

Eabhnat Ní Fhloinn

The use of technology in mathematics support: an overview of the 4th Irish Workshop on Mathematics Learning and Support Centres

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This article provides an overview of the 4th Irish Workshop on Mathematics Learning and Support Centres which was organised by the Irish Mathematics Support Network and took place in Dublin City University in December 2009. The workshop focused on the use of technology in mathematics support with speakers reviewing a wide range of different approaches and also addressing core issues such as the relative value of computer-assisted learning and the optimum manner in which to integrate technology into teaching. A brief review of each presentation is given, highlighting key points raised.

Irish Mathematics Support Network

In February 2009, an open meeting of those involved in mathematics support and research in mathematics education in Ireland took place in the National University of Ireland Maynooth, with a view to discussing the formation of a national mathematics support network. A representative from **sigma** attended the meeting to provide information about current networks operating in the U.K. As a result, the Irish Mathematics Support Network was founded, with the aim of facilitating easier communication within the community and allowing for greater collaboration and joint research opportunities. A committee of six people was elected for a two-year period and a designated email address (irishmathsupport@gmail.com) and mailing list have been set up. The Irish Mathematics Support Network is supported by **sigma**, NCE-MSTL (National Centre for Excellence in Mathematics and Science Teaching and Learning), NDLR (National Digital Learning Repository) and AISHE (All-Ireland Society for Higher Education). The network assumed responsibility for the organisation of the annual conference, known as the Irish Workshop on Mathematics Learning and Support Centres, which was hitherto organised on a more informal basis.

Irish Workshop on Mathematics Learning and Support Centres

The Irish Workshop on Mathematics Learning and Support Centres is an annual event, taking place in December of each year. The first workshop took place in 2006 in Dublin Institute of Technology, and since then, it has been hosted by the University of Limerick and by the National University of Ireland, Maynooth, before coming to Dublin City University this year. The aim of the workshop is to provide a forum for discussion and analysis of the most pertinent issues in mathematics support in higher education. It is a one-day event with little or no registration fee in order to make it accessible to as many people as possible. Full details of this year's workshop, along with presentation abstracts and slides are available at [1].

Workshop theme

The theme of the workshop was “*The Use of Technology in Mathematics Support*”. Previous workshops had dealt with recent developments in the field of mathematics support as well as the effectiveness of such support [2], so it was felt that a workshop focused on technology would be well received. This proved to be the case with this year’s workshop attracting the largest number of abstracts and participants to date, with ten presentations and over sixty attendees on the day.

For mathematics support centres, or other support initiatives, funding is often critically low and hardware or software options often come with a considerable cost attached. Therefore, it is of particular benefit to ascertain how suitable other centres found various technologies, or to learn about open-source software or freely-available resources. This workshop also provided a platform for those developing such resources to report on progress made to date and ask for suggestions from the mathematics support community as to how to improve existing software to better suit their needs. We now briefly review the key points from each presentation.

Keynote talk

Martin Greenhow, Brunel University

“Setting online questions in maths (and beyond); issues of pedagogy and technology.”

The keynote presentation focused on the important issue of using technology for online learning and assessment purposes. Specific details were given about the Mathletics package [3] developed by the speaker, which consists of computer-aided assessment questions authored using QM Perception. The speaker, drawing on his considerable experience in this field, emphasised the importance of correctly structuring questions so as to maximise the learning involved. For example, embedding meaningful feedback within each multiple-choice question is strongly encouraged, so that the student can experience such quizzes as interactive learning processes and be made aware of particular errors they have made while they are attempting the quiz. Interestingly, certain students appeared to deliberately give the wrong solution so that they could read the feedback provided. The speaker also addressed various ways of marking multiple-choice quizzes, such as attaching weightings to the marks involved, based on how confident the students profess themselves to be in their responses. He discussed the benefits of getting students to set questions, allowing them to set the context to suit their own situation and highlighted the importance of getting students to discuss the problems. Finally, he provided an initial analysis of exam grades noting that students who were exposed to CAL achieved a 5% better grade on average than those who had not used CAL.

Contributed talks

Shazia Ahmed & Lorna Love, University of Glasgow,

“Personalised Learning through Innovative Use of Technology.”

In the University of Glasgow, two posts have recently been created with the aim of improving retention: a Maths Advisor and a Study Support Co-ordinator. On entry, students take a compulsory, zero-credit Maths Skills Test, which aims to identify gaps in their knowledge. Subsequently, they can avail of support in the form of one-to-one help through the Student Learning Service or peer-assisted learning sessions. The virtual learning environment, Moodle, along with mobile technology, is used as a more personalised form of supporting students, with students able to book appointments directly via Moodle and being reminded of these appointments via text to their phones. They also highlighted the benefits of an introductory lecture which addresses the biggest fears and challenges for first year students and having 2nd and 3rd year students present to answer queries.

David Doyle, Institute of Technology, Sligo

“Using Technology to Increase Active Engagement with First Year Maths.”

This speaker concentrated on the use of Moodle with a group of first year science students, focusing particularly on a series of online quizzes which aimed to increase student participation and engagement with the material. A number of marking approaches were tried with different cohorts: initially, the quizzes were used as formative assessment only, with no marks assigned, but this attracted few attempts by students; subsequently, students were awarded marks once they achieved 80-100% but most attempts were made around exam time; finally, students had to score 100% in each quiz within two weeks of lectures finishing in order to obtain continuous assessment marks and this resulted in greater participation, more attempts per quiz and an improved attitude in students towards the quizzes.

Leslie Fletcher, Liverpool John Moore’s University, Sue Milne, ELandWeb Ltd, Shazia Ahmed, Glasgow University and Paul Neve, Kingston University

“The FETLAR Project – Open Educational Resources and E-Assessment Tools for Mathematics.”

The FETLAR project (Finding Electronic Teaching, Learning and Assessment Resources) [4] is a UK Higher Education Mathematics community project, jointly funded by the Higher Education Academy (HEA) and the Joint Information and Systems Committee (JISC) under the Open Education Resources Programme, and managed by the MSOR Network.

It aims to “collect, create and collate” e-learning resources to help students improve their mathematical skills. Currently, FETLAR has built upon a number of existing projects, such as QTItools, MathAssess and STACK in order to deliver dynamic assessments as part of their content. A brief demonstration of their resources was given by the speaker.

Noel Gorman, Martin Marjoram, Donal Healy, Ciarán O’Sullivan and Paul Robinson, Institute of Technology, Tallaght, Dublin

“The Use of Technology in Mathematics Support – Approaches Used and Lessons Learnt at ITT Dublin.”

Four different approaches to mathematics support using technology were addressed in this talk: namely the use of CALMAT for tutorial support; Moodle-based “Key Skills Testing” in mathematics; the use of MapleTA for learning, testing and assessment; and the use of an e-book [5] as a blended learning solution for mathematics revision for pre-entry potential mature students. It was found that the use of technology can promote active learning in mathematics; that the effectiveness of the technology used depended on the profile (age, motivation) of the students involved; and that suitable cognitive scaffolding must be provided to assist students to reflect appropriately while using technology to enhance learning.

Paddy Johnson and Tim Brophy, National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL), University of Limerick

“An Introduction to the Dynamic Mathematics Software GeoGebra.”

During this hour-long presentation, participants were given a step-by-step guide to creating applets using the free dynamic mathematics software package GeoGebra [6], which was developed by Markus Hohenwarter in 2001. Having demonstrated several existing applets from the NCE-MSTL website, the main features of the package were introduced and a number of useful shortcuts explained. The strength of the package’s ability to link aspects of geometry, algebra, calculus and statistics was emphasised, as this allows students to observe the visual effects of altering one term in an equation, for example. The speakers also highlighted the number of hits that their resources receive outside of office hours, reinforcing the need for flexible “24-7 support” supplied by technology. The NCE-MSTL is promoting the use of GeoGebra at all levels in the Irish school system.

Samuel King, Loughborough University

“Evaluating the Impact of Response Technology on Student Engagement and Achievement.”

This speaker focused on the impact of response technology (also known as clickers or electronic voting systems) on a group of undergraduate students from Automotive, Aeronautical and Mechanical Engineering departments in Loughborough University. The study incorporated observations, one-minute questionnaires, longer questionnaires, interviews and focus groups. Although the students were very positive about the devices, with 80% of those surveyed saying that the handsets were “useful” or “very useful”, there was a negligible impact on attendance and students’ overall grades.

Ciarán Mac an Bhaird, NUI Maynooth

“The Challenges and Benefits of Using Technology in Mathematics Support.”

This presentation reported on the level to which technology is used in providing support for mathematics students. First year students who fail a mathematics proficiency test are enrolled on a mathematics proficiency course on Moodle. The course involved text, online videos and quizzes each week. There is also an equivalent mathematics foundation course for non-Mathematics students. Follow up support workshops are run every week for students struggling with course material. In these workshops, the tutor uses Sympodium to present the material, meaning that the notes written during the session can be directly transferred onto Moodle. Students do not have to take notes but are free to simply listen to the tutor. Students have responded very positively to this approach. The speaker identified the initial cost of the unit as a potential disadvantage. In addition to these workshops, screencasts and podcasts are also being developed as extra resources for students.

Alun Owen, Loughborough University

“Two Projects for Enhancing the Provision of Statistics Support.”

The main focus of this presentation was to provide an update on the progress of the statstutor project, which is an online resource aimed at supporting non-specialist students with understanding statistical analysis. It is aimed at both undergraduates and postgraduates from a range of disciplines. It forms part of the mathcentre [7] resources, and consists of topic-based resources using the STEPS Glossary [8] as a basis as well as case studies based on RSS CSE (Royal Statistical Society Centre for Statistical Education) materials [9]. The speaker invited input from any interested parties during the development of this resource.

Ewan Russell and Steve Joiner, Sigma-CETL, Coventry University

“LEGO NXT as a Device to Enhance the Teaching and Learning of Mathematics.”

The use of LEGO NXT in mathematics-specific activities was the focus of this presentation, which provided details and demonstrations of trigonometry activities developed by summer placement students in sigma. One such example was the navigation of a track using a robot, requiring students to calculate various angles in order to keep the robot on-track. Although Java, ROBOTC or NXT-G can be used to program the robot, ROBOTC is about 130 times faster than NXT-G. Overall, preliminary trials of the activities have been positively received, with 73% of students involved saying they “agree” or “strongly agree” that the activity was enjoyable.

Conclusions

This workshop showcased some of the valuable uses being made of technology in mathematics support both in Ireland and the U.K. A broad variety of software options were reviewed and their relative merits explored. It is clear that the use of technology allows us to be a continual support to students, over-riding issues such as timetabling and personnel resources, and therefore continued work in this area is required. It is both encouraging and commendable to note the number of high-quality existing resources (and those currently in development) that are made freely available for use in mathematics education, and this is a trend which we hope will continue for many years to come.

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