NBN Co STEM+X initiative report

How access to services over the **nbn**™ broadband access network is opening up a world of online education opportunities.

About this report

This report was developed by NBN Co, the company building Australia's broadband access network and reports on the STEM-X initiative undertaken by NBN Co and the ABCN.

About NBN Co

NBN Co (the company) was established on 9 April 2009 to design, build and operate Australia's new broadband access network.

NBN Co is a wholly owned Commonwealth company – a Government Business Enterprise – and is represented by Shareholder Ministers: the Minister for Communications and the Minister for Finance.

Visit www.nbn.com.au for more information about NBN Co.

About ABCN

The Australian Business and Community Network (ABCN) is a not-for-profit organisation established in 2005 that connects business with disadvantaged education through mentoring and partnership programs.

ABCN works with a network of public schools across Australia to deliver a range of critical skills, employability and leadership programs that involve business professionals mentoring students.

Visit www.abcn.com.au for more information about ABCN.

Contents

Foreword

Here at NBN Co, my colleagues and I are passionate about helping to bridge the digital divide, whether it is between young and old, city and country, or Australia and the rest of the world.

We are proud to say that since connecting the first homes and businesses some six years ago, Australia has soared up the Organisation for Economic Co-operation and Development ranks when it comes to internet equality, jumping from 29th in 2012 to 17th today. We forecast that Australia will rank in the top 10 in 2021[1].

Providing broadband access to areas that were deprived of it or had inadequate access helps drive helps drive economic and social benefits by supporting employment, health, agriculture, business, emergency services and education.

For education, we see the **nbn**™ broadband access network opening up a world of learning opportunities online. This includes gaining access to the internet for the first time, being able to participate in online courses and long-distance education, or benefiting from the increased employment opportunities of a remote workforce.

This couldn't be more important than across regional and remote Australia where we are doing our bit to help level the playing field with the city. We have worked hard to bring broadband connectivity to regional communities so they can seize economic and social opportunities from their hometowns.

The STEM+X initiative has been developed in partnership with the Australian Business and Community Network (ABCN) in order to get students from eight underserved schools around the country excited about the possibilities of learning science, technology, engineering and mathematics (STEM), by combining it with their hobbies and passions: the 'X' in 'STEM+X'.

It is predicted that one in two Australians will need online skills such as programming and software development to remain competitive in the 2030 workforce.[2] Therefore, getting students energised about learning STEM subjects will be absolutely critical to their future success.

Through access to services over the **nbn**™ access network and creating awareness of the importance of STEM learning, we want to encourage Australians to leverage this broadband connectivity, plan for the future and prosper in the digital economy.

Kathrine Dyer
Chief Network Deployment Officer
NBN Co

1. *Connecting Australia* report: the nation's first social and economic study into the impact of the nbn™ access network, which was conducted by data analytics and economics firm AlphaBeta (and commissioned by NBN Co).

> One in two Australians are predicted to need online skills such as programming and software development to remain competitive in the 2030 workforce.
>
> NBN Co's Chief Network Deployment Officer
> Kathrine Dyer

40% → 97%

Prior to the commencement of the initiative, only 40 per cent of the 170 student survey participants said they understood how STEM affected things they were passionate about. After the completion of the initiative, this figure rose to 97 per cent.

Background of the NBN Co STEM+X initiative

Why STEM?

Science, Technology, Engineering and Maths (STEM) lay the foundation for the way we view and make sense of the world, teaching critical and creative thinking as well as problem-solving. These skills are crucial to the workforce of the future with 75 per cent of the fastest-growing occupations requiring STEM skills[3] and the contribution of digital technologies to the Australian economy forecast to be $139 billion, or seven per cent of Australia's gross domestic product, by 2020.[4]

Despite STEM skills being in high demand for future economic growth in Australia, there is a decline in the number of students studying STEM-related disciplines in secondary school and beyond. A significant gender and socio-economic imbalance also exists in take-up of STEM subjects: 2009 data shows year 12 students from low socio-economic schools are almost 30 per cent less likely to undertake STEM studies in year 12 than high socio-economic schools.[5]

Research has also shown that understanding the diverse range of applications of computer science, and its opportunity for positive social impact, is important in encouraging young women into this field.[6] That is why this is the 'STEM+ X' initiative as the '+X' relates to how the personal passions of the students can be enhanced through STEM disciplines. It enables students to make their learning personal and integrate their passions.

The NBN Co STEM+X initiative focuses on students aged 10 and 11 to inspire their interests in STEM-related subjects, well ahead of when students begin to identify their own specialisms and consider their options for higher education.

Collaboration: NBN Co, ABCN and How Ridiculous

Access to fast broadband over the **nbn**™ access network is helping to break geographical barriers and is enabling children in regional Australia to access a world of education resources remotely.

NBN Co recognised the need to show students how STEM was applicable in their daily lives and how STEM subjects, combined with their own interests and passions, could help create future careers.

NBN Co teamed up with ABCN and YouTube influencers *How Ridiculous* to execute the NBN Co STEM+X initiative.

ABCN has a proven track record of driving passion for STEM among school-age Australians, having developed STEM skill strategies that bring STEM subjects to life in partnership with some of Australia's biggest corporate organisations.

With over 2.8 million YouTube subscribers, *How Ridiculous* are a group of three Australians, who are passionate about making a difference. Their content spans science, technology and social giving, and they enjoy a particular reverence among young people. Bringing *How Ridiculous* on the NBN Co STEM+X journey undoubtedly increased the 'fun factor' for participating students.

2. NBN Co and the Regional Australia Institute, *The future of work – setting kids up for success* (2016)
3. Becker, K. and Park, K., *Effects of integrative approaches among STEM subjects on students' learning*, *Journal of STEM education* (volume 12 – issues 5&6, July–September 2011)
4. Deloitte Access Economics, *Australia's Digital Pulse 2017*
5. Lamb S., et al, *Educational opportunity in Australia 2015: Who succeeds and who misses out*
6. Google, *Women who choose computer science – what really matters* (2014)

Rollout of the STEM+X initiative

Launched in February 2018, the NBN Co STEM+X initiative saw students from eight underserved schools across the country tasked with developing an idea to help brighten their community's or Australia's future by attempting to solve real-world challenges.

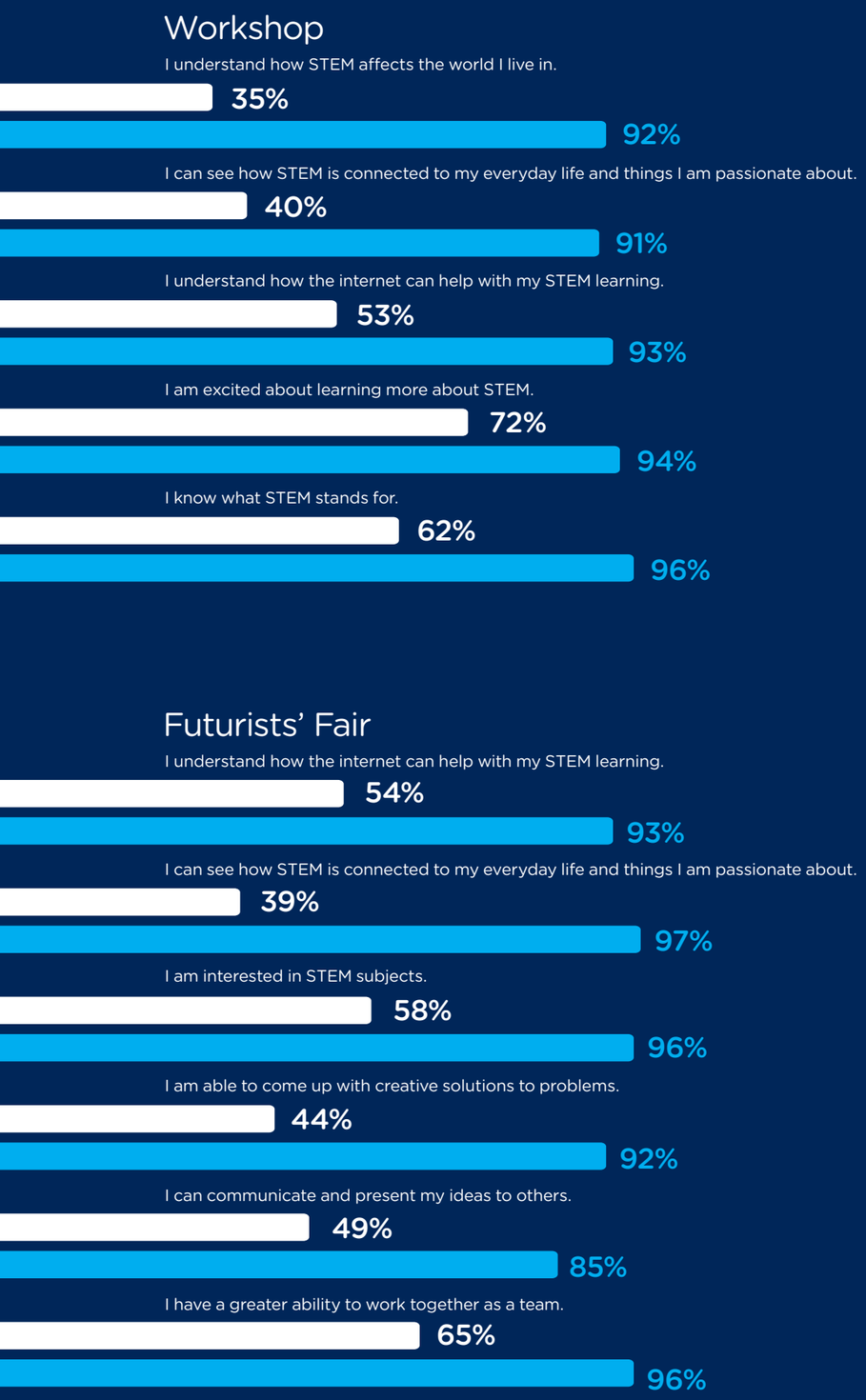
Students undertook a full day workshop, facilitated by NBN Co and ABCN, to nurture and grow their understanding of STEM as well as take their project brief.

Following three months of brainstorming, students then saw their hard work come to fruition when they presented their ideas via an **nbn**™ access network-connected video conference, to a panel of STEM experts at the **nbn**™ Futurists' Fair in Sydney.

The STEM experts were made up of NBN Co's Chief Network Officer Kathrine Dyer, ABCN's Chief Executive Officer Allegra Spender, as well as Scott Gaunson and Brett Standord from the YouTube channel *How Ridiculous*.

This report provides the perspective of those schools around Australia about the challenges and opportunities in engaging students in STEM.

> "Through the STEM+X initiative, our aim was to inspire students to focus on having a growth mindset, innovation, collaboration and creativity when tackling problems and challenges because these are the skills that will equip them for the STEM jobs of the future."
>
> ABCN's Chief Executive Officer Allegra Spender



Key insights from the STEM+X initiative

Student insights

By Allegra Spender, Chief Executive Officer, ABCN

Businesses and governments alike are dedicating resources to developing STEM skills in children and their educators. They are also providing the bricks-and-mortar as well as technology infrastructure needed for the cultivation of STEM skills.

However, even though there is much activity taking place, little focus has been given to addressing the STEM issue in underserved schools where there is the greatest need. This is where ABCN sees the greatest opportunity to make an impact in conjunction with partners such as NBN Co.

Students at underserved schools are notably lagging behind their peers in STEM studies. For example, data collected in 2009 for year 12 students from underserved schools show they are almost 30 per cent less likely to undertake STEM studies in year 12 than their peers at higher socio-economic schools.

We have mentored students alongside NBN Co and have seen a marked increase in their attitudes and understanding of STEM as well as the importance of it for the jobs they may have in the future. Throughout the STEM+X initiative, we worked closely with NBN Co to measure the effectiveness and impact of the initiative on those involved.

Indicative of the potential long-term impact that the initiative may have had on participants, 78 per cent of students said they were somewhat to highly likely to pursue a STEM-related career. In addition, our measurements revealed the following:

- A career in STEM: on completion of the initiative, 78 per cent of students rated themselves as somewhat to highly likely to pursue a STEM-related career.
- Understanding STEM: on completion, 93 per cent of students said they understood how access to fast broadband could help them with their STEM learning, compared to 53 per cent of students prior.
- Creative thinking: 93 per cent of students said they were now able to come up with creative solutions to problems, compared to 44 per cent of students prior to taking part.
- Communication skills: 85 per cent of student said they were now able to communicate and present their ideas to others, compared to 49 per cent of students prior.
- Relevant to their passions: on completion, 97 per cent of students said they could see how STEM was connected to their everyday lives and the things they are passionate about, compared to 39 per cent of students prior.

Not only was the STEM+X initiative an engaging way to teach students STEM skills, it made a positive impact on all who took part, with all the students agreeing that they would tell their friends about the kick-off workshop and many agreeing they would use design thinking to solve problems in the future.

Teacher insights

Many of the teachers involved in the initiative talked about the increased focus on learning and sense of empowerment from taking part.

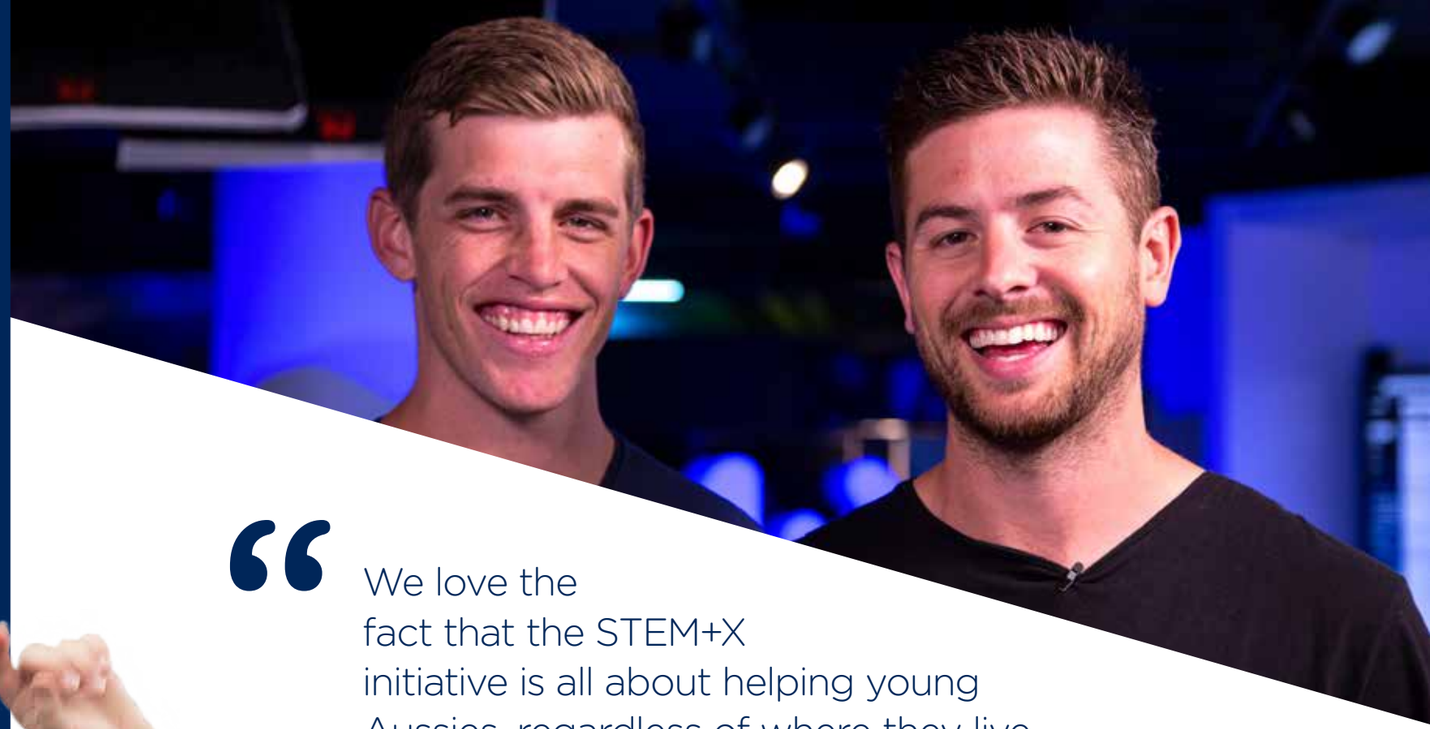
Teachers involved agreed or strongly agreed that, as a result of the **nbn**™ Futurists' Fair, students demonstrated:

- a greater understanding of the link between STEM and their passions and interests;
- a greater interest in STEM subjects;
- a greater ability to apply STEM skills such as creativity, critical thinking and problem-solving to a group task.

"I want to extend our appreciation for the thought, organisation, professionalism, and amazing opportunity that our school has been fortunate to have been involved in. This has been one of those opportunities that our kids will look back on when they are 30 or 40 and say, 'remember when...!' when our kids are that age, things will probably be that far advanced with technology that they will have a great laugh!

We are so appreciative of the zest and engagement that this project created. I must say that it isn't over, though, as the kids of Invermay Primary School are trying to get sponsors to get their app up and going!"

With appreciation,
Tony Brazendale
Principal, Invermay Primary School
Launceston, Tas



"We love the fact that the STEM+X initiative is all about helping young Aussies, regardless of where they live, develop their skills in a variety of areas to enable them to flourish in our complex modern world. We've been fortunate to have had many great opportunities afforded to us and we're stoked that this campaign has provided similarly great opportunities for kids in Australia."

How Ridiculous Co-founder
Brett Stanford

Our school presentations

The following schools presented their STEM+X ideas via an **nbn**™ access network-connected videoconference to a panel of STEM experts at the **nbn**™ Futurists' Fair in Sydney.

Glenorchy Primary School, Hobart, Tas.

Students were passionate about raising awareness of plastic waste and created an app for teachers to track how much plastic is coming into their classrooms via students' lunch boxes.

They used gamification to incentivise students and parents as a reward for reducing the amount of plastic being sent to schools in lunch boxes each week.

The most important thing students gained from the initiative:

"We have used this initiative as an exemplar to teach how to use inquiry-based learning to cue children into STEM and link children's learning to their passions."

Wendy Potter, principal

Beaconsfield Primary School, Freemantle, WA

Students developed an app to capture and communicate fundraising efforts for their local community. For the students at Beaconsfield Primary School, this would be applied to support a range of initiatives to benefit the school such as a new drinking fountain or funding for children to go on a school camping trip.

The most important thing students gained from the initiative:

"An understanding that if they all work together they can identify and resolve a problem."

Janette Tuttle, teacher

Townsville Central State School, Townsville, Qld

Students designed a sustainable 'dream shelter' to protect students while outside, using motifs of coral found on the Great Barrier Reef. In addition, they engineered circuits to incorporate into the school's building design that will sound an alarm if a door or window is left open, therefore conserving energy.

The most important thing students gained from the initiative:

"Skills to help them work in a group and a greater understanding of STEM in the workforce."

Liam Dunn, teacher

Invermay Primary School, Launceston, Tas.

Based on extensive research into environmental science, including future scenario reports from the CSIRO, the students of Invermay Primary School used real-world scientific data to enquire about the impact humans have on the environment. They then designed an app that scans the logos and barcodes on rubbish found in the environment, and users receive game points in an effort to encourage people to reduce pollution.

The most important thing students gained from the initiative:

"This has been one of those opportunities that our kids will look back on when they are 30 or 40 and say, 'remember when...!'"

Tony Brazendale, principal

Para Hills Primary School, Adelaide, SA

At Para Hills Primary, the students are aware some families need a little extra support to afford the essential items required for attending school. They developed a website called 'School Savers', which aims to provide students with basic school supplies, clothing and other items they may not have otherwise been able to afford. The items would be funded by donations from organisations and individuals."

The most important thing students gained from the initiative:

"The ability to break down their thinking processes and the link between their passion/future, and their current learning and development."

Brooke Taylor, teacher

Canadian Lead Primary School, Ballarat, Vic.

The students at Canadian Lead developed a prototype of an app based around a program called 'The Zones of Regulation'. The app is designed to help children (and adults) regulate their behaviours, emotions and feelings, and would benefit the school and the wider community to combat bullying.

The most important thing students gained from the initiative:

"Greater understanding of the impact of STEM for now and into the future for their own career prospects."

Darlene Cameron, principal

Islington Public School, Newcastle, NSW

Based on extensive research, including engaging with scientists and other environmental experts, students used software to model possible pollution-reduction solutions to create a new rubbish trap/boom for a local creek. Groups began modelling an app to assist in educating people about the value of plastic reduction, re-use and recycling as well as developing a web page hosting content created by the students with their learnings.

The most important thing students gained from the initiative:

"Seeing themselves as capable of making change in their community and world. Seeing they can access information through experts when they get stuck. Pursuing an idea and working collaboratively."

Georgie Read, teacher

Winning school:

Leanyer Primary School
Darwin, NT

The ‘Tech-X’ team at Leanyer Primary School has created a solar and wind power-generating connective phone case and app with customisable drone to support community safety during extreme weather disasters. In the event of an emergency, such as a bushfire or flood, the user would be able to connect with emergency services and have a drone deliver a care package to wherever they are.

This is particularly useful in situations where the person is in a remote or hard-to-reach location and ensures they receive emergency supplies until they can get to safety or can be reached by emergency services.

The judges thought the idea was extremely well researched and thought-through. The presentation was delivered with energy, enthusiasm and professionalism. The video showed a depth of creativity and was well produced. The use of the charger and drone prototypes helped visualise how it would be used in an emergency. All judges thought the idea was multi-layered and had real-world potential.

The most important thing students gained from the initiative:

“Students and staff engaged completely in developing skills, knowledge and understandings in STEM. The project learning process was a wonderful opportunity, particularly having experts at hand to assist the development of skills and knowledge.“

Leah Crawford, principal

For parents: supporting STEM

With increased connectivity rolling out across the nation over the **nbn**™ access network, parents and guardians can use online tools and resources to bolster their child's STEM education at home and help kids to apply their passions to STEM. There is an array of great free online resources available such as Khan Academy, Little Bins for Little Hands, ABC Splash, Code.org and Ask Dr Universe.

Because STEM is integrated with all aspects of life, there's a lot you can do at home to help your child build on the skills they will learn at school and to make STEM fun and exciting. Whether it is an online video tutorial, a simple conversation in the kitchen, a STEM-related activity or an experiment in the garden, there are many ways to get children involved with STEM.

We encourage all loved ones to think of how they can link STEM learning to the interests of young Australians in their lives. The most important thing you can do is to encourage curiosity, creative thinking and problem-solving, as well as encouraging children that they could be good at STEM.

Simple conversations with your children can be started with questions like:

- Why do you think this happens?
- How do you think that works?
- What do you think might happen?

Online resources and platforms such as Google and YouTube are helpful to find answers to questions and explore STEM activities outside the classroom. Many home-based activities promote the development of STEM skills, from gardening and cooking to playing with Lego and other construction toys.

NBN Co and ABCN believe that, along with fast broadband, preparing children by including forward-thinking subjects within the umbrella of STEM is critical for the future of Australia.

A strong foundation for an uncertain future

By the year 2030, one in two Australians are predicted to need online skills to remain competitive in the future workforce.

This is why it's vital that the entire community encourages the learning of STEM skills and why access to services over the **nbn**™ access network is fundamental to supporting today's education of tomorrow's workforce in STEM subjects.

If students are to develop a lifelong engagement with STEM, they must see how it relates to their unique circumstances and aspirations.

Through NBN Co's STEM+X initiative, not only are we showcasing the benefits of improved connectivity, we are also providing a platform for young Australians to think about the challenges of today and the technology that might be utilised to tackle those challenges.

With such a positive outcome from the initiative, we are confident we are contributing to inspiring our future workforce around the importance and relevance of STEM.

Research methodology

One hundred and seventy students from eight schools across Australia took part in the evaluation of the NBN Co STEM+X initiative. Students and teachers were surveyed at three points throughout the campaign period: before and after the workshops as well as after the **nbn**™ Futurists' Fair.

This report was published by NBN Co, the company building Australia's broadband access network.

ABN 86 136 533 741