

INDUSTRIAL PANEL

Mathematics Degree Review Project



Joint Project between London Metropolitan University
& Institute of Mathematics and its Applications

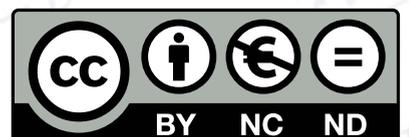
Dr Pargat Singh-Calay with Makhan Singh



To view the Industrial Panel Project in action,
watch the below DVD or visit www.mathcareers.org.uk



INDUSTRIAL PANEL Mathematics Degree
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1. Introduction and Aim

Mathematics is a STEM subject. STEM refers to Science, Technology, Engineering and Mathematics - subjects that are becoming increasingly relevant and necessary in today's workplace. The Government has created a STEM agenda, which contains a series of initiatives geared towards creating a strong supply of scientists, engineers and technologists. The aim is to meet the increasing demands of the STEM sector, which is essential for developing the UK economy. It is very important that students obtain relevant Mathematics (STEM) education in order to help sustain the UK's future economy.

London Metropolitan University (and its predecessors) has offered graduate level studies in Mathematics for well over 40 years. The degree courses offered in the Mathematical Sciences prepares students for employment in a wide variety of occupations in the public and private sectors. Mathematics graduates often secure jobs in the general areas such as scientific research, design and development, management services, computing, financial work, statistical work, teaching and postgraduate study.

London Metropolitan University has recently conducted a major review of its Mathematical Sciences undergraduate provision and new courses will be offered to students in 2012-13. It was felt important that design of the curriculum should have input from employers; with course designers collaborating with representative of industry to ensure that their teaching is also relevant and up-to-date.

2. Method

Around September 2010, the Academic Leader (AGL) for the Mathematics Area, Dr Pargat Singh-Calay, had a conversation with a member representative of the Institute of Mathematics and its Applications (IMA) where the AGL had mentioned that the Faculty of Computing (FoC) at London Metropolitan University would like to set up an industrial board i.e. industry panel to help advise periodically on the Mathematics degree course contents. As a result a few days later the AGL was contacted by Makhan Singh (IMA Project Manager for the National HE STEM Programme) with an offer of help to set up an Industrial Panel project to review the maths degrees and their curriculum content in the context of meeting the needs of employers. Following several meetings held between the AGL and Makhan Singh, the remit and scope for the project had been established (i.e. in essence setting up a panel of several employers to review the London Metropolitan University Mathematics degree).

The IMA then set about approaching employers on behalf the Faculty of Computing at the London Metropolitan University, to gauge interest and support for the project; targeting employers who had previously shown a willingness to participate in such activities (i.e. career profile interviews on the MathsCareers website – www.mathscareers.org.uk - completed through the MathsCareers project manager, Susan Bolton). This method proved to be very successful as five (enthusiastic) employers stepped forward and agreed to participate to share their knowledge and time (as volunteers) for the project brief – *“reviewing the curriculum content of the London Metropolitan University Mathematics Degree from an employer’s perspective.”*



The Industrial Panel was made up of an eclectic mix of people, from a range of backgrounds, experiences, age and gender. Employers involved were Corda, Unilever, NHS, Walsh Group and ex-Rolls Royce.

All five employers were sent the maths degree curriculum content for review on a USB; alongside a review template (see appendices). The employers were then given a period of six to eight weeks to review the curriculum and to fill out a review questionnaire to capture their thoughts and feedback.

The Industrial Panel received module specifications for the following degree programmes currently offered by London Metropolitan University;

1. BSc (Hons) Mathematics;
2. BSc (Hons) Mathematical Sciences;
3. BSc (Hons) Mathematics & Computer Science;
4. BSc (Hons) Mathematics & Engineering Applications;
5. BSc (Hons) Decision Science;
6. BSc (Hons) Financial Mathematics.

The list of modules they were asked to review is listed in the appendix number 1 with samples of the detailed comments.

It must be noted that one member of the panel was caught at an extremely busy time; and therefore he only wished to review a subset within his area of expertise. This worked well; it allowed the project to keep the involvement of this particular employer; and hence maintaining the Industrial Panel as a mixed and diverse set of employers.

Having completed the questionnaire, a meeting with the Industrial Panel was then arranged. This meeting took place on 9th June 2011 at London Metropolitan University, where discussion and feedback was given to Dr Pargat Singh-Calay as well as the Dean of the faculty. The meeting was chaired by Professor Nigel Steele (former President of the IMA and Emeritus Professor Coventry University). The discussion of the meeting was recorded and the minutes are appended to this report, appendix 2. The terms of reference for the group were developed by Professor Nigel Steele and concurred by Dr Pargat Singh Calay. These were;

- To review existing programmes within the Department in terms of the extent to which they prepare students for a career in industry or commerce.
- To identify new and existing directions in industry and commerce that might be incorporated into programmes.
- To strengthen and develop the Department's engagement with industry and commerce at all levels, including teaching, research, student projects and careers advice.
- To review the Department's research activities and portfolio, giving where and when appropriate, advice on developing new strategic directions.



3. Outcomes

An important outcome of the Industrial Panel was the fact that members were happy and keen to be involved in the design of the courses at the university and to be kept informed of future progress; seeing the Industrial Panel as a long term partnership. In the academic year 2012/13, new degree programmes will be offered in Mathematics whose modules will be derived from existing modules and it was exciting to gain feedback that could add value to the new programmes of study.

The 11/12 courses will be replaced in 12/13 by;

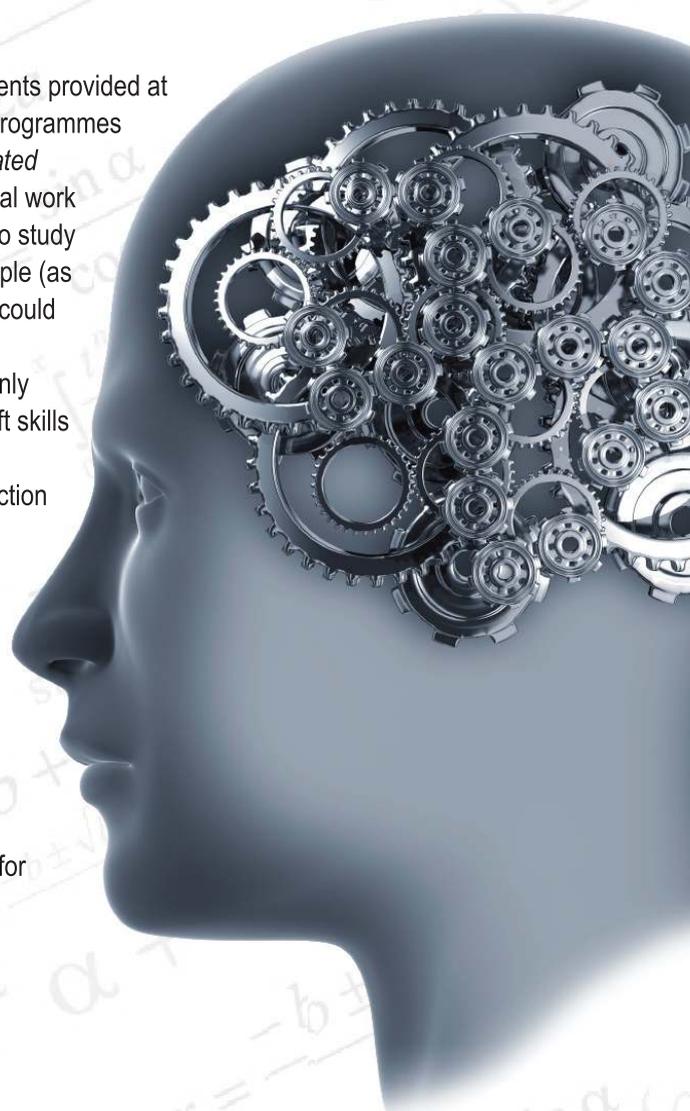
1. BSc (Hons) Mathematics;
2. BSc (Hons) Mathematical Sciences;
3. BSc (Hons) Mathematics & Computer Science;
4. BSc (Hons) Mathematics & Statistics;
5. BSc (Hons) Financial Mathematics.

A key outcome of the Industrial Panel has been that advice and comments provided at the meeting have been considered when developing the new degree programmes and curriculum content; all of which will be fed into the new “*Work Related Learning*” module in which students will undertake industrial/commercial work style projects to recreate a working environment. This type of project, to study by the students, could be supplied by the employers on a CD for example (as expressed by one of the Industrial Panel members), where employers could provide real data and allow the students to visit their company. This integrated work process could also allow the students to develop not only their Mathematical thinking at a deeper level but also enhance their soft skills development. In many careers, job performance is often soft skills dependent. These skills are often intangible and tend to be more a function of personal traits. Example characteristics of soft skills include presentation skills, communication, time management, negotiation skills and the ability to pitch and sell ideas (often to senior management). Hard and soft skills are both of vital importance and go hand in hand when in the world of work. Employees are seldom demoted or sacked due to their lack of technical knowledge; so it is essential that today’s (Mathematical Sciences) undergraduates understand the vital importance of soft skills development.

The Industrial Panel played a key role in identifying new (work) areas for curriculum, including;

- Large sparse data sets.
- Graphs and networking.
- Social network analyse.
- Viral marketing.
- Anti-terrorist applications.
- Visual analytics.
- Teaching procedural languages to provide the students with the skills to learn other computing languages.

The degree programmes offered at London Metropolitan University do have the option of including a placement year, but only a small number of students undertake this. A member of the Industrial Panel commented that students who undertake a



placement year are at an advantage when they graduate and start applying for jobs as they will have that experience. Companies also benefit from employing placement students as they are cheaper to employ and the recruitment costs are reduced. Some students are already aware of the advantages of undertaking a placement year however following discussion with the Industrial Panel, it has been highlighted that these advantages, such as increased employability and the opportunity to earn money, need to be further developed so that more undergraduates begin to appreciate the value of placement years. Discussions with members of the Industrial Panel have since taken place to come back to London Metropolitan University as guest speakers on this topic. Another important suggestion was that students should be trained to speak to non-Mathematics people because when employed, an individual can find themselves speaking to senior managers who may not have a Mathematics background; again valuable feedback when developing the “*Work Related Learning*” (WRL) module. A further important outcome of the Industrial Panel work was that two of the panel members have since accepted the invitation to be the industrial advisors on the university validation panel.

The Industrial Panel also suggested that a member of University staff within the faculty may benefit from a secondment to a company. This could be achieved by either the staff member taking unpaid leave from the university for a set time period; or a lecturer and an employee at the company swapping roles, again for an agreed period of time. These ideas will be reviewed in the next academic year.

The Industrial Panel agreed that the current membership of the group would benefit from representatives from other industries; to wider the scope of the group. The names of the members of the Industrial Panel will be passed to the Faculty-wide group (the Industrial Liaison Group); with the next meeting to be arranged for June 2012.

Some of the Industrial Panel employers agreed to provide industrial projects as and when needed; again an excellent outcome to maintain partnership between employers and London Metropolitan University.



The Industrial Panel discussed further the possibility of the Mathematics Area at London Metropolitan University offering on-site, short (top up) courses to employers (for upskilling the workforce). Short courses in financial forecasting with statistics and Mathematical software packages were suggested as potentially viable short courses (it was also mentioned that it would be beneficial if the university and/or the IMA could recognize the short courses in some way). This topic of discussion is being looked at by the Mathematics Area and it is expected that this will become a subset project from the Industrial Panel.

Faculty initiatives and roles that are relevant to the remit of employer engagement, all lend themselves nicely to future discussions of the Industrial Panel. These initiatives and roles include the Student Enterprise Coordinator; Employer Engagement Officer; World of Work Agency; WoWBIZ (WOW.BIZ is an exciting new initiative being developed within the Faculty of Computing that will facilitate real placement opportunities and innovative employability training within the context of a virtual business within the Faculty); and of course as mentioned earlier, the newly proposed work related learning modules which are part of the new course being introduced in 2012.

4. Final Thoughts

The feedback from the Industrial Panel has been invaluable and the idea that this forum will continue as a long term partnership (even beyond the lifetime of the National HE STEM Programme) will itself be a key performance indicator of sustainability and legacy. The Industrial Panel was originally set up with the prime objective of “*reviewing the curriculum content of the London Metropolitan University Mathematics Degree from an employer’s perspective.*” However the Industrial Panel has gone beyond this remit; it has been an exciting project where ripple effects have occurred whereby several unexpected new outcomes have developed including Industrial Panel members being industrial advisors on the university validation panel and offering new ideas for upskilling the workforce (i.e. short courses).

Overall the experience has been a very positive one and at this early stage of its creation the London Metropolitan University team can see the long term benefits of maintaining this group.

It was great to have an Industrial Panel made up of a group of well versed and experienced individuals; who were more like ‘critical friends’ than evaluators or auditors. The Industrial Panel was made up of enthusiastic, passionate, people orientated individuals; not just seeking to refine and enhance the Mathematics degree programme for the sake of the subject alone; but on an altruistic level, seeking to improve the opportunities for the graduating students. The AGL would like to take this opportunity in thanking the Industrial Panel members for giving their time to feedback and helping the Mathematics Area to increase the quality of degree programme at London Met; which will of course become an excellent outcome for the next generation of under graduates. Thanks must also go to Professor Nigel Steele for chairing the group; having his independent and experienced views as Chair helped maintain a focused and impartial viewpoint at all times. And last but not least, thanks also go to Makhan Singh and the IMA; for the sheer dedication in helping me put this project together. Setting up the Industrial Panel was no mean feat; and having someone to bounce ideas around with and explore new thoughts at the development stage helped enormously.

On a final thought, it is always interesting to hold up the mirror to ones self when asking for (constructive) feedback – one never knows what guise the feedback may come in and how we may react to the challenges of our (right or wrong) current thinking. So it was pleasantly welcomed when we received positive feedback as well; which just goes to show that the Industrial Panel was not just there to address improvements; it also had a role in telling us what we were getting right too!

“My overall assessment of these Mathematics courses provided by the Faculty of Computing at London Metropolitan University is very positive. My view is that they offer great value to students providing them with a solid foundation training in Mathematics. The course modules cover all of the relevant content I would expect to see on such courses. In addition, I am very impressed at how well the Faculty of Computing at London Metropolitan University has woven employability training into the core of all of these Mathematics courses. This is in total contrast to the usually optional opportunities provided at most universities, which are usually not taken up by students.”



"In particular the Work Related Learning module, which is core for all of these courses, covers everything from preparing a CV and interviewing skills, to performance evaluation. Being an employer of mainly Mathematicians, these are the competencies that I find most Mathematics graduates lack. Therefore, I would expect London Metropolitan University Mathematics graduates to stand out from the crowd in this respect, and be welcomed by employers."

"...these Mathematics courses offer the students significant advantages in terms of employability, while at the same time providing them with a firm foundation training in Mathematics. I would expect the students who graduate from these courses to stand out from the crowd at interviews, and to be able to fit into a working environment more easily and quickly compared to most other graduates."

The role of the Industrial Panel therefore provided an excellent platform for me and the department to realize our strengths as well as our opportunities for growth and expansion. It was refreshing to get this feedback and to know that we are also in parts, getting it right in meeting the needs of employers.

Collaboration between London Metropolitan University and industry will always be a bi-directional two-way process. Each individual Industrial Panel member will over time have the ability to make themselves known to students as a prospective employer and/or industry to work within. More over, the Industrial Panel will play its part in helping to have an effect on course curriculum from an industrial standpoint, keeping it pertinent, appealing and attention grabbing so that students are more attractive as potential employees. It is a win-win situation for the university and the employer(s).

The only reservation I've had in the whole experience is that I find the label 'Industrial Panel' quite limiting; Mathematics is a subject which is not limited to just industry – it is one of the most (if not the most) holistic/all encompassing subject that exists; perhaps the future term 'World of Work Panel' might be more apt! For the time being I can say this; Industrial Panels are good news; please go and spread the word!



Appendices

Appendix 1

The list of modules for review, offered as part of study for Mathematics and Mathematics related courses study at London Metropolitan University

Year 1 – Module Notes:

- MA1H01N: Study Skills for Mathematicians.
- MA1031N: Calculus
- MA1032N: Logic
- MA1033N: Mathematical Techniques 1
- MA1034N: Introduction to Data Analysis
- MA1035N: Mathematical Programming
- MA1037N: Mathematical Techniques 2
- MA1038N: Personal Development for Mathematicians
- MA1040N: Linear Algebra
- MA1041N: Numerical Methods

Year 2 – Module Notes:

- MA2E01N: Employment Skills for Mathematicians
- MA2031N: Differential Equations
- MA2032N: Mathematics of Finance.
- MA2034N: Further Mathematical Techniques
- MA2035N: Graphs and Networks
- MA2036N: Further Discrete Mathematics
- MA2038N: Groups and Vector Spaces
- MA2039N: Project Management for Mathematicians
- MA2040N: Foundations of Statistics
- MA2042N: Medical, Biological and Forensic Statistics
- MA2045N: Data Mining
- MA2046N: Simulation

Year 3 – Module Notes:

- MA3031N: Mathematical Modelling
- MA3032N: Computational Methods in Finance
- MA3033N: Real and Complex Variable
- MA3034N: Advanced Numerical Mathematics
- MA3035N: Automata and Languages
- MA3036N: Cryptography and Number Theory Finance.
- MA3038N: Error Correcting Codes
- MA3039N: Linear Optimisation
- MA3040N: Advanced Operational Research Techniques
- MA3041N: Forecasting.
- MA3044N: Mathematics Independent Study
- MA3046N: Project Preparation.
- MA3P47N: Project

Appendix 2

The template that the panel was asked to fill in.

What are the strengths of the degree?

What are the weaknesses of the degree?

What opportunities exist in the current degree that could be expanded upon?

What recommendations/changes would you suggest the degree needs?

If you were to go on a short maths course; how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)?

What content would you like to see in a short course?

Would you expect the short course to be accredited; if so, from whom?

Any other comments/thoughts/feelings?



Appendix 3

Individual Panel members

1. Chris Bean,
Walsh Associates
Industry: Civil Engineering also jobs in Finance and systems
2. Dr. Melissa Goodman,
CORDA,
Industry: Defence & Space
3. Professor Dave Collett,
NHS
Industry: Blood and Transplant
4. Dr. Benjamin Dias MIMA,
Unilever
Industry: Manufacturing, Marketing and Retailing Fast Moving Consumer Goods
5. Dr. Alan Stevens CMath FIMA, Formerly Rolls-Royce



Appendix 4

Review of maths degree at London Metropolitan

Individual Panel members Comments; Chris Bean

1 What are the strengths of the degree?

The modules that catch my eye are: 1038N (Personal Development), 1H01N (Study Skills), MA2E01 (Employment Skills), MA3046N (Project Preparation). My perception is that the course aims to produce well rounded students and not just machines for passing modules

2. What are the weaknesses of the degree?

I wonder if the modules are flexible enough to support a student who has (or develops) a clear idea of their future career path – This may already be covered by the opportunities for project work and individual study.

3. What opportunities exist in the current degree that could be expanded upon?

I would emphasise how the techniques studied relate to business processes, needs and opportunities – I do see that this is already covered, but is it reinforced as the modules progress?

4. What recommendations/changes would you suggest the degree needs?

Expanding on the fact that a course should produce well rounded graduates, I wonder if there should be some time set aside for activities with an arts bias.

5. If you were to go on a short maths course; how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)?

This is unlikely in my current role, but individual days are preferable to block release.

6 What content would you like to see in a short course?

There would need to be a link to my own business needs. I would want to see how the course could make my firm more cost effective, or profitable, or safer.

7. Would you expect the short course to be accredited; if so, from who?

Yes – Ideally by a body recognised in my own industry.

8. Any other comments/thoughts/feelings?

Are the students given the information about the modules that we have been asked to review? These summaries will help them see what is ahead and may help them programme accordingly. The anticipated hours required for each module are also a useful tool, but has anyone looked at how these time blocks overlap – will there be enough hours in the day in week 8?

Individual Panel members Comments; Dr. Melissa Goodman

1. What are the strengths of the degree?
 Course touches on many additional skills/topics which are useful and valued in a work context, such as:
 - Project management and oral presentation (e.g. MA2039N);
 - Programming;
 - Use of different Mathematical and simulation packages (e.g. Witness);
 - Written reports and group work (e.g. MA2032N, MA3031N);
 - V&V (MA2046N);
 - Study of real-world problems in context (e.g. MA1033N).

2. What are the weaknesses of the degree?
 Modules which teach students how to be students, planning time, researching etc. add little value. They provide credits for gaining non-unique skills which could potentially devalue the brand of their degree. None of these should be core or prerequisite modules.

3. What opportunities exist in the current degree that could be expanded upon?
 - Creating a map of modules to the career paths they support, to ensure that the students gain a complementary and complete set of skills.
 - Expanding upon the project management course (MA2039N) with further topics, such as the fundamentals of putting a team together, working with a changing scope, basics of PRINCE2 & Lean techniques, project forecasting and reporting, what to do when things go wrong, communicating effectively at all levels.
 - Advising students to take the optional sandwich placement and ensuring suitable options are available for all.
 - Advising students who will be entering a work environment following their degree take at least one module covering oral presentation, group work and written reports.
 - Marking written reports for readability, spelling, grammar and style with additional support available for students to improve (possibly in conjunction with the English department?)

4. What recommendations/changes would you suggest the degree needs?
 - Courses offering non-unique skills to be optional, zero-credit modules.
 - Make the link clearer between the module paths and the benefits they give post-degree (as 3a). For example, all major/single-honours degrees prepare students both for postgraduate study and for entering industry – only one will be relevant.

5. If you were to go on a short maths course; how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)? A 3-day block would be the most likely, although this may be negotiable, depending on the perceived benefits of a longer course.

6. What content would you like to see in a short course?
 Would depend upon the needs of the individual and their employer, but courses in statistics or financial forecasting would be the most relevant to my organisation.

7. Would you expect the short course to be accredited; if so, from who?
 Yes. Accreditation from the University would be sufficient, from the IMA or similar institution even better.

8. Any other comments/thoughts/feelings?
 This course includes many useful soft skills which will add benefit to students and their future employers alike. However, the balance between soft and hard skills seems wrong at the moment. While employers want graduates who are articulate and organised, they also want them to have proved themselves in a demanding academic degree. Do keep the marketable soft skills listed in 1, as well as, but not at the expense of, the Mathematical content of the degree.

Individual Panel members Comments; Professor Dave Collett

This review is based on the 5 available statistics modules, MA1034N, MA2045N, MA2042N, MA2040N, MA3041, and covers the joint degree in Statistics and X.

1. What are the strengths of the degree?

The emphasis of the statistics modules is on the practical applications of statistics, which is to be applauded. As the authors of the Course Specification observe, knowledge of statistics is extremely valuable, and the skills obtained from the degree programme in the interpretation of quantitative data are important for many, if not most, careers. The programme contains some modern material, notably the module on data mining, and the module that includes material on forensic statistics.

The programme incorporates use of a wide range of statistical software (I saw SPSS, SAS, MINITAB and R mentioned).

There is some emphasis on the development of key skills, particularly in the presentation of results of statistical analyses. These skills are essential, as it is much easier to train a new employee in the use of a statistical technique than in the ability to communicate with clients.

2. What are the weaknesses of the degree?

I sensed that the statistics modules may have evolved from more traditional modules, in order to appeal to a wider audience. Thus, the content of the module entitled 'Introduction to data analysis' (MA1034N) is the sort of thing that would appear in a first course in statistical methods. A student's first exposure to statistics should help them to see that this is an exciting, modern subject, but this has not come through in the syllabus for this module. Indeed, some of the data mining material in MA2045N may well be appropriate for a module in the first year. This would lead on to the revision of the module on 'Foundations of statistics' (MA2040N) to include some of the statistical methods referred to in MA1034N. This could be accommodated by dropping repeated measures and some of the material on designed experiments. This revised module would then be offered in the second year, as MA2040N is at the moment.

Some of the module content does seem a bit outdated. For example, the learning outcomes for MA1034N refer to being able to use statistical tables. I would much prefer a sound knowledge of what is meant by a p-value and how this can be interpreted from computer output. Similarly, covariance analysis is covered in MA2040N, but this would now be handled using software that enables factors, variables and combinations of the two to be combined in a general model.

Given that there are very few modules, the course organisers clearly have had to make some very difficult decisions on what to offer. The material in years 1 and 2 (possibly with some reorganisation) seem about right, but the only final year module is on forecasting. Of course, there may be good reasons for this in terms of attracting students from economics etc, but this does seem to be an unusual choice. I think that a module that strengthens the statistical modelling skills of their students would be valuable to a wider range of potential employers. Such a module could include some elements of prediction/forecasting, and could also include something on computational inference procedures, such as bootstrapping, that can be used to assess properties of estimators, irrespective of whether these are mathematically tractable.

3. What opportunities exist in the current degree that could be expanded upon?

See above.

In addition, I am not clear if the final year project has to feature statistical analysis if this is part of a 'Statistics and X' degree. It should!

I wonder if there is any scope for incorporating more material on statistics in practice. A successful format in another University I was associated with invited local employers to provide data, to come and present the data and questions that the data were designed to address and then return to hear presentations from the students on their findings. It is hard work to run such a module, but it does enable students to acquire valuable interpersonal skills and improves their employability. It also enhances links between the University and local employers.

4. What recommendations/changes would you suggest the degree needs?

See above

5. If you were to go on a short maths course; how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)?

I encourage my staff to undertake intensive training, over 3 days say, with further time to assimilate relevant material when back 'in the office'. I also encourage staff to acquire MSc in statistics through part time study, and allow 1.5 days a week over two years for this.

6. What content would you like to see in a short course?

There is already a strong market in presenting courses in statistics that are of relevance to health, pharmaceuticals, finance, etc, and I think it would be difficult for another provider to enter this market at the moment. However, some market research may be fruitful, to gauge local demand.

7. Would you expect the short course to be accredited; if so, from who?

I don't think that accreditation of short courses is standard practice – whether or not they become profitable usually depends on word of mouth recommendation.

8. Any other comments/thoughts/feelings?

I think that it is very commendable for the University to be engaging with the IMA in this way.

Individual Panel members Comments; Dr. Alan Stevens CMath FIMA

1 What are the strengths of the degree?

These modules contain material that I think is attractive to employers (not necessarily all modules to all employers) in the sense that they would expect graduates to have a reasonable knowledge and understanding of the subject matter, and also, in the sense that they might be persuaded to send employees on a course for one (or more) of the modules.

MA1031N	MA2031N	MA3031N
MA1033N	MA2032N	MA3032N
MA1034N	MA2034N	MA3034N
MA1035N	MA2036N	MA3036N
MA1037N	MA2039N	MA3038N
MA1040N	MA2040N	MA3039N
MA1041N	MA2042N	MA3040N
	MA2045N	MA3041N
	MA2046N	

2. What are the weaknesses of the degree?

These modules don't say 'Look, you really need employees who know this stuff'. Certainly, in terms of getting employers to send people on one of these as an individual course, you would need to do a lot of persuading!

MA1H01N	MA2E01N	MA3P47N
MA1032N	MA2035N	MA3033N
MA1038N	MA2038N	MA3035N
		MA3044N
		MA3046N

3. What opportunities exist in the current degree that could be expanded upon?

4. What recommendations/changes would you suggest the degree needs?

- a. The use of industrial placements.
- b. Getting employers to provide (and partially supervise) individual or group projects.

5. If you were to go on a short maths course, how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)?

I have seen all these variants in my time. However, the more recent trend has been for release in smaller blocks.

6. What content would you like to see in a short course?

This is where you need to talk to individual organisations as their requirements vary.

7. Would you expect the short course to be accredited; if so, from who?

A one or two day course – no. For a longer course I might expect a diploma or some such from the University.

8. Any other comments/thoughts/feelings?

There is a lot of politically correct content in the specs, which is why I've concentrated on the modules. If you intend to sell these modules/degrees to industry, concentrate on the meat – what they will get for their money. Although everyone will say they want socially and ethically responsible mathematicians, I doubt they will pay you just to provide that!

Individual Panel members Comments; Dr. Benjamin Dias MIMA

1. What are the strengths of the degree?

It is great to see that all Courses have the following components:

18. Organised work experience/sandwich year/year abroad

19. Career education, information and guidance

24. Main educational aims of the course

- Develop practical and analytical skills that will be applicable in the modern business environment.
- Enable students to demonstrate appropriate transferable skills and the ability to work with relatively little guidance and support.
- Ensure that students are competent in the use of the IT skills that are needed in the workplace
- Equip students with a body of knowledge and study skills to enable them to progress to, and succeed in postgraduate study

25. Course learning outcomes

25a: Knowledge and Understanding

25b: Cognitive/intellectual skills

25c: Transferable skills including those of employability and professional practice

25d: Subject specific practical skills

- Modules available where specialist careers advice will form part of the module.
- Individual presentation lasts usually between 5 and 15 minutes and is assessed on effectiveness of communication, style of presentation, ability to condense information in short, sharp and informative sentences
- The application of the different techniques to solve real-world problems in areas of the physical Sciences used to introduce and illustrate the ideas of Mathematical modelling.



Year 1 – Module Notes:

- MA1H01N: Study Skills for Mathematicians – Very good to have this bridge from school life to University life. I wish I had this option when I joined University.
- MA1034N: Introduction to Data Analysis – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA1038N: Personal Development for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.

Year 2 – Module Notes:

- MA2E01N: Employment Skills for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.
- MA2035N: Graphs and Networks – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA2039N: Project Management for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.
- MA2040N: Foundations of Statistics – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA2045N: Data Mining – Excellent Material. Should be made Core, and every student should take this course. With the proliferation of large data sets in every field/business, this is becoming an essential skill required of a Mathematician. The skills gained from this course would make students significantly more employable.
- MA2046N: Simulation – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.

Year 3 – Module Notes:

- MMA3P47N: Project – The skills gained from a Project like this would make students significantly more employable.
- MMA3031N: Mathematical Modelling – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MMA3041N: Forecasting – Becoming more and more essential in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MMA3046N: Project Preparation – Very good to have this bridge to ensure a more successful project. The skills gained from this course would make students significantly more employable in my industry.

2. What are the weaknesses of the degree?

Some essential skills are missing from the modules (see answer to Q4)

Year 3 – Module Notes:

MA3031N: Mathematical Modelling – This module is weak as it is missing an introduction to the Bayesian approach.

3. What opportunities exist in the current degree that could be expanded upon?

Year 3 – Module Notes:

MA3P47N: Project – Having the project run as a short industrial placement, or at least having the projects proposed by industrial co-supervisors would make students significantly more employable in my industry.

4. What recommendations/changes would you suggest the degree needs?

The following essential skills are missing from the modules

Techniques for dealing with noisy real-world data sets

Techniques for dealing with large data sets that are sparse

Bayesian Approach only mentioned in MA2042N (Medical, Biological and Forensic Statistics), which I assume not everyone will take.

The following useful skills are also missing from the modules;

An introduction to relational databases: With the proliferation of large data sets in every field/business, data is almost always stored in a relational database. Therefore, having some knowledge about relational databases will be very useful and make the students more employable.

5. If you were to go on a short maths course; how long could you be released for from your employer (e.g. 1 week block; 3 days block; 1 day per week for a year etc)?

These days a maximum of 1 to 3 day blocks, with a possibility of a 1-day-per-month only if it is leading to a qualification such as a diploma.

6. What content would you like to see in a short course?

- The following courses would be very useful as a short course for industrial mathematicians in my industry.

Year 1 – Module Notes:

- MA1034N: Introduction to Data

Year 2 – Module Notes:

- MA2035N: Graphs and
- MA2040N: Foundations of
- MA2045N: Data Mining
- MA2046N: Simulation

Year 3 – Module Notes:

- MA3031N: Mathematical Modelling
- MA3041N: Forecasting

7. Would you expect the short course to be accredited; if so, from whom?

Yes:

1 to 3 day Courses accredited by the IMA, so that it can be used as evidence of continuing professional development.

1-day-per-month Course leading to a qualification such as a diploma, accredited by the University.

8. Any other comments/thoughts/feelings?

It would be preferable to have the short courses for industrial mathematicians run at least once per quarter. However, if it is only offered once per year, it would be preferable to have it in Q1, so that the delegates have time during the year to show the value of applying their newly learnt skills in their job in time for their performance review at the end of the year.

Year 1 – Module Notes:

- MA1H01N: Study Skills for Mathematicians – Very good to have this bridge from school life to University life. I wish I had this option when I joined University.
- MA1031N: Calculus – Would consider as Core Material
- MA1032N: Logic – Would consider as Core Material
- MA1033N: Mathematical Techniques 1 – Would consider as Core Material
- MA1034N: Introduction to Data Analysis – Becoming more and more essential in my industry. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA1035N: Mathematical Programming – Would consider as an interesting option
- MA1037N: Mathematical Techniques 2 – Would consider as an interesting option
- MA1038N: Personal Development for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.
- MA1040N: Linear Algebra – Would consider as Core Material
- MA1041N: Numerical Methods – Would consider as Core Material

Year 2 – Module Notes:

- MA2E01N: Employment Skills for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.
- MA2031N: Differential Equations – Would consider as an interesting option. May be essential for other fields.
- MA2032N: Mathematics of Finance – Would consider as an interesting option. May be essential for jobs in Finance.
- MA2034N: Further Mathematical Techniques – Would consider as an interesting option
- MA2035N: Graphs and Networks – Becoming more and more essential in my industry. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry.

- MA2036N: Further Discrete Mathematics – Would consider as an interesting option
- MA2038N: Groups and Vector Spaces – Would consider as an interesting option
- MA2039N: Project Management for Mathematicians – Excellent Material. Should be made Core, and every student should take this course. The skills gained from this course would make students significantly more employable.
- MA2040N: Foundations of Statistics – Becoming more and more essential in my industry. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA2042N: Medical, Biological and Forensic Statistics – Would consider as an interesting option. May be essential for other fields.
- MA2045N: Data Mining – Excellent Material. Should be made Core, and every student should take this course. With the proliferation of large data sets in every field/business, this is becoming an essential skill required of a Mathematician. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable.
- MA2046N: Simulation – Becoming more and more essential in my industry. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry.

Year 3 – Module Notes:

- MA3P47N: Project – Would consider as Core. Having the project run as an industrial placement would make students significantly more employable in my industry.
- MA3031N: Mathematical Modelling – Becoming more and more essential in my industry – but missing an introduction to the Bayesian approach. If a Bayesian approach was included, it would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry, especially if a Bayesian approach was included.
- MA3032N: Computational Methods in Finance – Would consider as an interesting option. May be essential for jobs in Finance.
- MA3033N: Real and Complex Variable – Would consider as an interesting option
- MA3034N: Advanced Numerical Mathematics – Would consider as an interesting option
- MA3035N: Automata and Languages – Would consider as an interesting option
- MA3036N: Cryptography and Number Theory Finance – Would consider as an interesting option. May be essential for jobs in Cryptography.
- MA3038N: Error Correcting Codes – Would consider as an interesting option. May be essential for jobs in the Communications industry.
- MA3039N: Linear Optimisation – Would consider as an interesting option
- MA3040N: Advanced Operational Research Techniques – Would consider as an interesting option
- MA3041N: Forecasting – Becoming more and more essential in my industry. Would be very useful as a short course for industrial mathematicians in my industry. The skills gained from this course would make students significantly more employable in my industry.
- MA3044N: Mathematics Independent Study – Would consider as a useful option
- MA3046N: Project Preparation – Very good to have this bridge to ensure a more successful project. The skills gained from this course would make students significantly more employable in my industry.

Appendix 5

Minutes of the Industrial Panel Meeting

Thursday 9 June 2011, London Metropolitan University

Present:	Nigel Steele (Chair)	NS
	Chris Bean (Walsh Group)	CB
	Pargat Singh Calay (London Metropolitan University)	PC
	Dave Collett (NHS Blood and Transplant)	DC
	Benjamin Dias (Unilever R&D)	BD
	Nino Folic (London Metropolitan University)	NF
	Melissa Goodman (CORDA)	MG
	Hazel Kendrick (IMA)	HK
	Dominic Palmer-Brown (London Metropolitan University)	DPB
	Alan Stevens (Formerly Rolls-Royce)	AS
	Vanessa Thorogood (IMA)	VT

1. Welcome

NS welcomed everyone to the meeting.

2. Statement of Membership

The Panel agreed that for this meeting, membership numbers were sensible.

The Panel also identified that communication was missing from the agenda. The video produced of this meeting will be seen by the Mathematics faculty and maybe the university's marketing department. The minutes, if suitable, will also be made public.

3. Remit and status of Committee

Subject to a few changes, the Panel agreed to adopt the Terms of Reference for the Industrial Liaison Group of another University. NS agreed to send this to VT to make the changes.

Action NS

4. Introduction to today's business; status of courses and modules

PC circulated to the Panel module specifications for the following degree programmes currently offered by London Metropolitan University;

- BSc (Hons) Mathematics;
- BSc (Hons) Mathematical Sciences;
- BSc (Hons) Mathematics & Computer Science;
- BSc (Hons) Mathematics & Engineering Applications;
- BSc (Hons) Decision Science;
- BSc (Hons) Financial Mathematics.

In the academic year 2012/13, new degree programmes will be offered in Mathematics whose modules will stem from existing modules. The advice and comments provided by the Panel from today's meeting will be considered when developing the new degree programmes.

The employability module of the current degrees is being replaced with a work-related learning module. Students will undertake work style projects to recreate a working environment.

Students also have the option to undertake Academic Independent Study instead of a project at level three. Where a student is offered titles of projects to pick from for their project, the student picks a topic to study which is not part of the curriculum.

The degree programmes do have the option of including a placement year, but only a small number of students undertake this. MG commented that students who undertake a placement year are at an advantage when they graduate and start applying for jobs as they will have that experience. Companies also benefit from employing placement students as they are cheaper to employ and the recruitment costs are reduced. Some students are already aware of the advantages of undertaking a placement year and these advantages, such as increased employability and the opportunity to earn money.

5. Discussion of above in terms of professional importance; changes which could/should be made

In turn, each member of the Panel highlighted key points from their comments of the module specifications.

AS's perspective of the module specifications was of an employer interested in the modules for their employees and made the following comments;

- Modules containing employability skills will not be of interest to employers as they will assume their employees will already have these skills. These modules can include more Mathematical content to compensate the removal of the employability skills.
- Employers could provide real data for 4b and allow the students to visit their company. This would also allow the students to develop knowledge of the company. The students can then present their project to senior executives of the company.
- Employers prefer short courses as it is easier to release people.
AS would expect a short course to provide a certificate on completion as evidence for CPD, whilst a longer course would be more in line with a diploma.
- Taking into consideration of the location of London Metropolitan University, the financial industry and statistics for engineers were suggested as potential areas for developing short courses in.
- The project management and oral presentations are an advantage of the modules as these skills are not normally included in traditional Mathematics degrees.

MG highlighted the following point;

- Giving credits for developing soft skills, such as CV writing, took away the opportunity for more academic study, though it was appreciated that students do not take these opportunities unless they were given credit for them. MG agreed to give a masterclass in CV writing.

Action MG

BD highlighted the following points;

- To ensure that links with industry happen in practice.
- Soft skills are important, but the employer can provide training for these. Competencies are more valuable.
- Placement years are also valuable.
- It will be an advantage to the students to expose them to relational databases.
- Approach employers early for industrial projects, as they will need to incorporate these into their timelines, budgets etc.
- CV writing could be included as part of the project, along with interviewing the students for undertaking a project provided by Unilever.
- DB agreed to provide industrial projects.

Action DB

DC provided the following comments from a statistics view point;

- The statistical content of modules should be suited to employers needs.
- The statistics software packages currently used are good.
- Exposure to statistics should be exciting.
- Incorporate project based work with industry.
- DC is happy to provide data sets in medical statistics.

Action DB

CB provided the following point;

- Soft skills are very important. A good CV will catch the attention of an employer and invite that person for an interview.

AS, DC and CB agreed to speak to the Mathematics undergraduates concerning careers.

Action AS, DC and CB

The Panel discussed the IMA's Tomorrow's Mathematician Today Conference and PC asked the Panel for suggestions of a guest speaker to attract delegates. PC agreed to email HK for suggestions.

Action PC

DB also suggested that students should be trained to speak to non-Mathematics people because when employed, an individual can find themselves speaking to senior managers who may not have a Mathematics background.

6. Future directions; new expertise, staff development etc

The Panel discussed further the possibility of the Mathematics department at London Metropolitan University offering on-site, short to employers for their employees. Short courses in financial forecasting with statistics and Mathematical software packages were suggested. The cost of running the courses would need to be covered by the employer. It would also be beneficial if the university and/or the IMA could recognise the short courses in some way.

The Panel made the following suggestions for the undergraduate degree programmes;

- Large sparse data sets.
- Graphs and networking.
- Social network analysis.
- Viral marketing.
- Anti-terrorist applications.
- Visual analytics.
- Teaching procedural languages to provide the students with the skills to learn other computing languages.

The Panel also suggested that a member of staff within the faculty may benefit from a secondment to a company. This could be achieved by either the staff member taking unpaid leave from the university for a year, the university seconding the staff member to the company or a lecturer and an employee at the company swap roles.

7. Regularity of meetings

The Panel agreed that the current membership of the Panel would benefit from representatives from other industries. The names of the members of the Panel will be passed to the Faculty's Industrial Panel.

8. Date of next meeting, agenda to include report on outcomes from this meeting

To be arranged for June 2012.

