



VIRTUAL  
**STEM** EVENTS

# INTRODUCTION

The CV19 pandemic affected all aspects of life in the United Kingdom with teachers reporting that career guidance was disturbed. Prior to CV19 secondary schools were working to ensure they had well thought out, stable, long-term careers programmes, a development that was negatively affected by the pandemic.

The on-going multiple school and bubble closure disrupted the opportunities for education and school careers guidance. STEM Ambassador activity dropped by 81.5%\*, with most STEM Ambassador activity being remote rather than face to face engagement in schools promoting an interest in STEM. The reduction in STEM opportunities is important because 'Maines (1983) 'found that students who, in secondary school, indicated a high level of interest in STEM were more likely to choose a STEM major and persist in that field' (cited by Miller, Sonnert and Sadler, 2017, p 96). As STEM career events could not happen an alternative needed to be found. This had to be undertaken by trial and error as there is little in the current literature about online education specifically from the student voice perspective which is important to build strong programs (Keaton and Gilbert, 2020)

This case study sets out the impact of the virtual events that have been run by The South East (SAH) with support from STEM Ambassadors and companies in the region. The case study was undertaken as part of the contractual requirement to provide STEM information advice and guidance to young people in the South East. Due to the pandemic the research was not systematically planned but developed organically over time as each virtual event informed the next. The virtual work included inputs from STEM professionals at different stages of their careers. It was through inputs such as: talks; recorded workshops; virtual company visits; and career pathway live sessions, that it was possible to demonstrate aspects of the world of work to young people and the employability skills that are needed to be successful in the STEM workplace. In order to support teachers the mechanism for engagement became the website ( Figure 1)



Figure 1 The revamped website to make it easier for teachers, parents and home educators to find the materials they needed in the first lock down.

# METHOLOGY

To develop an understanding of the effectiveness of the STEM provision provided in a virtual world, data was collected from a range of sources. User behaviour online was gained from analytics both from the website monthly data and google analytics from codes inserted into various part of the site.

Student evaluation came from postcards and four questions asked using a 4-point Likert scale. Student permission was sought in both face to face and virtual activities. No pressure was exerted for young people to complete evaluation.

Other data was collected unsolicited from users of the events via emails.

Young people also submitted their learning outcomes via email, some data was submitted to the 'Askanambassador' email address, whilst other data came from focus groups conducted on virtual calls. Questionnaires were administered to both teachers and STEM

Ambassadors after sessions with data collected using QR codes into google forms.

The triangulation of data from these multiple sources provides evidence that provides a narrative of engagement. All data has been anonymised and all those who provided examples of work or comments have been contacted to gain consent. Ethical considerations were considered, and the data is illuminative not definitive.

As an outcome of the discussion it was clear that our aims needed to change in accordance to the engagement with the virtual world.



Figure 2: STEM Insight: Making sure that all content contributed to the SAH's aims of STEM Education.



## CAREER EVENTS

Face to face events allow young people to gain first-hand experiences of careers with the numbers of participants historically attending dependant on venue size and locality. The pandemic required the STEM Hub team to try something new. The accessibility, ability to break down barriers and provide opportunities for the most disadvantaged pupils has always informed the work of the STEM Hub, and these, plus some newly identified factors have underpinned the successful virtual events developed during these unusual times.

Young people internalise ideas about what 'people like them' can do and reflect upon their personal fit to both the education and labour markets. For some students, the barriers to participation in STEM are about class, for others it is ethnicity or gender that influences their choices (IOP, 2013). In the South East, working with a large and diverse role model population, the STEMHUB has gained evidence of an ongoing change in company awareness. In 2008, the support from most companies was targeted at young people who were already thinking of a career in STEM, but by 2019 this had widened to also include those who had not thought STEM was 'for them'. These changes have been brought about by both the changing education landscape and use of research evidence.

The pandemic made face-to-face events of all kinds impossible. Providing the likelihood that young people would miss out on STEM opportunities and be unlikely to get the same support as previously. The decision was taken to develop an online presence and create an online community for both learners and STEM Ambassadors.

The events had an element of competition, for example the Mars competition, where all who entered were given certification. Students being identified as successful in these unusual times was important as Dabney et al. (2012) found that students who participated in activities in science clubs or competitions were 1.5 times more likely to report a STEM related career interest in university than students who did not participate.



Figure 3 shows some of the successful competition entries to the Mars competition set by Libby Jackson. The competition winners received certificates and copies of her book Space Explorer.

## ASK AN AMBASSADOR

The virtual events used an email address to enable users to ask questions or share their work. The material submitted in demonstrated that levels of engagement were high, and that the pupils reported that they had learnt new things. The students responded to the email address – ‘askanambassador’ to share their follow-up learning as well as ask questions about careers or subject knowledge. The feedback Figure 4 was from a narrative NHS event.

It is naive to imagine that online learning must be reduced to watching videos or that the STEM Ambassador input in a recorded format cannot have an impact on life choices and understanding of STEM opportunities and careers. The feedback by Sarah clearly shows the impact that is possible. Distance and correspondence education in various forms has been around for over a century (Keaton and Gilbert, 2020) with online learning in modern virtual events starting in the 1990s. The decision for the Hub to engage was not due to a view that virtual was better than face-to-face but that this mode of engagement was possible, while face-to-face was not. However it was important to the team of educators who created the event that all activities had an element of meaningful engagement. For example after engaging with

STEM Ambassador input the ‘askanAmbassador’ email was signposted for the learners. Workshop materials set challenges and competitions along with prizes for taking part.

Live talks were also recorded enabling engagement after the live event. One example of the power of such contact can be seen by the email figure 5 and the support provided by STEM Ambassador, leading to the decision by the student to go to university in 2021.

Online learning has found to be very effective and the opportunity to enable all students to engage with a talk and gain personal support from STEM Ambassadors demonstrates the power of the STEM Ambassador programme. The moderation of the communication for the safety of all is an important aspect of this work.

I wanted to thank you for taking time and effort into making this program for people in youth. I found this particularly helpful due to my interest in possibly working in the NHS in the future, as well as my liking to the three sciences. My father, who works for the NHS, has always urged me to look into pathways in medicine and I have taken quite an interest into it.

This program has furthered my knowledge regarding jobs in the NHS and has enlightened me to the many different jobs in healthcare. It was also quite interesting hearing an inside opinion to working in a hospital and hearing the descriptions to different jobs.

Additionally, I found the use of examples of patients experiencing certain diseases/illnesses/injuries to be very useful in identifying which healthcare worker has which job. The workers from different wards naming equipment and their uses were very informative and interesting to listen too, and the advice given towards the end of many of the video clips were incredibly helpful.

Thank you

Sarah

Figure 4 feedback after the launch of the NHS event, which featured a narrative storyline



"I'm a year 13 student due to start university in September 2022 and I'm in the process of exploring academic opportunities in biology during my gap year. I'm specifically looking for internships or work experience in laboratories that would further develop my practical skills and contribute to current research. I appreciate that currently lab work maybe limited due to COVID-19 and that internships are often not available to A-Level / gap year students, however, I feel I would be a valuable addition to a laboratory."

*I am afraid this is very difficult this year. We are certainly not taking on any summer students, and I don't think most places are yet. This is because we really have to prioritise lab access for our graduate students over the summer as they have missed out on a lot of time due to the pandemic. I have attached some slides from another talk I gave about what students could be doing now and in there are some places they can begin to look at for work experience, although many of these places such as the NHS are suggesting alternatives which can be done online rather than offering actual lab based experience.*

*Sorry not to be more helpful but hopefully the student will understand the very difficult situation laboratories find themselves in with limited capacity and the need for social distancing.*

"Thank you for following that up for me.

Since looking about for opportunities I have made the decision to go to university this year and take up my offer at Durham. Given the unusual circumstances, I will give the gap year a miss.

Thank you very much for your work on my behalf, it is very appreciated"

## EVENTS IN AND OUT OF SCHOOL

In the last decade, most STEM events organised by the SH occurred in-school time (IST) providing young people, regardless of background, access to careers in STEM professionals and enabling them to make more informed choices for their future.

The research into Out of School Time (OST) events found that STEM outreach activities are influential on choices and outcomes (Dabney et al, 2012) but that access is often limited by the historical class, gender, and ethnic groupings of the young people. Virtual events can be used OST as well as IST.

Research identifying that STEM identity is formed in Primary school (Ofsted, 2021) virtual events have provided both opportunities for traditional IST activities for both secondary and primary pupils as well as bespoke activities such as workshops.

'Analytics' from the virtual events has shown that the STEM events embraced both the out of school time (OST) and in-school time (IST) event boundaries and have the potential for parents to be involved alongside the students. Involvement of parents is important in developing Science capital (Archer et al, 2013) Borup (2016) identified that parental involvement is important to student success. Evidence from emails sent by parents demonstrate both commitment, enjoyment, and learning from their children's engagement. Overtime as the virtual events developed there were more opportunities for students to submit their work providing increased opportunities for learning. It also enabled the learning of the young people to be more transparent to the hub and to influence the way the events were structured in the future.

The virtual STEM events have provided opportunities to engage with the wider community in a way many previous STEM events were not able to. For example on the 17/07/20 **1,238 sessions** of the virtual STEMfest were accessed by unique users. The face-to-face event would have supported only 400 pupils in school time. (Figure 6 STEMfest image)

The importance of providing young people with access to inspirational role models who demonstrate how STEM careers opens doors to new opportunities is paramount if young people's expectations are to alter. Research suggests that structured OST can impact motivation, interest, academic achievement, and career choice (Falk, 2006; Simpkins, Davis- Kean, & Eccles, 2006; Stake & Mare, 2005). The feedback from the virtual structured events suggests that this format enabled students to engage with a wide range of content.



Figure 6: STEMfest image

## MEANINGFUL ENGAGEMENT

By the end of 2020 the STEM Hub team had added live talks and interactive STEM classroom subject knowledge activities, alongside the bespoke primary and secondary virtual career fairs. In the 18 months from the start of the pandemic more than **100,000** young people, their parents and teachers engaged with the Virtual STEM opportunities.

Alongside this more than **143,000** downloads of curriculum enrichment was recorded from the STEM Insight area of the website ([www.thestemhub.org.uk](http://www.thestemhub.org.uk)) (April 2020- August 2021).

The live talks in particular enabled pupils and the home educated youngsters to ask questions, take part in live simultaneous science experiments, record resulting and discuss topics such a reliability of experiments, hydrogen cars and personal career journeys.

The work of the SAH is influencing users in other places in the world (Figure 7a)\_ The STEM Hub brand has developed a global following, but the focus of the work is with schools in the South East.

In June 2021 more than **20,000** primary children engaged with STEM professionals in moderated Live talks. In undertaking these events it was clear that the materials were being viewed by increasing numbers of users and although most were in the south East it is clear that schools across the country were

engaging with the events (Figure 7b) – whole page spread)

Online learning was effective and enabled all students to engage and gain personal support from STEM Ambassadors, this interactivity demonstrates the power of the STEM Ambassador programme. The live talks were moderated for Safe guarding reasons and to ensure all team members would be able to work online appropriately NSPCC training in was undertaken by all who would moderate live chats.

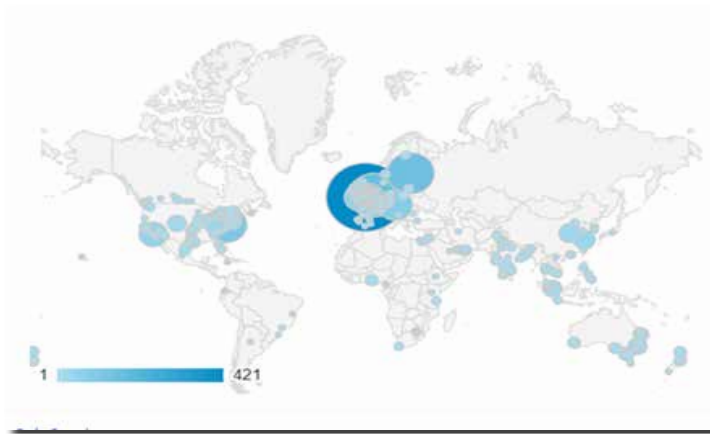


Figure 7a: The growing engagement with users across the world.



Figure 7b: Locations of the schools taking part in the Live talks in June 2021, 20,000 children engaged with these moderated Live talks





March 2020 September 2021

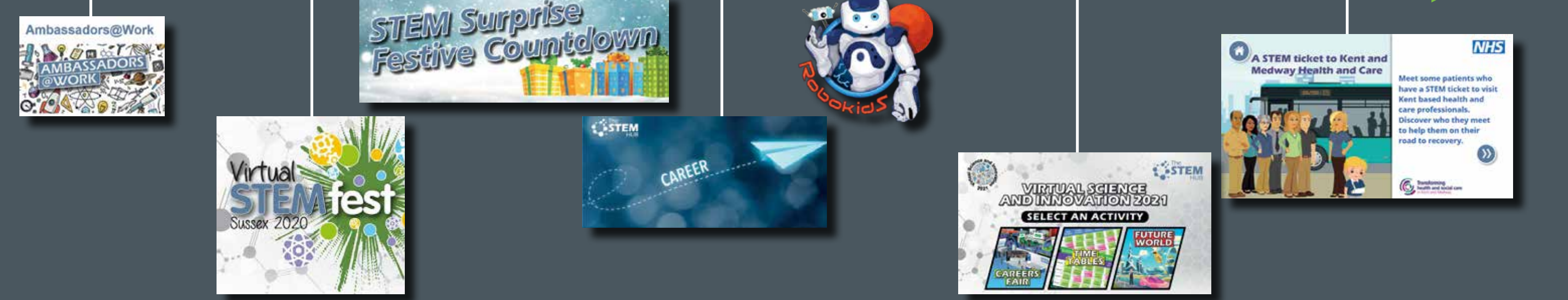


Figure 8: time line of virtual events.



## VIRTUAL FOR WIDER ACCESS

There have always been issues of access to STEM events for some students from disadvantaged areas. Pre-pandemic some career events handpick a small group of learners to travel to the event, in the pandemic the virtual events did not have travel time, costs or limitation on numbers.

Virtual events are not without issues: The STEMfest, run in the first lockdown in July 2020, funded by the CEC, to support a secondary school in Hastings, where only 75% of pupils in the target school had access to Wi-Fi and hardware. 25% of the pupils without access was unacceptable so this event was re-run in September 2020 when the school was open and IST access for 100% of their students was possible. 75% of the pupils' having access was a greater number than the face-to-face event that could ever have achieved.

In face-to-face events the activities that students engage with are often part of a timetabled decision made by the organisers. In the virtual event the young people can be in more control of their learning, revisiting aspects of their choice. The September re-run of the STEMfest event was also available OST to extend the opportunities. Feedback and analytic from the July 2020 event was used to monitor which aspects of the site were utilised most and as a result the event was changed in the Re-boot (September 2020) to maintain a new feel (figure

9a). The analytics demonstrated that schools from across the South East took part in the virtual event, and increased the opportunities for a greater range of students to take part (figure 9b).

In a virtual event there is no pressure for reticent young people to talk to the professionals who students perceive have always known what they would/could be. In the virtual experiences young people can take ownership of their time. Lee et al, (2017) postulated that virtual classroom may provide a more comfortable learning space for many female students. The authors noted that unwelcoming classroom environments influenced take up of Computing by females. Taking part in the virtual event provided opportunities for engagement for many more pupils and feedback demonstrated increased understanding; teachers also reported that the format enabled the students to be focused on the STEM professionals, gaining new both subject knowledge, and career understanding, with less of an emphasis on 'a day out' of school.



figure 9a Image of the STEMfest reboot

City	Users
1. Maidstone	110
2. London	105
3. (not set)	98
4. Northfleet	97
5. Gravesend	58
6. Reading	51
7. Bracknell	32
8. Ashford	26
9. Brentford	20

Figure 9b – City using the reboot with number of users

# FEEDBACK & IMPACT OF STEM EVENTS

The virtual events combined directed instruction activities, career inputs and more open-ended learning opportunities. 80% of feedback from primary teachers identified the activities were very good or excellent.

Postcard feedback from young people demonstrated the opportunities to follow their own interests was enjoyed. The range of competitions and activities supported both female and male students.

The age range of the young people taking part in virtual events has spanned the whole 5-19 age range. Some events have been Key Stage specific, for example Jamboree was aimed at KS 1 and 2 or STEMFest, a festival whose target audience was secondary. These Key Stage specific events did not have as many unique visitors as the cross Key Stage activities such as the innovation and science event to celebrate Science week in March 2021. Parents and teachers supported very young people in submitting their work. Elsie's submission from a virtual innovation and science online festival is remarkable for her age. Although only 5, Elsie contributed an example of technology for the future.(figure 10)

Feedback was compared between face-to-face activities and the virtual events. The same four questions were used for each event. Feedback from the last face-to-face STEM Hub event run in March 2020 demonstrated that young people learned about STEM careers, they enjoyed the event, but most learners did not report that

they had gained any new subject knowledge. The event was less likely to be linked to learning activities when the students returned to the classroom. The evaluation used was from a STEM Club feedback form. The simple four question format enables comparisons to be made from one virtual event to the next.

The enjoyment in a face-to-face event is evident, resulting in agreement with the statement to come to an event like this again (See figure 11.a,b,c.) It is the other questions where the "so what" element of such events occurs. STEM Professionals provide their time and while it is not to be expected that all who attend an event will want to be a STEM professional as a result, learning about something new could be seen as a non-negotiable for attending a day out of school.

Hi I am Elsie,  
I made a butterfly robot that can fly and find out how butterflies live.  
I choose a butterfly as it can fly quietly not like a bumble bee that buzzes.  
I hope you like my design I am going to bring it into school next week for our science competition.  
Elsie Age 5



Figure 10: Elsie's submission to the innovation and science event 2021.



Figure 11 (a,b,&c) 4 questions used in all events. STEM Clubs material.



*"It was extremely fun; the staff were really amazing, and I learnt about blood and tarmac".*

Lulu (Y7)

Lulu's comment reflected most of the postcards written at the end of a face-to-face event that reflect upon the "nice people, the fun and enjoyment" all of which demonstrate the experience was pleasurable. Online questions have demonstrated similar engagement and pleasure but also things that have been learnt.

Less than 2% of postcards from the face-to-face events communicated information about learning something new. (figure 12 b and c). This contrasts strongly with submissions from the virtual events where most feedback is new learning focused. It should be noted that the return rate for feedback from a virtual is much lower than from the face-to-face events as there is no compunction to complete the evaluation process before leaving the virtual event. Generally the feedback that is submitted from a virtual event is more detailed (figure 12a). In addition information gained from the virtual events is often in the form of materials submitted to the Askanambassador or STEMhub email. From the range of submissions received, it is postulated that there was more follow-up by teachers after a virtual event.

One of the striking things about the teacher evaluation is how little the hub knew about virtual events at the start of March 2020. The jamboree

was billed as a two day event, with brand new content on day two, something that reflected past face-to-face events and unnecessary in a virtual environment. There were far more activities each day than hours in the day to undertake them. In hindsight it demonstrates how little the SAH knew about structuring a virtual event, but it was great to know day 1 was a success and day 2 was being looked forward to.

Unlike face-to-face school events there was also feedback from parents from virtual events who suggested the events are worthwhile. One parent who was home schooling her children, encouraging them to take part in a bridge building workshop led by a female apprentice engineer reported that

*"There is a serious danger that the children might have learnt something today"*

Teachers in school with Key worker groups also sent feedback from the first virtual event

*"I really enjoyed the Jamboree as did all my students. Thank you and your team for all the support and all the wonderful things you are doing."*

(Primary School Teacher from Southend).

*"Thank you so much for the amazing virtual Jamboree. It was absolutely amazing!!! I have loved it, the teachers have, as have the children so far! Day 2 still to come."*

(Primary School Teacher from Sevenoaks)

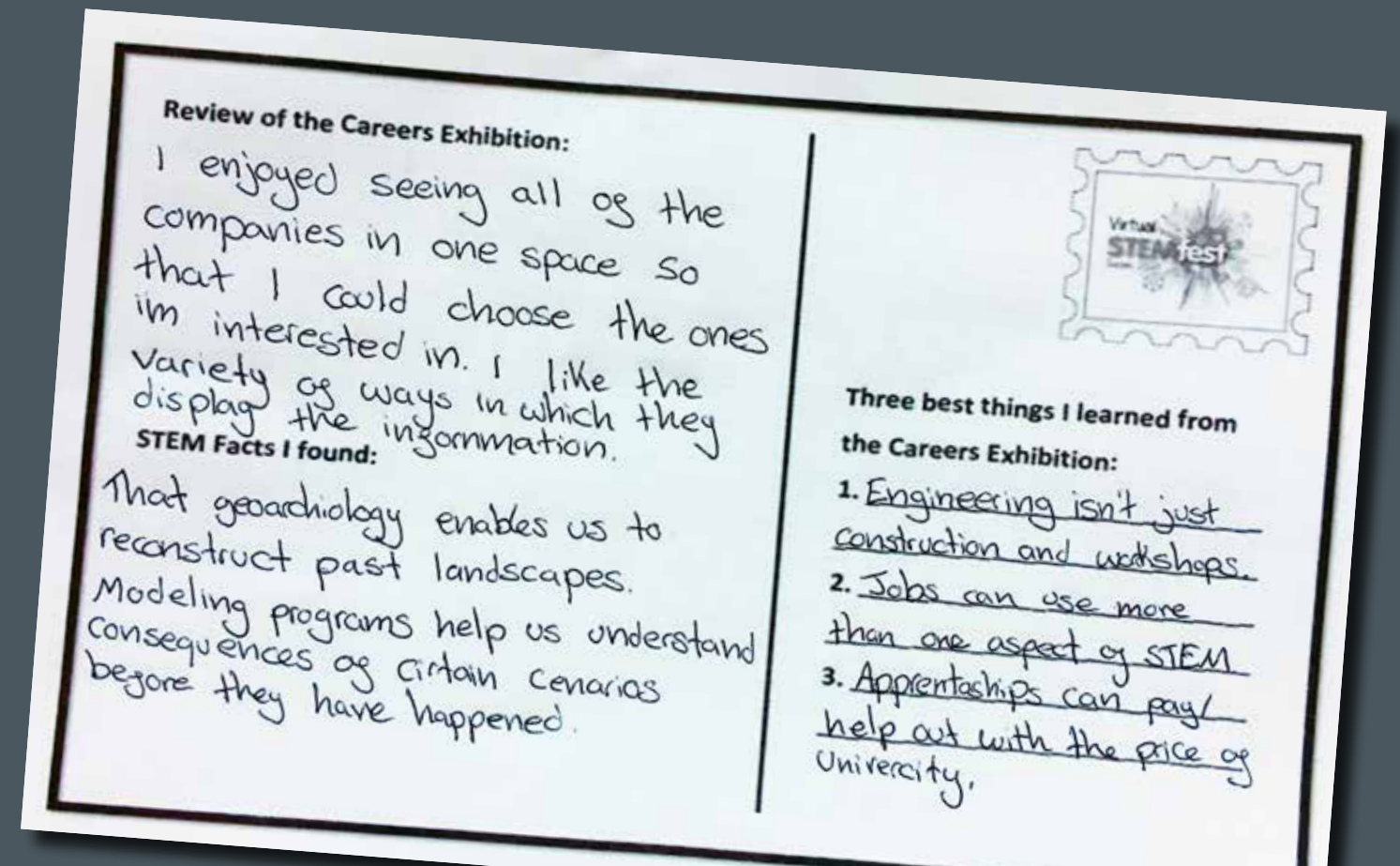


Figure 12a postcard feedback from virtual event.

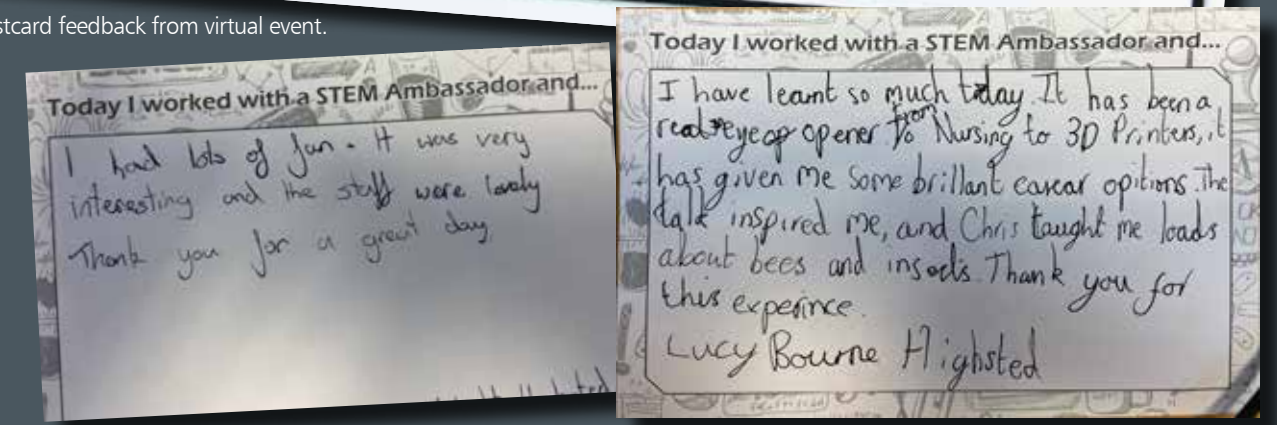


Figure 12b, c. feedback from face to face event, many more had fun cards 12.b than learning cards 12.c event.



# CONTEXT & MULTI-LAYERED VIRTUAL LEARNING

Research both from academic papers and from past events demonstrates that a nonlinear format provides a more effective user experience in a virtual learning space. When E-learning materials have a linear design, where all learners are forced into a single-mode pedagogy, learners do not learn (Robberecht, 2007) and this can contribute to digital fatigue.

Results from the analytics were clear that the first event created by the team (Jamboree, 2020) was too linear in design; it mirrored the events planned for a face-to-face event it had replaced. It was evident that the time spent on each section by the users was lower than when a multilayer approach was used in later events.

Science shows have always been very effective element in face-to-face events, but in the virtual event very few learners made it to the end of a 40-minute virtual science show. Most learners changed to other part of the site after 10 minutes or left the site entirely. Live talks, where students

carried out simple science experiments feeding back their results to the presenter were more engaging and upwards of **500** primary children have attended each one of these experiences (some talks had **3,000** children in a live talk).

The live talks were more successful than the science shows although the three shows with high profile presenters brought audiences to the virtual events, they just did not keep them in the shows. Research based findings were also used to inform the future of online learning experiences. Three of the most important findings were:

1. The value of context for learning to reduce gender inequalities (Evans & Gibbons, 2007)
2. The dynamic nature of multimedia seemed to help learners to create mental models more effectively and improved comprehension than found in traditional teaching approaches (Kamal et. Al, 2000).
3. Competition increases engagement and long-term STEM engagement (Miller et. al, 2018)

The research prompted the first virtual events to have a geographical context, for example the Crawley STEM Fest 2021 was commissioned for the Crawley students who would have attended the single face-to-face IST event, (figure 13 )the Jamboree 2020 focused on primary children from East Kent and the Southend carer fair 2021 featured a scavenger hunt around Southend.(figure 14) The geographical context was increased by use of interactive maps.(figure 15)

The innovation event was set in a futurist world (figure 16) and the second Jamboree had a Water

world, a jungle theme alongside the map of Kent (Figure 15) It appeared that context did not have to be geographical; and could be based on a book or themed around an issue for example the care of the oceans. The feedback from the users expressed enjoyment with the range of contexts.

Switching to a virtual delivery was not without costs, however feedback on the events created has been very positive, including the way the events have met the Gatsby Benchmarks (<https://www.gatsby.org.uk/education/focus-areas/good-career-guidance>) Figure 17

The 'analytics', suggest a virtual event can provide much needed access to and stability for STEM career guidance, especially when viewed with other subject and career support such as Ambassadors@Work, (figure 18) STEM@Home, (figure 19) Career Friday (figure 20) Apprenticeship Talks, Assembly Talks and the Gallery. ([www.thestemhub.org.uk](http://www.thestemhub.org.uk)).

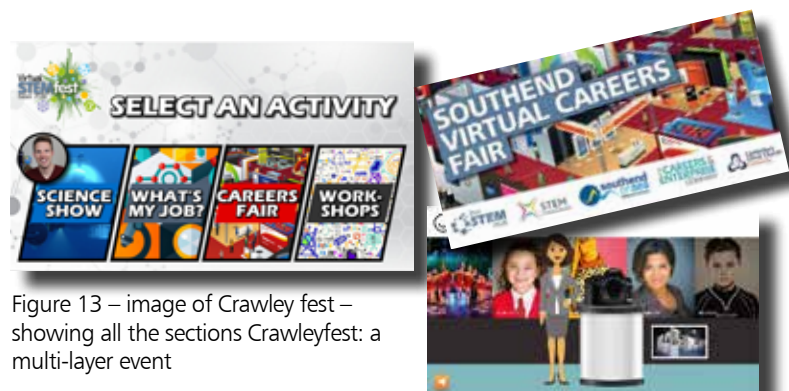


Figure 13 – image of Crawley fest – showing all the sections Crawleyfest: a multi-layer event



Figure 14 – Southend – image with a scavenger hunt opportunity Scavenger hunts to add interactivity



Figure 15 – Jamboree 2021 ( map of east Kent) Interactive map linking STEM companies to locations and other learning sections



Figure 16: Innovation and science event, multilayer future world.



Figure 17: Gatsby benchmark 2 labour market activity competed by Daisy.

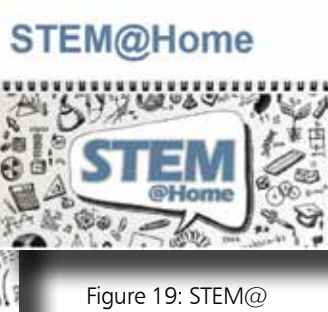


Figure 18: Amassdors@work: case studies, video and much more from SA in the south East



Figure 19: STEM@work: themed curriculum based support provided by SA

Figure 20: career Fridays: Live talks on careers by STEM Ambassadors



## THE EVENT IN NUMBERS

Pre covid the hub would have organised directly STEM provision for about **4,000** young people in a year in events like STEM@work and Big Bang. Teacher requests would have been the main way that STEM Ambassadors were linked to learners.

The closure of schools and the restricted access for non-school groups, meant that for teachers and others, making requests for STEM Ambassador was not a high priority. As is clearly shown in figure 21 below, the teachers began to request support again when schools opened in September using Teams and zoom, but this dropped again when tiers and closures became the reality in the South East in later 2020. The closures in January 2021 again affected the schools' engagement, but by this time the virtual events had become a way of working and STEM Ambassadors were also volunteering virtually.

The numbers of pages viewed during these challenging times is presented in Figure 22. The number of pages viewed was taken as data source as initially this was the only data available to the hub. As more events were planned, greater feedback mechanisms in terms of site use and user experience were built into the events.

The total engagement recorded for all events was **105,725** page views. Page views was the only consistent data for all events as goggle analytics were introduced in September 2020, prior to this website analytics was used. Events when schools were in operation had smaller unique users with teachers sharing the materials

with whole classes. The change in mobile and desk top user and the change in times of use supported the hypothesis that schools were the main users, with the drop in use at weekends and lunch times also support this notion. The teacher feedback and registration for the events provide additional support for this hypothesis. For example the teacher in Essex has more than **250** students in year 8, working with their teachers this would be 10 teachers, who might only focus on one page in a lesson. Also the way the early events were built, large sections of the site was recorded as one page.

*I've got most of our year 8 students taking part in the careers event and I have printed the worksheets they complete at each stand (STEM Lead, Essex).*

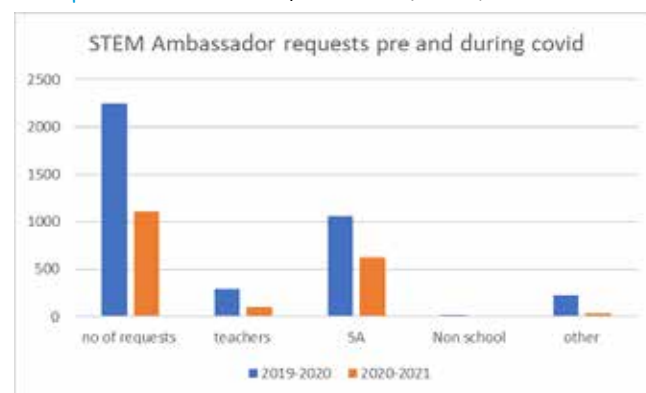


Figure 21: Data from digital platform comparing ambassador requests 2019/2020 to 2021

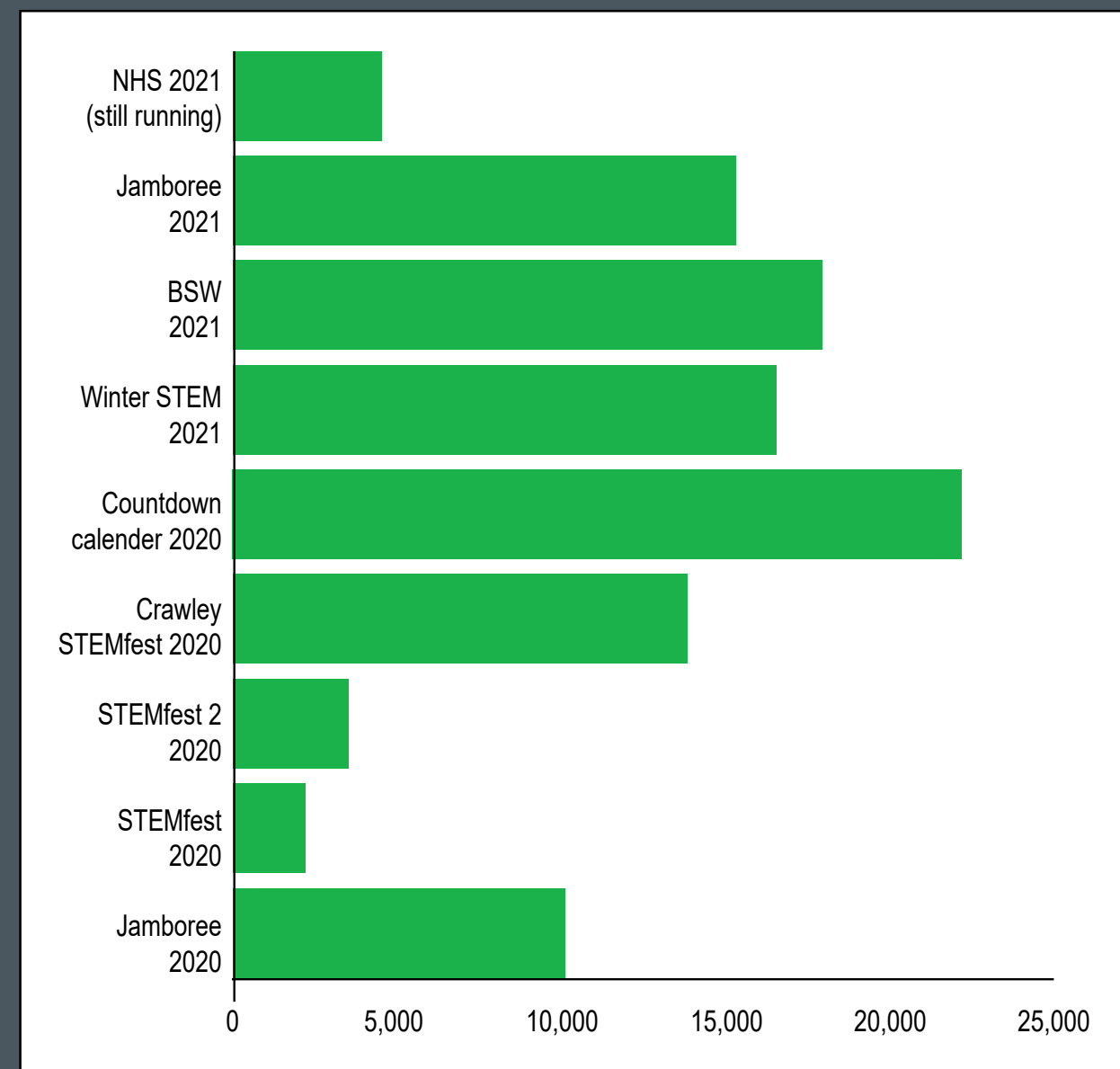


Figure 22: Page views of the materials, the one consistent form of data used from March 2020, when the website analytics did not count users.



Figure 23: Science and innovation where both primary and secondary timetabled workshops were provided to support teachers.

## TEACHER BEHAVIOUR

All virtual spaces are planned so they can be used in a multipurpose way, often with more than one section and focus. Our research suggests that too many activities in one place causes teacher stress, although it appears that the pupils do not have the same issue.

Human-Computer Interfaces (HCI) have discovered that children have unique likes, dislikes, and needs that are often different from those of adults. Many events now have a timetable section to support teacher led sections (figure 23).

Teacher stress has been a factor to consider, as not only is this one form of feedback, but teacher response influences dramatically the ability for students to engage at all. This requires pre-event resources and communication to support schools and colleges to prepare themselves and their pupils for the event with the opportunity to sign up for events well in advance.

When the material is short impactful and narrates a clear journey into a STEM role the teachers feedback demonstrates the impact on pupils:

*The impact was pretty remarkable: students had not really considered careers at all. The short videos galvanised their desire to know more, and several came back to their tutors with additional research that they had done"*

Ellie (Teacher feedback after students' engagement with career fair 2020) Figure 24



Figure 24: Image of the SA speaking in a simple short video



## PUSH AND PULL FACTORS

The Push and Pull factors are the forces that push students towards certain careers – school and family influence Push factors. The Pull factors are what companies can use to showcase the reasons why working for them is an enticing possibility.

Career advice is wider than any STEM outreach activity, but within the STEM arena, the virtual event appears to facilitate increases in the Pull factors. This is important at a time when the Push factors of teachers and parents can be reduced.

The Pull effect is further enhanced through the virtual events as the format enables companies to demonstrate to more pupils what the workplace is like and inspire them with the opportunities of work through carefully curated videos. A virtual event can enable a company to showcase their unique and most interesting features and personnel, which may not be possible in some face-to-face activity.

The Pull factor, in present times, is very important as teachers report that students are feeling abandoned by exams being cancelled and inconsistent messages about future job roles.

The videos provided by one engineering company that was used in both STEMFests and is hosted on Ambassador@Work ( Figure 25) demonstrate how less than 6 minutes can inform, inspire, and engage young people, providing an example of a 'clear line of sight to work' (CAVTL,2013).



Figure 25: Career profile on ambassadors@work.

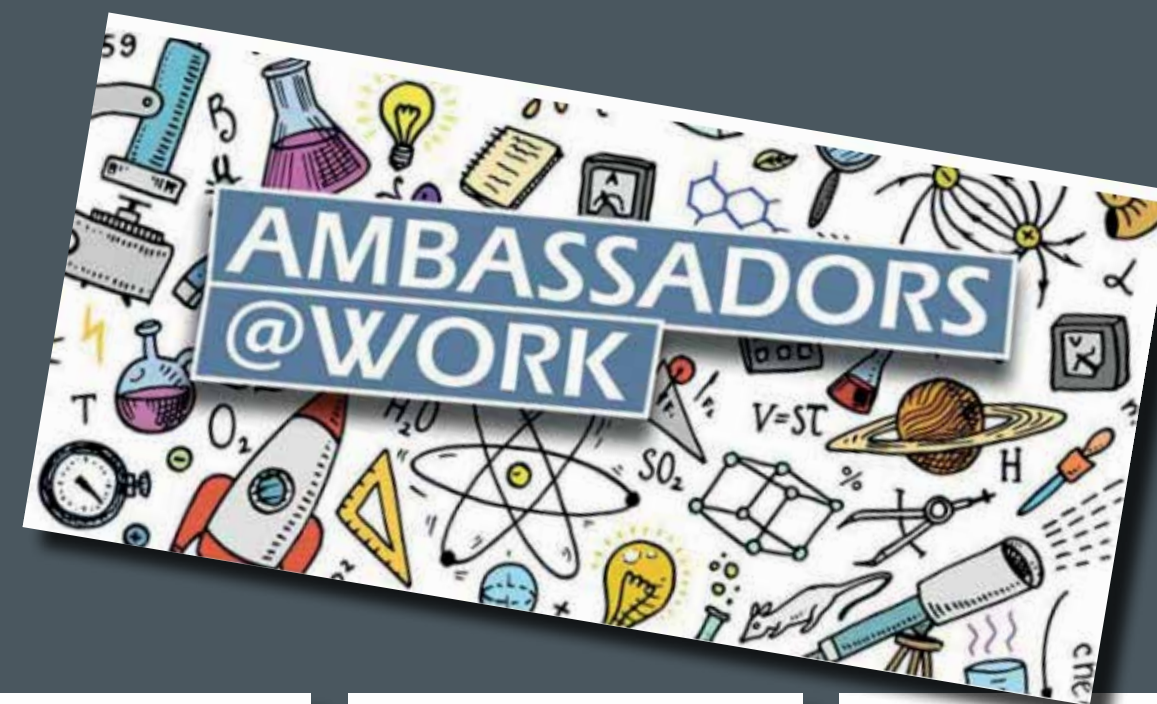


Figure 26: Sections within ambassadors@work.

# ANALYTICS INFORM STRUCTURE

User behaviour has been analysed and the outcomes used in each subsequent event to ensure maximum learning outcomes for participants whilst understanding that virtual learning spaces work in different ways to traditional face-to-face input.

The analytics have informed an approach that is nonlinear, interactive, contains context-sensitive active learning elements, and accommodates various learning levels and interests (Phelps 2003, Chen and Macredie 2002). One of the first events where all these elements were in place was the Crawley STEMfest. Active learning elements have included What's my job, scavenger hunts and Desert Island risks (DIR), where participants select team members to help them off imaginary desert islands. (figure 27) The NHS event in 2021 was narrative based and had a bus, a map and the highway to health as the various contexts into the event (figure 28). For primary aged pupils the

ability to place characters onto a bus to explore both the range of NHS jobs and locations was motivational. This interactive activity helped the users to engage with the multiple STEM Ambassadors a patient might meet when attending a hospital.

The most successful events are complex, have multiple ways into activities, allow for participant's choice and independence, and provide support by clear signposting that is consistent throughout. Successful events support teachers to access materials. The 2021 Jamboree and the Innovation and science event

2021 were great examples of mixed audience and multiple entry to access learning opportunities.

In each event new features were tried, that linked to research from past behaviour on our site and published research by others on effective online learning. One effective way to increase the complexity was to have challenges and opportunities hidden within the site. For example, the labour market information in one event was turned into a simple scavenger hunt, (Southend 2021) In another event (Crawleyfest 2021) 12 fossils were hidden and when the students found the fossils, they provide more information on the roles within a specific company or organisation. In the Crawley example fossils were selected by the key sponsor who were a geophysical service company.

Modern and young person facing design was found to be essential if engagement by target audience was to be achieved

The Desert Island risk was created to provide a functioning game format that would identify not just job roles but also the skills and aptitudes that are required in the workplace. As can be seen (figure 27) the information is clear, and the graphics appealing. The format contains a range of media and links both graphics and videos emphasising the SAH-S commitment to learners participation in rich contexts. In these activities career information and context takes on meaning. Feedback from pupils on this game is always high, with students sending in their Dream DIR team and the points as well as reasons why their team were chosen (see Figure 29).



Figure 27: DIR, nonlinear, interactive, contains context-sensitive active learning elements



Figure 28: NHS event with multiple ways to engage and active learning elements

Figure 29: A submission for DIR explaining team choice, demonstrating understanding of soft skills and STEM careers

I got 70! Noooo I was so close! Im going to play again Did anyone get lower than that?  
Hello ask a stem ambassador,  
I am emailing to show you my competition group of team mates and my points  
Points:  
210 points  
Team mates:  
Claire = campfire skills, carries a hammer and a compass, good at problem solving, can find a good shelter, can find safe ground to camp on  
Hulween = can make a horn, good at maths, physics and engineering, varied skill, can detect noise distance  
Shane = first aid, calm under pressure, good at biology, chemistry and maths, has good teamwork skills, can help keep you healthy and well  
I chose them because of there (sic) skill, ways of surviving and things they said  
Hulween has skills with making a horn and can find noise distance and Claire can help with making a fire by finding flint and so the by passers can see the smoke from the fire and come and save us  
Thank you for letting me enter the competition and I hope I picked a good team



## CONCLUSION

**The Hub team started the world of virtual from a standing start. For a team who had previously undertaken face-to-face activities and used their website to signpost people to other organisation's sites, the pandemic provided challenges.**

The feedback from STEM Ambassadors, STEM Companies, teachers, parents, and young people have spurred the team to continue to learn and improve.

At times “keeping on – Keeping on” (West, 2018) has been a challenge, particularly with the network's lack of understanding of the nature of learning in a virtual world. The misconception that virtual means that students watch videos in a passive way, is a long way from the truth. The evidence shared in this case study has demonstrated that students learn skills and knowledge and understand what they have learnt.

The team have created content, supported STEM Ambassadors to create content of all types. This case study documents only a small part of the work the Hub team have undertaken in the time span between April 1.2020 and September 31.09. 2021. The virtual events support more reserved young people, provide access to those who might not have been selected to attend a face-to-face event. The virtual events have supported parents to understand and learn alongside their

children. Virtual events have made careers and opportunities visible, and at a time of retraining there is also value in getting STEM out into the wider community.

There is more to celebrate, and all events will continue to inform the Hub's future work, and perhaps the case study will enlighten others to a more educated conversation about the value of online STEM learning. The debate is worth having!

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