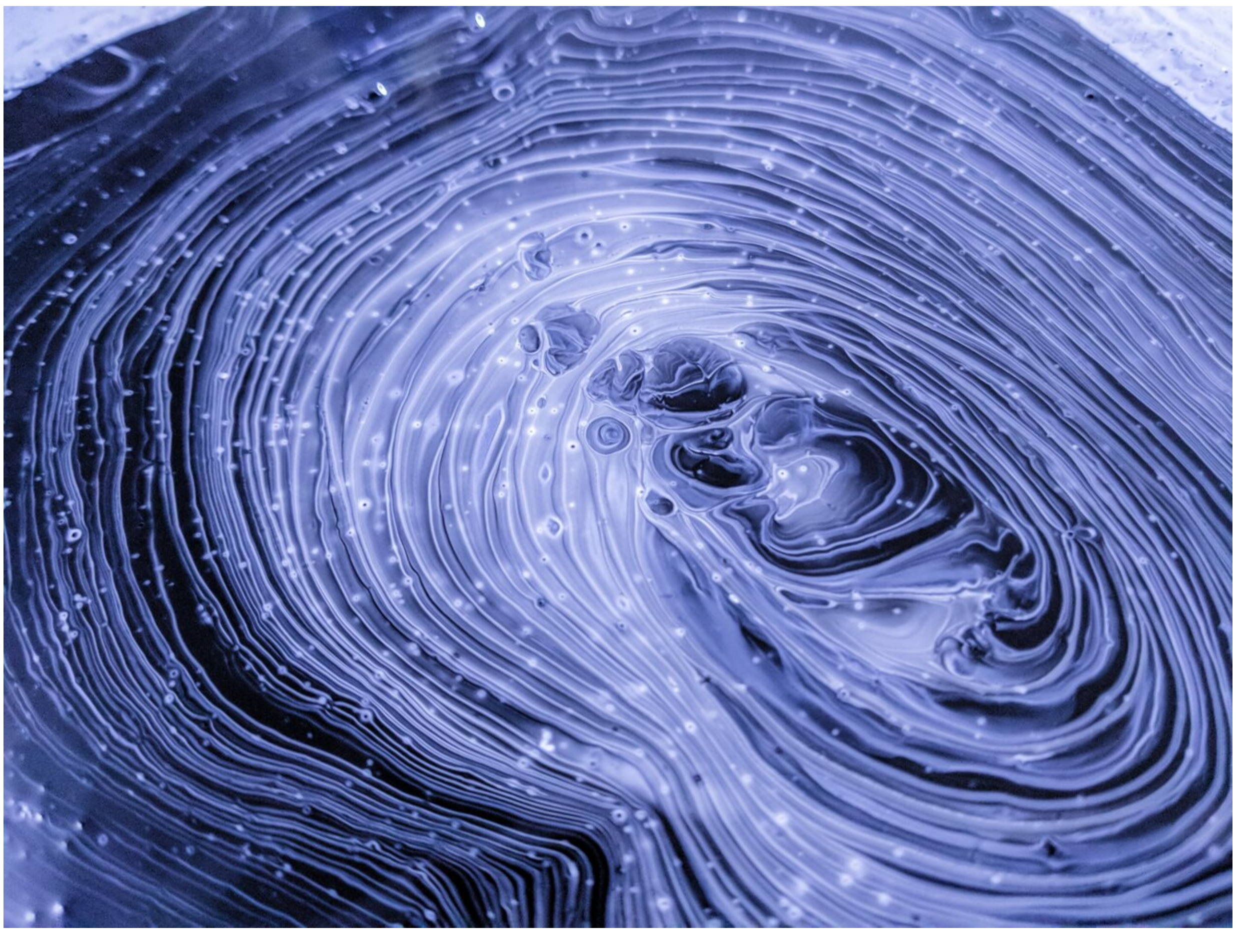
Don't just solve for x: letting kids explore real-world scenarios will keep them in maths class

October 30 2019, by Jill Fielding-Wells and Kym Fry



Credit: CC0 Public Domain

In real life, ordering pizza for a group of people involves having a conversation about what people like, how much they can eat, how much they want to spend and whether pineapple really belongs on pizza.

But in the context of a traditional maths class, the concept of ordering a pizza typically becomes a problem like this:

"If one pizza serves four children, how many pizzas do we need for a class of 28 children?"

An alarming number of Australian students don't choose mathematics in the senior school years. Figures from 2017 – the most recent available—show only 9.4% of Australian students in years 11 and 12 were enrolled in extended mathematics. This is the lowest percentage in more than 20 years.

Surveys of senior students indicate they believe maths is too hard, too guarded by a rigid set of rules and not applicable to real life.

Clearly, the way we teach is turning students off mathematics. But an inquiry-based approach can make maths relevant and interesting.

So, what is inquiry-based learning?

According to the OECD, today's children face an uncertain future due to technological disruption.

To meet these challenges, the report notes:

"[…] students will need to develop curiosity, imagination, resilience and self-regulation; they will need to respect and appreciate the ideas, perspectives and values of others […]"

These skills can't be taught by rote learning or a series of procedures.

An inquiry approach in mathematics is when learning typically starts with a complex question. In the case of the pizza example, that question could be: "What pizzas do we need to order for our class party?"

As students engage with the question, they work collaboratively—guided by the teacher—to develop an understanding of the mathematics in a more natural way.

Rather than the outcome being a single, correct answer ("We will need seven pizzas for a class of 28"), students put forward a potential solution. They then explain their reasoning and the mathematics they applied to justify their decisions.

The question of what pizzas a class needs provokes an extended investigation that moves beyond simple arithmetic. It requires decisions about how many and what pizza options should be considered (planning for data gathering), surveying of students' pizza preferences (data collection and recording), summarising of the responses (data cleaning and representing), and reporting findings (data summarising).

Students analyse the data to determine how many and what types of pizzas to order (fraction representation and arithmetic) while noting that, in the context, whole pizzas must be ordered.

Mathematical evidence collected by students is used to support, justify and convince peers of their conclusion. The class may then extend this investigation to consider drink purchases, total cost and so on.

In doing this, students develop a deeper understanding of both the mathematics used and when and how it is useful.

Inquiry more closely aligns with the real work of mathematicians. In practice, mathematicians identify, or are approached with, a problem. They must decide on the maths they can use to solve it. Then they come up with a procedure, solve using the mathematics and monitor the outcome.

In traditional classes, student mathematicians typically only solve the mathematics—ironically, this is the only step that can be handed over to technology.

Do we know it works?

Research supporting inquiry in mathematics is building. One of the most comprehensive reviews of the research evidence evaluating the inquiry-based approach to teaching maths and science from primary through to university was conducted in 2013.

It identified a number of benefits for students. These included an enhanced capacity to: transfer learning to new situations; seek challenges; tolerate failure; and build resilience to wrestle with challenging problems.

Inquiry was found to enhance the learning outcomes of both lower- and higher-achieving students and students with specific cultural backgrounds including First Nations peoples.

Students who learnt via this method also reported seeing mathematics as interesting and motivating.

Research shows the inquiry-based approach is effective in all year levels. Examples include children as young as 5-6 being able to make predictions using data, to more complicated concepts such as calculating and adjusting volume and proportion using a scaled house plan.

The main constraint on implementing inquiry in secondary classrooms is the flexibility needed to engage in problems that often cross disciplines.

For instance, the question "What is the best design for a paper plane?" draws on science for the principles of flight, mathematics for statistics and measurement, and technology for design.

Rigid scheduling of classes compromises such learning. But it can be overcome with liaison between teaching teams.

Strict assessment regimes also put pressures on teachers to complete teaching units at certain times. But inquiry can mean more content is covered in deeper, more connected ways.

Importance of teacher skills

Although the inquiry method is student-centred, encouragement of independent, creative and critical thought must be driven and supported by a skilled teacher. This means recognising when to challenge the students and when to provide support.

The nature of inquiry lends itself to exposing what students don't know. During small group discussions, students put forward ideas and the teacher can identify roadblocks in their approaches.

At these times, a responsive teacher can work with students to develop the conceptual knowledge needed to move forward with their inquiry.

Likewise, students ready to be challenged can apply more advanced concepts as they push themselves to use and develop more complex mathematical solutions. As with all teaching, a balanced approach is key.

Commons license. Read the original article.

Provided by The Conversation