ACOUSTICS 2012

Masters course in Acoustics at London South Bank University - A route on to our PhD programme

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The Masters program in Environmental and Architectural Acoustics (MSc) from London South Bank University is taught at the Department of Urban Engineering. This was the first Masters course at the University and has been running for more than 30 years. The MSc program is delivered on a two and five semester basis depending if taken on a full-time or part-time basis with a 2 semester exemption, if the applicant have already been award an Institute of Acoustic Diploma. The course is focused on the application of tools to solve real world acoustic problems in the built environment. The Masters students spend 50% of the time in the laboratory undertaken practicals which either prove or disprove classical acoustic theory using the very latest acoustic equipment. The course culminates with a thesis which the student normally undertakes over the summer. The best dissertations are then put forward for international awards and the students get to go to an international conference in an attempt to attract them on to our PhD programme.

1. Introduction

At university there is a constant drive to teach and apply the latest scientific knowledge and professional practices, so as to provide the students the best possible education. This is a great endeavour that challenges the structure and basis of each educational institution. In order to adapt to the fast changing requirements in these difficult economic times it has been necessary to provide focused, innovative education that offers something to potential employers as well as to academia.

Employers' requirements are based on communication skills, professional management and scientific research with understanding of the derived international standards which must be adhered to. As such, the course would need to be validated by an appropriate professional body; in the UK this would be one registered with the Engineering Council.

This has been the approach taken by London South Bank University since the course started in 1977, it was also the first Master programme at the University. We are fortunate enough to have a fully equipped and staffed acoustic laboratory with a reverberation chamber, sound proof booth and an anechoic chamber. We run the latest software packages such as CADNA, CATT-Acoustics, Revit:Ecotect, Google Sketchup, ARTA, and winMLS.

Each year the course recruits approximately 12 students, usually split 50:50 between part-time and full-time. There is also a possibility to join the second year of the course directly, if the student possesses an Institute of Acoustics Diploma. This has proven popular as it saves the sponsoring company/student time and money. The students come from a wide range of backgrounds including architects, musicians, audio technologists, designers, physicists, electrical engineers, mathematicians and building services engineers. This allows plenty of scope for group discussion.

Figure 1 shows the structure of the course by semester. Within a semester, the students are involved in several different complementary learning situations, lectures, tutorials, experiments, group work, seminars and individual study. The combination of these activities lead to in-depth theoretical and practical knowledge related to a number of different problem areas, this is shown in Figure 2.

Semester 1

Morning 9-1pm	*Afternoon 2-6pm*
Research Methods 7	Subjective and Environmental Acoustics 7
Thermal Environment, Acoustics Lighting 7	Measurement and Control of Sound 7 + Open lab

Semester 2

Morning 9-1pm	*Afternoon 2-6pm*
Environmental Management 7	*Project Lab*
Architectural Acoustics 7	Measurement and Control of Sound 7+ Open lab
Engineering Project 7	

Figure 1. Full-time model for the Masters course in Environmental and Architectural Acoustics

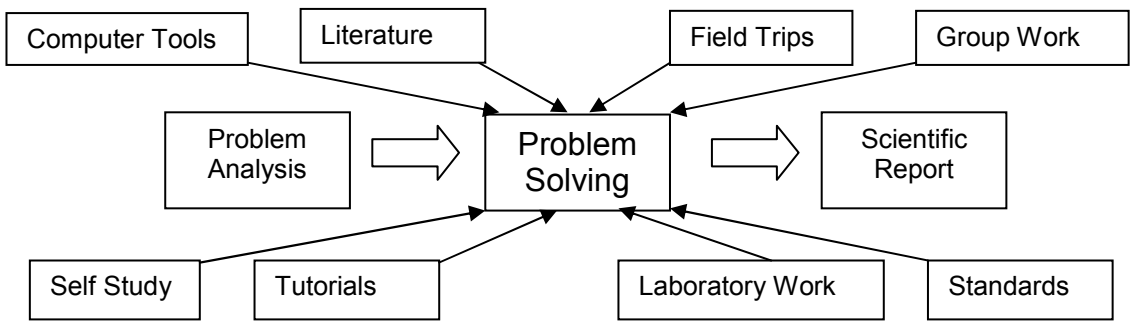

Figure 2. Problem solving structure diagram for the Masters programme.

Through problem-based learning in groups the students develop competences in the areas of focus, as well as management and organizational skills. The learning is formalised through technical reports and oral presentations. Additionally, within the groups, there is a great deal of peer learning, in which students share their skills to achieve a common goal. Another important element of the group work is the social environment generated. The students belong to a unit, and as such have responsibilities to it. The students share contact details through a Microsoft Live Group, a Blog (lsbu-acoustics.blogspot.com), emails and SMS texts. This allows experiment based information to be distributed very efficiently such as measurement results and digital pictures.

The students not only come with a great deal of disparate experience, they also come from across the globe, such as Columbia, USA, Canada, Australia, France, Spain, Greece, Saudi Arabia, Argentina, Turkey, Ireland, India etc; making an international working environment that forces the students to confront social and cultural differences common in modern working environments.

2. The South Bank University Approach

At London South Bank University we expect the students to come with a deal of professionalism and commitment, as such every student is individually interviewed for a place on the course. The entry requirement for the programme is a first degree in a numerate subject or suitable experience in an associated field, but interest in the subject is the key.

The taught modules, see Figure 1, consist of six 20 credit modules. These are taught morning and afternoon two days a week for 36 weeks for those taken the course on a full-time basis. Meanwhile, the students are strongly encouraged to pursue their project idea, as this 60 credit module is essential for the award of MSc. The students submit project proposals at the end of their first semester.

2.1 Experiment, Experiments, Experiments

The students are given hands-on experience with the latest acoustic equipment, but before they have the chance to break the expensive analysers and microphones we will teach them how it used to be done! Luckily as the course has been around for such as long time we have vintage Bruel and Kjaer sound level meters, e.g 2203 and 2209, so that the students learn more than just how to press the right button at the right time.

There are four specific acoustic modules and two generic modules, Research Methods and Thermal Environment, Acoustics and Lighting, which shows the relationship with our sister courses in Building Services. Below is a brief outline of the acoustic modules.

In Measurement and Control of Sound the students are given a grounding in acoustics. This is taught over two semesters, the first on measurement, calibration, changes with frequency and time, how sound propagates (we use hairdryers for this, see Figure 3) and end up being able to measure and understand the various sound insulation parameters. The second semester concentrates on case studies, noise control applications, vibration issues and practical investigations, which are undertaken in small groups. The students undertake approximately 15 experiments in total, of which three are written up formally.

In Subjective and Environmental Acoustics the students learn about the human hearing system and its protection, and noise in the built environment. This module is taught over one semester in two halves with approximately 10 experiments undertaken by the students ranging from audiometry to head and torso based experiments on the effectiveness of active noise cancelling headphones, see Figure 4. For the environment aspect the experiments range from Noise Mapping to a BS4142 noise assessment.

In Architectural Acoustics the students learn about room acoustics at different frequencies and the tools available to address these problems. There are many field trips undertaken to illustrate various aspects/challenges that need to be tackled. In recent years these have included measurement at the Royal Academy of Music, Henry Wood Hall, St Paul's Cathedral, Tate Modern, and the Royal Festival Hall, see Figure 5. The latest measurements tools are compared to the earlier systems such as balloon burst, loudspeaker, to dodecahedron sound source using impulsive, wideband interrupted noise, Maximum Length Sequences and exponential Swept Sine signals. Modelling is undertaken using CATT-Acoustics with SU2CATT and Google Sketchup for the detailed work and Autodesk Revit:Ecotect for quick and simple simulations.

Finally, we have the Environmental Management module which is focused on two areas: legislation and what we have decided to call cheap acoustics. Legislation is self explanatory, however cheap acoustics can cover a very wide range of subjects and it's up to each student to decide what interests them. This also acts as a mini-project and provides an opportunity for the students to practise their oral presentation skills. For more information see [1].

During these modules we have guest lecturers visit to address a specific topic or to present the latest acoustics equipment. In recent years we have had Rion, Norsonic, Svantek and Bruel and Kjaer on the instrumentation side, experts on speech intelligibility, a seminar on the workings of the Association of Noise Consultants, and visit from consultants on how to be a consultant.

2.2 The Newman Fund and Research Focus

Research has always supported our teaching. Hence, many of our students have made the leap from being a Masters student to becoming a PhD candidate. The intermediate step has been a research focused dissertation on a project of their choosing. This has lead to projects with Telent on improving the speech intelligibility on London Underground, to working with the Royal Academy of Music and the London Philharmonic Orchestra, to working with Brookfield's on the Strata Tower (the first skyscraper with building integrated wind turbines), see Figure 6.

To encourage the best students to make this step, we have been successful in a number of external funded awards. The Acoustical Society of America administered Newman Fund [2] has helped significantly by first allowing us to develop our own website [3] through the Schultz Grant, and then by

repeatedly awarding the Newman medal to our best student each year. We are also fortunately in being sponsored by a local acoustic consultancy, RBA Acoustics [4], they also make an award for best dissertation prize. This is greatly appreciated and leads nicely to another area which strongly encourages students to consider research – that of attending conferences.

2.3 Encouraging the students into Research

Over the past six years a new approach to encourage students to undertake research and perhaps go on to the PhD programme has been implemented. This was started with the generosity of the Royal Academy of Engineering international travel awards. National conferences were attended if they were located near London, Southampton in 2006 and Reading in 2008 [5,6,7], to reduce costs. Then it was decided that the best students should write and present their dissertations as a paper, Acoustics 08 [8,9] and Euronoise 2009 [10,11,12] in Paris and Edinburgh, respectively. Finally, the students presented their dissertation at international conferences, for example Ghent 2010 [13,14] and Acoustical Society of America in Seattle 2011 [15].

Figure 3. Sound Propagation Experiment using Hairdryers

Figure 4. HATS for Active Noise Cancellation

Figure 5. Acoustic students at Henry Wood Hall

Figure 6. Strata Tower with Integrated Wind Turbines

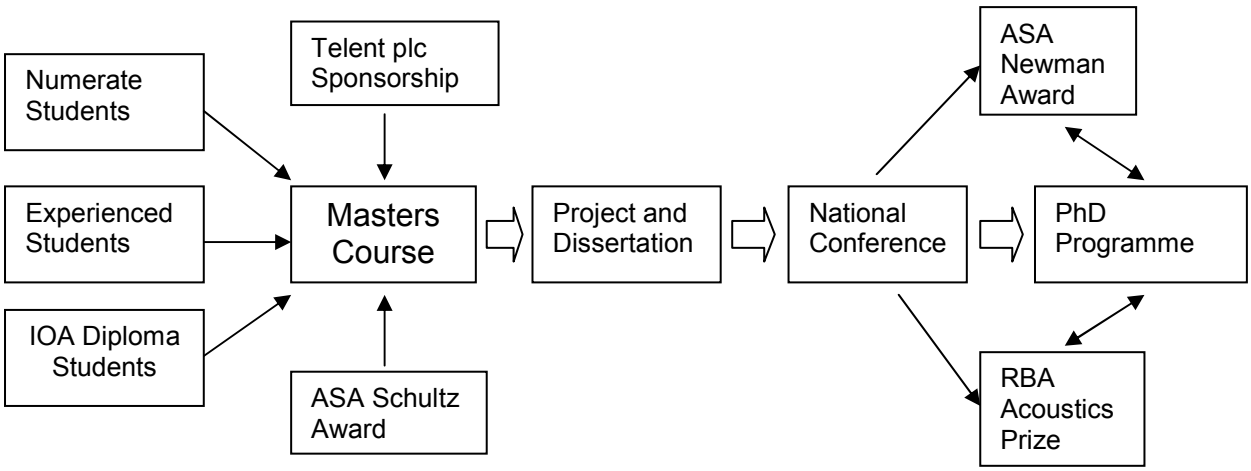

Figure 7. Encouraging the students towards our PhD programme

2.4 The PhD Plan

The early results of our drive to tempt the best students on to the PhD programme are encouraging, thus demonstrating that the model is a valid one. So far, nine students have progressed on to the PhD programme, of which four have completed their studies. In addition four, have won the Newman medal and three the newly introduced RBA Acoustics Prize. However, not every award winner went on to the PhD programme.

Here are a few case studies of Newman winners and their progress.

Georgia Zepidou undertook her MSc dissertation on , "Rehearsal rooms for classical musicians" , which was presented at the ICA 2007 in Madrid [16]. Now she is writing up her doctoral thesis which is entitled, "Development of techniques for the mitigation of noise exposure for classical musicians". Georgia is a classical trained musician and architect.

Gil van Buuren undertook his MSc dissertation on, "Low frequency acoustics of listening rooms using a numerical wave model", which he presented at Euronoise 2009 in Edinburgh [10]. Gil is a classical musician and now an acoustic consultant and Director at AECOM.

Nick Durup undertook his MSc dissertation on, "An investigation into the acoustic modelling, design and testing of a music rehearsal facility", which was presented to the joint IoA/Belgium Acoustical Society in Ghent 2010 [13]. Nick is now undertaken research entitled, "An investigation into the effect of vocal strain on teachers". Nick is an audio technology graduate and an acoustic consultant with the Sharps Redmore Partnership.

John Zeman undertook his MSc dissertation on, "The measurement and evaluation of bespoke three-dimensional absorptive panels - A comparative analysis" . which was presented at the 161st Meeting of the Acoustical Society of America in Seattle 2011 [15]. John graduated in Sonic Architecture and has just started working for Veneklasen as an acoustic consultant.

3. Conclusions

London South Bank University's Masters of Science Program in Acoustics is based around real world problem solving using the latest equipment either in the field or based in the laboratory, this usually depends on the weather! This puts the bulk of the learning responsibility on the students, they must strive to achieve the necessary competences in order to fulfil the requirements of each module. However, the students have an excellent text [17] which provides a useful source of assistance.

The Acoustics Group approach to postgraduate education has been found to successfully combine students from disparate subject areas and experiences. In the end the group based approach continues to win international recognition and feeds our growing PhD programme.

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