The University of Edinburgh
Principal's Teaching Award Scheme

Project Final Report

A curly arrows app for Chemistry?

Team members:
Dr Alison Hulme, Dr Peter Kirsop, Professor Stephen Gilmore

This report outlines the outcomes of our PTAS-funded study on the development of an app for use to support first year teaching of organic chemistry, specifically in the initial instance to support the organic chemistry taught in classes Chemistry 1A and Chemistry 1B. There are two major conclusions from this project: firstly that a fully functional app would be warmly received by the students and could prove educationally beneficial; secondly that the resource investment needed to develop such an app is far beyond that provided through the PTAS fund.
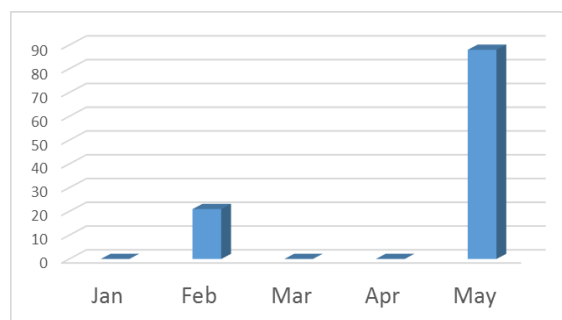

Figure 1. (a) Feedback from usage in class in S1 2014-15. (b) App usage during S2 2014-15.

In this PTAS project we co-created a new app to support first year teaching of the use of curly arrows, a fundamental skill which is essential for thinking and practising like a chemist. Two undergraduate students (Sarah Piggott, a 3rd year chemist on the MChem Chemistry with Materials Chemistry with a Year Abroad programme; and Martin Dimitrov a 3rd year informatics student on the BSc Computer Science programme) were selected from applicants to work on the project over the summer of 2014. These students brought their own skill-sets to the project, Sarah having previous experience of both Public Engagement work and blogging with the School of Chemistry, and Martin having completed the "Software Engineering Large Practical: Android Development" Informatics course.

The app covered two aspects of the first year course, electrophilic addition to alkenes and alkynes, and nucleophilic substitution reactions. In addition a sorting challenge was developed which gave students practice at recognising and distinguishing between nucleophiles and electrophiles, a skill which is required for successful mechanism writing using curly arrows. The app was introduced to the class in S1 2014-15, during a lecture slot with postgraduate demonstrators on hand. Instant feedback for the session was collected on post-its and collated as a word-cloud (Figure 1a). Particularly notable was the increased uptake of the associated exam question in the Chemistry 1A exam at the end of the semester. In S2 2014-15 students were allowed to use the app alongside their studies (without prompting) and take-up was monitored via website statistics (Figure 1b). Of note is the increase in usage in the week up to the Chemistry 1B exam, suggesting it enabled revision.

Outputs
Presentations and Workshops

School	Detail	
First year tutors (academic and postgraduate)	Tutors used the app within the framework of 1st year tutorials	2014-15
University		
PTAS conference	Short presentation	Jun 2015

Undergraduate project

Martin Dimitrov took the experience he gained from the curly arrows app project and used it as inspiration for his final year BSc Hons undergraduate project, in which he chose to develop a scoring/gaming element for the app. A gaming approach to learning had been discussed during the development of the app over the summer of 2014, but there was not sufficient time to explore its possible implementation.

Curriculum Redesign

Perhaps the most significant educational output of the curly arrows app project has been the complete overhaul of the organic chemistry material taught within the Chemistry 1A/B first year courses for 2015-16. By focusing attention on the use of curly arrows we were able to highlight that this is the most important skill students need to acquire and should shape how we teach the first year material.

Future
We have not been able to implement, or disseminate, the usage of the curly arrows app more widely because it is simply not fit-for-purpose as yet. The first year students repeatedly complained that it did not work well on mobile phones and iPads. That said, they were overwhelming positive about the instant feedback which the app gave and how it helped them to learn. We were limited by the coding skills and experience of the undergraduate student and would not recommend this as a route for future development. If the University is to explore this kind of approach in more depth it would require the appointment of full-time, qualified staff in IS who have experience in app development. We are working with the recently appointed Reader in Chemistry Education, Dr Michael Seery, to explore how we can best proceed with future development.