

About STELR



STELR* is a national secondary school science program – the key education initiative of the Australian Academy of Technological Sciences and Engineering (ATSE).

The *Australian Curriculum* aims to ensure that all Australian students develop a solid foundation of scientific knowledge. However, unless schools make specific decisions to promote it, science teaching too easily falls back to a default position that leaves students unaware of how stimulating and rewarding science can be.

As a national academy dedicated to the use of the technological sciences and engineering to improve all aspects of Australian life, ATSE is well positioned to address this problem. It has the expertise, resources and will, and being unfettered by the constraints of day-to-day education management, it can bring an objective, broadly based, and fresh view. Drawing on the latest education research, STELR is the result of the particular insights ATSE is able to bring to bear.

The STELR program offers a range of curriculum packages, all designed to engage student interest in science, and hold it. They do this by demonstrating the excitement of scientific discovery and the benefits of technological innovation. Two basic strategies are used:

- *Relevance* – STELR courses present the big ideas, like conservation and transformation of energy, in the context of topics that are highly relevant to students, so that they see the point of science. The current STELR packages use global warming – an issue that surveys show students are very concerned about – as the springboard for investigations into renewable energy technologies. Planned biology, chemistry and physical science packages are framed around sustainable living, looking at food production, ocean acidification, solar air conditioning and low-energy architecture.
- *Inquiry-based learning* – STELR courses use a contemporary “inquiry-based” pedagogy that leads students to understanding by means of testing and developing their own ideas. STELR provides purpose-built equipment for “hands-on” experimentation for this purpose. Practical content keeps interest high, and students feel that their discoveries have personal meaning to them. STELR-trained teachers ensure that students meet learning targets by encouraging and guiding, as much as by traditional “transmission” teaching.

The combination of relevance and inquiry-based methodology has proven to be resoundingly successful, with students who previously turned away from science discovering that they actually enjoy it. In fact, STELR is recognised as providing best practice in innovative science teaching by the education departments in every Australian state and territory, as well as being fully supported by the Australian Science Teachers Association. Thirteen universities use STELR curriculum materials and equipment in their teacher training courses as examples of excellence in inquiry-based learning.

The decision to run STELR is made easy for principals and teachers, because the STELR curriculum packages fall within *Australian Curriculum* guidelines. So STELR replaces current content – it isn't additional to it. STELR is taught to every student in the year, not just those who already know they like

* STELR (pronounced “stellar”) – acronym for “Science and Technology Education Leveraging Relevance”

About STELR



science and volunteer. Ultimately, we aspire to having all Australian students participate – in the public, Catholic and independent sectors, and in remote areas as well.

STELR was first tested for proof-of-concept in four schools in 2008. In 2012, over 300 schools are running it and over 90,000 students and 1000 teachers have participated. The program has been refined and improved on the basis of feedback from teachers, students, and independent researchers from Deakin and Curtin universities. Hardly any schools, having run the program, have withdrawn.

Right from its first stages, students and teachers have responded enthusiastically, and formal assessment methods only back this up. Students show increased engagement in science classes, and their perceptions of the value of science, of its relevance to their lives, and of the career opportunities that it offers, all improve. Importantly, STELR schools already report an increase in the uptake of science subjects in Years 11 and 12, meeting the primary aim of the project.

STELR is a success by any measure, but development continues. As noted, additional curriculum packages are being created for Years 7 and 8, so soon students will be able to enjoy exciting and stimulating science classes over four successive years. One new package will enable students, at any STELR school, to mathematically explore in real time the production and utilisation of solar energy generated at schools with solar panels.

Work is also proceeding on web-based delivery of STELR, with an application to be known as *STELR Interactive*. Students with any sort of computer platform – PC, Mac, iPad or Android tablet – will be able to access course materials, carry out and submit assignments, and receive marks and feedback on the site. Information and communication technology (ICT) and mathematics elements already present in many of the STELR modules will be expanded, taking advantage of the opportunities afforded by the digital medium.

Aims

As noted, STELR's primary aim is to address head-on declining participation rates in science and mathematics at the upper secondary school level. A number of secondary aims flow from this:

- *Careers* – raise awareness of technology-related careers and increase the number of students choosing these (thereby helping address the current shortfall in scientists and engineers).
- *Appreciation* – stimulate a general interest in students, and ultimately in the community at large, in scientific discovery and technological innovation, with an appreciation of the benefits these bring.
- *Scientific literacy* – improve scientific literacy amongst students and the community at large. Scientific literacy includes concepts such as isolating variables, evidence-based reasoning and quantification, plus a general understanding of how scientists work and how science advances.
- *Teaching quality* – improve the quality of science classroom teaching practice (in fact, the inquiry-based learning techniques used in STELR are suitable for any subject).

About STELR



The STELR program

Any school adopting STELR receives far more than just lesson plans and books. Schools become part of a complete program designed to ensure that lessons are delivered in a way that is maximally conducive to student learning, and that teachers get the support they need to competently and confidently present the material.

The STELR program includes all the following:

- *Teacher training* – two teachers from each new school attend a professional learning workshop held at the start of each school year. These seminars are run by experts in inquiry-based learning. Teachers learn the pedagogy of inquiry-based learning, as well as becoming familiar with the content and equipment of the STELR courses. These teachers take their training back to other teachers at their school.
- *Curriculum materials* – schools receive teacher and student workbooks for each course. Like the curriculum packages as a whole, this written material has been refined and improved over the development stages of STELR, so that they both inform and stimulate in accord with the principles of inquiry-based pedagogy.

The renewable energy module includes an ATSE-commissioned DVD, *Global Warming: Cold Facts Hot Science*, to set the context for the course and stimulate interest.

- *Classroom equipment kits* – each school receives a full set of purpose-built STELR equipment. This includes multimeters (20), solar panels (10), wind turbines (with differently sized replaceable vanes – 20), hand-driven generators (2), and more, including cables and spare parts. No other equipment is required. The equipment is sturdy – designed to withstand classroom use for many years – and simple, with straightforward controls and limited functionality – so students are not confused by complicated options that they do not need.

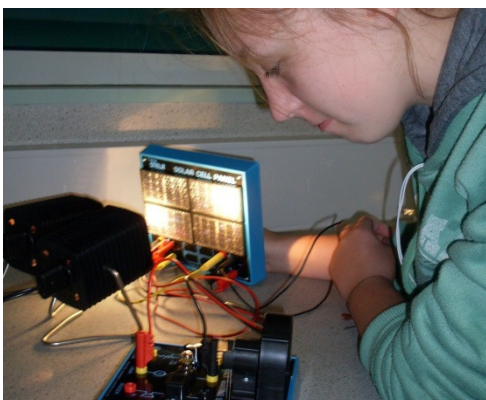


Figure 1. The STELR solar panel

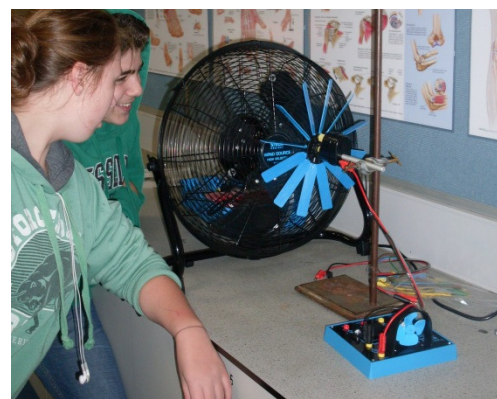


Figure 2. A STELR wind turbine in use.

About STELR



Teacher support – each school has a STELR-appointed mentor to provide advice as courses progress. STELR also sets up a network of local STELR teachers to share experiences and suggestions.

- *Online resources* – the STELR website provides a range of additional information for students and teachers, including case studies on a range of energy resources, career profiles, and additional background information.
- *Testing* – each curriculum package has online “pre” and “post” knowledge tests for students. Pre tests give teachers an indication of where to focus attention in the course, while the post tests give them, and the STELR project team, information on how successful the course has been.

Curriculum packages

STELR currently provides teachers with a choice of three curriculum packages, each with their own set of resources. More packages are being developed. The choice of curriculum package allows teachers to meet the varying needs of their schools, as they differ across Australia.

Within individual packages, too, there is flexibility. Each package has core content that must be used, but also a number of optional activities. Teachers can select from these according to the time they have available, student ability, or because some activities might be of particular relevance to their classes.

The three packages currently available are:

- *The STELR Core Curriculum* – a 6–10 week program designed for Year 9 or 10 students. The emphasis in this program is the physical sciences.
- *The STELR Chemistry Curriculum* – a 5–6 week chemistry program designed for Year 9 or 10 students. It is ideal for Year 10 students who completed the STELR physical sciences program the previous year.
- *The STELR Integrated Curriculum* – a 10–12 week program designed for Year 9 or 10 students. In this curriculum, physical and chemical sciences are interwoven, with aspects of the Earth, space and biological sciences also included.

Conclusion

The whole of the STELR project rests on making science stimulating, exciting, engaging and interesting. We know it is doing well when teachers report:

We found the STELR activities highly enjoyable for students and teachers alike. Students were voluntarily coming back to complete activities during their recess and lunch times. This has not occurred before in Science.