

## Increasing Learning by Decreasing Choice: What Do Students Think?

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*In first-year engineering mathematics programmes in Dublin Institute of Technology, students were commonly required to attempt five out of eight questions in their end-of-year examination. As these questions are based on well-defined areas, this allows students to entirely omit certain topics and still perform impressively. This approach causes serious problems in later years, as students lack the basic knowledge required to attempt more advanced mathematics. A common example of this is differential equations: many students skip integration in first year, only to discover this is a pre-requisite for second and third year material. This observation is borne out by the fact that the most common problem for which engineering students sought help in the Students' Maths Learning Centre last year was basic integration, with 56% of those coming from second or third year.*

*One way to address this problem would be by reducing (or even eliminating) choice questions on mathematics papers in first-year: if the material covered is necessary groundwork for later years, it should not be possible for students to omit it entirely. In this study, the results of an anonymous survey completed by students to determine their opinions of reduced choice in early years are presented.*



# Increasing Learning by Decreasing Choice: What do Students Think?

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## 1. Introduction

- Honours (Hons) and Ordinary (Ord) degree engineering programmes available in Dublin Institute of Technology
- Students with high grades in 3<sup>rd</sup> year Ord may transfer into 3<sup>rd</sup> year Hons
- Issue: Large choice in engineering maths exams
- Students tend to omit certain topics
- Causes difficulties in later years
- Example: Most common problem for engineers seeking help in Maths Learning Centre is integration
- 56% of these are from 2<sup>nd</sup> or 3<sup>rd</sup> year
- Need integration for differential equations
- Survey: Obtain views of engineering students on reducing/eliminating choice in maths exams

## 2. Structure of Survey

• 10 questions, anonymous, on WebCT

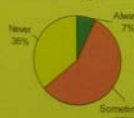
Year, Degree Type	Number of Responses
1 <sup>st</sup> yr, Hons	79
2 <sup>nd</sup> yr, Hons	57
3 <sup>rd</sup> yr, Hons	54
4 <sup>th</sup> yr, Hons	50
1 <sup>st</sup> yr, Ord	1
2 <sup>nd</sup> yr, Ord	2
3 <sup>rd</sup> yr, Ord	33
<b>Total</b>	<b>276</b>

• Fewer Ord responses... but 40% of 3<sup>rd</sup> and 4<sup>th</sup> yr Hons respondents are former Ord students

## 3. Results of Survey

- First 4 questions asked students "Have you ever avoided questions on integration/differentiation/statistics/matrices by choosing other questions?"
- As expected, far more students avoided integration or statistics than differentiation or matrices.

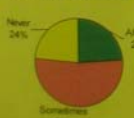
### Avoided Integration



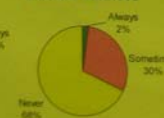
### Avoided Differentiation



### Avoided Statistics



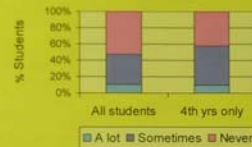
### Avoided Matrices



## 4. Further Results of Survey

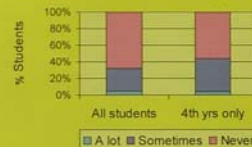
- Next 4 questions asked students "Have you struggled in other subjects because you avoided questions on integration/differentiation/statistics/matrices in earlier years?"
- Results for all students compared with those of 4<sup>th</sup> years

### Avoided Integration... Struggled as a Result



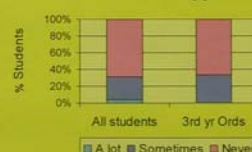
- Major problem: 47% struggled when integration avoided, (rising to 58% for final year students)
- "I've struggled all through college without understanding basics of integration; many classmates are the same."

### Avoided Differentiation... Struggled as a Result



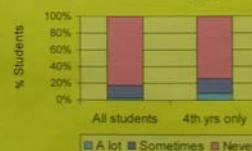
- "Differentiation is sometimes skipped in Leaving Cert, can make college difficult... In later years lecturers assume you know how to do it."

### Avoided Statistics... Struggled as a Result



- No difference between all students and 4<sup>th</sup> years – but 3<sup>rd</sup> year Ord students struggled slightly more

### Avoided Matrices... Struggled as a Result



- As expected, less avoid matrices, so less problems later

## 5. Opinions on Choice

- Issue of choice in exams provoked lively debate, such as:
  - "Choice in exams defeats purpose of exams entirely"
  - "Choice is good. It relieves stress. Keep it please!"

### There should be no choice on maths papers in:



- Suggestions from students:
  - Reduced choice, rather than none
  - No choice in continuous assessment but choice in end-of-year exams

## 6. Compulsory Questions

- 60% favoured compulsory questions on some topics
- No difference when older years studied in isolation

### There should be compulsory questions on:



## 7. Selected Students' Comments

- Students commented on other aspects of maths education:
  - "Need smaller classes... for more individual time with lecturer... impossible in large group... Easier to ask questions in smaller group."
  - "Tutorials effective at routing out problems early on."
  - "Formulae should be allowed; unlikely that engineers in business do not check these before using them so I don't see the need to try and learn them off."
  - "Some lecturers immediately stimulate interest in maths – makes it so much easier!"
  - "Only for Maths Learning Centre. I'd not have got by"

## 8. Conclusions

- Students recognise need for some compulsory questions (e.g. on calculus) to avoid problems later
- 25% of students felt choice should be removed from some end-of-year maths papers
- Many more supported removal of choice from continuous assessments during the year