

Extracurricular activities to enhance the employment outcomes of Mathematics graduates

Nadarajah Ramesh

Department of
Mathematical Sciences
University of Greenwich
Old Royal Naval College
Park Row
London SE10 9LS
N.I.Ramesh@gre.ac.uk
<http://www.cms.gre.ac.uk/staff/details.asp?id=258>

Tony Mann

Department of
Mathematical Sciences
University of Greenwich
Old Royal Naval College
Park Row
London SE10 9LS
a.mann@gre.ac.uk
<http://staffweb.cms.gre.ac.uk/~A.Mann/>

Kevin Parrott

Department of
Mathematical Sciences
University of Greenwich
Old Royal Naval College
Park Row
London SE10 9LS
a.k.parrott@gre.ac.uk
<http://staffweb.cms.gre.ac.uk/~pa10/>

Abstract

The employability skills of Mathematics graduates have been an area of concern for the Mathematics community, employers and stakeholders nationwide. Higher education institutions are addressing these skills in many ways, embarking on different strategies, to enhance the employment outcomes of their graduates. Although this topic has received a good deal of attention lately, it is useful to explore different ways to enhance students' employability skills as they can impact positively on their employment outcomes. This may take the form of specific employability initiatives at department level, appropriate for the programme portfolio, to complement traditional careers advice services provided centrally by the university. This paper describes how the employability skills of Mathematics students can be enhanced by providing relevant extracurricular activities throughout their degree programmes, and discusses the implementation at our institution. Student feedback on the activities has been very positive and the implementation appears to have enhanced our graduates' employability outcomes.

Keywords

employability, professional body, employer engagement, Mathematics, graduates skills

1. Introduction

The skills of Mathematics graduates have been a concern for many Higher Education Institutions (HEIs), the Mathematics community and employers nationwide (see Waldock, 2011a or 2011b, for example). It is important for business too that students should leave university better equipped with a wider range of employability skills (Higher Ambitions, 2009). In view of this, enhancing students' employability skills, both within the curriculum and outside the curriculum, is essential not

only for their personal development but also to meet the needs of the nation's workforce. Learning activities associated with academic programmes, and related extracurricular activities, should aim to facilitate the development of graduate skills as much as possible throughout the programme of study to ensure a positive learning experience resulting in a successful employment outcome. This paper describes how students' employability skills can be enhanced using learning related extracurricular activities during Mathematics degree programmes. We discuss how, in addition to the development of soft skills within the curriculum, a Mathematics business game, advanced skills workshops, professional society engagement and interaction with employers are utilised in our institution to help students develop the necessary set of graduate skills to enhance their employability outside normal classroom activities. The impact of these initiatives, and their success, is evaluated mainly through formal feedback from questionnaires as well as available employment and student placement statistics.

2. Developing Graduate Attributes

One of the fundamental aims of academic programmes is to provide students with a good knowledge and understanding of the subject area to give them a strong foundation to build up their career with confidence. To achieve this aim successfully, the degree programme should facilitate the development of general graduate skills of students as much as possible throughout its duration. There are two main approaches most institutions adopt to carry out this task. One approach is to take this up within the usual teaching and learning activities thereby embedding employability skills into the curriculum. This covers group-work, presentations, question and answer sessions, and seminars with an emphasis on problem-solving and the communication of solutions to non-mathematicians, and prepares students for the process of applying for placements and graduate jobs. The other approach is to tackle this outside the usual classroom based teaching and learning activities. The practical difficulty of finding space for graduate skill development in a crowded curriculum (Waldock, 2011b) implies that it is worth exploring attractive ways outside the curriculum.

In this paper we focus our discussion mainly on how this second approach is taken up at Greenwich. We organise a number of events and learning-related extracurricular activities to help students identify, understand, and develop specific graduate skills during their programme. These are designed to ensure students have a smooth transition from education to employment at the time of their graduation. When encouraging students to take part in extracurricular activities as part of a skills development process it is important to raise student awareness of the wider purpose of the activities and their values (Waldock, 2011b). This is certainly true and, in addition, students will engage better if they understand the benefits of the activities. We found it easier to do this under the four initiatives discussed below.

2.1 Professional Society Engagement

Learned societies and professional bodies play a major role in the development and advancement of most subject disciplines. In addition, many degree programmes offered by HEIs are approved or

accredited by the relevant professional societies. A recent project funded by the National HE STEM programme has focused on the need to include in undergraduate teaching an indication of the importance of professional bodies in supporting practitioners (Good and Mann, 2012). These professional bodies are also part of the support available to graduates in making their careers. In view of this, it makes every sense to make use of these facilities and resources to enhance student employability. As part of this employability initiative, we have been working on increasing student awareness of professional bodies and their services with the view to facilitating greater engagement with them (Ramesh et al, 2013). In this process, students are encouraged to take up membership of these societies and make use of the information and resources on employment and careers, and attend seminars, careers events, and other events related to their personal and career management. The short-term purpose of this is to help our students gain greater understanding of their developing employability skills while the long-term benefits include continued professional development and networking opportunities. We have worked with three professional societies in the Mathematical Sciences area, namely the Institute of Mathematics and its Applications (IMA), the Royal Statistical Society (RSS) and the Operational Research Society (ORS).

Meetings and workshops (careers, membership awareness and skills development) were arranged for our undergraduates throughout the year. Some of them were held during the scheduled PDP sessions and others outside the normal timetabled lessons. The main objectives of these events have focused on preparing students well for employment by communicating the role of the societies in supporting practitioners and to increase students' awareness of the membership and its benefits in their career development. Careers meetings were arranged with the IMA for our undergraduates focusing on membership and careers. A careers workshop was organised with the RSS with the emphasis on employment opportunities for mathematicians in the field of Statistics. Another workshop with the ORS outlined career routes and what mathematicians can do with their knowledge of Operational Research. Tutors have also emphasized the benefits of engagement with societies to students. All of these meetings, aimed at greater engagement with professional bodies and enhancing employability, received excellent student feedback.

The professional body meetings have resulted in greater student awareness and interest in professional body membership and engagement. This was evident from the attendance at these meetings and also from the formal feedback we obtained through questionnaires. For example, 79% of the participants of a workshop felt that the event provided them with new insight into what is involved in being a professional mathematician in different sectors. Very few students had previously taken up IMA or RSS membership but as a result of our professional body engagement activities, over 150 students signed up for e-membership with the IMA, and some students have also taken up membership with the RSS or the ORS. This provides clear evidence of an impact on these students' attitudes. Student feedback included:

“It (IMA meeting) encouraged me to take my career options more seriously”

“Encouraged me to think about my career, professional body and opportunities”

As a result of this initiative our students have engaged more with professional bodies. Some students have attended branch talks and Early Career Mathematician conferences. Others have attended local events in London, Young Statistician meeting and OR careers event in Nottingham.

2.2 Employer Engagement

We have been working towards greater engagement with employers and companies (Bradshaw et al, 2012) to help students recognise the purpose of extracurricular activities in developing the necessary graduate attributes and competencies. Significant interaction with employers makes it easier to increase student awareness of the need to develop their employability skills. Hence, under this initiative, we increased our engagement with employers to provide up-to-date information about careers, employment opportunities and necessary graduate skills development.

Financial, insurance and pharmaceutical industries present many employment opportunities for mathematicians. To increase students' awareness of the opportunities in these sectors, we organized a number of careers workshops with employers from these industries. Workshops delivered by people from a leading insurance company, the Bank of England, and the pharmaceutical company GSK provided students with first-hand knowledge of what a mathematician can do in these sectors. These events, mostly with near full-capacity attendance, were well received by the students and made a notable impact on their career plans. They have inspired many students to think more about pursuing a career in these fields or to seek employment in those industries when they graduate. This led to increased take-up in the final year modules in Actuarial Mathematics and Financial Modelling, and some students have taken up postgraduate studies to become actuaries or medical statisticians while others have since gone on to take up placements in these areas.

The activities outlined above have impacted positively on our students' motivation and aspiration. Survey results (combined) from employer events revealed that, among the 112 responses, 92% of them felt that the events had given them a good insight into various employment opportunities in industries. When asked whether they were better informed (after the events) about the careers open to Mathematics graduates, 81% of them either agreed or strongly agreed. The following is a sample of comments made by students after the careers talks from employers.

“Excellent presentation, very informative, interesting and engaging”

“The talk was really good and exciting. This has really made me want to go into Actuarial sector”

These provide evidence of how greater engagement with employers could impact on students' motivation, determination and drive to succeed. As these employer interaction events have been very successful in raising student awareness of developing graduate skills, in addition to providing good networking opportunities, our department is planning on organizing these events regularly in the coming years.

2.3 Business Game

Business awareness is a graduate competency that employers value highly. However, many graduates find it difficult to demonstrate this to their prospective employers. Under this initiative we developed, in association with the IMA (Bradshaw, 2012), a business game specifically for

Mathematics students to develop participants' understanding of how businesses operate. The game aimed to simulate business functions of the company whose business was to make boxes according to a client's specification, although various other possibilities exist for this exercise. Students were divided into "companies" and allocated members of their team to various roles in the company, such as production, finance, marketing and design. One staff member assumed the role of a supplier and another one became the customer. The groups then began the activities by sending their marketing unit to liaise with the customer while the purchasing units negotiated with the supplier. Many activities such as negotiation within groups, designing prototype items, accounting for expenses and profit and purchasing raw material etc. took place at a fast speed which kept students engaged. Shortly after the busy start, students began to understand that whilst some discussion and planning was necessary, too much of it could delay production and impact on the cash flow of the business. The team that achieved the most profit was the one that coordinated the tasks well, delegated the jobs evenly and had workers who concentrated on delivering their output within the set deadlines.

This business game proved a very enjoyable and insightful experience for our students, as it provided an opportunity to exercise multiple skills capturing the essential elements of typical business operations. This activity helped students recognize and appreciate how different units such as design, finance, marketing, manufacturing and research within a company work together, and the importance of coordinating their functions, as well as ensuring financial viability, to be successful in a competitive business environment. Results of the questionnaire study showed that 88% of the respondents thought that the event had helped them understand the importance of having good graduate skills along with their degree. The IMA is keen to encourage other HEIs to use this business game and a DVD, made as part of the HEA project, is available.

2.4 Advanced Skills Workshop

One of the problems that graduates seem to encounter when they start to apply for jobs is that their knowledge of software packages does not go beyond what was used in their undergraduate teaching. This may have resulted from the fact that students on Mathematics programmes predominantly used maths related packages and were not sufficiently exposed to Statistics packages and vice versa. Furthermore, there are advanced features in many packages that are useful for practical purposes but may not be part of core course content. In addition, the skills workshops we proposed are too specialist to be part of the curriculum but they are relevant to niche jobs. This problem essentially disadvantages many students or prevents them from applying for certain jobs where the employer may look for a well-developed range of software skills.

To address this we embarked on advanced skills workshops that aimed to expand students' knowledge of the practical use of software packages, and their advanced features, in industry and commerce. This initiative was designed to equip students with broader technical skills to help them succeed in their pursuit of employment. We ran a number of half-day workshops to include Introduction to R, Matlab's Financial and Econometrics Toolboxes, Excel and VBA for Financial

Modelling, and Excel Pivot Tables. Some of these were tailored to meet student demand and feedback.

These activities provided students with advanced knowledge and understanding of software usage with hands-on experience. Our expectation is that the knowledge of these packages and their advanced features will give graduates an edge in applying for specialised jobs where employers look for specific software skills. Some students have actively gained further experience of these tools making use of the learning resources and material provided by the workshops. Questionnaire results show that, when asked whether the workshops have broadened their knowledge on practical applications and advanced features of the software packages to enhance success at work, 48% of the workshop participants strongly agreed and a further 46% agreed. The following are sample comments from the workshops.

“Really enjoyed the workshop. It helped me understand more about programming”

“I feel it will really help me with my degree and my final year project and employment”

The advanced skills workshops provided students with a resourceful and positive learning experience, enhancing their academic and technical capabilities in different ways. Some have applied the knowledge they gained with these workshops in their final year projects, after finding out that the workshop offered valuable learning opportunities. Their broader technical expertise with the range of software skills will provide students with greater chances of succeeding in their career path.

3 Conclusions

This paper described how the employability skills of students in Mathematics and Statistics programmes can be enhanced using extracurricular activities to improve their employment outcomes. The events and activities undertaken have given our students a better understanding of their employability skills and made them focus much more on their development. Students have utilized the knowledge and skills they gained from the activities to apply for industrial placements, short-term internships, graduate positions and postgraduate studies. Networking opportunities arising from the engagement have also contributed to their graduate skills development. Formal feedback from students, using questionnaires, suggests that the activities have improved awareness of employability, facilitating the development of a wealth of knowledge to help them make an informed choice about their career plans. Some of those who took active part in these activities had already been successful in their pursuit of employment when they reached their graduation.

Although it takes time for the initiatives to produce hard evidence to measure the success in terms of employment figures, the results so far show that there has been some evidence of enhanced employability outcomes for our graduates. Alongside the project activities, the number of students taking up final year modules involving work placement has risen from 25 in 2011/12 to 63 in 2012/13, demonstrating increased awareness of the value of placements. The number of students taking up yearlong industrial placements has increased from one in 2012/13 to five in 2013/14. Many

students secured graduate-level employment with leading companies and an increasing number of students have gone on to take up MSc programmes in prestigious institutions. To add to this, the most recent DLHE survey results recorded an increase of 10% in employment outcomes for our graduates. All of these provide evidence of how the activities of the initiatives have impacted on students' motivation, determination to enhance their employability and also on their employment outcomes. We believe that some of the methods discussed here may be useful to academic tutors at other institutions to promote the development of employability skills among students. The initiatives on our business game, professional body and employer engagement are transferrable to a wider circle of teaching and learning community beyond Mathematics.

4 References

Bradshaw, N., Moreno, E., and Ramesh, N.I. (2012) Maths Graduates: where are they now? In Further Work Developing Graduate Skills in HE Mathematics Programmes. Edited by Rowlett, P. Birmingham: HE STEM, pp 10-11. Available at <http://mathstore.ac.uk/headocs/FurtherGradSkills.pdf> (accessed 19 February 2014).

Bradshaw, N. (2013) IMA Business Game, *Mathematics Today*, 49(1), p. 28.

Good, C and Mann, A. (2012) Being a Professional Mathematician. Available at www.beingamathematician.org (accessed 19 February 2014).

Higher Ambitions, November 2009. Department of Business Innovation and Skills. Available at <http://bis.gov.uk/assets/biscore/corporate/docs/h/09-1452-higher-ambitions-summary.pdf> (accessed 19 February 2014).

Ramesh, N, Bradshaw, N, Mann, A and Parrott, K. (2013) Professional body and employer engagement to enhance employability of Mathematics students. HEA's STEM Annual Conference, University of Birmingham, Birmingham, 17-18 April, 2013.

Waldock, J. (2011a) Developing Graduate Skills in HE Mathematics Programmes - Case Studies of Successful Practice, edited by Waldock, April 2011. Available at <http://maths.shu.ac.uk/msor/graduateskills/> (accessed 19 February 2014).

Waldock, J. (2011b) Developing Graduate Skills in HE Mathematics Programmes. *MSOR Connections*, Vol 11 No 3, Autumn 2011, 16-19.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission.

© 2014 The Higher Education Academy