WOLFRAM CONSULTING SERVICES

Australian Christian College Online Mathematics Platform

Industry: EdTech **Applications:** Automated Question Generation

ABOUT

Australian Christian College (ACC) is a not-for-profit Christian education organization made up of several co-educational schools across Australia. Covering K–12 education, their mission is to have every student become a positive influence on the world around them.

ACC is Australia's largest non-government distance education provider, with four schools equipped to provide a hybrid of in-house and fully remote learning.

12

The ACC organization has **12** schools across Australia, from Western Australia to the Gold Coast.

4

ACC has **4** distance education schools, offering remote learning in Queensland, New South Wales, Western Australia and Tasmania.

2,000

Collectively, ACC teaches around **2,000** students in K–12.

THE CHALLENGE

A key issue ACC wanted the Wolfram Technical Consulting team to solve was online math assessments. They needed a platform with a corpus of questions that would work for students learning both on-site and remotely.

Inadequate content

The only questions available to students at the time were those that came with the standard curriculum textbooks—just 3 to 15 questions per subject topic (such as factoring polynomials). This limited student practice and made it difficult to accurately determine individual student ability.

ACC wanted a cohort of new questions, but didn't want to have to depend on a third-party provider for access, nor did they want to burden their teachers with the time-consuming task of content creation on top of their other duties.

Constrained by software

ACC schools had an established Canvas environment that worked well for other aspects of their online learning. Any new assessment platform would need to integrate with the existing system rather than act as a separate application.

A hybrid environment

With students joining from all over Australia, workflows needed to function seamlessly in a hybrid environment, where a student might be learning from the classroom or from the other side of the country.

THE APPROACH

Templated questions

The Wolfram Technical Consulting team used Wolfram Language to create a template notebook that would be able to automatically generate problems of a given structure. This gave ACC staff the ability to write a handful of custom math questions from which they would be able to acquire an unlimited number of questions with randomized parameters.

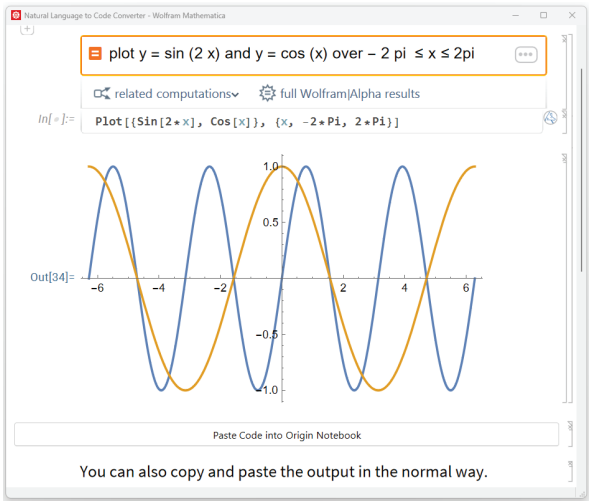
"Wolfram is an industry standard tool, well-known in the sector. It was the natural bridge to take students from K–12 to their future careers.

I wanted students to become so comfortable with questions that it became a natural extension of what they knew. To achieve this, I thought we might need 30 questions, to which Wolfram said, how about as many as you like?"

— Jeremy Kwok
Director of Technology
Australian Christian College

Templates were set up to be quick to write and deploy. Staff would be able to write text content, leaving “placeholders” for any parameter values they wished to randomize, then the Wolfram System would take care of the rest.

To make question writing as easy as possible for anyone not familiar with Wolfram Language syntax, the Wolfram team set up an integrated “code converter” window built using Wolfram|Alpha. This enabled staff to make natural language queries (with access to the entire Wolfram Knowledgebase) from within the notebook environment.



Endless practice

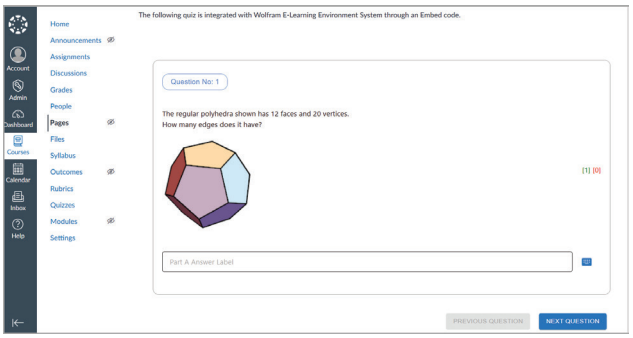
In addition to the customizable template questions, ACC was given access to the Wolfram Problem Generator, a tool that produces randomized practice questions on the fly, covering algebra, calculus, statistics, number theory and more.

This let ACC automatically generate an unlimited number of beginner, intermediate and advanced math questions at the press of a button.

Richer content

Bringing this all together was Wolfram’s e-Learning Environment (WeLE), which served as a temporary “bank” for generated question content. By setting up Learning Tools Interoperability (LTI) integration between WeLE and Canvas, the Wolfram team was able to insert these questions directly into the Canvas environment through the use of iframes. This allowed for more varied subject matter, such as tables, diagrams and images.

Furthermore, this integration kept students in an environment with which they were familiar, with no need for them to learn how to use a secondary application to do their math homework.



Hybrid compatibility

With the new question platform assimilated into Canvas, it was able to function seamlessly for in-class and remote students alike.

Since content could be controlled in-house, ACC was not at the whim of a third-party provider and could be completely flexible about what content they wanted to push and when.

ACHIEVEMENTS

Unlimited New Content

Since utilizing the Wolfram e-Learning Environment, the ACC online learning platform has gone from just 3 to 15 fixed questions per module to an unlimited number of custom questions. Content is no longer restricted by a third-party provider, but can be fine-tuned with Wolfram Language.

Thanks to the Wolfram|Alpha Problem Generator, students can practice on auto-generated questions with randomized parameters, ranging from basic arithmetic to advanced calculus and spanning three levels of difficulty.

Built-in Access to Computable Knowledge

With direct access to Wolfram|Alpha, ACC staff have been able to perform calculations and access information quickly without leaving the question-writing environment—all with natural language input. This has given them access to over 30 years' worth of curated data—10 trillion data points—from both a traditional mathematical setting and related areas of interest, such as science, technology and engineering.

Smooth Hybrid Learning

Thanks to a seamless integration of Wolfram technology into ACC's Canvas environment, the new question platform works well for all learning types without interruption. Whether a student is learning in-person from the classroom or a distance learner catching up from another time zone, the question platform is able to accommodate.

"ACC is dedicated to providing their students with the highest quality of educational content and learning facilities, using Canvas as a delivery method for course material, explanatory videos, exercises and tests. They wanted the ability to create their own mathematical questions and feed them into their Canvas-based system directly.

Wolfram Notebooks, which come with palettes for typesetting mathematical expressions, made the question-writing process quick and easy. On top of this, the Wolfram e-Learning Environment provided the perfect setting for storing questions before they were deployed to students."

—Danny Finn
Senior Applications Developer
Wolfram Research

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