CASE STUDY

HowCloud: Round-the-Clock Maths Support

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Among the challenges facing our students when they seek help with the mathematics or statistics in their degree courses are finding the confidence to come through the door and finding the time to visit while a question is fresh in their mind. At Coventry University, we have piloted a scheme that aims to help such students over these obstacles by offering an alternative to the face-to-face tutoring we provide on a daily basis in our drop-in centre.
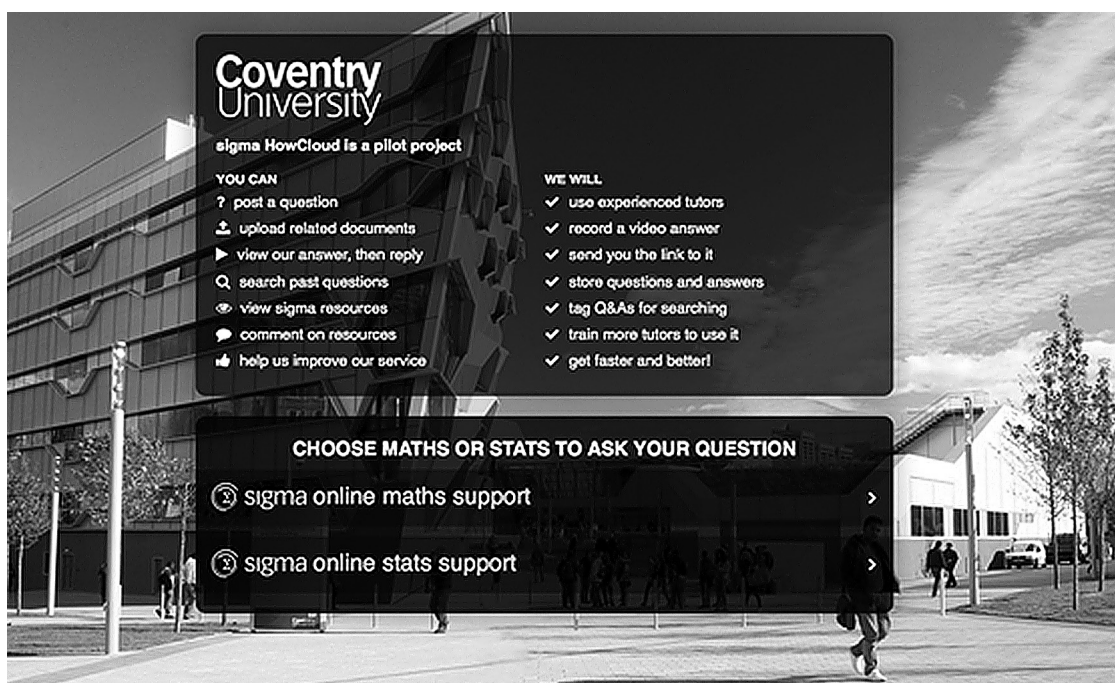

Figure 1. Screen-shot of the HowCloud opening page, customized for Coventry University

HowCloud is a browser-based platform that offers students support with maths and stats off-campus and out-of-hours. A student submits a question from their computer, tablet or mobile phone. A member of Coventry's maths & stats support team is alerted and posts an online reply.

On the opening page (see Figure 1), students are offered two links, one for Mathematics support and another for Statistics support. The first time first they log on to the service students are asked to register with their name and email address and to agree to a code of conduct (see below).

After choosing between maths and stats, they are next invited to post a question or search the resource bank of previously answered questions. If they choose to post a question, they are presented with the window shown in Figure 2.

Figure 2. The window for posting questions

Questions can be typed into a text box in the browser window alongside, or separate from, an uploaded PDF, which might be a screen-grab or a scanned document.

The question window also has WYSIWYG formatting with a LaTeX option for displaying mathematical expressions.

The answers can be posted in various formats:

- as a short video of the tutor seen writing a whiteboard with voice over;
- as a typeset or handwritten static web page;
- as a static PDF to be viewed in the browser or downloaded.

To create a video, the tutor writes on a standard graphics tablet and wears a microphone headset.

The platform is the brainchild of Joseph Ros. He began its development while he was studying for an economics degree at the University of Warwick and, with some help from his contemporaries, he used it to support students in Coventry schools revising for their GCSE maths exams. Although it is several years since he graduated and left Warwick, the service has been continued by current students. Each year the questions keep coming and the answers are enthusiastically pored over by the students as the exam period approaches. Since then the platform has matured and diversified. For instance, it is now used to deliver live interactive mathematics tutorials worldwide.

We heard about HowCloud through various contacts, including *Mathematics in Education and Industry* (MEI), http://www.mei.org.uk, who used it as part of their distance-learning programme. Meanwhile, our University Library (where we in Coventry's maths/stats support team, known as **sigma,** live) had removed all the books from the top floor to make way for a new venture called the *Disruptive Media Learning Laboratory* (DMLL). Keen to encourage innovation in teaching and learning and get off to a flying start, the DMLL gave us a modest grant to try out HowCloud. As a result, since January 2015 our students have been able to fire off their questions about maths and stats at any time of the day or night from anywhere with an internet connection.

What the platform offers

When a student posts a question, it appears on the main page as shown in Figure 3.
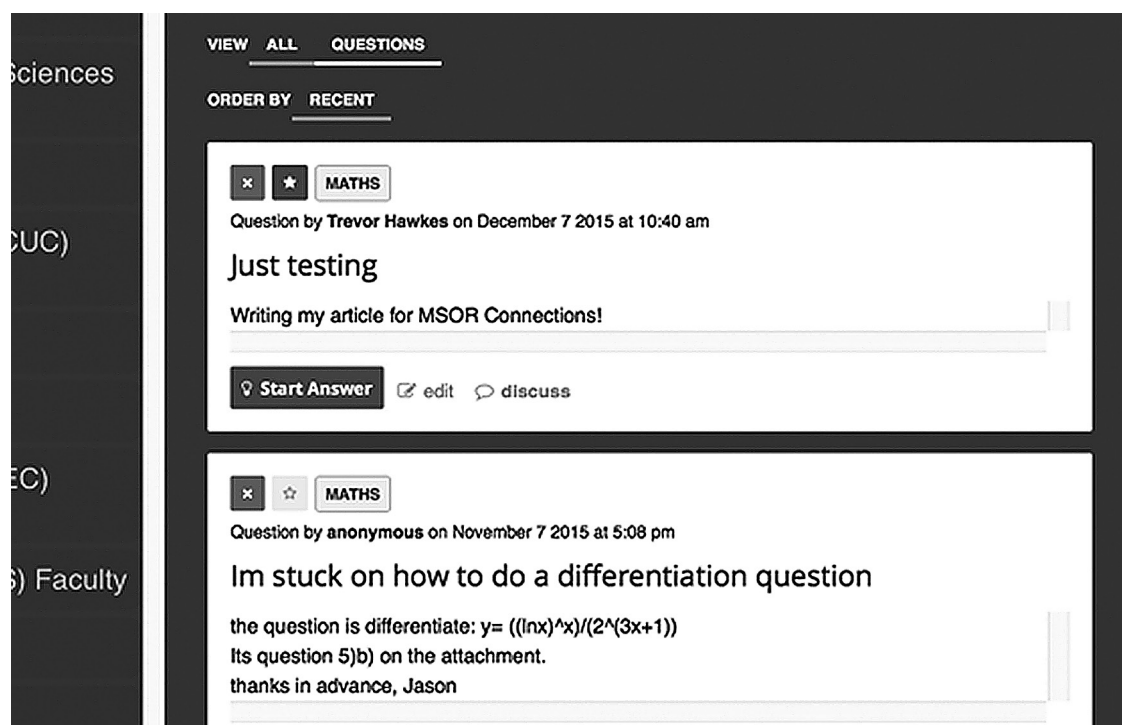
Figure 3. Recently-posted questions can be seen by all users

At the same time, an email alert containing the question is sent to the members of staff who are tasked with providing the answers. At Coventry we have currently nominated one person to handle the maths questions and another to coordinate answers to the statistics ones. In principle they will farm out the questions to the most appropriate tutor to post an answer, but in practice the traffic so far has been small enough for them to respond to all the questions themselves without calling in colleagues to help. Like Amazon Prime, we have aimed for a next-day delivery if a question cannot be answered at once, and for the maths questions at least we have mostly met this target.

There are various options for creating a post to answer a question.

- The quickest and simplest way is to write out the answer by hand, scan it as a PDF file and upload it to the answer box (see Figure 4 below). This is useful if you have little time and want to give the student an answer as soon as possible. It is perhaps the least effective method, depending on the detail provided in the answer.
- If you have more time, can type fast and are a fluent LaTeXnician, you can write your answer in elegantly formatted mathematical text using HowCloud's WYSIWYG window – again, it's less personal but can turn out to be more reliable and legible than a shaky hand.
- The voice-over video is perhaps the most user-friendly medium for your answer. Listening to someone explaining things as they write is, for most students, a more comfortable and effective way to learn. Two of the five senses are engaged and students can always replay a section if it goes by too fast.

5. **(Optional exercises)**: Differentiate the following

    (a) $\cos^2 x + \cos^2 y = \cos(2x + 2y)$;

    (b) $y = \dfrac{(\ln x)^x}{2^{3x+1}}$;

    (c) $y = \dfrac{6}{(2+t)^3 (1-t)^4 \cos^3 t}$;

    (d) Find an expression for $\dfrac{dy}{dx}$ if $xy^2 - x^2 y = 1$.

    (e) Find and classify the stationary points of
$$f(x) = 5x^6 + 6x^5 - 15x^4 + 50.$$

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◉ **Start Answer** ☑ edit 💬 4 responses discuss

❌ Answer by Aiping Xu on November 12 2015 at 3:33 pm

First differentiate the numerate $u = (\ln x)^x$ by taking logarithms

$$u = (\ln x)^x$$

$$\ln u = \ln\left((\ln x)^x\right) = x \cdot \ln(\ln x)$$

$$\frac{1}{u}\frac{du}{dx} = \ln(\ln x) + \frac{x}{\ln x}\cdot\frac{1}{x}$$

$$\frac{du}{dx} = (\ln x)^x \left(\ln(\ln x) + \frac{1}{\ln x}\right)$$

Figure 4. A question with a hand-written answer

Furthermore, if a student still doesn't understand, a thread of questions can be created with further answers provided, all linked to the original question. Indeed, the interface prompts the student by asking: "Still unsure? Post a follow-up".

To create the video, you will need a microphone and a tablet with a stylus (an outlay of around £40 for reliable equipment). If you have not used a tablet before, it may take some perseverance to learn to write legibly and at a suitable scale for the screen. Once you have plugged these devices into your laptop, found a quiet space to work where you won't be interrupted, and decided how to present your answer, it typically takes from 10-30 minutes to write, review and post a 5-10 minute clip online; you may like to upload some auxiliary material or even to prepare part of the answer ahead of recording and fill in in the missing bits of the argument as you talk – this acts as a prompt to your train of thought. The software allows you to pause and continue the recording, and if you are unhappy with part of it, you can go back and re-record over it.

The questions and answers are saved and can either be deleted or moved to the archive to be searched and re-used later. As the store of answers grows, more of the questions can be

answered with a reference to past posts. We are still working on ways to organise the archive and to prime the search engine to present helpful results. We strongly encourage students to search the previously-answered questions before posting one of their own.

The HowCloud server is strong on analytics and, with further growth in usage, knowledge of the detailed habits of our clients, such as their degree programmes, their locations, times of posting, and the devices they are use, will help us to tailor our service better to their needs.

We also have a code of conduct that students agree to when they register. If they post inappropriate questions or a question that is direct from coursework, then they are warned that they might face disciplinary action from the University. This adds some security to our service and reduces the risk of us providing answers to questions that contribute directly to degree credit.

Future Plans

Although we began the HowCloud experiment at Coventry at the beginning of 2015, it took time to bed down and for students to get into the habit. We relaunched it in October, and have had a better response, although perhaps still not enough to justify the investment; nevertheless, we are enthusiastic about its potential and intend to continue our subscription for the rest of this 2015-16 academic year.

As part of our ongoing commitment to improve and increase our services, including HowCloud, we also intend to use the live version of the site to offer maths support to our secondary campuses in London and Scarborough. Students will be able to come at a set time and get maths support from our tutors in Coventry using the live HowCloud interface.

Joe Ros is committed to maintaining and developing the version we use, at the same time diversifying the product in the direction of live online tutorials for secondary-level mathematics students. We are currently working with him on further improvements for the benefit of the UK maths support community. If you would like to find out more, please contact us via our emails listed above.