Review a legacy resource: industrial problem solving for higher education

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In 2011-12, the Mathematical Sciences HE Curriculum Innovation Project (which I coordinated), part of the National HE STEM Programme, funded a project 'Industrial Problem Solving for Higher Education' (IPSHE), described in an article by Benjamin, et al. (2012). This built on the approach taken by the Department of Engineering Mathematics at University of Bristol – a "long-standing teaching methodology that emphasises experience with real research problems in every year of undergraduate education to develop transferrable skills in addition to technical ones" (p. 23). The key output from this project was a wiki hosted by Bristol containing information on the teaching methodology and a collection of problems suitable for different undergraduate levels. The aim was to "lower the bar for other institutions to adopt a similar teaching methodology" (p. 23). This wiki is still available via https://wikis.bris.ac.uk/display/ipshe/Home.

Projects are grouped into 'introductory', 'intermediate' and 'advanced', "intended to correspond loosely to the first, second and third years of UK mathematics undergraduate study" (p. 24). There are 15 introductory, 23 intermediate and 20 advanced project briefs. Project briefs contain background information and materials sufficient to explain the project, along with indication of required prerequisites, hints and suggestions for how the project could be extended.

Some sample project briefs, chosen somewhat arbitrarily but with an eye on demonstrating the range of topics available:

- Car parking – "How can you arrange to park for 100 cars in a farmer's field so that as little grassland is driven over as possible?" (introductory);
- Home Decorating – "You are called in by a decorating shop who want to publish a table to show their customers how many rolls of wallpaper they will need to paper their room" (introductory);
- Automatic disease diagnosis – "Students are asked to perform the role of a consultant assisting the department of health, using data to automatically diagnose diabetes on the basis of a number of measured attributes" (intermediate);
- Bolton Satellite Systems – "Students are asked to analyse a control system to stabilise the orbit of a satellite" (intermediate);
- Customer Solutions – "Students are asked to perform the role of a consultant investigating the possibility of an automatic customer direction system for supermarket self-service checkouts" (intermediate);
- London Tube – "Can you identify potential inefficiencies and vulnerabilities in the London Underground network, from the data provided?" (intermediate);
- Search strategies – "In this problem students are asked to explore the efficiency of stochastic search strategies for an autonomous explorer vehicle" (intermediate);

- Automatic Music Classification – “Students are asked to work with raw audio signals and to develop techniques for distinguishing types/genres of music using machine learning” (advanced);

- Disease Spread on a Network – “Students are asked to consider the relationship between social networks and the spread of contagious diseases” (advanced);

- Perception-based Decision Making – “Students are asked to consider the way in which humans make judgements based on previous experience” (advanced).

I believe this archive of material can provide useful inspiration to anyone looking for topics for student activities in a project-based mathematical modelling module.

References

Benjamin, O., Homer, M., Lawry, J. and Rossiter, J., 2012. Industrial Problem Solving for Higher Education Mathematics. In: J. Waldock and P. Rowlett, eds., *Employer Engagement in Undergraduate Mathematics*. Birmingham: MSOR Network. pp. 23-25. Available at: http://www.mathcentre.ac.uk/resources/uploaded/EmployerEngagement.pdf [Accessed 27 March 2018].