***StudentShapers Translation of research in to teaching projects:***

***Proposal questions and guidance***

Use this document to plan and draft your responses to key questions before submitting them via the proposal portal at <http://www.imperial.ac.uk/students/studentshapers/how-to-get-involved/studentshapers-translation-of-research-in-to-teaching-projects/>

* **Project title**

Pedestrian dynamics for MSc/MEng Civil Engineers

* **Lead staff partner**

Dr Arnab Majumdar

* PhD supervisor (if different from above)
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* **Faculty**

Engineering

* **Department**

Civil and Environmental Engineering

* **Additional staff partners**

Dr Marc Stettler

* **Duration of project**

10 weeks

* **Expected timescale for input of project in to taught curricula**

1-2 month(s)

* **Total funds requested**

£4600

* **Costings breakdown**

|  |  |  |  |
| --- | --- | --- | --- |
| Number of students | Cost/week | Weeks | Total cost |
| 2 | 230 | 10 | £4600 |

According to the standard student shapers bursary rate, the total cost also represents both students working on the project for 2 days a week for a total of 10 weeks, costed at £230 per student per week.

* **Rationale for project (e.g. from Student feedback, liaison with the Academic Rep Network, curriculum review outcomes, industry input)**

*There should be a robust background that underpins the project. This may come from a single or variety of sources, but together should identify how the project directly enhances the curriculum with aspects of current disciplinary research. It may be that his project is linked with other educational development work taking place in the department, in which case the wider context in which the project is situated should be outlined.*

Pedestrian dynamics is a fledgling industry that incorporates a wide array of different disciplines, including safety, infrastructure design, modelling and psychology. This project will develop a MSc/MEng level course on this subject, covering both academic and practical aspects.

Civil Engineering Transport courses T 29 and CI 4734 are being redesigned to include more rigorous, quantitative methods. Pedestrian dynamics offers the opportunity to include these quantitative methods, as well as develop the Civil Engineering curriculum to include state of the art engineering disciplines.

Furthermore, feedback from a consultancy based in London suggests that there is a significant need for graduates with experience in pedestrian dynamics, as well as the analytical skills to critically appraise the benefits and drawbacks of specific models.

Finally, the development of this course represents an opportunity to ensure that research currently being done at Imperial is incorporated into the undergraduate experience. The Transport Risk Management Centre (TRMC) in Civil Engineering has developed significant expertise in the area of pedestrian dynamics, and is actively researching specific areas within this industry. This course would be the primary method of disseminating this research to the undergraduate and graduate populations at Imperial College.

* **How does this project link to current research activity within your discipline?**

*In lay terms you should clearly explain how the curriculum will be enhanced by current research activity in your discipline, and hence underpins Imperial’s research-based education.*

Pedestrian dynamics is a developing area of research within the department of Civil and Environmental Engineering, and to Imperial College London as a whole. Current research activity within this discipline is being conducted by researchers at the Lloyd’s Register Foundation Transport Risk Management Centre at Imperial College London.

Areas of research include movement responses to terrorist attacks, evacuation from complex buildings, movement of visually impaired pedestrians and macro/micro scale interface modelling. Elements of this research will fit neatly into the curriculum, providing an insight into potential future research activities for students.

* **Project outline, including how an authentic staff-student partnership will be adopted and how the work aligns with the Learning and Teaching strategy**

*A description of the project. Within this it should be made clear how the work will lead to a curriculum development that is commensurate with the learning and teaching strategy. The proposed methods and practicalities of the project should also be covered to demonstrate that aspects of the Guiding Principles for Partnership are adopted:*

* *A partnership approach should equally value the expertise of staff and students*
* *Partnerships should present equal opportunity for all students*
* *Partnerships should achieve an appropriate distribution of power*

This project entails the design and recording of four, hour-long lectures, and the writing of four, hour-long of workshops based on these lectures. These will introduce, develop and expand the concepts of pedestrian dynamics, with no previous experience required. There will also be coursework and exam questions set for the students, at an MSc and MEng level.

This new material will modify around half of the previous course content, including adapting safety theory, safety management systems, accident and incident investigations, and quantified risk assessments to include urban environments and human safety concepts. The new content improves significantly on the previous content as it both reflects the current research expertise of academics within the department and relates more with the environmental aspects of the course - especially when viewed from the perspective of transportation in urban environments. Furthermore, the new course material will be significantly more up to date with current research topics and regulations than the previous content. Additionally, the course content itself allows for much more interactivity to be incorporated into the teaching methods than previous content.

This course will be developed with an aim to incorporate with the rest of the module, and will include modern methods of improving interaction levels, for instance using a flipped classroom approach, with recorded lectures and reading material, followed by workshops based on the previous week’s work. Further approaches will include Mentimeter polls and discussions, as well as potential guest lectures from a number of specialist engineering consultancies.

The module learning objectives for this section of the course would be:

1. Understand pedestrian movement in both emergency and non-emergency situations, including emergent properties of crowd dynamics and individual behavioural theories.
2. Design pedestrian dynamics experiments and run simulation models to analyse and predict crowd behaviours, appreciating the limitations of both of these methods.

A basic outline for the lectures and workshops is provided below:

**Overarching theme: how would you analyse a moving crowd?**

Lectures

1. Pedestrian dynamics introduction
   * Introduction to industry.
   * Emergent properties of human movement behaviour (lane formation, zipper, etc).
   * Hydraulic model example.
   * Current research and application.
2. Evacuation behaviour
   * Theoretical models: how do people act in emergencies?
   * Quantitative evidence: what theories are supported?
   * Modelling examples: how do we model this?
3. Simulation models
   * Types of computer model (e.g. ABM, cellular automata, network, fluid, etc)
   * Benefits and drawbacks of each.
4. Data
   * How data is important for everything in this industry.

Workshops and pre-work

1. Pedestrian dynamics introduction
   * Pre read: Two seminal papers to introduce the concepts.
   * Mentimeter poll to check understanding after lecture.
2. Evacuation behaviour
   * Pre read: Two seminal papers, one outdated, one up-to-date.
   * Mentimeter poll to check understanding after lecture
3. Simulation models
   * Pre read: One seminal paper, one flawed paper.
   * Mentimeter poll to check understanding and test interpretation of paper.
   * Presentation of two (or more) simulation models to show different methods of modelling.
4. Data
   * Pre read: Collation of data set paper, and example experimentation paper.
   * Mentimeter poll to check understanding and interpretation of experimental approach.

The proposed course integrates with Imperial’s revised learning and teaching strategy in a number of ways, including:

* Curriculum Review: Updating this module will allow for the inclusion of more multidisciplinary educational content, and interaction with the world outside of Imperial through a potential guest lecture delivered by a pedestrian dynamics consulting company.
* Interactivity: The flipped classroom approach is a modern pedagogic method, very different to lecture-based classroom sessions, that will allow students to investigate taught components of the course themselves through the workshops. Thus, they will move away from simply retaining information. Additionally, the use of feedback apps such as Mentimeter polls during the delivery of the course enables increased interactivity between the students and course teachers.
* Inclusivity and diversity: The use of group work within the workshop sessions will fulfil this requirement. Student’s diverse experiences of culture are also fundamentally embedded into this course through its content, which will examine human behaviour, cultural aspects of which are extremely relevant.
* Online and digital enhancements: Again, this strategy requirement will be fulfilled through the use of the flipped classroom approach and feedback apps. The video lectures will be uploaded onto Blackboard so that the students can access them whenever and wherever is convenient. Further, students will be encouraged to use their own mobile phones or computers to give instantaneous feedback through Mentimeter polls.
* **Projected outcomes and benefits for both the department and or student experience and how long-term impact will be sustained.**

*The tangible project outputs should have a longer term and sustainable outcome on curriculum development in the department. This may, for example, contribute to a different approach to learning by students, embedding of a learning technology into a module etc.*

This project represents the opportunity for Imperial College to provide one of the first taught courses on a rapidly growing industrial and academic sector of engineering. By providing this course on pedestrian dynamics, the College would stand out in its educational capacity, as well as its reputation as a world leading academic institution.

Further to this, it would allow far more collaboration between the Civil Engineering Department and the rest of the College. A key example of this is the possibility to include the recently launched Dyson School’s Human Behavioural Experience Group (HubEx) as a population that would be interested in attending the course.

For the students themselves, this course provides them the opportunity to perform rigorous engineering, while tailoring it to both academic and industrial problems. An example of this might be the use of department technology to obtain data for calibrating and validating specific computational models. This project will develop the course in conjunction with industrial partners, and there is an opportunity for both guest lectures and internships provided for the students.

Finally, this course will be developed to include novel pedagogical techniques, including a ‘flipped-classroom’ and continuous reinforcement through formative appraisal (e.g. a Mentimeter poll), while still providing the required level of technical content and summative assessments in exams.

* **Proposed method of progress checking/update; (include whether this will come from multiple sources, student/staff partners, event-based feedback from stakeholders, etc)**

*Consider how you will ensure that the project maintains progress; this may involve aspects beyond the final formal phase of the partnership, to ensure that the longer term impacts are sustained.*

This project will be checked at various milestones before conclusion, including by members of the Civil Engineering faculty, and by industry professionals.

The primary milestone will be to confirm that the course accurately represents the current state of the pedestrian dynamics, and is of the pre-requisite difficulty for an MSc/MEng course module. In order to pass this milestone, all lectures, pre-reading material and exam level questions will be inspected by faculty academics and industry professionals.

The dedicated staff partner (Dr Arnab Majumdar, Reader) will supervise the project, reviewing both the course content and proposed delivery according to his significant experience and expertise in teaching master’s level courses within the Department of Civil and Environmental Engineering. One of his duties will be to ensure that the course can continue to run at Imperial after the completion of any PhD research, either through teaching it himself, or ensuring that other researchers under his supervision are able to deliver it competently. He will also assist with the design of assessment activities. He will aid with the design of coursework activities to ensure the workload is appropriate, utilising his previous experience of designing coursework projects for this course. He will also aid with the design of examination questions, again ensuring that these are at a level of difficulty sufficient for MEng examinations, and can be marked in accordance with department procedures.

Dr Marc Stettler (Senior Lecturer) is responsible for the teaching of the environmental half of the course (the content of which will remain the same). Regular meetings, and input from, this staff partner will ensure that the new content thoroughly links and blends with the continuing course content.

The course itself will be included in the department GTA and lecturer feedback processes on SOLE, to allow continuous updating and improvement in subsequent years.

Furthermore, there is scope to extend the development of this course to target an IExplore course. This will be considered after the conclusion of the MSc/MEng course design.

* **Experience and/or training undertaken in teaching in Higher Education**

*PhD students would normally be expected to have some experience of GTA work in a range of different modules/settings and thus be familiar with a number of different learning and teaching activities. You should also have completed some of the Graduate Schools GTA programme, or be intending to do so. It may be that you select some additional courses from the GTA programme that would directly inform the project.*

Both PhD students involved in this project have significant GTA experience. Alastair Shipman has recently obtained Associate Fellowship of the Higher Education Academy (AFHEA) as a consequence of his GTA work on a variety of modules within the department of Civil and Environmental Engineering, including: CI-222 Statistics; CI-220 Complex Mathematics; CI-231 Structures, CI-120 Linear Algebra. He has assisted in tutorials, created and delivered an hour-long statistics lecture, and marked tests and examinations.

Georgia Bateman has conducted GTA work on courses in the Department of Civil and Environmental Engineering, and the department of Physics during the course of her PhD: CI1-120 Year 1 Mathematics, and MSc in Physics ‘Research Skills: MATLAB’. During this work, has assisted students in tutorial sessions, created content for a short (15 mins long) lecture, marked tests, and conducted viva examinations. She is working on her application to become an Associate Fellow of the Academy of Higher Education.

Both Georgia and Alastair have also supervised MEng, MSc and UROP projects on pedestrian dynamics within the Civil and Environmental Engineering department.

Their wide variety of GTA and supervisory work exemplifies their skills in two areas of significance to this project: creating and delivering course content, and providing feedback through a variety of different mechanisms including, oral coursework and examinations.

* **Benefits of this project to your career plans and aspirations**

*Outline how being involved in collaborative educational development work may be beneficial to your future career plans.*

Both applicants wish to pursue a career in research and teaching in higher education, for which experience of developing curriculum content and delivering teaching through modern, innovative teaching methods would be of great benefit. The opportunity to do this through a student shapers project is a unique opportunity that, both student applicants would relish the opportunity of.