

Functional mathematics in a digital age: What do we really need to teach?

by Dr Rhonda Faragher

Many parents of children with Down syndrome find themselves in a conversation with school staff about the need to learn functional mathematics. But just what is 'functional' mathematics in our rapidly changing, technological world?

Firstly, stop and think about what you might include in a list of topics of 'functional mathematics'. How have you used mathematics today? What topics did you use? Did you write your calculations, compute mentally or use a calculator?

The big three topics that frequently make the cut are money, mass and time. Were they on your list? Unfortunately, they are often the areas students with Down syndrome find most difficult. What about areas where these students are known to be more successful: geometry, algebra and graphing? Are these functional? How do we decide what to teach?

Numeracy

Numeracy is the *application* of a broad range of mathematics (not just number or arithmetic) in life contexts. Before we can *apply* mathematics we need to know and understand the mathematics. Furthermore, we need a surprisingly wide range of mathematics across our life contexts.

Numeracy involves knowing mathematics from across the discipline (e.g. geometry, algebra, statistics) and being able to decide when to use the mathematics and how. Most adults have their own 'rules of thumb' for calculations and rarely were these taught in school. We find quick, approximate methods.

A key point is that mathematics is not the same as numeracy. This point is emphasised in the Australian Curriculum (www.australiancurriculum.edu.au) where mathematics is a 'learning area' while numeracy is a 'general capability' and goes across all subject areas.

Rather than talk of 'functional' mathematics, a more apt terminology would be the mathematics required to be numerate.

Developing numerate adults

A major goal of schooling for all learners, including those with Down syndrome, is to prepare students for a numerate adulthood. The more mathematics we know, the more we are able to use in the contexts of our lives. In school, students need to be taught mathematics. They need to be given access to the mathematics curriculum, appropriate for their year level and adjusted as necessary. The application of mathematics to life contexts is best taught in the contexts themselves. At school, that means in all subjects, not just mathematics. That is why numeracy has been designated a 'general capability' to be taught in all learning areas.

Let us return to our earlier list of 'functional mathematics' topics. What should we teach to build numeracy? Money is clearly important. Let us consider money in some depth.

Financial literacy

Tendering cash was once the main focus of programs designed to teach students about money. Technological advances are rapidly removing the use of cash in Australia. Electronic funds transfer (including payment of wages), EFTPOS, and payWave are just some of the innovations that have led to a dramatic drop in the use of coins and the amount of cash being withdrawn from ATMs in Australia.

In order to purchase we no longer need to be able to tender cash or check we have been given the correct change. What we need to learn is broader, deeper and forms the basis of 'financial literacy'. What this encompasses has been specified in the *National Consumer and Financial Literacy Framework* (Australian Securities and Investments Commission (ASIC), 2011). This framework considers three dimensions: Knowledge and Understanding; Competence; and Responsibility and Enterprise. These dimensions emphasise that financial literacy goes beyond knowing how to use money to buy goods and services and includes managing money, finding best value, and understanding the ethical use of money. Clearly a school program that focuses on use of coins and calculating change is no longer adequate. That would be a focus on skills that are no longer essential while missing key concepts such as budgeting and managing electronic funds.

The area of financial literacy is changing rapidly as new technology emerges. Smart phones have changed the way financial transactions occur. This came home to me recently. I had carefully followed the advice to set up two accounts for my daughter—one where pay was deposited and other that was the day-to-day account. The latter was linked to her EFTPOS card and was kept to a maximum balance of \$200. If she used it all then that would be a learning experience and not a disaster. That worked fine until the bank released a mobile app and her friend showed her how to download it to her phone. It was just so easy to transfer \$200 at a time – several times in the first day! That was a learning experience for both of us.

So, the key is to teach about the nature of money. I have found the use of a bucket to be a good visual. Pay goes in, bucket fills up. Bills go out, bucket empties. If your bucket is empty, you can't spend any more. Notice here, there are no numbers and no calculations. It is a visual analogy that explains a fundamental concept of financial literacy. From that, other concepts such as saving can be understood. It is good practice to save some amount from every pay. This can be shown as some money going out of the main bucket into a saving bucket. Interest can also be explained as the bank adding a bit extra to your bucket.

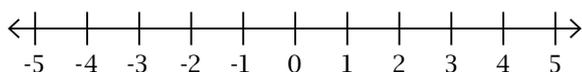
Other ideas about developing financial literacy (for all of us!) can be found on the MoneySmart website:

www.moneysmart.gov.au

What else should we teach?

If we wish students to become numerate adults, we must provide access to as broad a range of mathematics as we can in the early childhood and school years. There are some key points that must be acknowledged about learning mathematics by students with Down syndrome. These are discussed in detail in the book *Educating Learners with Down Syndrome* (2014):

1. The majority of people with Down syndrome experience a great deal of difficulty learning number. Students with Down syndrome will learn to count and understand what operations (such as subtraction) do but computation is rarely automatic.
2. Computation can be achieved by the use of an electronic calculating device and students need to be explicitly taught how to do this from an early age. Calculators should be available at all times.
3. When supported by an electronic calculator, students with Down syndrome have been shown to achieve a diverse range of mathematics, including algebra, trigonometry, Cartesian geometry and linear programming. Mathematics is not as hierarchical as once thought—it is indeed possible to learn algebra if you are yet to reliably add single digit numbers.



Number line

At school, a general principle to follow in deciding what to teach is to teach students what others in their year level would be learning, with adjustments. These adjustments should include the use of calculators and visuals. For example, having a number line, a visual representation of numbers, reinforces the key concept of where numbers are in relation to each other.

The secondary years, when the gap between students with Down syndrome and their class peers seems to be vast, is the time when many students are offered a 'basic skills' or 'functional mathematics' program. These are usually of little benefit. As noted, most students with Down syndrome have a fundamental, possibly inherent inability to attain early arithmetic skills. Basic skills programs typically revisit work students have been taught for years, without success and with little likelihood of any improvement. What a waste of everyone's time!

A more productive approach is to adjust the curriculum for the year level. There is an increasing number of examples of success with this strategy (see for example, Monari Martinez & Benedetti, 2011). The important benefit of this approach is that it ensures our learners with Down syndrome are taught a wide variety of mathematics that is so important for future numeracy. The more mathematics you know, the more at your disposal to be used in life contexts.

Concluding remarks

The mathematics learners need to be numerate adults is much broader than ever before. The way we do mathematics in life contexts is also changing with the rapid advent of new technologies. It is very likely that functional skills learnt now will be redundant in future adult contexts. Rather than spending precious school mathematics time learning skills that are considered functional now, we should focus on teaching students as much mathematics as possible.

References

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