IN SUMMARY

- Variation theory (VT) is a way of analysing and planning teaching and learning activities which focuses on what changes and what stays the same and the effect this might have.
- Researchers suggest different emphases for different critical aspects when structuring variation in maths lessons, but recommend that students should see difference before sameness, including counter- or non-examples.
- Well-structured tasks are important, but successful use of VT also requires teachers to be effective in using these tasks to direct pupil attention.
- Using VT can be a way of helping maths teachers develop professionally, but may also formally characterise what they are already doing.
- Teachers should make sure they select and use examples very carefully as a way of drawing attention to mathematical structure.
- Professional development that increases maths teacher expertise in example and problem choice may be particularly beneficial.

Variation theory (VT) is not unique to mathematics education but has often been used to explore mathematics learning by focusing on the different ways that it is possible to look at, or experience, the same thing, or mathematics teaching by paying ‘deliberate attention to what and how [teachers] exemplify mathematical ideas, processes and practice in their teaching’. It assumes that ‘learning is about developing new ways of seeing or experiencing the object of learning and so it is necessary to ‘experience certain patterns of variation and invariance in order to discern critical features [key ideas] of the object of learning’.

IMPLICATIONS: Teachers can use VT to analyse maths teaching or learning as it suggests (a particular type of) planned variation is necessary for students to notice what is to be learned. Considering lesson activities using VT principles can allow teachers to direct students’ attention and anticipate their responses.
IMPLICATIONS: Teachers should recognise that researchers suggest different emphases for different critical aspects in the way that lesson materials are structured and enacted.

Research suggests that learners should experience difference before sameness, including counter- or non-examples.

Well-structured tasks are not enough to enact VT successfully – teachers must also be effective in directing students’ attention to the intended critical feature/s.

It has been suggested that one way using VT can help teachers is to ‘facilitate teachers’ awareness of mathematics as a connected field of study by directing their attention to structural similarities and differences’. Teachers often characterise elements of VT as things they already do, or ‘common sense’. However, some studies have shown that maths teachers are often unconscious of differences in quality in the example choices they make or that they make them randomly. VT encourages a focus on example choice as of ‘decisive importance’, choosing multiple examples carefully to allow learners to distinguish between essential as opposed to non-essential aspects may enhance learners’ perception of ‘deep structures’ and can improve student outcomes.

IMPLICATIONS: VT can help teachers’ professional development in terms of awareness of mathematical connections, but may also be a theory that simply formally characterises what they do already.

Teachers should ensure they select (collections of) examples carefully, considering their utility in revealing mathematical structure.

VT suggests that it is important for learners to avoid focusing on surface features but to examine mathematical structure, but may also be a theory that simply formally characterises what they do already.

Research suggests that learners should experience difference before sameness, including counter- or non-examples.

VT encourages a focus on example choice as of ‘decisive importance’, choosing multiple examples carefully to allow learners to distinguish between essential as opposed to non-essential aspects may enhance learners’ perception of ‘deep structures’ and can improve student outcomes.

IMPLICATIONS: VT may help learners explore mathematical structure and support deep learning in mathematics.

Professional development that increases teacher expertise in carefully structured example and problem choice in maths lessons may be particularly beneficial.

‘Variation theory has several dimensions, including use of multiple representations of what a concept is, and what it is not’

‘Tasks that carefully display constrained variation are generally likely to result in progress in ways that unstructured sets of tasks do not, as long as learners are working within mathematically supportive learning environments’

Watson and Mason, 2008

REFERENCES

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