

nustem



Image Credit: Ivy Road Primary School via Twitter

ANNUAL REPORT

July 2021

Contents

Execu	tive Summary	\$
Our V	ision 5	;
Obj	ectives 5	;
1	Develop, deliver and enable high-quality STEM interventions for key stakeholders	;
1.1	Response to Covid6	;
1.2	STEM in Early Years	3
2	Support and influence STEM outreach and widening participation within Northumbria University 9)
2.1	Physics Experience Week)
2.2	Evening Lectures)
3	Influence STEM careers and engagement policy at local, national and international levels)
3.1	Tomorrow's Engineers Code)
3.2	Public Engagement Workshops 10)
3.3	Airbus GEDC Global Diversity Award11	L
4 engag	Work in partnership with organisations to develop, disseminate and embed effective practice in STEM ement	,
4.1	Supporting Remote Workshop Delivery12	<u>)</u>
4.2	Reading Sparks	<u>)</u>
4.3	EPSRC Engagement Fellows	3
4.4	Museums Northumberland Projects13	3
4.5	British Science Week Packs	ŀ
4.6	Putting Careers in Science Textbooks14	ŀ
5	Produce high quality research on young people's STEM learning and career choices	;
Produ	ce evidence of impact of the work of NUSTEM 15	5
5.1	REF Impact Case Studies15	;
5.2	Scientist of the Week15	;
5.3	Unconscious Bias in Early Years15	;
6	Contribute to Teaching and Learning at Northumbria University	,
6.1	Translating Environmental Science into policy, outreach and decision making	7
7	Looking Ahead 18	3
Apper	ndix 1 Yearly Interactions 19)
Apper	ndix 2 NUSTEM Publications in 2020/21 20)
Apper	ndix 3 NUSTEM Theory of Change Infographic21	L

Executive Summary

It has been a challenging year for everyone, and NUSTEM was no different. I am immensely proud of how the NUSTEM team have worked together, whilst working remotely. Members of the team have been through personally and professionally difficult circumstances and I couldn't ask for a better set of people to have supported each other and the work of NUSTEM. Thank you to all of them.

This year we have continued to work to develop ways to support schools through remote delivery and shared our learning with many other organisations through seminars and informal discussions. We have redeveloped our classroom workshops for primary schools so that they could take place using a remote format through video conferencing software, with resources being sent to school before the sessions. We have also been able to work with an increased number of academic colleagues through our online NUSTEM Encounters Assemblies, as well as support public engagement activities more broadly across the university. Through our work, Northumbria University has been able to support local communities and schools throughout the pandemic.

Collaboration with others is an important way for NUSTEM to influence the STEM engagement landscape. This year we have worked with organisations such as Museums Northumberland, Engineering UK, British Science Association and the Reading Agency, and with EPSRC Engagement Fellows Dr Helen Bridle (Heriot-Watt University) and Professor Trevor Cox (Salford University).

Following on from the project with the NELEP on the Careers in Initial Teacher Education (CITE) last year, we adapted the training materials for serving teachers, and were able to offer the three session CPD in the Autumn and Spring this year. The training continues to receive positive feedback and has led to further collaboration with the NELEP and a Multi Academy trust to explore the impact of whole-school training in careers-related learning.

This report provides a broad overview of the work of NUSTEM in the academic year September 2020 – July 2021, how we have responded to the challenge of the pandemic, and shows how we continue to work to improve the diversity and number of young people choosing a career in STEM.

Dr Carol Davenport Director, NUSTEM July 2021

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Working for a vibrant and sustainable STEM sector which meets the needs of learners and employers, reflecting the diversity of wider society.

The year in numbers 2020 - 2021

7363 interactions with Children and Young People

SCHOOLS



interactions with the wider community, including families, teachers and science communicators.



1380

books and activity packs gifted to North East families during lockdowns



EXTERNAL



88

partner schools and

schools linked through

collaborative projects

Northumbria University researchers participated in NUSTEM activities during



Sharing learning and resources with the wider STEM Engagement community



ORGANISATIONS

Since 2014, NUSTEM has worked with 13860 individual primary school children, and had over 121600 interactions with children, young people and the wider community.



Northumbria University NEWCASTLE

Our Vision

NUSTEM's vision is for a vibrant and sustainable STEM sector which meets the needs of learners and employers, reflecting the diversity of wider society.

We believe that by supporting children, families and teachers to identify how their personal characteristics align with the characteristics of people who work in STEM, children (and their influencers) will feel more confident that a career in STEM is for 'people like them'. Alongside this, NUSTEM shows the breadth and application of STEM in the world around us. Together these should lead to an increase in the number and diversity of young people choosing a career in STEM once they leave compulsory education.

We recognise that changing the diversity of different STEM sectors requires systemic change and a focus on improving workplaces for those who have traditionally not been included. Employers need to show young people, and their families, that STEM is indeed for 'people like them', and that they will be supported and valued in the STEM sector they have chosen.

Objectives

In order to realise this vision, NUSTEM will:

- 1. Develop, deliver and enable high-quality STEM interventions for key stakeholders.
- 2. Support and influence STEM outreach and widening participation work within Northumbria University.
- 3. Influence STEM careers and engagement policy at local, national and international levels.
- 4. Work in partnership with organisations to develop, disseminate and embed effective practice in STEM engagement.
- 5. Produce high quality research on topics related to young people's STEM learning and career choices and produce evidence of impact of the work of NUSTEM.
- 6. Contribute to Teaching and Learning in Engineering and Environment & Health and Life Sciences.

In the following sections, we will highlight some of our activities this year which relate to each of these objectives.

1 Develop, deliver and enable high-quality STEM interventions for key stakeholders



Map showing location of NUSTEM partner schools in 2020/21

Number of interactions with children and young people during 20/21: 7363 Number of interactions with key influencers and other adults during 20/21: 1283

Appendix 2 contains the detailed breakdown of interactions by different audiences.

1.1 Response to Covid

The disruption to schools and universities means that NUSTEM work with primary and secondary schools has all been online this year. We were able to build on the planning for remote delivery done during summer 2020 and adapted our primary workshops to be delivered online with the support of the teacher in the classroom. For secondary schools we have delivered pre-recorded assemblies and moved Physics Experience Week and the Evening lectures online.

For teachers we have run two sets of our Careers-related learning in primary schools (CLiPS) training online which has received good feedback from participants.

1.1.1 NUSTEM Encounters

The NUSTEM Encounters model provides a structured process through which a guest speaker (academic or industry professional) can engage in interactive discussions with children in a school. This model has worked well as an online activity.

Prior to the Encounter, a member of NUSTEM staff speaks with the visitor to create a short information sheet about the speaker which is sent to the school. The children use this information to write questions that they would like to ask the speaker. The 'best' questions are sent back to NUSTEM and we work with the speaker use these questions to plan their presentation. This has the advantage of building intrigue and engagement among the children, and allowing the speaker to tailor their presentation to align with the children's interests.

Where possible, we also linked the Encounter to one of our STEM@Home activities so that children could do an activity in the classroom, or at home to extend the encounter.

We also provided pre-recorded Encounters that schools could access at a time of their choosing.

Number of Encounters assemblies: 21

Year 4 Tigers @NYPSTigersYr4

This morning we have been watching an assembly from <u>@nustem_uk</u>. It is an interview with Shahrzad who is an electrical engineer. We are listening out to hear if she answers any of our questions and we have heard Kiyah and Zak's questions so far! <u>@Newyorkprimary</u>



9:47 AM · Feb 9, 2021 · Twitter for iPad

1.1.2 Online Workshops

Alongside the development of our NUSTEM Encounters and the STEM at Home resources we have redeveloped our classroom workshops so that they could take place using a remote format through video conferencing software. We've had to think carefully about structure and delivery methods, and about how we best facilitate child interaction in those sessions.

Three of our partner schools were integral in the development of these new format workshops and helped us to practice delivering in the new environment. They provided us with important feedback that allowed us to ensure the final workshops were of high quality and enjoyable for the pupils and teachers to take part in.

During the summer term all primary partner schools were offered a range of workshops from Early Years to KS2. Our Exploring Extreme Environments schools have all taken part in the new Imagining the Sun workshops and are scheduled to have the Underneath the Ice sessions in the last part of the summer term.

Number of workshops: 108

1.1.3 Online storytime and book gifting

Children's early literacy has been shown to be correlated with their attainment in later schooling. For the past few years, NUSTEM has been developing storytime activities to allow children and their carers to explore science through storybooks – thus supporting both literacy and science. With support from three

funders this year we have been able to run online storytimes for partner schools. With the support of the schools, we sent children in reception and nursery classes a copy of a science story book and a simple paperbased activity linked to the book that parents could do with their children. We then arranged a number of early evening online story reading sessions, where families could listen to the story read by a member of NUSTEM staff and try out the activity together. The SHINE Trust supported the Me, You, and Science Too (MYST) project, UK Space Agency supported Family Space Explorers 2, and Science and Technology Facilities Council (STFC) supported additional story times with Exploring Extreme Environment schools.

Number of online storytime sessions: 41 Number of books gifted to families: 1380

1.2 STEM in Early Years

The aim of the STEM in Early Years is to develop, deliver and enable high-quality STEM activities in nursery and reception. In the Early Learning Goals, used to assess children at the end of reception, there are links to STEM subjects and the attributes of people who work in STEM. However, in nurseries and reception classes, teachers are supported by other adults who will be key influencers but may not have the STEM qualifications or training to the level that a teacher has. This project is an opportunity to include these adults in promoting STEM and STEM careers to very young children and to ensure that gender (and all other) stereotyping is avoided during STEM interactions with children.

We have produced a series of units each based on a high-quality STEM story book. Each unit includes:

- STEM related questions to go with the book
- a STEM person with a related career and their attributes
- instructions for three adult-led activities
- three child-initiated activities related to the story and a STEM@home activity.
- practitioner guides for each activity including appropriate explanations of concepts, vocabulary lists, questions, and suggestions for developing play, extending STEM learning and promoting STEM attributes.

The unit will help settings to develop a consistency in approach to science and STEM for all adults.

So far, The Meteorologist and The Glaciologist units have been trialled and used in partner schools, with The Marine Architect ready for the summer term.

Feedback has been very positive and we will work with the Northumberland Early Years Professionals Network to widen the range of EYFS setting this intervention could be used with, and are also exploring collaboration with the Primary Science Teaching Trust.





Meteorologist curious observant collaborative nustem

2 Support and influence STEM outreach and widening participation within Northumbria University

This year NUSTEM has continued to support academics with public engagement and outreach, particularly at the bid-writing stage. Although we couldn't go into schools NUSTEM Encounters, Evening Lectures and Physics Experience Week all provided opportunities to share Northumbria research with children and young people.

2.1 Physics Experience Week

The structure of our Physics Experience Week for year 12 students was adapted for remote delivery this year. In doing so, we were able to recruit participants from a wider geographic area. Out of the 21 participants who took part in the week, 8 were from the North East and the remaining were scattered across the country. We also took advantage of the online format and hosted guest speakers from the European Space Agency, and Newcastle and Keele Universities. The participants worked on 10 different projects provided by researchers from Northumbria, Newcastle and Durham Universities. They attended an online synchronous lecture from Northumbria's undergraduate Physics Programme and used their research skills to escape a physics-themed escape room. In future years, we are hoping to expand the Experience Week format to other subjects, starting with a pilot Maths Experience Week scheduled to take place in 2022.

2.2 Evening Lectures

This year we hosted six evening lectures fortnightly between the October – December. After testing a few platforms, we decided to broadcast the lectures on Microsoft Teams as Live Events. This platform ensured the highest quality video for participants and the chat and Q&A could be moderated by NUSTEM staff. In addition, recordings of the lectures were made available online immediately after the event finished, which allowed for those who couldn't attend the live event, to re-watch at their own pace. There was an improved attendance for many of the lectures when compared to previous years.

We also worked alongside our guest speakers to the break their presentation into smaller sections, allowing for some Q&A from the audience in between sections rather than at the end of the lecture. By adopting this format, we were able to keep lectures as interactive as possible.

3 Influence STEM careers and engagement policy at local, national and international levels

3.1 Tomorrow's Engineers Code

NUSTEM has been supporting Engineering UK to support the launch of its Tomorrow's Engineers Code, which aims to increase the diversity and number of young people entering engineering careers. Carol Davenport is a member of the Advisory Board. NUSTEM has also developed a practical guide that companies and other organisations can use to help them make changes to their STEM engagement activities. As you would expect, our recommendations include a strong focus on working with children from a young age, engaging with their families and teachers and ensuring that activities are accessible to families without a science background.

Weblink: <u>https://www.tomorrowsengineers.org.uk/improving-practice/resources/nustem-implementing-the-te-code/</u>

3.2 Public Engagement Workshops

As part of two international research collaborations, NUSTEM has led public engagement workshops for solar physicists and polar scientists from across Europe.

3.2.1 SOLARNET

SOLARNET is a European Commission project aimed at fostering networking between solar scientists, conducting joint research activity and supporting access to research infrastructures. Some of the activities in the project involve training in scientific

principles and in public engagement. Originally planned as a face-to-face workshop, but moved online, we developed a two-day workshop which facilitated networking and skills development for solar researchers interested in public engagement. The days included sessions on storytelling, understanding audiences, evaluation and unconscious bias.

Participants in the workshop found it very valuable, and helped them to consider what public engagement meant to them.

'Before attending this workshop, I was mostly thinking about lectures. However, now I learned that outreach can be so much more and definitely much more interactive!'

"This is an inspiration for future projects that I can think of. It also very useful to be able to tell funders/directors, etc. that there are projects running successfully already."

SOLARNET Workshop Participants

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

weblink: <u>https://est-east.eu/news/14-english/news/1046-the-solarnet-public-engagement-training-workshop</u>

10



3.2.2 TiPPACS



Tipping Points in Antarctic Climate Components

TiPPACS is a European Horizon 2020 project which is investigating the possibility of sudden and large changes in the water and ice sheets in Antarctica.

Researchers are modelling the ocean and ice to predict if there are tipping points which would affect the climate system.

As part of the dissemination activities of the project, NUSTEM is running public engagement workshops which support researchers' communication skills. The first session was held online in May 2021 with colleagues from all five of the partner institutions in the project.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820575

Weblink: https://www.youtube.com/watch?v=gD7N8Z9PxqU

3.3 Airbus GEDC Global Diversity Award

NUSTEM was one of the three finalists for the 2020 Airbus GEDC Diversity award. Our runner-up prize was \$1500 to help promote our work and to receive coaching from an Airbus executive. Consequently, the autumn saw us meeting regularly with Philippe Gourdon, VP Aircraft Operations. The focus of the coaching was to explore how NUSTEM could share our Theory of Change, and expertise in STEM Engagement, to support companies with Equality and Diversity. We found Philippe's insights into business thinking invaluable, and he also brought other Airbus colleagues involved in equality and diversity to our coaching sessions that further helped us and our ideas. Although the coaching has now finished, as a team we continue to consider how STEM engagement could be used by companies as a way to strengthen diversity throughout the workplace.

We commissioned an infographic that summarises the Theory of Change (Appendix 3) which we will use to support discussions about STEM engagement with companies and organisations.



4 Work in partnership with organisations to develop, disseminate and embed effective practice in STEM engagement

4.1 Supporting Remote Workshop Delivery

Throughout this report we've highlighted a number of different ways that we've engaged our audience through remote technologies. The NUSTEM team have spent time over the past year refining our online delivery model and explore how best to use software and hardware to support our workshops.

We've been in a fortunate position over the last year that's allowed us the time to explore this new area. As such, it's been important to us to share our learning with the wider STEM engagement community. Our

development work has been used by the two Museums Northumberland projects (see 4.4.) where we've provided both teams with technical support and workshop development expertise to allow them to successfully start delivering their own remote workshops.

We've also shared our work through the STFC Wonder Network and delivered a training session to members of the Association of Science and Discovery Centers (ASDC) Network. In that session we shared our findings from a survey of IT capability of primary schools, and also outlined a range of different models for remote delivery.

Weblink: ASDC training session recording: <u>https://youtu.be/AU7rDvukEIA</u>

4.2 Reading Sparks

Reading Sparks is a new project from the Reading Agency that aims to engage children and families with science through reading. The project is funded by Arts Council England and Science and Technology Facilities Council and delivered in partnership with public libraries, the British Science Association, and NUSTEM.



We've been working closely with the Reading Agency to support two strands of the Reading Sparks project: STEM activity and book bags that libraries can loan to families; supporting library and youth services staff to facilitate the production of media relating to the books by diverse groups of teenagers.

Working alongside the reading agency and other partners in this project has been a brilliant opportunity for NUSTEM to share their underpinning methodologies and their practiced skills in training and resource creation, beyond the usual STEM outreach audiences.

Weblink: https://readingagency.org.uk/young-people/004-get-involved/reading-sparks-1.html



Joe describing the structure for a remote workshop delivered with the support of the classroom teacher.

4.3 EPSRC Engagement Fellows

4.3.1 Inventive Podcast

Inventive is a podcast project led by Professor Trevor Cox from Salford University. The podcast will explore different narrative approaches, interweaving interviews with a diverse range of engineers with pieces of fiction inspired by the engineers' stories.

NUSTEM is support the project team to create curriculum resources linked to the podcast. This includes career posters and case studies or the engineers, and classroom worksheets linked to the stories and the engineering science.

Weblinks: http://hub.salford.ac.uk/inventivepodcast/ and https://nustem.uk/inventivepodcast/

4.3.2 Let's do Engineering

Let's do Engineering is a project led by Dr Helen Bridle from Heriot-Watt University. The project brings together engineering professionals, musicians, artists, storytellers, children and families together to design fund and engaging engineering activities. NUSTEM is working with the project team to support Engineers' knowledge of science capital, unconscious bias, and working with families with young children. We're also helping with shaping the evaluation of the project.

Weblinks: <u>https://www.letsdoengineering.com/</u> and <u>https://www.youtube.com/watch?v=gFYZCudX9bc</u>

4.4 Museums Northumberland Projects

NUSTEM is supporting Museums Northumberland on two projects: The Union Chain Bridge (funded by Northumberland County Council, Scottish Borders Council and National Lottery Heritage Fund) and Our Past, Your Future (funded by North of Tyne Combined Authority).

The STEM engagement activities of both projects are based on the NUSTEM model of career-inspired sustained engagement with children, teachers and families in primary schools. NUSTEM staff meet regularly with Museums Northumberland staff to discuss workshop and activity design, evaluation and ongoing management.

Working with a partner organisation in this way has been highly beneficial for both partners: ensuring the programmes are underpinned by research and best practice for Museums Northumberland and exploring how to adapt our approach for new audiences for NUSTEM.

A total of 33 primary schools are involved in these two projects.

Weblinks: Union Chain Bridge project <u>http://unionchainbridge.org/</u>

Our Past, Your Future project <u>https://museumsnorthumberland.org.uk/project/our-past-your-future/</u>



Museums Northumberland projects schools

4.5 British Science Week Packs

Every March the British Science Association (BSA) coordinates British Science Week, a ten-day celebration of science, technology, engineering and maths. To support schools and other organisations to run events during the week, the BSA produces activity packs based around a theme. The 2021 theme was 'Innovating for the Future' centred around innovation and problem solving and highlighted how STEM knowledge can be used across a range of careers.

NUSTEM collaborated with BSA to incorporate the use of the NUSTEM Attributes into the activities included in the activity packs. Companies which provided activities were asked to choose which of the attributes (skills) their activity would help children and young people to develop. NUSTEM's STEM Person of the Week was included as one of the activities in the primary and secondary packs.



Packs	Jan-21	Feb-21	Mar-21	Total Downloads
Activity Packs				
Early Years	2524	8745	15192	26461
Primary	4590	17084	30796	52470
Secondary	1853	6479	9166	17498
TOTAL	8967	32308	55154	96429

Weblinks: https://www.britishscienceweek.org/ and https://nustem.uk/resource/stem-attributes/

4.6 Putting Careers in Science Textbooks

The ASE book 'Teaching Secondary Physics' is a textbook used by trainee and new teachers. This year Carol Davenport has been part of the team of authors producing the 3rd edition of the book. Building on NUSTEM's work around linking careers to curriculum learning, the book includes careers links for each subject chapter. This will help new teachers begin to talk with their students about careers and include careers in their subject teaching.





The Asso for Scien

5 Produce high quality research on young people's STEM learning and career choices

Produce evidence of impact of the work of NUSTEM

5.1 REF Impact Case Studies

The Research Excellence Framework (REF) is the system that the government uses to assess the quality of research in UK universities. As part of this process, the impact that academic research has on wider society is collected in Impact case studies. NUSTEM research and activity was used as the basis of an Impact Case Study in Engineering titled 'Utilising engineering research to transform STEM aspirations and education-engagement strategies in North East England and Nigeria'.

Weblink: https://www.northumbria.ac.uk/research/ref-2021/uoa/engineering/impact

A second Impact Case Study, "Transforming STEM and digital literacy education for under-represented groups: improving user behaviour, skills and aspirations" strongly featured NUSTEM activity, and has been submitted under Computer & Information Sciences.

Weblink: https://www.northumbria.ac.uk/research/ref-2021/uoa/computer-science/impact

5.2 Scientist of the Week

One of NUSTEM's regular interventions at in primary is the STEM Person of the Week resource. A 5-week, teacher-led intervention design to showcase a range of STEM professionals and the skills and attributes they use in their work. The resource is a few years old, and was originally co-developed with one of our partner schools. The school also took part in a research project to see whether the intervention was able to have a lasting impact on the pupils who took part.

We've now published this research which found that the STEM Person of the Week project reduced the frequency of stereotypical words used by children to describe scientists, and that the effect lasted well beyond the end of the intervention.

The STEM Person of the Week resource continues to go from strength to strength and is now being used by Museums Northumberland in schools partnered with the Union Chain Bridge and Our Past Your

Future projects, STFC Particle Physics, and was included in the British Science Week activity packs.

Weblinks: resources - <u>https://nustem.uk/stem-person-of-the-week/</u> Research article - <u>https://www.tandfonline.com/doi/10.1080/02635143.2021.1941840</u>

5.3 Unconscious Bias in Early Years

This research project is a new collaboration between Joe Shimwell and Carol Davenport from NUSTEM, Kay Heslop from the Department of Social Work, Education and Community Wellbeing at Northumbria University, and Theresa Illy from the Northumberland Early Years Team. Kay and Theresa coordinate the Northumberland Early Years Professionals Network which promotes best practice in early years settings such



as private and school-based nurseries across Northumberland. The project is exploring the gender diversity of story books used within these early years settings, and whether an awareness of unconscious bias can affect the book choices that early years practitioners make.

Phase 1 of the research involved gathering information about the more recent 10 books that practitioners had read with children in their setting. We then held two Early Years Professionals Network meetings. In the first session we looked at unconscious bias and its possible effects on behaviour, and provided two analysis tools for practitioners to use in their setting. One tool explored the stereotypes in storybooks, and the other looked at the arrangement and use of the space by children within the setting. Practitioners used these tools and then at the second meeting discussed their findings with other members of the group. We also presented the initial findings of our analysis of the book list gathered from practitioners.

Key findings from this first analysis include:

- There were a broad range of books used by practitioners 100 unique books out of 147 submissions.
- The top ten more used books were all 'old favourites' with the most recent of them The Gruffalo's Child by Julia Donaldson being published in 2004.
- Human lead characters were equally likely to be male (13%) or female (12%)
- 71% of the books had a non-human lead character(s).
- Non-human lead characters were much more likely to be male (28%) than female (10%)
- Where books were chosen for reading by children there was little difference in the gender of the lead characters, but where books were chosen by practitioners more than twice as many books had male leads (33%) as female (15%) or gender unknown leads (15%).



Phase 2 of the research will begin 2 months after the second training session and will involve collecting the last 10 books read with children by practitioners to see if there is any change in book choice following the training sessions.

6 Contribute to Teaching and Learning at Northumbria University

NUSTEM staff continue to be part of the teaching and learning teams within the University. Carol Davenport and Antonio Portas again taught the Applications of Physics module on the Maths and Physics Foundation Year, and are preparing to teach the Introduction to Mechanics and Energy module next year. They intend to update the examples used in the module to be more inclusive and use careers links to the different topics to support student understanding of careers. Jonathan Sanderson has been part of the teaching team in Computing and Information Sciences, supporting undergraduate students with web development and postgraduates on the MSc Advanced Practice programme.

The Careers in Initial Teacher Education materials were included in the first year of the BA (Hons) Education to raise awareness of unconscious bias and career choices for students. Students found the Book analysis activity beneficial and felt that it would make a difference to their teaching.

"The activity allowed me to pick apart the story...and look at the characters as though they were real people and assess their personality and what using these characters could teach children... I have never really assessed the meaning of a story or the lessons it provides and therefore this activity allowed me to look at the story and see what could be taught about life from it and how I could develop children (sic) social skills using the story." Undergraduate student

"I will research the pedagogy around using stereotypes in children's literature further. Perhaps, it is not wise to dismiss books because of a gender or other bias, but instead gain awareness of the bias and address it in a class discussion. I believe developing children's critical thinking skills will be more beneficial for them to notice bias in their own lives." Undergraduate student

NUSTEM also delivered Celebrating Diversity sessions for new and returning students at the university, and led unconscious bias training sessions for staff.

6.1 Translating Environmental Science into policy, outreach and decision making

Building on our successful environmental science outreach work with foundation year geography students, this year we have supported final year undergraduate students as part of their environmental science knowledge exchange module.

Two NUSTEM primary partner schools worked closely with a group of students to create a series of environmental science based lessons for children in KS2. They created lesson plans around the themes of transport, energy and trees. The partnership has been a great success and the students were able to produce a high-quality set of resources that were tried and tested in the classroom. The project was an excellent example of knowledge exchange; with the teachers and environmental science students both learning a great deal from the process.

Feedback from all involved has been overwhelming positive, and we are looking to support the module again in Autumn 2021.

This model of undergraduate – primary school interaction will also be transferred into similar activities for the Engineering Foundation Year and first year BEng /MEng students.

7 Looking Ahead

This year has seen NUSTEM develop their expertise in remote delivery. Whilst we are hoping to return to in-person workshops during the next academic year, we are intending to reflect on the benefits of using online technologies to delivery school activities. One of these benefits is the possibility of working with schools that are more remote from Newcastle and who have not previously been able to take part in activities, and this is something that we will explore, particularly in relation to our Encounters Assemblies and family activities.

As a team, we recognise that working with children and their key influences is only one part of the solution to increasing diversity within STEM sectors. Whilst we can encourage young people to choose STEM careers, they will only remain in those jobs if the companies they work in are inclusive and good places to work. Following our coaching from Philippe Gourdon as part of the Airbus GEDC Global Diversity award, we are now in conversation with Airbus UK to explore how NUSTEM's expertise in STEM engagement can be used to support businesses with culture change around diversity and inclusion. We're also looking to broaden our work with EngineeringUK on the Tomorrow's Engineers code to develop similar Practice guides aimed at other STEM sectors, for individuals and small and medium enterprises (SMEs).

Within some departments in the Engineering and Environment Faculty of Northumbria University we are seeing the culture of public engagement and outreach strengthening and we will continue to facilitate this with colleagues. We are also looking to work more closely with colleagues in Health and Life Sciences, particularly around chemistry where there is already some overlap with Engineering and Environment.

Next year will see NUSTEM's 8th year of operation, and we will be reviewing our strategy to ensure that there is coherence between how we approach support for all the different phases of education; from early years, primary and secondary. Development of a strong research and evidence base has been a strong aspect of our approach since we began, and this year we will be looking to develop larger research projects on aspects of our approach. We'll also be looking to develop more collaborations with local and national organisations to disseminate our Theory of Change and good practice.

Appendix 1 Yearly Interactions

	Interactions	2014 – 2015	2015 – 2016	2016 - 2017	2017 – 2018	2018 –2019	2019 - 2020	2020 - 2021	Total to date
Children and young people	Pre-school and Primary	4877	9322	10573	6033	12542	8019	4471	55837
	Secondary school	6497	10754	5883	4501	4438	3266	2892	38231
	Community events	3054	2145	1018	803	570	526	*	8116
ers	Teachers	447	1410	873	951	1220	875	566	6342
nence	Parents and Families	818	2055	1480	1409	1116	1049	98	8025
Key Influ	Wider community	1277	891	706	550	464	356	867	5111
	Totals	16970	26577	20533	14247	20350	14091	8894	121662

Total Interactions to date

* NUSTEM supported a number of online community events, but do not have data on the number of viewers for the events.

Appendix 2 NUSTEM Publications in 2020/21

J. Shimwell, J. DeWitt, C. Davenport, A. Padwick, J. Sanderson, R. Strachan (2021) 'Scientist of the Week: evaluating effects of a teacher-led STEM intervention to reduce stereotypical views of scientists in young children.' Research in Science & Technological Education https://www.tandfonline.com/doi/10.1080/02635143.2021.1941840

C. Davenport (2021) 'Waves' in *Teaching Secondary Physics*, (3rd Edition). C. Harrison, J. de Winter, M. Hardman (Eds), London: Hodder Education

Vega E, Namdeo A, Bramwell L, Miquelajauregui Y, Resendiz-Martinez CG, Jaimes-Palomera M, Luna-Falfan F, Terrazas-Ahumada A, Maji KJ, Entwistle J, Núñez Enríquez JC, Mejia JM, Portas A, Hayes L, McNally R (2021) Changes in air quality in Mexico City, London and Delhi in response to various stages and levels of lockdowns and easing of restrictions during COVID-19 pandemic. Environmental Pollution. https://doi.org/10.1016/j.envpol.2021.117664

C. Davenport (2021) 'Avoiding Stereotypes' in *Primary Science Leaders' Survival Guide* 3rd Ed., Association for Science Education

C. Davenport (2021) 'How we can widen career aspirations for the next generation.' Physics World, March 2021. Available at <u>https://physicsworld.com/a/how-we-can-widen-career-aspirations-for-the-next-generation/</u>

Hamish Johnston (2021) *Physics World Weekly Podcast* 1st *April* 2021. Available at: <u>https://physicsworld.com/a/inspiring-young-children-to-careers-in-science-the-physics-and-economics-of-heat-pumps/</u>

C. Davenport, A. Padwick (2021) 'Inclusive teaching in science: changing culture and practice'. Primary Science, 166, pp 29 - 30

C. Davenport (2020) 'Unconscious bias and primary schools', Primary Science, 165, pp 7 - 8

Appendix 3 NUSTEM Theory of Change Infographic

INCREASING DIVERSITY AND NUMBER OF YOUNG PEOPLE CHOOSING STEM CAREERS

1. Diversity in the UK STEM Sector

Diverse teams produce more creative and innovative solutions to problems, and companies with diverse boards are more profitable.

However, for over 50 years, there has been a recognition that many STEM sectors are not diverse. Girls, young people from areas of higher level of socio-economic deprivation, and from black and some minority ethnic groups are under-represented throughout the sectors.



Increasing diversity of the STEM workforce will improve UK STEM sectors, and provide more people with interesting and fulfilling careers.

young people choosing a career in STEM. This infographic aims to help business and organisations shape interventions that will make a difference.

2. NUSTEM'S Role

reflecting the diversity of wider society.



3. The Context



Research consistently shows that children and young people like science, and find it inspiring. However, this doesn't translate into them wanting to have a career in science or STEM.



Many children and young people from under-represented groups don't see STEM as **being done by someone like them.**



NUSTEM's research is committed to creating a vibrant and sustainable

A recent paper from NUSTEM outlined a theory of change exploring ways

to improve diversity in the STEM sector, and increase the number of

STEM sector which meets the needs of learners and employers,

Before the age of 8, **young children make career limiting decisions** about what they would and wouldn't like to do when they are older.

4. The Solution



Start working with families and children **from a young age.**



Use attributes of people working in STEM to help children to see what they have in common with them.



Show parents and carers the **different** routes into STEM careers.



Support teachers to include careers in their subject lessons. Showcase local opportunities.



Ensure that **company culture is inclusive of staff from different backgrounds.** Make STEM sectors good places to work.

To find out more, visit nustem.uk

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