IMPROVING

MATHEMATICAL TEXTBOOK DESIGN

1 WHAT'S THE CURRENT SITUATION?

Research suggests that the majority of students do not read the text in their mathematics textbooks. When they do, most do not read proficiently, even if they are good general readers.

2 WHY DOES IT MATTER?

Reading is necessary to understand mathematical tasks. On a broader scale, proficiency in reading mathematics enables us to critically evaluate the news.

3 WHAT CAN WE DO?

One approach is to give specific mathematical reading instruction. Alternatively, we can improve mathematics textbook explanations to better support the learner. We took the latter approach.

4 WHAT DID WE DO?

We rated the quality of mathematical explanations using *comparative judgement*, asking judges to 'choose the better' of two explanations. Judges saw 15 different comparisons from a pool of 16 explanations, taken from an A Level textbook (aimed at students aged 16-18 years). Judges were A Level mathematics teachers, A Level mathematics students, and mathematics undegraduates.

5 WHAT HAPPENED?

All 3 groups shared similar understandings of what makes a 'good explanation'. In addition, difficulty and superficial features were not associated with quality. However, diagram placement was: explanations with diagrams in the main text achieved higher scores than explanations with diagrams in the margin.

6 SO WHAT?

These findings align with results from Science Education that placing corresponding text and pictures together supports learning. This is known as the *spatial contiguity principle*.

7 WHAT NEXT?

We went on to investigate *how* students read these explanations. Were there differences in how students read the diagrams due to placement? We used eye-tracking to make inferences about attention and cognitive processing.

8 HOW?

We asked 34 A Level students to read the explanations, recording their eye movements as they read.

9 WHAT HAPPENED?

Students did not process the diagrams differently. However, they gave significantly less attention to diagrams placed in the margins.

10 WHAT DOES ALL THIS MEAN?

Textbook-users preferred explanations when diagrams were in the main text, and students read diagrams more with this placement. This suggests that if diagrams might support students' learning then materials should avoid placing them in margins.

11 LOOKING FORWARD

These findings highlight how design principles could improve instructional materials in a straightforward and low-cost way. Future research could investigate whether diagram placement also affects learning outcomes in mathematics.

THIS IS A SUMMARY OF:

Woollacott, B., Alcock, L., & Inglis, M. (2023). The spatial contiguity principle in mathematics textbooks. *Research in Mathematics Education*, 1-21.

FOR MORE INFO, EMAIL: B.WOOLLACOTT@LBORO.AC.UK