In 2011 sigma-sw made a successful bid to the HE STEM programme to pilot a summer intern programme for students across the region. Four students took advantage of the programme, based at the Universities of Bath, Cardiff, Exeter and Plymouth. An article in the previous edition of Connections [1] described the intern programme. The following are reflections from participating students.

References


Using Simul8 to Simulate a Mathematics Support Centre

Matthew Taylor, Cardiff University

This past summer I spent eight weeks working with Cardiff University School of Mathematics undertaking a research project measuring the efficiency of Mathematics Support Centres. This was achieved by using computer simulation to model a Mathematics Support Centre and observe various performance parameters such as: ‘time spent in the centre’, ‘average queuing time’ and ‘the number of students who successfully exit the system having received a desired amount of support’. A subsidiary aim of the project was to produce a user-friendly online resource, which could be
used by tutors involved in running a Maths Support Centre or interested in setting up such a service. The idea was that a tutor could access various simulation models, input any data or predicted data they may have relating to student arrival rates, number of tutors available and mean consultation times. The tutor would then be presented with an accurate estimation of how efficiently a particular model would suit their needs.

My first few days working on the project largely involved studying existing research in this area. I found that the majority of previous studies into the effectiveness of Mathematics Support Centres were student-centric, focussing on what impact the centre had on a student’s learning and confidence. This project aimed to shift the focus of study towards the Centre and how it operates, working under the rationale that a highly effective Centre must also be highly efficient. As such, learning impact was not directly taken into consideration.

The software package chosen for this project, Simul8, processes systems using discrete simulation, making it a useful tool for modelling real-life systems. It possesses many advantages for this kind of research, providing hard output data to back-up any conclusions and allow for real-life limiting factors such as failure rates and capacities.

The experiment itself was conducted in three stages. Firstly the conceptual model had to be constructed, making sure that the underlying algorithm captured the fundamental features of a Mathematics Support Centre. It was then important to scrutinize the validity of the model, in order to determine if the simulation was an accurate representation of the real-life system. Finally the output data collected over a suitably large number of trials could be analysed and its significance with regards to efficiency assessed.

The majority of trials were based upon the model used by Cardiff University, as accurate and appropriate data was readily available to me over the summer. One interesting result showed that increasing the number of tutors to three or four, whilst producing expected results such as lower queuing times, actually increased the maximum time spent in the system on average. This may be due to students who wish to consult three or more times with a tutor being able to receive an extra consultation and then leave the system successfully within the set time limit.

Another interesting result from the simulations was the benefit of providing separate support in statistics or in other problem areas. This result was obtained using purely hypothetical input data and so holds no real validity but I feel it would be an interesting area to explore further, if accurate data could be collected.

Finally, the research demonstrated the benefits of separate rooms to deal with problems such as flooding, whereby a large group of students turn up together, perhaps the day before an assessed homework is due, all with the same problem. As many batch students will have the same questions, it was also found that it was possible to encourage discussion and promote independent learning with minimal, negative effect on the efficiency, through the imposition of a minimum queuing time.

The simulation models have been made available via the YouSimul8 website [1]. The website does not require any simulation software to be installed and so can be accessed by anyone with an up-to-date web browser.

The project provided some very valuable insight into the efficiency of Mathematics Support Centres but in order to further the research it is vital that more rigorous data is collected and recorded universally among other universities. Essential to running a simulation of this kind is information on length of visit, what topic the student wishes to receive support with, the number of times a student consults with the tutor and the length of each consultation.

More dialogue between universities will also allow for more accurate models to be developed of existing Mathematics Support Centres at other institutions of higher education.

I thoroughly enjoyed my work on the project, as it allowed me to experience what mathematical research is like on a day-to-day basis, it allowed me to explore a practical application of my mathematical knowledge and also allowed me to network with other students on similar programmes across the United Kingdom. I feel my confidence in my ability to work independently and trust my own instincts and judgements has also benefited greatly from participating in this research project. As an added bonus, I found the CETL-MSOR conference a great insight into how the teaching of Mathematics at undergraduate level can move forward.

References


Creating a community of practice for Maths and Stats support staff and an online resource for students

Ollie Bond, University of Exeter

My project involved investigating the online presence of mathematics and statistics support. A very common problem encountered by many mathematics students is that a lot of online mathematics resources are not pitched at the right level for them, and the good resources are somewhat scattered across the internet and not all in one place. My project aimed to help eradicate this problem, and I expressed interest in it as I have experience of providing online resources for other students on my course.

In order to get the project started, I had several meetings with Dr Barrie Cooper (my supervisor) regarding the steps to take with the project and to review my progress frequently. We both shared ideas on how to contribute to the main page and what sorts of tasks should be carried
out. We also communicated with each other through email, and a blog was set up for me to update my progress, which can be accessed at http://blogs.exeter.ac.uk/sigma/. Barrie registered for an area on the Open University’s LabSpace (http://labspace.open.ac.uk) on which all the content would be delivered. I was given administrative rights to this area and this meant that I was free to experiment with different VLE (Virtual Learning Environment) components.

Finding the online resources involved looking at syllabi for the first year Exeter mathematics course and exhaustively finding resources that would cover them. Some entries span more than one topic, and some of them come from the same resource website (e.g. mathcentre, or Wolfram MathWorld). There was a lot of searching Google and YouTube involved with this part of the project, and my objective was to look through the entries that came up and to selectively choose resources which I felt were of at least a reasonable quality.

Outputs: Firstly, the main page can be accessed at http://tinyurl.com/sigmaproject. This contains numerous links and graphics. One main aspect of the project was collating a number of online resources spanning a typical first year course, including topics such as complex numbers, linear algebra, calculus, probability and an introduction to statistics. Over 200 resources were collected by me in the end, although I had to look through many more than that in order to determine which resources were suitable for students. These were then put in an online database, which includes categorised topics, a search facility, and my opinions on the navigability, effectiveness and presentation of all the resources. I gave each resource a score out of 5 for each of these criteria.

Another major output was the mathematical wiki, to which students can freely contribute after registering for free on the website. The complex numbers section has a fair number of resources, including clear LaTeX typeset derivations, a highly readable ‘start-to-finish’ style, and also several GeoGebra applets where students can play with the mathematics. This is yet to be fully implemented on the other pages, but contributions from other students at the University of Exeter will soon be encouraged.

Among other aspects was a survey which was sent out to a very large number of students, in order to pinpoint some excellent resources. The main recommendation from students was Wolfram Alpha. Also, a forum was added to the LabSpace area in order for students to discuss non-assessed mathematical problems.

When more people are made aware of our LabSpace area and what it contains, contribution from students and staff can be encouraged. This will help to increase the awareness of the website, meaning that the repository of online resources can be expanded by incoming and current students and staff, and the discussion and overall interactivity on the website can be made much more hands-on.

I benefited a lot from this project and I am very glad I participated. I gained a greater appreciation of academic research and what working from home involves, whilst my teamwork and organisational skills were enhanced. As a group we were able to set up meetings to collaboratively get work done, and we actively shared a lot of ideas.

What do drop-in usage statistics tell us?

Callum Anderson, Plymouth University

The project entitled “What Do Drop-In Usage Statistics Tell Us?” was focused on examining the data collected by various institutions regarding their respective mathematical and statistical drop-in centres. It built on the work already done at University of Limerick by Olivia Gill and John O’Donoghue [1] and of Dónal Dowling and Brien Nolan for Dublin City University [2]. The aims of the project were:

- To investigate the usage of mathematics support in (a very small number of) universities, to compare and contrast the patterns at different institutions and to identify particular features that could be introduced at University of Plymouth.
- To conduct suitable exploratory statistical analyses on these data
- To present the work at a national conference.

The project began after an initial briefing meeting with my supervisor, Dr David Graham, where he gave me the report cards from the University of Plymouth drop-in centre, SUM:UP (Support for Undergraduate Mathematics at the University of Plymouth). The first step of my project was to input these data into a spreadsheet which resulted in a comprehensive database of drop-in centre usage statistics SUM:UP. During this period of the project I attended the first meeting of the students and supervisors participating in this sigma-SW scheme where I presented the progress that I had made so far on my project. I compiled the data from the 2010/11 academic year along with some basic summary statistics. Feedback on my work was positive and encouraging and included some ideas of where to look next and aspects of drop-in centres that other institutions would find interesting to investigate and to compare with data that they had. Also at this initial meeting I asked if the other institutions would consent to sharing some of their drop-in centre data to further the project. The universities from Bath, Cardiff and the West of England consented to my request and supplied me with data via email over the next couple of weeks.

Initially I compiled and investigated the data from Plymouth for three academic years (2008/09, 2009/10 and 2010/11). The next step was to start looking in greater detail at both the Plymouth data and that sent to me from the other universities and to compare the findings. This process was helped by two further meetings with the other students participating in the sigma-SW internship scheme.

1. [1]
2. [2]
in which further feedback and discussion was shared by the four of us.

Two of the most interesting findings concerned repeat visits and the correlation between coursework deadlines and drop-in centre attendance.

<table>
<thead>
<tr>
<th>Autumn 2008 – Summer 2011</th>
<th>Autumn 2009 – Summer 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plymouth</strong></td>
<td><strong>Cardiff</strong></td>
</tr>
<tr>
<td>3600 Visits</td>
<td>2215 Visits</td>
</tr>
<tr>
<td>1126 Different Students</td>
<td>490 Different Students</td>
</tr>
<tr>
<td>3.20 Visits per student on average</td>
<td>4.52 Visits per student on average</td>
</tr>
<tr>
<td><strong>Bath</strong></td>
<td><strong>UWE</strong></td>
</tr>
<tr>
<td>2624 Visits</td>
<td>309 Visits</td>
</tr>
<tr>
<td>580 Different Students</td>
<td>173 Different Students</td>
</tr>
<tr>
<td>4.52 Visits per student on average</td>
<td>1.79 Visits per student on average</td>
</tr>
</tbody>
</table>

Table 1 – Details about the number of repeat visits from the four institutions

Table 1 illustrates the details of the number of repeat visitors from each of the four institutions and the number of visits each visiting student makes on average. It is worth noting that at Plymouth roughly, the top 100 users account for around 50% of the visits, hence 10% of the students who use the service account for 50% of the visits.

![Graph of the number of visits from a particularly popular module and when the coursework was set for this module, denoted by red circles](image)

Fig 1 – Graph of the number of visits from a particularly popular module and when the coursework was set for this module, denoted by red circles

Fig 1 demonstrates the correlation between coursework deadlines and SUM:UP attendance figures during Autumn 2010. Please note that there is a disclaimer in the SUM:UP centre stating that it should not be used for coursework questions directly, but questions may be indirectly asked; tutors are not answering students’ coursework questions.

Finally after fully exploring the data from the University of Plymouth and comparing this with the data from three other universities the findings were written into a report and presented at the CETL-MSOR Conference 2011.

There are a few of key areas in which this project could be developed and further investigated. First, there should be common data set collected by all universities about their particular drop-in centre, this would allow for a much more complete and in-depth comparison between institutions to be accomplished since one of the main areas in difficulty in this project was comparing the data from multiple universities. Secondly, it would be worth investigating what type of student uses the drop-in centres; is it the high achievers looking to ascertain the maximum possible grade or is it struggling students trying to understand and retain subject knowledge? Thirdly, a more extensive exploration into the effect of drop-in centres on students’ performance in their subject would be valuable. Finally, it would be worth having a student survey (potentially nationwide involving as many universities who wish to participate) on how effective their drop-in centres are.

I have thoroughly enjoyed working on this project and feel that I have gained a great deal from it. It has been a first and brief introduction into academic research and into working within a network of institutes. It has also increased my abilities to work independently and as part of a team, provide feedback on the work of others, write reports and meet self-set deadlines. Overall it has been a very valuable experience and I would strongly advise students to take a similar opportunity if it is presented to them.

References

Helping students learn how to learn mathematics
Andrew Kennedy, University of Bath

There has been much research into learning styles ([1] – [3]) and a number of websites have translated this into advice for students on how to learn ([4], [5]). There are also many other websites offering study advice to students, but few designed to help students think about how they should learn mathematics. The aim of this project was therefore to use learning styles to encourage students to think about how they learn, and to provide practical advice and examples of how they can incorporate new and varied techniques into their individual learning.

The project uses two types of learning styles, learning modes and thinking styles, to help students understand how they approach learning. Each has its own section in a microsite, accessed from the Bath MASH webpage, with a description of each learner category in the section, an online test to encourage students to think about how they prefer to learn in various scenarios and an advice
which questions are good indicators of preferred learning mode and which will need to be refined to make the test less biased.

I have really enjoyed being involved in this project. Not only have I found out more about how I learn, but I have had a chance to develop my skills in a way which will hopefully aid other students in their learning. Throughout the project the staff and students from the four universities have provided valuable input which has helped shape the structure of the final site. Special thanks are due to my supervisor, Dr Jane White, and to Dr Emma Cliffe of the University of Bath, whose support and advice made the project possible.

References


The first aim in the future is to expand the range of examples available on the microsite. Currently the examples given all relate to convergence of sequences. This suits mathematics students at Bath who meet this topic in the first couple of weeks; adding examples from other subjects will allow students from other disciplines to make better use of the site. The other aim is to capture data from the website on the answers given in the tests. Particularly for the learning modes questionnaire it will be important to see...