What the flip? Inverting the foundation maths classroom

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• All students in DLL have disrupted studies
• Primarily mature students (21+)
  – Median age of 30 in DLL compared to 19 over the whole University of Sheffield (Marshall et al., 2017)
• Maths and statistics module is compulsory for all students
• Collaboration with the Mathematics and Statistics Help centre (MASH)
Overall module structure

Semester One
- Pure maths
- +Maths anxiety workshop by MASH (Uusimaki & Kidman, 2004)
- 40% exam

Semester Two
- Statistics
- 20% report

Semester Two
- Pure maths
- 40% exam
What is flipped learning?

- Students learn the content before the lesson
  - Multimedia content on virtual learning environment (VLE)
- Lessons for consolidation and clarification
- Student-centred
  - Active in own knowledge construction
- Teacher/lecturer as a facilitator

“School work at home and home work at school” (Charles-Ogan and Williams, 2015)
Why flip?

- To reduce maths anxiety (Charles-Ogan and Williams, 2015)
- Give higher flexibility for students
- Provide additional support
- Provide a safety net
Weekly teaching structure

- Same format each week so no unpleasant surprises
- Flipped materials given 2 weeks in advance (Woodard, 2004)
- Often mention that MASH is available for additional help (O’Sullivan et al., 2014)
PowerPoints designed by tutor to explain concepts and walk through examples.

Interest and compound interest

Attached Files: interest.pptx (62.146 KB)

These are Powerpoint slides that you should work through before the lesson. Make sure you are familiar with the topic, although clarifying explanation may be given if needed.

Got a question? Padlet

This is a Padlet. It works like a notice board. If there is something you do not understand, or want more background, I will look at these and go over them in the lecture.

Percentage of an amount quiz

Enabled: Statistics Tracking
Please have a go at this quiz before attending the lecture and tutorial, so that you can check the level of your understanding. You can have a go at it multiple times, and the numbers will change each time.

Percentage Math Trick 2 - Solve percentages mentally - percentages made easy!
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**Rounding to Decimal Places**

To **round** a number to a certain decimal place, you need to make the number have that number of decimal places.

You may have to round up the ‘last’ number if the subsequent number is 5 or greater.

**e.g.,**
Round 3.141593 to 2 decimal places.
3.141593 → 3.14

Round 3.141593 to 3 decimal places.
3.141593 → 3.142
(because the number after the 1 is 5 or greater)
Anonymous question posting for the interactive lecture (Padlet)

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Flipped learning materials

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**Decimals**
Put a note here for me to go over in the lecture if there is something you don't understand or want extra explanation for. This padlet is anonymous.

- **My calculator doesn't like dividing decimals?**
- **Relating to square-roots**
  I know they were last week, but I just thought that this was cool...
  [https://youtu.be/cSlNn6pf74t?t=6m26s](https://youtu.be/cSlNn6pf74t?t=6m26s)
- **Standard Form Questions**
  0.594 is what in standard form
- **Please can you go over multiplying and dividing metric units?**
Flipped learning materials

Untimed, formative online quizzes to check understanding (Numbas)
(Juhler et al., 1998)
Flipped learning materials

Untimed, formative online quizzes to check understanding (Numbas) (Juhler et al., 1998)

Write the following numbers in scientific notation.

\[ 0.0804 = \underline{\_} \times 10^{\underline{\_}} \]

Show steps (You will lose 1 mark.)

Submit all parts 4 marks. Try another question like this one Reveal answers

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Interactive lecture

• Tutor discusses Padlet questions and any further questions
• Multiple-choice formative assessment using Plickers (Friedman, 1987)
• Immediate feedback and model answers for students (Nuñez-Peña et al., 2015)
• Tutor can check understanding
Tutorials

• Exam-style question worksheets
• Small groups or individually
• Share solutions with the whole class (Patel and Little, 2006)
• Worked answers on the VLE at the end of the week

Conversions

1. Write 50% as a fraction in its simplest form.
2. Write 88% as a fraction in its simplest form.
3. Write 120% as a fraction in its simplest form.
4. Write 89% as a decimal.
5. Write 12% as a decimal.
6. Write 150% as a decimal.

Percentage Changes

1. Haile has a pack of 12 biscuits. He gives 5 away. Find the percentage change in number of biscuits that Haile has. State whether it is an increase or decrease.

2. It is Sana’s birthday. She already has £50. She is given another £26 in birthday money. What is the percentage change of Sana’s money? State whether it is an increase or a decrease.

3. The table below shows the height of a child between the ages of 2 and 10.

<table>
<thead>
<tr>
<th>Age / years</th>
<th>Height / cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>102</td>
</tr>
<tr>
<td>8</td>
<td>126</td>
</tr>
<tr>
<td>10</td>
<td>139</td>
</tr>
</tbody>
</table>

Calculate the percentage change of the height of the child between the ages of 2 and 8. Indicate whether the change is an increase or decrease.
Student feedback

Student ratings of usefulness/enjoyment of aspects of the course

- The course as a whole
- PowerPoint slides
- Numbas quizzes
- Padlet for questions for the lecture
- Videos
- Website resources (Bitesize, etc)
- Interactive lectures
- Plickers quizzes
- Tutorials
- Tutorial worksheets
- MOLE layout

Usefulness rating
Enjoyment rating
“Great delivery. It has breaking maths down into very understandable bits.”

“I really felt that the lecturer was open to questions and totally non-judgemental of anybody who raised an issue.”

“The sessions are helpful and fun and have helped to lessen my maths anxiety substantially. I like the Plickers quizzes for the quick thinking aspect and to cement what we have learned from the weekly materials.”

“Explanations are given clearly. The weekly materials are posted 2 weeks in advance which is helpful to me as it allows me to prioritise my time. The tutorials are helpful in that we can stay to ask questions if we are struggling but if we feel we are okay we can reflect on our answers in our own time.”
## Exam results

Frequencies of marks in the January exam for the years 2015/16 and 2016/17; percentage change of the frequencies; and percentage change relative to the class size

<table>
<thead>
<tr>
<th></th>
<th>15/16</th>
<th>16/17</th>
<th>Change: total numbers</th>
<th>% change: class performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>11</td>
<td>11</td>
<td>0</td>
<td>-25.3%</td>
</tr>
<tr>
<td>40-59</td>
<td>16</td>
<td>19</td>
<td>+3</td>
<td>-11.2%</td>
</tr>
<tr>
<td>60-89</td>
<td>31</td>
<td>45</td>
<td>+14</td>
<td>+8.5%</td>
</tr>
<tr>
<td>90+</td>
<td>16</td>
<td>24</td>
<td>+9</td>
<td>+12.1%</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>99</td>
<td>+25</td>
<td></td>
</tr>
</tbody>
</table>
Class performance

- Fewer fails
- More passes at 60+ progression level
- Higher median mark

<table>
<thead>
<tr>
<th>Mark</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail</td>
<td>-25%</td>
</tr>
<tr>
<td>60+</td>
<td>+10%</td>
</tr>
</tbody>
</table>

Change in key marks compared to last year

<table>
<thead>
<tr>
<th>Year</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015/16</td>
<td>73</td>
</tr>
<tr>
<td>2016/17</td>
<td>77</td>
</tr>
</tbody>
</table>

Medians of the January exams compared to last year
Outcomes

- Maths anxiety reduced
- Higher flexibility
- Safety net for students
- Fewer students asking “WTF?” (What the flip?)


