



ANSTO Submission

to the House Standing Committee on
Employment, Education and Training Inquiry into
the education of students in remote and complex
environments

ANSTO

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Introduction

The Australian Nuclear Science and Technology Organisation (ANSTO) is home to much of Australia's scientific landmark infrastructure, including: Australia's only multi-purpose nuclear reactor, OPAL; a comprehensive suite of neutron beam instruments; the Australian Synchrotron; the National Imaging Facility Research Cyclotron; and the Centre for Accelerator Science.

ANSTO scientists and researchers use this infrastructure to investigate public health, the environment and the nuclear fuel cycle to find solutions to some of the biggest questions in science for the benefit of all Australians.

As one of Australia's primary national research organisations, ANSTO is also heavily committed to Science, Technology, Engineering and Maths (STEM) education, with a focus on educating students and the public on nuclear science and technology.

ANSTO has a dedicated STEM education and outreach function located in the ANSTO Discovery Centre. This function develops and facilitates educational activities for students, including a range of opportunities for student from remote areas of Australia, offering a wide variety of learning resources aligned with education curricula. In the last five years, almost 68,000 primary and secondary school students have participated in ANSTO's STEM education activities.

ANSTO, in this submission, would like to share several initiatives that have helped to increase student participation and engagement in STEM, including engagement from students in regional and rural communities. The submission will also outline initiatives that have provided professional learning opportunities and resources for STEM teachers. In particular, this submission focuses on:

- Supporting the delivery of the Australian STEM Curriculum in a flexible way to meet local learning needs and interests of remote students, including examples of innovative ways in which the curriculum is being delivered in remote schools; and
- Innovative approaches to professional learning (with a focus on STEM).

Supporting the delivery of the curriculum in flexible ways for remote students and schools

ANSTO teaches elements of the STEM curriculum to students through innovative programs and educational initiatives, with a focus on multisensory learning where students are engaged in STEM through sight, sound and touch. These programs are accessible to students nationally and have been successful in engaging and educating students in rural and regional communities.

1. School Excursions

ANSTO hosts school excursions, which are aligned with content and skills in the Australian curriculum for Years 3-6 Science, Years 7-10 Science and Senior Physics and Chemistry. These excursions consist of an interactive presentation in the ANSTO Discovery Centre on nuclear science and technology, as well as a tour of ANSTO's world-class research facilities. Students are provided with a workbook during the excursion to be completed throughout the tour. This allows students to seek out answers to problems through visual inspection or by asking a researcher and/or scientist.

**ANSTO hosts 300 class excursions annually.
20% of these are from rural and regional schools.**

2. Videoconferencing

ANSTO has supported over 230 video-conferencing activities and lessons, which are particularly beneficial and accessible for students in rural and regional schools because it brings the experts to their classroom. The videoconferences offered at ANSTO address syllabus outcomes across both primary and high school curriculums, enabling students to have remote access to the unique resources at ANSTO Lucas Heights. The videoconference lessons offered at ANSTO include:

- **Nuclear Science Inquiry Skills:** In this two-lesson (plus homework) program, students plan and conduct an investigation first-hand through consultation with an ANSTO educator. Students are able to nominate to use high-quality radioactive sources and instruments at ANSTO for their planned remote experiments. An ANSTO educator then undertakes the experiment from the Lucas Heights campus, remotely following the student-designed experimental plan. This program is designed to address content and skill outcomes in the Year 9, Year 10 and Senior Physics Australian Curriculum and NSW syllabuses.
- **Nuclear Science as a Human Endeavour:** In this two-lesson (plus homework) program, students investigate the production of nuclear medicines in the OPAL multipurpose reactor, the use of nuclear medicines to diagnose and treat disease, and the science behind working safely with radiation. Students complete hands-on activities to understand half-life and fission,

view animations and behind-the-scenes footage of the OPAL reactor, and collect data from a short experiment demonstrating how to work with radiation safely. This program is designed to address content and skill outcomes in the Year 9 and Year 10 Science Australian Curriculum and NSW syllabuses.

- **Meet an Expert:** In this two-lesson (plus homework) program, students research and present information about a practicing Australian scientist. An ANSTO researcher is interviewed by students, who are asked to pre-prepare questions. Students then use the responses provided by ANSTO's researchers to prepare a presentation on the researcher and their work. This program is designed to address Science as a Human Endeavour and Science Inquiry Skills content descriptors for Years 5-10, as well as skill outcomes for senior science subjects.

2,000 students in remote and regional areas of Australia have participated in ANSTO's videoconferences.

3. ANSTO XR Application

In August 2018, ANSTO introduced a virtual reality application for students, teachers and the general public. The virtual reality experience takes the user on a tour of Australia's OPAL multi-purpose reactor. This technology is particularly effective in displaying the unseen world of atoms and enabling students to understand the benefits delivered through the OPAL reactor. For instance, the app enables students to "see" a neutron and learn about how they are put to work inside the reactor.

This is an example of an innovative, fun and engaging way that the nuclear science curriculum is being taught to students. This application is freely available to all students.

The ANSTO Virtual Reality App has over 15,000 downloads from students, teachers and the general public.

4. Big Ideas Forum

ANSTO's Big Ideas Forum is an annual event that commenced in 2016. The forum brings 22 students and 11 teachers from across Australia to Sydney to meet world-class researchers and go hands-on with nuclear-based science and technology.

Year 10 students, along with their teachers, from any school across Australia are invited to apply for the program by answering the question: "*What problem would you like to solve through science for the future of our society?*"

ANSTO covers the cost and expenses for the successful applicants to visit ANSTO's Sydney facility for a week to participate in the forum. Throughout the week, students explore ANSTO's facilities, work

side-by-side with researchers to investigate the scientific problem they would like to solve, and have the opportunity to understand what a career in STEM involves.

The Big Ideas Forum also includes professional development activities for teachers, including hands-on workshops, meetings with ANSTO's researchers, and learning experiences in ANSTO's unique facilities. The NSW Education Standards Authority (NESA) and the ACT Teacher Quality Institute (TQI) have endorsed ANSTO as a facilitator of professional development for teachers. This program provides 10 hours of Registered Professional Development for teachers in NSW and the ACT.

Approximately 10 per cent of schools that have participated in the Big Ideas Forum have been from rural or regional areas

Case Study: Yuendumu School is a remote educational institution located in the heart of the Tanami Desert in the Northern Territory. The successful students and their science teacher attended the ANSTO Big Ideas Forum in 2016 with the aim of understanding the effects of processed foods and changes to diet on the public's health over time. Students were able to work with an ANSTO researcher for a week to undertake research on this topic, whilst visiting ANSTO's facilities and learning about science and technology more broadly.

5. Flexible Learning Opportunities for Rural and Regional Students

ANSTO has worked closely with regional schools over the past few years to help increase engagement in STEM as well as in the effective teaching of nuclear science and technology. This has resulted in *ad-hoc* learning and development events and opportunities being planned for schools and students.

Examples of flexible and *ad-hoc* learning activities that have taken place include:

- **Tailored visits to ANSTO:** ANSTO has invited students from rural schools to its facilities for several days to participate in radioactivity workshops, learn about nuclear medicine production, go on a tour of the OPAL reactor, and participate in hands-on engineering activities. The ANSTO Motel, on site at the Lucas Heights campus, provides rural schools with the opportunity to visit for several days at a time for intensive STEM workshops and learning activities. Programs such as this have been well received by both students and teachers from rural communities.
- **Tailored visits to rural and remote areas:** ANSTO has visited rural areas to educate students on nuclear science and technology through virtual reality exhibitions and interactive activities. This involves ANSTO assembling a scientific workshop in a school and/or communal space in a regional town, where students from different schools are invited to participate in

activities over the course of a day. These activities are centralised around learning about careers in STEM, nuclear science and technology syllabus outcomes, nuclear medicine production, as well as the general sciences.

ANSTO will continue to introduce the benefits of nuclear science and technology to students in rural and remote communities in innovative ways to drive positive engagement in STEM. New applications utilising virtual and augmented reality technologies will also be developed by ANSTO to bring theoretical science to life through multisensory learning.

Through these programs, ANSTO hopes to inspire young people to consider a career in STEM, contributing to a strong national pipeline of talent for Australian science.

ANSTO's Professional Learning Programs for STEM Teachers

Over the past five years, ANSTO has supported 1,400 STEM teachers from all Australian states and territories through the delivery of various professional development courses. These courses are available to be completed in person and/or remotely, providing teachers with innovative ways to plan class content and lessons for students. These programs are also eligible to contribute to teachers' professional development hours, given ANSTO's status as a registered provider with NESA and the ACT TQI.

Registered Professional Development

Professional learning courses offered by ANSTO include:

- **Teacher Development Days:** ANSTO offers professional development days, which enable teachers to interact with Australian scientists, learn about Australia's capabilities in nuclear science, participate in engaging workshops and access ANSTO's educational resources. This program addresses Australian Professional Standards for teachers, and provides six and a half hours of teacher development.
- **Planning for ANSTO e-learning videoconferences:** ANSTO offers teachers an opportunity to learn how to utilise videoconferencing technology to engage with nuclear science and ANSTO's experts, as well as providing tips to teachers on how to best integrate videoconferencing classes into an overall learning program. This program addresses Australian Professional Standards for teachers, and provides three teacher development hours.
- **Planning for ANSTO e-learning Meet an Expert sessions:** ANSTO assists teachers in planning for the Meet an Expert Videoconference through the provision of materials to assist with lesson planning. This program addresses Australian Professional Standards for Teachers, and provides two teacher development hours.
- **Planning for ANSTO school excursions:** ANSTO supports and educates teachers on how to link textbook information on nuclear science with its real world applications, as well as how to contextualise excursions for students back in the classroom. This course also assists teachers with planning for a visit to ensure it is integrated with class-based content, including through the development of pre- and post-excursion educational content. This program addresses Australian Professional Standards for teachers and provides three teacher development hours.

ANSTO intends to continue to grow its teacher development programs nationally to encourage and inspire science teachers who will educate Australia's next generation of scientists. ANSTO also intends to expand the range of online learning resources for teachers.

Further information on ANSTO's educational programs, online resources and testimonials from students who have engaged with ANSTO's activities can be found below:

<i>School Excursions</i>	https://www.ansto.gov.au/education/secondary/secondary-school-tours
<i>Videoconferencing</i>	https://www.ansto.gov.au/education/secondary/videoconferences
<i>ANSTO XR Application</i>	https://www.ansto.gov.au/education/apps
<i>Big Ideas Forum</i>	https://www.ansto.gov.au/news/big-ideas-forum
<i>Tailored Visits to ANSTO</i>	https://www.transcontinental.com.au/story/4634727/from-hawker-to-sydney/
<i>Tailored Visits to Rural and Remote Areas</i>	https://www.eyretribune.com.au/story/6080298/ansto-holds-open-day/
<i>Professional Learning Programs for STEM Teachers</i>	https://www.ansto.gov.au/education/teachers/professional-development#content-tpd-days
