Errors and Common Misconceptions in the Classroom KS2 to KS5

Dr Audrey Curnock

Director of Education Unlimited

31/03/2015
Today’s talk is about trying to categorise errors and giving supportive feedback to encourage a deeper understanding of Mathematics.

When we look at learners work we try to see if the solutions were efficient, methodical, clear, accurate, based on sound mathematics. ....And of course (mostly) correct!

(....it’s not the answer but the journey!)

It’s not always the case that solutions bear this hallmark!

As teachers we want to find errors in learners work - to understand what’s going wrong in their thinking. Why? We all make small errors, accuracy can be evident. This is not in itself a major problem, of course it needs to be addressed.

But errors could contain or display misconceptions or that the topic has not been understood at all.
Errors could be

- calculation, or wrong values have been taken - or miscopied
- mis-applied a piece of theory, wrong operation applied (eg KS2 or 3 dividing when they should be multiplying)
- Muddled topics- wrong theory has been used - eg use Pythagoras but there’s no right-angle.
- The strategy adopted leads nowhere. (A different strategy was needed) (eg sequences and logs questions in KS5)
- Circular arguments (eg Trigonometric identities in KS5)
- Reasoning gone wrong (wrong deductions made during the question) eg A* questions in GCSE when two-stage problems are used eg sine and cosine rule.  
  
  https://youtu.be/4hy-tCkLdy8
As teachers what can we do to address this - why should we - and how will it help?

WHY : One of the principles of effective teaching “Expose and discuss common misconceptions.” (Swan, cf ILIM PD1).

- Research shows that Teacher Orientation towards Student Performance has some influence on improving learning & school improvement.(cf Honingh & Hooge & others).

WHAT : What teaching strategies should we use?

Use examples, question the thinking, address logical issues, address lack of knowledge or mis-learnt knowledge, or gaps in knowledge (it may take time to unravel where the thinking has gone wrong). Eg Page - year 9 student

Any others?

TASK - will develop your thinking on this.

Psychology of learners - don’t want their errors exposed for their peers to see, but they know they need help. Let’s look at a video clip

https://youtu.be/4hy-tCkLdy8
How will it help?

If you have holes in your knowledge this has to be addressed.

Mathematical learning develops as links in a chain. Topics are interconnected. When we learn new topics this needs to be build on a solid foundation, or it will not be absorbed (or learnt!)

What sort of feedback helps?

• Make sure feedback is corrective in nature; tell students how they did in relation to specific levels of knowledge. Rubrics are a great way to do this.  • Keep feedback timely and specific.  • Encourage students to lead feedback sessions.

These strategies are from “Classroom Instruction That Works” by Robert Marzano, Debra Pickering, and Jane Pollock. (2001)
Accelerating students learning—what’s the impact of various approaches? Effect Sizes here have been converted to months of school progress.


<table>
<thead>
<tr>
<th>Approach</th>
<th>Average Impact in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviour interventions</td>
<td>4</td>
</tr>
<tr>
<td>Collaborative Learning</td>
<td>5</td>
</tr>
<tr>
<td>Digital technology</td>
<td>4</td>
</tr>
<tr>
<td><strong>Feedback to students</strong></td>
<td><strong>8</strong></td>
</tr>
<tr>
<td>Homework (secondary)</td>
<td>5</td>
</tr>
<tr>
<td>one-to-one tuition</td>
<td>5</td>
</tr>
<tr>
<td>Meta-cognition and self-regulation</td>
<td>8</td>
</tr>
<tr>
<td>oral language interventions</td>
<td>5</td>
</tr>
<tr>
<td>Peer Tutoring</td>
<td>6</td>
</tr>
</tbody>
</table>

**Average impact in months**

![Bar chart showing the average impact in months for various approaches](chart.png)
Case Studies

The room is arranged into Key Stages.

**TASK**

In groups of 3 or 4 look at the solutions you’ve been given for this range of problems. Problems are from KS2, KS3, IGCSE, GCSE (KS4) & KS5

On the flip chart paper - draw 3 columns with these headings

- **Student topic**
- Identify the error - and what type - is it a serious error?
- Feedback you would give to improve the work and progress in learning.

On a post-it Note - what teaching strategies would you adopt to overcome these difficulties?
Rotate to the next table when your group has finished. (Be patient with other groups).

Can you add any further comments to those on the previous table? Here I’m mostly looking at the feedback you might give and teaching strategies.

Continue round the tables (time permitting) and return to first table. Look at any additional comments and discuss.

Each group will present their findings - Will one of your group hold the poster up and tell us about your findings and observations.
Our conclusions

• Myriad of errors and we use a wide variety of teaching strategies to help.
• Above all, Maths teachers are very much needed!!!
References


http://educationendowmentfoundation.org.uk/toolkit/about-the-toolkit/


https://youtu.be/4hy-tCkLdy8 video clip

PD1 & PD2 National Stem Centre e-documents, Standards Units - Improving Learning in Mathematics