

THE CONVERSATION

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Boredom, alienation and anxiety in the maths classroom? Here's why

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A student revising class work in Kenya. The quality of maths teaching in schools can have a profound impact on learner interest. Reuters/Thomas Mukoya

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The quest for appropriate teaching and learning practices for children and young people is ongoing and ever present. A major challenge is to make maths teaching more inclusive and maths itself more accessible to a wider cross section of children and young people. This is essential if we are to successfully meet the UN Sustainable Development Goal of ensuring inclusive and equitable quality education. This in turn is intended to promote lifelong learning opportunities for all.

One important imperative is to develop active and participatory approaches that lead to the development of problem solving and thinking skills. This specific issue came to the foreground in two recent research projects – in Scotland and in Ghana – which sought to investigate the quality of mathematics learning.

The Scottish project on developing mathematical thinking in the primary classroom was carried out in collaboration with teachers and local authorities. It was set up within a design based research framework, with the aim of promoting classroom-based action research on the part of participants in a Masters level course.

In reporting this research and development work the authors refer to the “epistemic quality” of the mathematics being taught and learned in school. This is the quality of what pupils come to know,

understand and become able to do.

In the parallel study, Evelyn Oduro reports similar findings from a study of teachers' assessment practices in Ghana. This study focused on "basic schools" – kindergarten through to junior high – and was conducted in 2011 with a sample of four classroom teachers and two head teachers. It involved a qualitative research design.

From the two sets of research in Scotland and Ghana, it's clear how high epistemic quality in the classroom can be supported. One can also see how low epistemic quality can be reinforced by external vested interests. These often involve excessive emphasis on high stakes external testing, summative assessment and school league tables.

Elephant in the classroom

In the Scottish project the teachers involved experienced very powerful responses to one of the set readings: Jo Boaler's book *The Elephant in the Classroom*. In it she writes:

*I have called this book *The elephant in the classroom* because there is often a very large elephant standing in the corner of maths classrooms. The elephant, or the common idea that is extremely harmful to children, is the belief that success in mathematics is a sign of general intelligence and that some people can do maths and some can't.*

Even maths teachers (the not so good ones) often think that their job is to sort out those who can do maths from those who can't. This idea is completely wrong and this is why. In many maths classrooms a very narrow subject is taught to children, that is nothing like the maths of the world or the maths that mathematicians use.

This narrow subject involves copying methods that teachers demonstrate and reproducing them accurately over and over again ... But this narrow subject is not mathematics, it is a strange mutated version of the subject that is taught in schools.

Fundamentalist approach

It is argued in the Scottish findings that the process of "mutation" reflects the process of didactic transposition, which can;

- change the mathematical knowledge profoundly such that the knowledge in question is not knowledge for acting and solving problems in the social contexts in which it was created and;
- lead to the epistemic quality of the subject becoming degraded as it is transposed into school mathematics.

The findings describe this mutated or degraded version of mathematics as being of low epistemic quality. It is characterised by a fundamentalist approach that presents the subject as infallible,

authoritarian, dogmatic, absolutist, irrefutable and certain. The degraded version involves right and wrong answers based on superficial imitative memorised and algorithmic reasoning.

In contrast, high epistemic quality is characterised by an approach which presents mathematics as fallible, refutable and uncertain. It also promotes critical thinking, creative reasoning and the generation of multiple solutions. It encourages young people to learn from errors and mistakes.

Creative mathematical reasoning involves novelty, plausibility and mathematical foundation. Creativity is also seen as an orientation or disposition toward activity that can be fostered broadly in school. Such creative reasoning can have many functions in mathematics. These include verification, explanation, systematisation, discovery, communication, construction of theory and exploration.

Low epistemic quality has a dramatic impact on students. It leaves them bored and demotivated. They also experience fear and anxiety and feel alienated from maths as a subject.

Ghana study findings

The Ghana study was conducted in a context in which “assessment for learning” was being used as a policy driver to promote higher epistemic quality. The findings illustrate how teachers use both formal and informal assessments in mathematics classrooms. Formal assessment dominates practice.

Of particular relevance were the teachers’ views about the nature of mathematics and the ways in which these can impact so as to degrade the “epistemic quality” of school mathematics.

The findings also highlight the ways in which teachers’ views are related to their classroom practices. What’s very interesting is how teachers’ assessment practices are affected by contextual factors. These factors are related to institutional policies, professional development and classroom conditions.

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