



CATALYSING CHEMISTRY
STUDENTS' LEARNING WITH
ONLINE LAB WORK

Abstract

Universities are innovating with an increasing variety of ways that students can engage with their courses. Deakin University in Victoria is investigating how it might offer chemistry units as part of its Cloud Campus, and to do this must understand how students would gain proficiency in and be assessed on practical lab components of these units.

Deakin partnered with Cengage in 2016 to undertake a trial of two Cengage resources – LabSkills and Quick Prep – with a select group of third year science students, to assess the viability of utilising these digital products for students taking first year chemistry.

The response to the trial was overwhelmingly positive. Some students commented that they would recommend to their lecturer that Quick Prep be made compulsory for first year chemistry, and that LabSkills could be used in subsequent years in the lab to practice before attempting practicals.

The findings from the student review are assisting Deakin in its inquiry into the potential to offer chemistry units online.

The digital classroom

Flipped classrooms, blended learning, and the demand for fully online courses are continuing to grow in Australia. As Deakin University continues to make innovations to the ways that its students can participate in courses, it has its eye firmly on digital alternatives to traditional classroom delivery.

This proposition becomes more complex for courses such as chemistry, which have a heavy practical lab-based learning and assessment component.

With resources available through Cengage's OWLv2, Deakin set out to discover whether learning chemistry entirely online is possible.

LabSkills and Quick Prep are features of OWLv2 that provide students with digital environments in which to practice and revise their chemistry skills and knowledge at their own pace.

This paper outlines an inquiry being made by Deakin University into the potential of offering chemistry units online, and tools from Cengage that could make this possible.

Setting the scene

Cengage had previously worked with Deakin University Associate Head of School (Teaching & Learning), Jan West, in 2015 when she was looking for new and interactive ways to use technology in the classroom. The Cengage specialist digital support team created a trial module of MindTap Human Physiology for 20 of Assoc. Prof. West's students, as the professional placement for a core unit of her biological science and biomedical courses.

Following the success of the 2015 project, Assoc. Prof. West indicated an interest in working with Cengage again in 2016 to implement a new trial with her science students. The project was inspired by a move by the School to develop versions of two first year units - Chemistry for our World (SLE133) and Chemistry for the Professional Sciences (SLE155), that are planned to be delivered fully online for the new Deakin Cloud Campus.

These units are both compulsory for students who did not complete year 11 and 12 high school chemistry. Students who did senior high school chemistry can choose to only do the Chemistry for the Professional Sciences unit.

The purpose of the project was to discover how practical-based learnings could be delivered in a digital environment.

100% OF STUDENTS
IN A 2016 TRIAL

'LOVED' OR 'LIKED'



100% OF STUDENTS
IN A 2016 TRIAL

'LOVED' OR 'LIKED'



"I enjoyed the interactive component of LabSkills. It was fun and engaging, rather than just sitting down and reading a page of information."

I liked how Quick Prep gave you a study guide to work on. It was good to have a large amount of questions to work through and help develop your knowledge."

*Michelle Drvodelic,
Bachelor of
Biomedical Science*

100% OF STUDENTS
IN A 2016 TRIAL

AGREED THAT HAVING STUDY TOOLS,
READINGS, QUIZZES, AND STUDY AIDS BUILT
INTO ONE ONLINE DESTINATION WOULD BE

'VERY HELPFUL' OR 'USEFUL'

→ IN STUDYING FOR A CLASS OR TEST ←

The trial

Assoc. Prof. West brought in Dr Damien Callahan who teaches into the two chemistry units, to collaborate with Cengage on creating a trial of Cengage OWLv2 LabSkills and Quick Prep, for 21 students to test the proposition.

As with the trial in 2015, the selected third year science students from Deakin Burwood completed the work as the 80-hour professional placement component of their course.

The students were asked to review the resources for their suitability in teaching first year chemistry in an online environment. They were given direction to review from the point of view of a student trying to learn chemistry concepts as well as from an ease of use perspective, and from the view of suitability for completing a chemistry unit with no face-to-face classes.

Student work included study, focus groups, and a student intercept survey to provide direct feedback about their experience of learning with LabSkills and Quick Prep.

They were guided to think about the resources and learnings with the following:

Scope: Do the modules provide enough detail for you to understand the topic? Are the tasks varied and interesting? How long does it take to complete? Did you stay focused on the material?

Audience: Is the material at a suitable standard for level 1 chemistry? Too easy? Too difficult?

Learning: If you don't understand something is there an option for feedback? How useful is this? Were the tasks engaging in the online environment? Did you learn new concepts as a result of completing the modules? What were the top two modules? What were the tasks in these modules that you considered the best for learning chemistry concepts?

The features reviewed were as follows:

- Multiple choice questions with instant feedback
- Videos (with questions)
- Interactive lab animations
- Interactive molecular calculations
- Click-and-drag lab experiments
- Quick Prep quizzes
- Interactive data charts
- Quick Prep Personalised Study Plan
- Interactive calculation experiments

Following the review period, the students were invited to the Cengage head office in Melbourne to participate in one of two focus groups to provide their feedback. The response was overwhelmingly positive, with all agreeing that LabSkills would be ideal for first year chemistry students, and unanimous support for Quick Prep for anyone who had not completed year 11/12 chemistry, as well as before an exam to refresh knowledge for any year or competency level.

At the conclusion of each focus group the students completed an online survey to provide feedback on specific features of the trialed resources, and their overall impressions of them.



“The visual components and interaction platform that is incorporated [into LabSkills] really helps consolidate knowledge. The step-by-step experiments would ensure that students understood the step before attempting the next one which I found helpful and essential.”

Andy Nguyen,
Bachelor of Biomedical Science

67% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'
RECOMMEND TO THEIR FRIENDS 

67% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'
RECOMMEND TO OTHER STUDENTS IN THEIR CLASS 

“ [LabSkills is] fun, visual, interactive, makes hard chemistry concepts very easy to understand. [LabSkills and Quick Prep] help students study chemistry effectively and efficiently. Helpful tool lecturers can use to teach hard to explain topics.”

Vaishnavi Mahendran,
Bachelor of
Biomedical Science

50% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'
RECOMMEND TO THEIR LECTURER 

Conclusion

As learning technologies continue to advance and become more widely adopted in Australian universities, both students and lecturers will benefit from the personalised and engaging learning opportunities that they offer.

While certain types of courses are now available entirely online, and some parts of others can be taken digitally, the new challenge is how to offer courses or units that have a heavy practical-based learning and assessment component, in a virtual environment.

Can chemistry be taught and/or assessed online, and what tools are available to facilitate this?

The Deakin trial is a positive starting point for the university to assess the viability of offering chemistry through its Cloud Campus. For first year chemistry students, LabSkills and Quick Prep from OWLv2 are tools that can help facilitate this.

The question for Deakin to investigate further is whether it will be possible for the university to offer chemistry units with wholly online lab work and assessments, or whether students would need to attend on-campus practicals and/or assessments.

Find out more about OWLv2 cengage.com/owlv2 or Cengage cengage.com.au

Focus group feedback on Labskills:

"I loved it. I haven't used anything similar before"

"Feels like you have a tutor right next to you"

"I like that I can study at my own pace"

Focus group feedback on Quick Prep:

"I loved the study plan! I didn't need to make my own notes"

"I loved having lots of questions because I'm an active learner"

"The visual presentation [and] interactive nature of the LabSkills module almost allows you to be in the lab without actually being there.

[Quick Prep allows] studying concepts at your own pace, without the pressure of time constraints or the worry of "being left behind" in class because you feel that the lectures are going too quickly. "

*Mary Sherissa Reyes,
Bachelor of Biomedical Science - Majoring in
Molecular Life Sciences*

72% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'

RECOMMEND TO THEIR FRIENDS 

72% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'

RECOMMEND TO OTHER STUDENTS IN THEIR CLASS 

"I liked the quiz at the beginning of the Quick Prep as it produced a study plan tailored to me and gave me the content that I needed to focus on. I would recommend [LabSkills and Quick Prep] to students who have not yet done any chemistry or are struggling with understanding the content. It is an easier and more interactive way to learn. "

*Mona Kumari,
Bachelor of Science,
Biology major*

67% OF STUDENTS
IN A 2016 TRIAL

WOULD 'DEFINITELY'

RECOMMEND TO THEIR LECTURER 