



## Submission by the Department of Industry, Innovation and Science

### Independent Review into Regional, Rural and Remote Education

August 2017

The Department of Industry, Innovation and Science welcomes the opportunity to make a submission to the Independent Review into Regional, Rural and Remote Education and is available to discuss further with the Review Panel any areas of interest.

Questacon – The National Science and Technology Centre is Australia’s national science engagement organisation. It is a division of the Department and is an informal learning institution which offers the opportunity for Australians to participate in STEM through accessible and engaging, hands-on approaches. For more than 30 years, Questacon has delivered informal learning experiences which complement and enrich the Australian Curriculum and make scientific and mathematical concepts more accessible to communities in regional, rural and remote areas of Australia.

This submission provides comments on the following discussion paper’s themes as they relate to Questacon’s activities:

- Curriculum and assessment,
- Teachers and teaching,
- School and community,
- Information and communication technology, and
- Entrepreneurship and schools.

Questacon’s responses will focus on Science, Technology, Engineering and Maths (STEM)-based approaches, particularly in terms of informal learning programs for students and teachers. Focusing on STEM-based approaches, Questacon aims to support schools across Australia which have the potential to build cultural and economic capacity within regional communities.

Engagements across the country brings Questacon into contact with many examples of best practice. Our activities are national in delivery, through either visiting regional centres to deliver programs to students or teachers, or bringing students or teachers from multiple regional areas to the national capital to share ideas, exchange skills and develop networks.

This two way approach facilitates Questacon’s mission to inspire and engage all Australians in science, technology and innovation.

A summary of Questacon initiatives is provided in Appendix 1.

## Curriculum and assessment

### **6.1.4 Are there other examples of innovative ways in which curriculum is being delivered in regional, rural and remote schools?**

The Questacon Outreach programmes are innovative hands-on, inquiry based activities that engage and inspire students in STEM.

STEM programs are typically aligned to a challenge or an issue that needs to be addressed through a project/problem based learning approach. Typically, the difference between the two is that project-based learning allows students to investigate and select their own topic or issue to address, whilst problem-based learning tends to be a topic selected by the teacher, but still allows students to investigate the issue in an open-ended way using consultation, collaboration and problem solving skills.

STEM as a problem solving approach is particularly relevant to students in regional, rural and remote regions, as they need to attain a mindset and broad range of experiences which will allow them to become creative problem solvers for issues within their community today and in the future.

Hands-on STEM approaches engage mixed ability students and unlock the potential of students who may not be considered to be academically gifted, but often flourish when given opportunities to be more self-directed in their learning.

*The Questacon Smart Skills* Initiative is a suite of programmes that engage young people in innovation, technology, engineering and design thinking through exciting, hands-on challenges, projects and workshops.

*Questacon Smart Skills* aims to create an awareness of technology, engineering and design thinking amongst young Australians. *Questacon Smart Skills* programme travels regional Australia delivering in-school workshops that immerse students in ideas, technology and creativity. By encouraging students to play with technology and make inventive creations, it engages and challenges them to find the innovator within.

*Questacon Smart Skills* undertakes three tours per year to regional areas around Australia. Each tour culminates in a regional Questacon Invention Convention—a three-day intensive programme that builds on in-school workshops to give self-selected participants a deeper insight into innovation and entrepreneurship.

The *Questacon Smart Skills* programme includes:

- An in-school programme of innovation focused workshops (helping to keep students engaged in STEM) and interactive workshops, visiting regional areas across Australia.
- A programme of regional and national Invention Conventions. An Invention Convention is an intensive 3 – 5 day workshop of innovation training incorporating mentorship from local entrepreneurs and business owners.

- A teacher support programme developed to support student workshops and facilitate ongoing use of enquiry-based learning techniques and provide a legacy for communities that will outlast the Tour and Invention Convention. While Questacon staff can inspire up to hundreds of students during a school visit, a teacher in that school who is empowered with the skills and support to continue that story can inspire thousands more students throughout the rest of their career.

*Smart Skills* activities are delivered locally and nationally through regional partnerships and digital communications technology (e.g. video conference). In 2016, the *Smart Skills* programme delivered 343 activities in New South Wales, Australian National Capital, South Australia, Western Australia and Queensland. The programme encourages students to refine and test their ideas and develop creative problem-solving skills. In-school workshops culminate in an intensive Invention Convention, including an ideas forum where students connect with local industry and entrepreneurs. The Invention Conventions involve partnerships with local and national enterprises that foster innovation.

Another programme is the *Shell Questacon Science Circus (Science Circus)* which has been touring Australia's states and territories for 32 years in partnership with Shell Australia, The Australian National University's Centre for the Public Awareness of Science (CPAS) and Questacon. The *Science Circus* is a practical component of a post-graduate Masters of Science Communication (Outreach).

The *Science Circus* delivers science shows within schools (primary and secondary levels), a public exhibition for families and community members, with around 50 hands-on per event, science-based exhibits and teacher Professional Learning (PL) workshops, which are accredited with NSW Educational Standards Authority (NESA).

## Teachers and teaching

### **6.2.3 What professional development should be available for teachers, schools and communities?**

The recently released NESA survey results with NSW teachers demonstrated a strong need for quality PL that is made more accessible to teachers in rural and remote areas.

From Questacon observations suggested options for teacher professional development (PD) may include:

- allowing time for schools within a town or region to share their STEM programs with each other. This would allow for greater efficiencies in reducing the amount of time that teachers would need to spend in researching and developing STEM programs. There may even be opportunities for student or teacher exchange within a regional town, to undertake the alternative STEM programs, creating further efficiencies and opportunities for collaboration.
- allowing science, ICT, maths, design & technology teachers and teachers from other subject areas (visual arts, music, history, geography, etc.) to plan, develop and timetable their STEM programs and activities within their school. Having a broad range of subject area teachers involved demonstrates that STEM approaches can be applied across many subject areas beyond STEM.

#### **6.2.4 What innovative approaches could be taken to support a high quality teaching workforce for regional, rural and remote school communities?**

Questacon delivers inquiry based professional learning STEM activities for primary and secondary teachers (Questacon is a NESA accredited professional learning provider) which are partly funded by the Australian Government, and partly funded by external funding bodies. These activities include:

- The *Shell Questacon Science Circus (Science Circus)* Teacher Workshops,
- The *Questacon Smart Skills* Teacher Workshops, and
- The *STEM X Academy* and *STEM XR Regional*.

The cost of touring and delivering student and teacher programs in rural and regional areas is relatively high. While costs to participants attending Questacon's teacher PL workshops range from cost-free through to \$30/person, this is only made possible through current funding arrangements.

The *Science Circus* offers a teacher workshop called 'Hands on Science Activities to Inspire Students & Teachers'. This workshop is aimed at primary school teachers and explores a variety of hands-on activities using familiar low cost materials (paper clips, plastic tubes, string, tape etc.). The workshop is practical and covers new ideas for teaching science and technology using activities that hold and challenge students.

The workshop activities align with the Australian Curriculum: Science and fulfil the following Australian Professional Standards for teachers:

Standard 2.1 Content and teaching strategies of the teaching area, and

Standard 4.1 Support Student participation.

This workshop is facilitated by science honours graduates who are studying a Master of Science Communication Outreach at the Australian National University. Hence, the workshop provides a unique opportunity for teachers in regional and remote communities to engage with enthusiastic and passionate science communicators in a professional learning environment.

The workshop gives teachers time to explore and test activities which increases the likelihood they will try them in their classroom. The focus of the workshop is hands-on science content, not pedagogy. The science content is in high demand with the workshop booklet being downloaded by participants over 300 times from the 1 July 2015 to 31 December 2016. The activities use simple materials that can be bought easily from the local supermarket for activities that require minimal setup and minimal equipment. Through the teacher PL workshops, the *Science Circus* can influence the influencers and inspire the inspirers so science can continue to be a fun, exciting, hands-on part of Australian classrooms.

Research from the Australian Science Teachers Association and Office of the Chief Scientist *Primary School Science Teaching Survey report 2014* shows that hands-on science is important throughout schooling, stating that "critical thinking skills are best developed in younger kids with hands on learning like science." This style of hands-on activity can help

teachers engage all students, especially “the kids that struggle with the writing tasks are the ones who really benefit from science because it’s hands on.” Ensuring these activities are simple and accessible is an important factor for teachers in the classroom. The report states the importance of “activity choices ... that will not only cater for teacher needs, but also cater for the range of facilities found in schools, resources and time available to teach science.”

*Questacon Smart Skills* Teacher Workshops are highly collaborative, hands-on and practical, aiming to build creative problem solving in STEM using hands-on design thinking approaches. The workshops involve various design challenges using inexpensive and recycled materials to meet the goal. Each activity is developed for in-class replication and emphasises the innovation cycle of think, make, try and refine.

The three Teacher Workshops address descriptors from the Australian Professional Standards for Teachers (Proficient Teacher level):

Standard 3.1 Establish challenging learning goals,

Standard 3.3 Use teaching strategies, and

Standard 3.4 Select and use resources.

All three Teacher Workshops are registered as accredited training by the BOSTES Quality Teaching Council and may be claimed as accredited PD by NSW teachers. Teachers in other states and territories who attend a Teacher Workshop may claim their attendance as teacher-identified PD or PL.

*Questacon Smart Skills* Teacher Workshops are delivered via face-to-face and/or via Skype to teachers in regional areas of Australia. Feedback from teachers who have attended *Smart Skills* Teacher Workshops have indicated that 53% of participants subsequently ran one or more of the *Smart Skills* Teacher Workshop activities with their own students.

The *STEM X Academy* programme was established in January 2016 to assist with the growing focus to boost teaching of STEM subjects. The programme was developed in partnership between Questacon and ASTA (the Australian Science Teachers Association), with CSIRO joining the programme in late 2016.

The two formats of the STEM X teacher PL programmes include:

- *STEM X Academy* (a five day residential programme held in Canberra, with primary and secondary teachers drawn from all Australian states and territories), and
- *STEM XR Regional* (a two day teacher PL programme held in a dedicated regional town during that state or territory’s school term).

Feedback about both STEM X PL programmes has been highly positive, with educational representatives in regional areas in Queensland, Western Australia, Northern Territory, New South Wales and South Australia lobbying ASTA to deliver the STEM X programme within a regional area of their home state.

## School and community

### **6.4.2 What motivates regional, rural and remote students to succeed and how can they be supported to realise their aspirations?**

*Questacon Maker Project* Virtual Excursions (1 hour duration) and *Virtual Projects* (5 to 6 weeks' duration) are delivered by Questacon staff via videoconference platforms to groups of students in all states and territories of Australia. These facilitated, hands-on sessions encourage students to build their own projects within their school, as well as presenting and viewing what students in other schools around Australia have been creating for the same project.

An excellent anecdote of how hands-on STEM activities, using simple, accessible materials, can be highly motivational for students of all abilities and interests is from a central New South Wales High School. The school has taken part in various Questacon Virtual Projects and the supervising teacher relayed a story about some participating students who had been suspended from school and were unable to attend Virtual Project sessions. The suspended students continued to work on their models at home (during the suspension period), so they could pick up the activity when they returned to school.

### **6.4.4 What role does/could the philanthropic sector play in improving outcomes for regional, rural and remote students in relation to school achievement and post— school transition?**

Currently, programmes within the *Questacon Smart Skills* Initiative are offered free of charge due to the support of the Australian Government, The Ian Potter Foundation (Principal Partner), and Samsung Electronics Australia (Technology Partner). The philanthropic sector plays an important role in supporting the delivery of established STEM programmes by assisting Questacon's capacity to serve families, students and teachers in rural and regional Australia. Feedback from students, parents and teachers who have witnessed or participated in the *Smart Skills* programmes has been highly positive, with many stakeholders expressing gratitude for the opportunity to access face-to-face workshops, expertise and activities within their regional area.

Similarly, programmes within the *Science Circus* are delivered at a relatively low fee of \$5 per student for school science show incursions, \$30 per teacher to attend a two-hour PL workshop, and \$18 for a family to enter the *Science Circus* travelling exhibition. These charges do not cover the cost of delivering the programmes, but go towards recovering some of the resource expended through travelling the programme to regional and remote areas. These costs to schools, parents and the community are kept low through support from the Australian Government, founding partner the Australian National University, and major partner Shell. Without support from these sources the programme would not be able to deliver activities at the current rates.

## Information and Communication Technology

**6.5.1 What has to be done to ensure ICT supports education in regional, rural and remote schools and communities like it does in the 'best of the best' city schools?**

**6.5.2 How could ICT be used to improve educational outcomes for regional, rural, remote students?**

**6.5.3 What are the main barriers to regional, rural and remote schools realising the full potential benefits of ICT?**

The logistics of delivering face-to-face STEM workshops to students and teachers in rural and remote regions presents many challenges, including the cost of travel to remote regions to deliver to a relatively small number of participants, difficulties in scheduling excursions that align with program availability and school timetables and program commitments, and school capacity to host programs in terms of venue availability and costs.

Questacon reaches rural and regional Australia through integrated videoconference platforms in the delivery of *Smart Skills* workshops and teacher PL workshops, both in real-time and as recordings that can be accessed post-event. Questacon has received feedback from teachers in remote areas and in schools of distance education about the unreliability of internet services in these areas, and how consumption of data for audiovisual based interactions can be prohibitive. Teachers have been unable to access some teacher PL workshops due to differing issues between schools in terms of firewalls and permission to access videoconference platforms such as Skype or Adobe Connect.

## 6.6 Entrepreneurship and schools

**6.6.3 Are there other examples where entrepreneurial education has improved outcomes for regional, rural and remote students?**

*Questacon's Enterprising Australians* initiative aims to raise community awareness of innovation, design thinking and entrepreneurial activities by sharing stories of innovative Australians. These stories take the form of short videos featured on our webpage, in social media and as part of a travelling exhibition.

Stories are available to schools as a tool for engagement, highlighting the multitude of paths young innovators take on their entrepreneurial journey.

The *Enterprising Australians* website showcases innovative Australians using STEM to solve a range of issues, particularly in areas beyond metropolitan cities. Students feel inspired and motivated to pursue STEM and entrepreneurial innovation focused activities. The outcomes of the initiative include:

- Families of participating students are more aware of STEM and innovation focused opportunities,
- Community supports young people to engage in innovation and STEM focused areas,
- Participating students undertake further studies in STEM,
- Future innovators and technologists are inspired to contribute to Australia's future, and
- Improved dialogue among Australia-wide network focused on the STEM agenda.

## APPENDIX 1: Questacon Initiatives

### Questacon Smart Skills Initiative

Questacon *Smart Skills* is a programme developed for secondary school students at no cost to schools that creates an awareness of technology, engineering and design thinking amongst young Australians. The programme includes: virtual workshops and regional tours; in-school workshops for students; and professional development workshops for teachers.

Complementing the *Smart Skills* programme is the Questacon *Invention Convention*, a three day programme that delivers intensive innovation and enterprise focused workshops in regional centres. The *Invention Conventions* involve partnerships with local and national enterprises to assist in fostering innovation.

*Maker project* workshops are two-hour workshops presented at The Ian Potter Foundation Technology Learning Centre in Canberra. These interactive workshops aim to create awareness of technology, engineering and design thinking in secondary school students.

### Shell Questacon Science Circus

The *Shell Questacon Science Circus (Science Circus)* is an award winning partnership programme between Questacon, the Australian National University and Shell currently in its 32<sup>nd</sup> year. The *Science Circus* programme tours nationally, returning to the same communities every few years.

The *Science Circus* facilitates and hosts a temporary science centre in regional and remote areas, presents in school science shows to pre-primary, primary and secondary school students and families, and facilitates teacher professional development workshops. The team of presenters consists of up to 16 students studying towards a Master of Science Communication Outreach at the Australian National University.

### Teacher Development Programmes – STEM X Academy

Questacon delivers a broad range of accredited programmes to pre-service, casual and registered teachers through the national outreach programmes and through stand-alone activities. The programmes build confidence, skill and content knowledge in teachers in the delivery of Science, Technology, Engineering and Maths (STEM) activities in the classroom.

The *STEM X Academy* is an intensive five-day programme delivered each January in partnership with the Australian Science Teachers Association and the CSIRO that joins teachers with researchers to develop new activities for the classroom.

*Engineering is Elementary (EiE)* programme is a highly successful STEM initiated developed by the Museum of Science, Boston. *EiE* provides teachers with a framework to deliver STEM content using hands-on problem solving through engineering activities. Questacon has undertaken a review against the Australian Curriculum and is delivering a pilot programme to Australian schools.



### Travelling Exhibitions

Questacon tours travelling exhibitions to a range of regional and metropolitan venues across Australia, fulfilling Questacon's national role and responsibility of providing access to hands-on informal learning experiences outside the centre of Canberra. The interactive exhibitions are developed in-house by Questacon and provide engagement for all ages. The travelling exhibitions provide a range of sizes, topics and complexity options suitable for most venue requirements.

The *Enterprising Australians* travelling exhibition highlights inventors and innovator stories of commercial success across the Australian business and entrepreneurial sector.

*Enterprising Australians* engages visitors in a selection of 'hands-on' and audio-visual experiences delving into each innovator's story. The exhibition aims to inspire and equip visitors with the confidence to innovate and develop ideas of their own by issuing the challenge to just start innovating about things they care about.

### Questacon Virtual Excursions

Questacon reaches rural and regional Australia through its Schmidt Studio and Virtual Excursions that are a part of the Questacon *Smart Skills Initiative* programme. The programme involves one hour hands-on workshops covering topics including environmental science, physics of flight and the innovation process. These videoconference workshops are designed for students in primary and secondary school and are an effective means for schools who have limited opportunities due to their location.

### Inspiring Australia activities

Questacon works in partnership with organisations throughout Australia to increase the coordination of STEM initiatives and strengthen community engagement and participation in STEM. As the national leader of the *Inspiring Australia* science engagement strategy, Questacon uses a 'national framework – local action' approach to maximise the reach, impact and visibility of STEM initiatives. Questacon delivers a number of flagship activities as part of the Inspiring Australia programme, including National Science Week, the Prime Minister's Prizes for Science, a national network of Inspiring Australia managers supporting year-round science engagement activities and local partnerships, and a growing network of regional STEM hubs boosting community participation and skills across Australia.