

Catherine Attard, Western Sydney University

engagingmaths.com

Twitter: @attard_c

important mathematical ideas. Diffy Towers offers the opportunity to extend students' knowledge of subtraction, to explore appropriate counting and reasoning strategies, and to build basic fact fluency.

Diffy Towers holds an important place in my practice, and I hope that this game becomes part of your practice, too. I welcome stories of your use of Diffy Towers with your students.

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A GAME TO ENGAGE STUDENTS WITH MATHEMATICS

We all know children love playing games, but how can we turn this love of games into rich mathematical learning experiences? What are the qualities of a good mathematics game, and should we be incorporating games into regular lessons and homework rather than a Friday afternoon filler activity?

WHY GAMES?

Why use games in the mathematics classroom? First and foremost, they're fun! Of course, that alone isn't a good enough reason to use them. However, when children talk about fun and school, they often perceive fun lessons to be those where they felt challenged and learnt something new. In my research on student engagement, many students talked about fun maths lessons they had experienced, and these are some of their quotes:

'Maths is kind of fun when you get to play some maths games' (Year 6)

'...if you sit on the carpet and the teacher goes on and on about what we're learning it gets boring and you get restless so that's why I like doing fun games.' (Year 6)

'Ms. C was a great maths teacher cause she kept giving us different kinds of games that we didn't do before that's about maths. But now it's kind of boring because all we have to do is maths tests, maths stuff, nothing fun about it.' (Year 7)

'I loved maths in primary. I remember how we always had these games and we would rotate.' (Year 8)

'I like the iPad games because they are really fun and they make me improve on my maths and I like the maths games that tells you when you are wrong or you are right because if you get it wrong you can improve on that' (Year 4).

A good game provides engagement at cognitive, affective, and operative levels. That is, there must be challenge embedded with the game – if it's too easy, children will get bored and no learning will occur. The game must be enjoyable to play, and it must promote

interaction and dialogue. There are many mathematics games on the market that are basically drill and practice with the intention of building fluency with number facts.

There are also an infinite number of traditional non-mathematics based games that have a range of mathematical skills and processes embedded within them. The best ones, however, are those that promote the Australian Curriculum: Mathematics proficiencies: Problem Solving, Understanding, Reasoning and Fluency. Take for example, the board game Mabble (<http://engagingmaths.co/teaching-resources/mabble-board-game/>). Mabble requires an understanding of **place value** and **computation**, but also requires the players to engage in **problem solving** and **reasoning**, while building **fluency** and demonstrating **understanding**. Mabble is self-differentiating; meaning anyone of any ability can play successfully. It is also easy to assess students' work with Mabble as they have to record their work and their scores.

MABBLE GAME PLAY

Mabble is a game suitable for anyone over the age of five. The objective of Mabble is to gain the highest points from completing equations on the game board in a crossword style manner. There are three types of tiles in the game: number tiles, operation tiles and blank tiles. Place all the number tiles face down on the table, and all of the operation tiles face up. The blank tiles can be used to differentiate the game. Each player or pair of players is dealt seven number tiles. The operation tiles remain in a communal pile, for all players to use. Players take turns to use some or all of their number tiles to make one correct equation. Players must build their equations so that they join or intersect either horizontally or vertically with any existing equation that is already on the board. Players replace the number of tiles used after each turn by drawing new number tiles from the pile. For each new equation, players score the total sum of

MABBLE (CONT.)

the digits used in the equation and 1,2,3 or 4 points for the operations +, -, \times and \div respectively. Play continues until there are no tiles left or no further equations can be made. The player who scores highest is the winner.

DIFFERENTIATING

There are several ways Mabble can be differentiated either through the setup of the game, the scoring, or the rules. Prior to deciding how to differentiate the game, it's important to have a clear purpose for using the game in your classroom. For example, you may be wanting to use the game to build understanding of the equal sign and the concept of equivalence. Or you could be wanting to build students' computational fluency. You could also be wanting to promote problem solving skills.

Some ways Mabble can be differentiated:

- Play the game in pairs rather than individual opponents to reduce student anxiety, promote peer mentoring and promote mathematical reasoning and communication
- Group students according to ability if you want to reinforce concepts and build fluency with number facts and problem solving
- Group students heterogeneously if you are using Mabble to teach new concepts (there are benefits and disadvantages to each type of grouping, and often this needs to be determined by your purpose for using the game and the unique group of students in your classroom)
- If you are promoting problem solving and reasoning or aiming to improve student engagement with mathematics, consider providing a calculator for students to check either their own equations or the equations of their opponents. This will alleviate pressure for those anxious students
- Younger students could be provided



with counters or other materials to assist in constructing equations

- Limit the operations available for early learners (for example, use addition and subtraction tiles only)
- To challenge students use a timer and set a time limit for each turn
- Use the blank tiles as wild cards or for new symbols, for example, a square root symbol or a decimal point (there are square stickers included in the game for this purpose)
- Allow students to change the rules – this could involve game play or scoring
- Stickers could be used on the actual game board to create a bonus point system

- Challenge students by requiring them to design a brand new game using the number tiles and the gameboard.

ASSESSMENT AND MABBLE

The scoring sheet for Mabble requires players to record their equations in one column and their scores in another. This creates a record of their work that can be captured for assessment. You can also take advantage of digital technology and have students photograph their Mabble boards. The photographs can be used to stimulate whole class reflection when projected onto an interactive whiteboard (see reflection prompts), or can be used for individual or group reflection. Conduct a 'gallery tour' where students walk around and view each other's game boards. This can then lead to a discussion of what was interesting, surprising or unusual about the observations.

PROMOTING ENGAGEMENT THROUGH GAMES

Is it enough to simply allow children to play the games? If children play a mathematics game at school or at home without reflection afterwards, then chances are they have wasted an opportunity for learning. It's important that children consider the mathematics involved in the game, the challenges that were faced and the strategies that were included. Often we don't know if children have learned anything while playing a game unless we ask some very strategic reflection questions that can be answered verbally or recorded in written form. Here are some examples of good reflection prompts, organised into the cognitive, affective and operative domains of engagement.

Cognitive

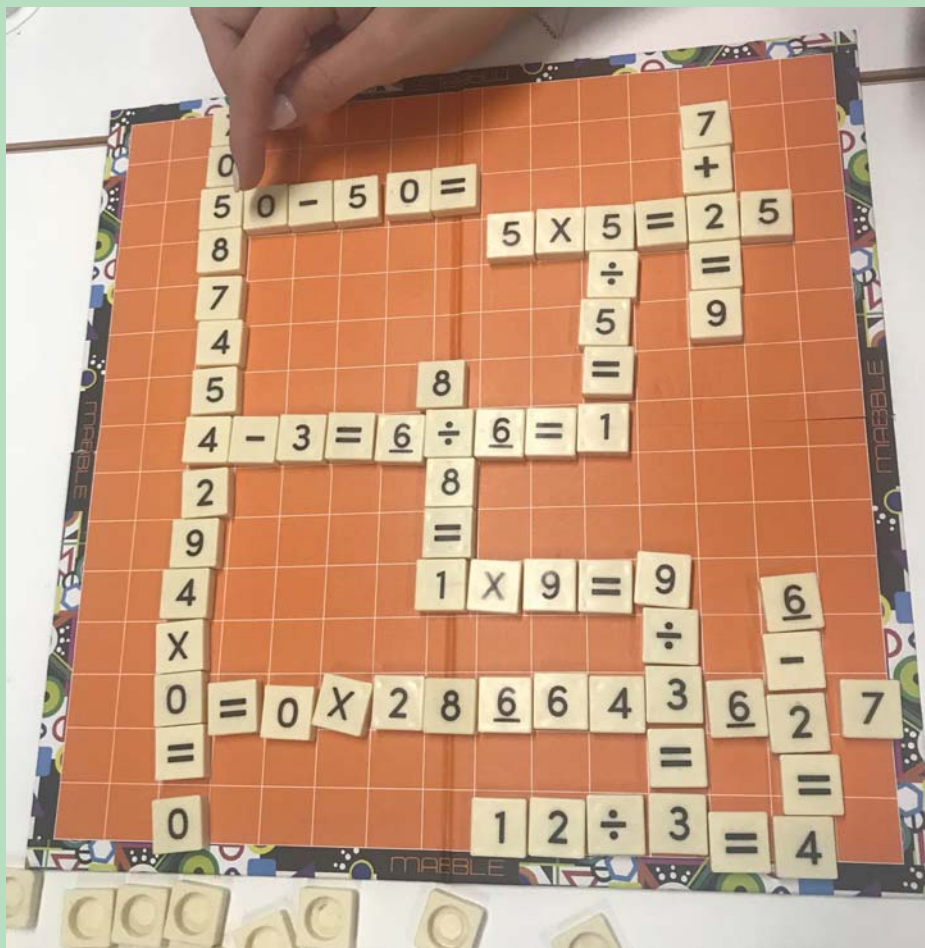
- Write a memo to someone about the most important mathematics you learned while playing Mabble.
- What was the tricky part about Mabble?
- What maths strategies did you use to help you play Mabble?
- Write two things that were difficult in Mabble.
- Can you connect the maths used in Mabble to something already known?
- Where would this knowledge be useful?

Affective

- What were the fun bits in your learning when you played Mabble?
- Why was fun about them?
- How did you feel playing Mabble with your friend/group?
- Survey your the members of your group about how they felt during the game and align them with your own.

Operative

- What were your strengths when playing Mabble?
- What is the most valuable advice you could give students who are



- going to play Mabble in the future?
- How could we change Mabble next time we do this?
- What would you do differently in your next Mabble game given the knowledge you have gained from this game?
- What did you find out about your problem solving skills and strategies during Mabble?

And finally, here is a list of some of my other favourite games that promote both mathematical processes and content:

- Mancala (an ancient strategy game)
- Monopoly
- Uno
- Numero
- Domino and card games
- Rowco

The following are some iPad apps that are mathematics based games:

- Pick-a-Path
- KenKen
- Deep Sea Duel
- Product Game
- 2048
- Threes
- Tangram
- Maya Numbers
- Banana Hunt
- Concentration

Of course, there are many more great games for mathematics teaching and learning. The important thing is that we encourage children to engage with them in a meaningful way and provide opportunities for them to reflect on the mathematics and learning involved: A game is only as good as the pedagogy it is embedded within. If we can do this, games can become part of our everyday routines and even homework tasks, rather than those Friday afternoon time fillers!