

Evaluation summary

Carbon capture and storage educational resources

Scope

In July 2011, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) conducted a review and analysis of a variety of carbon capture and storage (CCS) education materials currently available to be used by schools both in Australia and internationally. The materials were found to have a number of shortcomings, for example, some of the resources were lacking in teaching strategies and did not situate the information in the context of climate change. As a result of this analysis, CSIRO developed a set of CCS educational resources and conducted a trial and review of these resources in a sample of Australian and international schools. The resources were also reviewed by several Australian-based curriculum officers.

To gather an account of teachers' experiences and to obtain feedback on the quality of the resources, participating teachers were asked to complete an online survey both prior to and following the classroom trial and review. The surveys asked teachers to assess the resources across a range of different aspects, including:

- ♦ scientific integrity and balance of information;
- ♦ pedagogy and teaching strategies;
- ♦ usefulness of the resource components; and
- ♦ alignment to school curriculum

Teachers were also given the opportunity to provide details on outcomes of the trial process, such as changes in student awareness, and professional development.

Key findings

Key findings of the evaluation are listed below, including some of the comments made by the participating teachers and reviewers.

- ♦ Teachers indicated that they were inexperienced and lacked confidence in teaching about CCS. However, following the trial, teachers felt their teaching experience and confidence improved in this area.
 - *"I felt nervous when I agreed to be part of the trial as I had no real knowledge of this topic other than hearing a brief talk on it at a conference...The course work is so well prepared and presented that the teacher doesn't have to have prior experience with the topic."*
 - *"Honestly, I had been one of those teachers who loved the environmental side of SOSE; but was scared of the science...the diagrams of the step by step procedures for the science components were helpful."*
- ♦ Teachers' self-rated knowledge of climate change and related issues, and energy sources and related technologies improved following the review and trial of the educational resources. The greatest change was in relation to CCS.
- ♦ The education resources met the expectations of the teachers, who found the resources to be informative and easy to use.
 - *"Clarified and extended existing ideas plus complimented present scope and sequence by being flexible and easy to adapt."*
 - *"Very informative and easy to follow."*
- ♦ Teachers found the references and activity ideas to be particularly useful as resource components. In addition, the background information was found to be helpful in filling the knowledge gaps identified by some of the teachers.

Figure 1. Students completing an activity from the CCS educational resources.



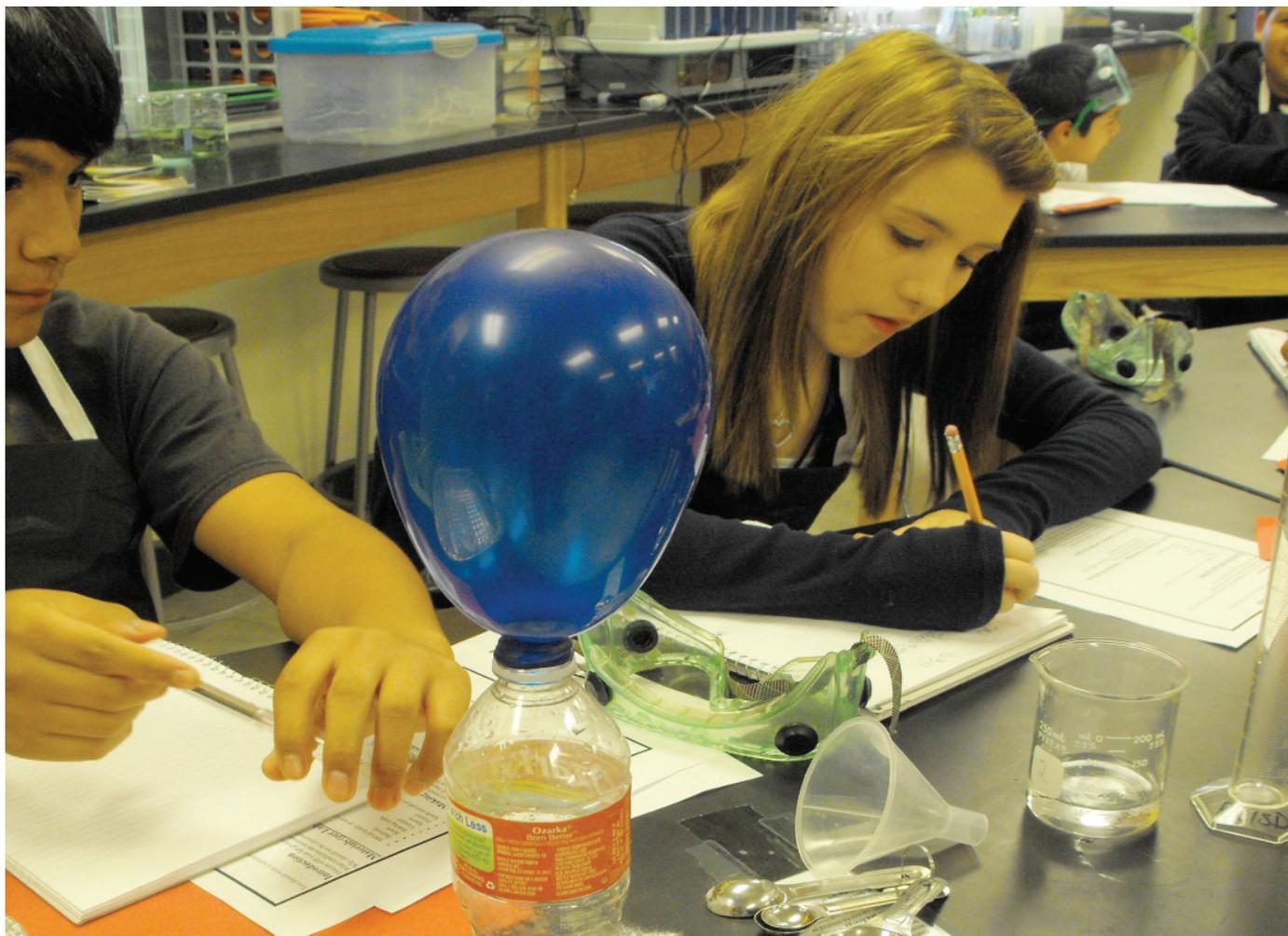
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- “The material has a good list of references.”
- “Yes, thorough support materials for non-science teachers.”
- “Basically allows greater depth and coverage.”
- “It flowed better thereby filling the gaps.”
- ♦ After using the CCS education resources in the classroom, teachers felt their students had gained an increased awareness of its subject matter, particularly with regards to CCS. Teachers also indicated that students were able to build upon their existing knowledge and confidence in discussing these topics.
 - “Student knowledge was definitely enhanced by the CCS materials and allowed them to build upon existing knowledge, or lack of, and then integrate this into their ongoing studies... Students were able to reflect because they had a better understanding of the issues and could actually speak and write about them”
- “Students and I knew little about CCS before the implementation of this unit. We now feel confident to openly discuss a variety of factors that impact on climate change and possible solutions.”
- “The students found the activities exciting and it really stimulated their interest throughout the course of the unit.”
- ♦ Following the use of the resources, participating teachers felt they had gained a number of key understandings, ranging from technical details to an understanding that immediate action and further education were required.
 - “There is not one technological answer.”
 - “Every level of society has a role to play in CCS and CO₂ reduction.”
 - “We have to be constructively proactive in doing this.”
 - “Enabling students via hands on activities needs to be a priority.”
- ♦ The materials were rated highly against the evaluation criteria addressing educational practices; all of which were considered important by the teachers. Out of the criteria, integrity and scientific inquiry were considered as the most important in teaching about CCS. The criteria in which the highest ratings were given included integrity of scientific concepts, and increasing knowledge and understanding of CCS.
- ♦ Alignment to school curriculum was considered important by the participating teachers and the majority felt that the resources were aligned with the science and geography topics currently taught at their schools. Others felt the materials were aligned in part, but could be easily adapted.

Figure 2. Students capturing CO₂ from a soda bottle.



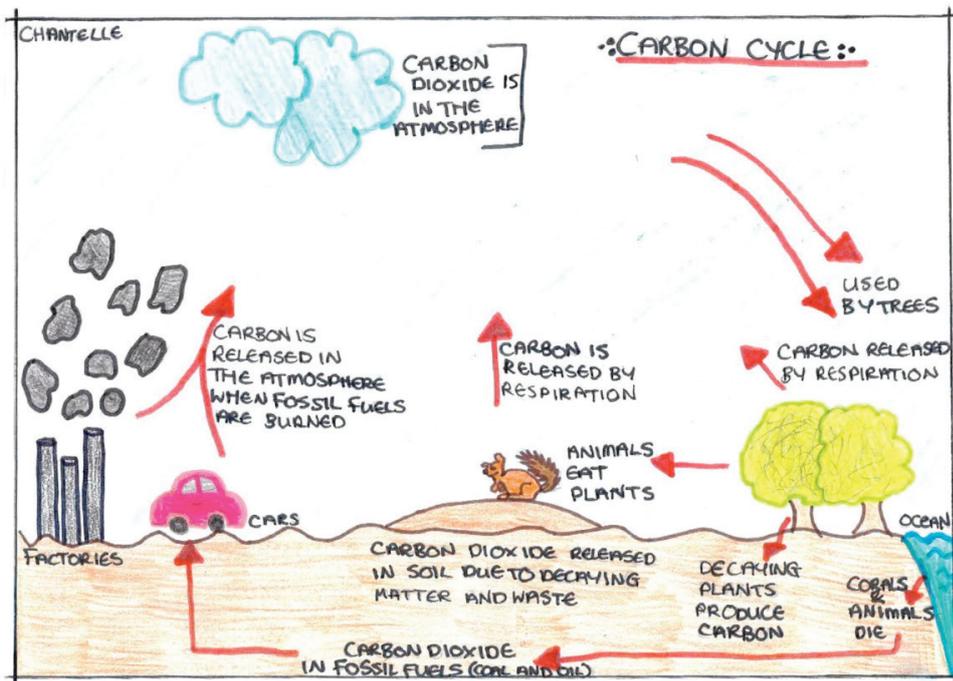
Constructive feedback

An important outcome of the evaluation process was to gather feedback that could be incorporated into the CCS educational resources. Therefore, in addition to the evaluation survey, comments were also sought through an external review process completed by five Australian-based curriculum officers.

This review resulted in a number of suggested changes, which tended to be editorial, such as grammatical changes or clarification of terminology. Comments were also made regarding the depth of the resources; in that teachers may need to prepare students before covering potentially difficult content.

In addition, one of the reviewers was concerned that some of the content may appear to be biased and that some of the potential impacts and risks associated with CCS had not been fully addressed.

In addressing these concerns the resources have been extensively reviewed to ensure that CCS is presented in a broader context as one part of a possible low carbon energy solution. The resources were also developed using the principles of inquiry-based learning to encourage students to think critically about CCS and other low emission energy technologies.



Recommendations

In considering the next steps forward for the dissemination and implementation of the CCS educational resources, several recommendations have been made to the Global CCS Institute and include:

INCREASE PROGRAM AND EVALUATION SCOPE

Seek to implement the CCS educational resources on a wider scale and monitor the progress across the range of classrooms.

OFFER PROFESSIONAL DEVELOPMENT OPPORTUNITIES

Increase awareness and use of the materials amongst teachers by conducting a Professional Development program on the CCS educational resources.

GLOBAL EDUCATION PROGRAM PROMOTION

Promote the CCS educational resources through teaching portals and associations.

BUILD ON EXISTING CLIMATE CHANGE EDUCATION PROGRAMS

Form partnerships with educational/research institutions which provide specifically tailored programs aimed at increasing student knowledge and understanding of climate change and mitigation technologies.

FOR FURTHER INFORMATION
CSIRO Earth Science and Resource
Engineering

Anne-Maree Dowd
t: 07 3327 4468
e: anne-maree.dowd@csiro.au

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CONTACT US
t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au