A Guide to...

CLASSROOM MATHS GAMES

Using Games in Classrooms

There is general consensus among teachers, particularly at primary level, that playing games assists in the teaching and learning of mathematics. Russo, Bragg and Russo (2021)[1] asked teachers to complete a questionnaire to find out how teachers use Mathematics games in their classroom. Here are a few highlights:

- 79% of teachers played maths games more than once a week.
- They were used to develop fluency, as warm-ups and to develop new concepts.
- Teachers favoured games that required minimal materials such as dice / cards or pen and paper

The video course at *drpaulswan.com.au/video-pl* on Classroom Maths Games goes further into this topic. The video PL is 45 minutes long, perfect as a staff meeting replacement. The video may be watched and rewatched by staff members, including upskilling new staff.

What is a Game?

There are many different opinions as to what constitutes a game in mathematics. Oldfield (1991, p. 41) used a series of criteria to define what constitutes a game:

- The activity is governed by a set of rules and has a clear underlying structure to it.
- The activity normally has a distinct finishing point.
- The activity has **specific mathematical cognitive objectives**.

Other definitions say that to be a game, an activity must also have an element of strategy and decision making. Gough (2001) referred to 'pseudo-games' - where there is little strategy used in the game or interaction between the player as 'luck races'. Everything that happens in the game depends on luck. Players have no choices and cannot change the outcome of the game. Some of the games featured in this guide and on my website are 'luck races'. These pseudo games are ideal for teaching students the basics of playing a game, for example, moving around a board, watching for good and bad spots, taking turns etc. These games may be modified to add elements of choice whereby player choice can have an impact on the outcome of the game.

In this guide and associated Video PL workshop, we have focused mainly on simple games with minimum setup.

[1] Teachers are encouraged to read the original article (see references)

What Does the Research Say?

Choosing Educationally Rich Maths Games

Russo, J., Russo, T., and Bragg, L. (2018) reviewed much of the literature on playing games and created five principles for choosing educationally rich mathematical games. Readers are encouraged to download the full article (https://www.researchgate.net/publication/328443542_Five_principles_of_educationally_rich_mathematical_games)

These principles may be used:

- to review games that are regularly played in class or throughout the school or
- when choosing new games.

In summary, for a great game:

- there needs to be a balance between skill and luck,
- the mathematics should be the key element of the game
- the game can be modified to suit the needs of the learners.

I will leave readers to look at the article and note the other two principles along with further explanation.

Effective Use of Games

Games in and of themselves do not teach – teachers do. Much of the research on the use of games in mathematics is dated, but here is a quick review;

- Bright, Harvey & Wheeler (1985) concluded that games can be effective, but ***simply using a game did not guarantee learning would take place***.
- Onslow (1990) noted, "one cannot assume that conceptual obstacles will be overcome solely by playing a game (p. 591)." He acknowledged that while games improve motivation, this was not enough. He went on to state: "***Children do not make implicit links between doing and understanding without guidance*** (p. 591)."
- Bragg (2005) noted that in order for games to be effective they must be carefully chosen to ***meet the needs of the learner***. If the game is too challenging or equally does not provide enough challenge, then the game may prove ineffective.

The implication is that games should not be chosen simply as a form of 'busy work'.

However, well-chosen games that meet specific criteria and are matched to the needs of the students can become the catalyst for discussion and debate about mathematics.

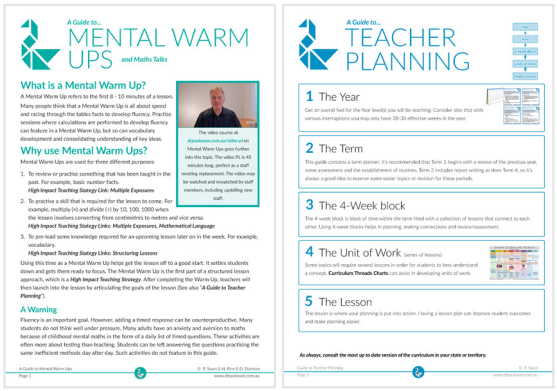
Benefits of Games

Game playing offers the chance for students to discuss **strategy** and moves. That is why I recommend playing the game ROWCO as a pair of players versus another pair, so each pair can discuss potential moves.

A teacher can draw out of the class the **thinking** that is required. The various interactions throughout the game provide an opportunity for **discussion** and sharing of thinking. This places the onus on the teacher to monitor the discussion to ensure that appropriate discussion is taking place and that the thinking is correct.

As well as learning maths concepts when children play games they can develop **social interaction skills** and etiquette such as not being a 'sore loser.'

Planning



Lessons are broken into chunks, so a game used as a warm up would need to fit into an 8 – 10 minute chunk at the start of a lesson (see also the ***Guide to Mental Warm Ups*** and ***Guide to Teacher Planning***). Short games that require little or no equipment are ideal for this purpose. Two 4-minute games could be played in a 10 min session, whereas you would need to interrupt a 20-minute game, which would cause classroom management issues.

If the game is about practice, then maximise the number of turns per minute is the priority, so 2 – 3 players would be ideal. If you have 5 or 6 players then there will be lots of wasted time between turns.

Practical Considerations

A series of 'class rules' such as 'who goes first' and 'how to deal with a draw,' need to be put in place early in the year to avoid unnecessary arguments.

If you intend playing a game on a regular basis then it is worth investing the time to develop what we call 'game fluency', that is familiarity with the way a game is played. Spending time to develop 'game fluency' when teaching a game will ensure that game sessions can run smoothly with the focus on the mathematics, not the mechanics of the game.

Enthusiasm for particular games can wane if you overdo it. Altering rules may be able to breathe new life into a game and to extend its life. After a 3 or 4 week cycle, it is recommended to put that game away and play another.

Basic Equipment

Teachers report that their preferred games are those that use minimal, replaceable materials. The Essentials Pack contains most of the standard materials you would want to use in a games session.

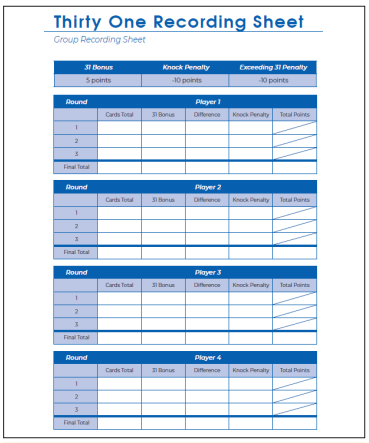
Specialist Equipment

Certain Card Games such as ROWCO, COMBO and Numero are well worth incorporating into your maths program, but require sufficient time to learn.

Assessment Opportunity with Games

At times a game may make use of a scoring sheet. Scoring sheets:

- help keep students on track in terms of the state of the game,
- focus students on the mathematics behind the game,
- may be used to assess students understanding.



*A recording sheet for a game in **Mathematics Games with School Friendly Cards Book 2***

Types of Games

For the purposes of this guide games have been broken into three main categories:

1. Understanding and Reasoning: ***Concept Games***
2. Fluency: ***Practice Games***
3. Problem Solving and Reasoning: ***Strategy Games***

Often there will be elements of two or even three types within a single game, but for ease of description three have been chosen.

What follows is a series of games that range from free downloadable games to commercial games that could form the basis of a bank of games that may be used for a variety of purposes and at different times within a lesson.

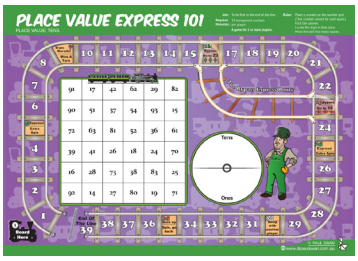
You can buy a pre-made kit of these items from drpaulswan.com.au/shop called the Essential Maths Pack. It comes with a set of activities.

1. Concept Games

Purpose: Teaching a new concept
Duration: Moderate
Differentiation Options: Few

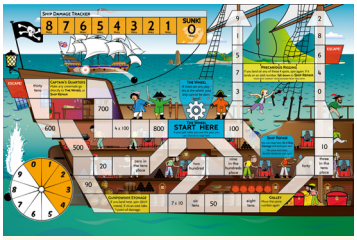
Running a concept game in your class involves playing a game for longer than your average practice game and includes some ***explicit teaching*** of the concept and then constant monitoring while the game is being played.

Place Value Express & Place Value Plunder



The concept of place value can prove difficult for students to learn. This is in part because there are many different aspects of place value.

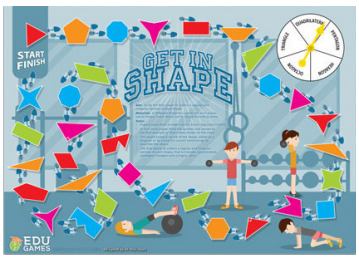
The board games Place Value Express 101 to 505, deal with the concept of ***a digit occupying a place***. There are five different versions of the game appropriate for Year 1 up to Year 4.



There is an element of strategy when choosing a number to cover with a counter (transparent 19 mm), hence once a number has been used it cannot be used again in the game.

The game Place Value Plunder deals with a different aspect of place value – renaming. This set of games would be played at a different time as students would need to be taught the concept of ***renaming*** before playing the game.

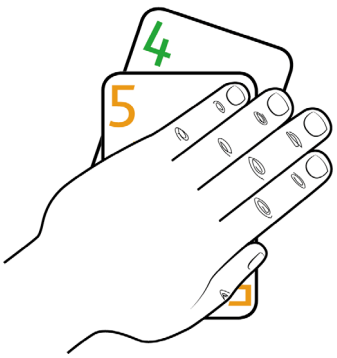
Get in Shape



The game Get in Shape was designed to target some specific misconceptions in Geometry.

In Get in Shape students need to recognise regular and irregular versions of shapes and shapes that have been rotated so as not to be in a typical position.

2. Practice games



Purpose: Reinforcing basic skills
Duration: Quick
Differentiation Options: Many

As the name implies practice games are often used by teachers to reinforce basic skills. Games are employed to make the practice more palatable. In order to be quicker, practice games may essentially be "luck races" where there may be few opportunities for player decisions and thinking to alter the outcome of the game. Practice games need to be differentiated to meet the needs of most students. Students will tire of practice ("luck") games faster than strategy games.

- COMBO (and variations that can be found as a downloadable on www.drpaulswan.com.au)
- The EDUGames series of games targets specific basic fact strategies
- Spindiv Multispin
- The free POP! Games

3. Strategy Games

Purpose: Engaging games leading to a discussion on mathematics
Duration: Moderate
Differentiation Options: Few

The decisions made by players in response to an opponent's moves will have a direct bearing on the outcome of the game. Examples include:

- Monster Manor (Basic Facts Multiplication)
- Place Value Plunder (Place Value)
- ROWCO
- Battleship
- Nim Type Games
- Mancala/Wari - cultural related strategy games

References

Bragg, L. (2005). The impact of mathematical games on learning attitudes and behaviours. Unpublished Doctoral Thesis Latrobe University.

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Gough, J. (2001) Dice and board games. Australian Primary Mathematics Classroom, 6 (2), 14-17.

Oldfield, B. J. (1991a). Games in the learning of mathematics - Part 1: Classification. Mathematics in School, 20(1), 41-43.

Oldfield, B. J. (1991b). Games in the learning of mathematics - Part 2: Games to stimulate mathematical discussion. Mathematics in School, 20(2), 7-9.

Onslow, B. (1990). Overcoming conceptual obstacles: The qualified use of a game. School Science and Mathematics, 90(7), 581-592.

Russo, J., Russo, T., & Bragg, L. A. (2018). Five principles of educationally rich mathematical games. Australian Primary Mathematics Classroom, 23(3), 30-34.

Russo, J., Bragg, L. & Russo, T. (2021). How primary teachers use games to support their teaching of mathematics. International Electronic Journal of Elementary Education, 13, 4, 407-419.

Printed Board Games

Purchase from www.drpaulswan.com.au/shop

All games come packed in a plastic wallet with spinners.

Mixed Year Level Board Games

a.	Mixed Maths Games A	Years 2/3	**$42.90** (4 game set)
b.	Mixed Maths Games B	Years 3-6	**$42.90** (4 game set)
c.	Mixed Maths Games C	Years 1-4	**$42.90** (4 game set)
d.	Mixed Maths Games D	Years 2-4	**$42.90** (4 game set)

Foundation+ Board Games

a.	Red Back Race	Subitising	**$42.90** (4 pack)
b.	You Can Count on Me	Counting	**$42.90** (4 pack)

Year 1+ Board Games

a.	Fairground Frenzy	Bonds of 5 and 10	**$39.00** (3 game set)
b.	Make to Ten Rollercoaster	Bonds to 10	**$42.90** (4 pack)
c.	Build a Band	Addition	**$42.90** (4 pack)
d.	Catch a Crook	Subtraction	**$42.90** (4 pack)

Year 2+ Board Games

a.	Take Off	*Subtraction*	**$42.90** (4 pack)
b.	Robot Race	*Odd / Even Numbers*	**$42.90** (4 pack)
c.	Astronaut Addition	*Addition*	**$42.90** (4 pack)
d.	Double Agent	*Doubling*	**$42.90** (4 pack)
e.	Double Dribble	*Double + 1*	**$42.90** (4 pack)
f.	Get in Shape	*Geometry*	**$42.90** (4 pack)

Year 3-6+ Board Games

a.	Martian Multiplication	*Multiplication*	**$42.90** (4 pack)
b.	Monster Manor	*Multiplication*	**$42.90** (4 pack)
c.	Multispin	*Multiplication*	**$32** (8 game set)
d.	Spindiv	*Division*	**$32** (8 game set)
e.	Race Car Rally	*Division*	**$42.90** (8 game set)
f.	Stop the Clock	*Time*	**$42.90** (4 pack)
g.	Fracto!, Decimo!, Percento!	*Fractions/ Decimals*	**$42.90** (3 game set)

Download & Print Games *Free*

$5 (Personal/Class Use) | **$15** (School License)

Foundation+ Board Games

a. Track the T-Rex	Missing Number
b. Walk the Dog	Counting

Year 1+ Board Games

a. Place Value Express 101	Place Value (2 Digit)

Year 2+ Board Games

a. Place Value Express 202	Place Value (Hundreds)

Year 3+ Board Games

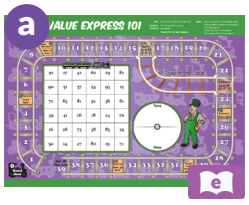
a. Place Value Express 303	Place Value (Thousands)
b. Skip Trip	Multiples
c. Bus Route	Elapsed Time
d. Flushed	Multiplication
e. Gold Rush	Multiplication & Subtraction

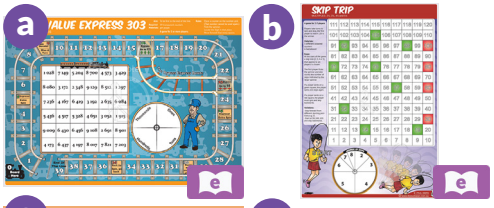
Year 4+ Board Games

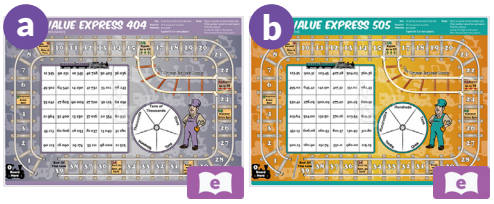
a. Place Value Express 404	Place Value (Tens of Thousands)
b. Place Value Express 505	Place Value (Tenths)

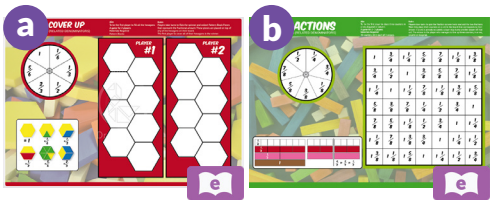
Year 5+ Board Games

a. Fraction Cover Up	Fractions
b. Rod Fractions	Fractions
c. Pattern Block Fractions	Fractions
d. Mining Boom	Squaring / Square Roots









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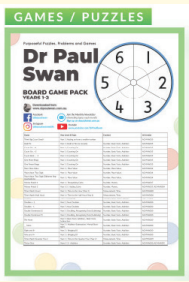

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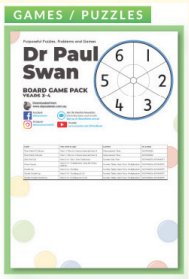
Free Games Pack
Years 1 - 2+



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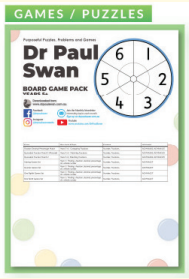
Years 3 - 4+



Dr Paul Swan
Free Games Pack
Years 5+

See also POP games.