Session	Topic/Class	Topic/Class	Topic/Class	Topic/Class
1	Geology	Moving and Making	Story Investigation	Rockets
2	Geology		Story investigation	Rockets
3	Invertebrates	Moving and Making	Materials	Rockets
4	Invertebrates		Materials	Rockets

Table 1

The cross curricular opportunity in Year 4 supported the DT curriculum.

Year 1, the planning supported basic literacy and simple maths activities linked to a story.

With the specialist activities a request went to experienced STEM Ambassadors with specific skills, and a request also went to STEM Ambassadors who had registered for AaPS. The responses from new STEM Ambassadors demonstrated that there was still a certain reluctance that they might be acceptable.

"Could you provide some more information on the training day. I would very much like to attend this as I live local to X but I'm not sure if my background is suitable."
(Armed Forces – Submariner).

Where possible new STEM Ambassadors were selected to work alongside other STEM Ambassadors, so for example one STEM Ambassador supported in the morning with rocks shadowing a geologist. The learning was not about how to be a geologist but instead to share strategies for handling resources; how to maintain interest when not all children could hold priceless rock samples at the same time. This was important as socialisation can promote positive and context-appropriate attitudes. It also supported new STEM Ambassadors by exposing them to the values, abilities, expected behaviour, and social knowledge essential for working effectively (Louis, 1980). The shadowing STEM Ambassador with the geologist said: " I have learnt so much and now know things that will help me in the future."

Working with the Rocket expert STEM Ambassador with explosive experience was a new STEM Ambassador who had work-related experience of explosives. He was quickly able to build the rocket motors and although this was his first STEM Ambassador activity his background suited the activity he supported. 120 pupils in Years 5 and 6 each set off a rocket of their own. At the end of the day the SA wrote:

"Thank you for the opportunity to join in today. Could you possibly put me in touch with X, I just wanted to get the list of equipment required for the rockets. Very happy to support any future nearby events".

This STEM Ambassador has put The Hub in touch with his organisations outreach team and support in other areas of the region will happen as a result of this successful experience.

In all classes it was clear that there were still some challenges due to the pandemic for example some of the Year 5 and 6 children initially did not want to take part and wanted to stay inside the school.

In Year 3 some of the children's skills in communicating was less well developed as most of the children had not had a full academic year in school. Reception children loved the rockets and were found standing by the gate to their outside area counting and cheering. The rockets were launched after a countdown from 5 but these children were counting up to 10 from 1. which pleased their teacher, and they were actively talking about what they could see – which was pleasing as communication skills for many of these youngsters is less developed than children in other places.

Most of the infant classes came to watch the older children launch their rockets and unsurprisingly the rocket activity received a good deal of positive feedback. It was clear that those children with 1:1 support who were reluctant initially to engage in learning got a boost of confidence when their rocket launched. It had been expected that 5% of pupils might opt-out of the rocket activity but in the end all pupils took part in all activities and the feedback demonstrated that they were motivated by the experiences.

"Rockets were awesome! I couldn't believe mine went up so high. Science is my favourite lesson now!"

Teddy – Year 5

Gaining feedback after the event was dependent on the science leader, who was not able to undertake the evaluation the following day as expected. Further evaluation is planned to take place with the focus group after half term. Much of the initial feedback, while very positive, was composed of comments such as "it was nice, the STEM Ambassador was friendly", "it was fun, and I liked the activity". Some comments that made us smile are included below:

"The rockets were so loud my Mum heard them at home. When I grow up I am going to be a scientist."
Joe – Year 6

"I want to have a pet mealworm at home now."
Neve – Year 2

"I can't believe we got to hold real obsidian like in Minecraft."
Lilly - Year 3

In all activities a whole year group were provided with a set experience. It was not logistically possible to enable all children to select an activity of their choice as not all workshops were the same length.

Also due to health and safety regulations some activities needed to be tailored to an age range. Many activities resulted in things to be taken home for example, 60 Year 4 pupils made a moving vehicle and were able to race them and then take them home; 60 year 1 children made a floating boat with a sail that they could take home after a workshop that started with a story.

Many rocket heads were taken home with the burn marks and the odours of ignition. These take-home experiences and sounds that were heard for some distance from the school, made the important link between science in school and the home. These experiences that bridge school and home improve science capital (Archer et al, 20210). In all sessions teachers and teaching assistants were on hand to support the pupils, they played an important part of the learning and learnt new things themselves. There were a number of teachers and teaching assistants who launched rockets and squealed louder than the children.

CONCLUSION

The project set out to engage young people who do not have access to STEM role models, and in this aim the it was successful. Engineers, Geologists, Biologists, Designers and Space Scientists came together and worked as a team.

New STEM Ambassadors learnt new skills and by shadowing others they are now equipped to run activities and have identified themselves as capable. Parents heard rockets from their houses, some mealworms did not find their way back to their homes, but drawings and observations were made. The children met people who had careers in STEM related roles who they would not have met without the event and the age range of the STEM Ambassadors was diverse, so some pupils worked with younger STEM Ambassadors who the children related to particularly well.

This project was an extension of the AaPS activity where more than 50 STEM Ambassadors registered to adopt a school. Supporting STEM Ambassadors who had yet to link with a school will hopefully increase the numbers of STEM Ambassadors who work regularly with one school. There are some learnings from the wider project. Like all successful events it takes time and commitment, and it is not something that can be set up and left to run itself.

LEARNING FROM THE WIDER AaPS PROGRAMME

(feedback from a STEM Ambassador who has adopted a school)

- *"It takes time and having @sophy to talk to has been brilliant"* (A)
- **Be ready to listen and adapt**

"I had an initial interview with the deputy head and the science coordinator at the school, we have established a plan. This involves me giving two assemblies (Years 3&4) and (5&6), and then starting a science club after Easter. They have also asked if I would be happy giving the odd presentation when required."

- **Linking with primary schools is not going to be easy and will need continued Hub support.**

"In respect to X there were a couple of problems with initial contact, (because of staff changes and a poor hand over) however, things are now progressing well. The contact @Sophy (Hub team member) made at the school had moved on without giving a good hand over, so nobody else was aware that the school had applied to take part in AaPS. After many attempts made by @Sophy, I suggested I contact the school myself and spoke to the science coordinator who was very keen to know more about the scheme."
(G has now adopted the school and has been in working regularly with the children.)

"X school are really grateful, they are a small school with limited teachers and resources. Getting availability and a plan needs some support and so working with @Sophy has been great." (This school now has a plan and meetings have taken place and a STEM Ambassador is now active in the school)

POSITIVES

"The school were very welcoming, and I had two meetings with Sarah, who was welcoming and friendly."
"Preparation of the talks with specific syllabus relevance for the year groups has been a highlight."
"It is a lot of work and will need to be maintained and updated every semester."

When running an AaPS day with STEM Ambassadors where children leading the learning don't forget to:

- Check the regulations – for example related to the amount of black powder allowed in a school setting.
- Find out what black powder is before agreeing to the activity.
- Trust the STEM Ambassadors who are the experts.
- Do all the boring things such as lists of who will attend and their DBS numbers and expiry dates.
- Continuously chase the school for feedback and pictures after the event.
- Have fun!

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