

Climbing up the Slippery Slope – helping first year engineers to master the peaks and troughs of differentiation

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Abstract: *This workshop will focus on the one mathematical concept always encountered by first year engineering undergraduates: differentiation. In our experience, this concept proves to be particularly challenging to those engineering students without an A Level in Mathematics and/or from a non-traditional mathematical background.*

After a short introductory presentation, participants will be asked to form small groups; they will remain in these groups throughout the workshop activities. Each group will be given three fictitious student profiles and asked to highlight the particular difficulties they believe will be encountered by each student when they first attend lectures on differentiation. Following this, each group will be given the opportunity to choose a variant on the main topic from a given list - for example, the general concept of a derivative, or finding maximum values. Flip charts and some materials will be provided. Each group will be asked to identify methods of teaching, focus on likely difficulties and come up with interesting and novel ways of presenting the material to these students.

Finally, each group will disseminate their portfolio of ideas to all participants. It is hoped that participants will benefit not only from lively discussion within their group but also, from the general showcasing of group outputs, they may take away ideas to be developed further in order to benefit their own teaching.

Outline of the workshop

Activity	Time (minutes)
Introduction – Welcome, formation of small groups, participants introduce themselves to each other	5
Presentation - Facilitators give an overview of the workshop format	10
Task 1 - Participants generate initial ideas inspired by picture cards and objects	10
Task 2 - From given student profiles, participants identify potential difficulties	10
Main Activity - The aim is for each group to develop interesting and novel teaching ideas	40
Dissemination - Each group will present their ideas	15

Overview of the workshop

The workshop will commence with participants placed into small groups; they will remain there for the duration of the session. Time will be available for members of each group to introduce themselves to each other.

The facilitators will then give a short presentation which will provide participants with information about the workshop and also highlight some of the general difficulties with mathematics that may be encountered by students with different backgrounds.

Task 1 is a warm-up session which has been designed to generate initial creative ideas. Each group will be given a selection of picture cards and everyday objects, for example, a ball, a toy car, a picture of a racing track. They will be encouraged to discuss and extend any initial creative teaching ideas that have been inspired by the selection of items.

Task 2 involves the sharing of knowledge and expertise between participants. It is intended to increase awareness of the difficulties that may be encountered by different members of the student population and the teaching challenge this presents. Each group will be given fictitious profiles of a dyslexic student, a mature student who has not studied for several years, a student who has English as a second language and a student whose highest qualification in mathematics is GCSE. Participants will list the difficulties likely to be encountered by these students as they start to study differentiation.

The Main Activity extends and develops the outcomes of the previous tasks and aims to produce concrete ideas which will enhance the student learning experience. Each group will be asked to choose one of the following topics: (1) introducing the concept of differentiation, (2) notation associated with differentiation, (3) local maximum and minimum points. They will then work together to produce accessible and inspirational teaching plans in a structured format. These should address specifically the challenges presented by at least one chosen student profile. Each group will then decide the target audience for their teaching material, for example, one-to-one support, small group tutorials or a lecture. Participants will be provided with paper and coloured pens in order to capture their outputs and ideas. Throughout this Main Activity, the facilitators will encourage and elicit creative thought, while allowing the participants the freedom to develop their own chosen path within the given remit.

Finally, each group will be given time to showcase their materials and disseminate their ideas to all participants and facilitators. It is hoped that members of the groups will benefit from this sharing of expertise and creativity and it may prompt further discussion between them during the remainder of EE2010.

Learning outcomes

The intention is that this workshop will allow individual participants to take away and develop in the context of their own style, needs of their students and their institution the ideas gained from discussion within their group and by listening to the feedback from the other groups. It is anticipated that participants will also benefit generally from increased awareness of the difficulties encountered by many students with disparate needs and wide-ranging mathematical backgrounds. The main learning outcomes are summarised below:

- Increase awareness of student difficulty
- Opportunity to share good practice
- Produce student-focussed teaching plans
- Enhance the teaching of differentiation

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