

Perceptual Subitizing — Activities and Games

Part 1 of the
Action Research Project

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Action Research Project

The theme for this project is:

Does an emphasis on subitizing promote improved number sense and computation skill?

Much has been written about our innate ability to subitize, compare and quantify before we can even count and yet we gloss over this natural ability when laying down foundations for number sense.

The first part of this Research Project is focussed on perceptual subitizing and the learning outcomes that we have for our students. These outcomes are expressed as a Top 5 as shown below and the activities that comprise the project are aimed at helping your students achieve success with each item in the Top 5.

My first Subitizing TOP 5		Start Date	Finish Date
★ I can quickly match subitizing cards.			
★ I can quickly say how many dots on a card without counting.			
★ I can compare 2 cards and say one has <i>more than, less than or the same</i> as the other card.			
★ I can play subitizing games.			
★ I can use subitizing to solve a problem.			
Congratulations _____			
A job well done!			
Quick Check			
1. Can you find me the card that matches this card?			
2. How many spots on this card? Did you have to count the spots?			
3. Does this card have more spots than that one? Which of these two cards has the most spots?			
4. Let's play a game of subitizing. Which card does the dice match now?			
5. I've chosen a card. Can you think of questions you could ask me to find out how many spots my card has?			
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Introduction

Perceptual subitizing refers to the ability to see a group of objects and to know without counting how many objects there are in the group. Dice and dominoes are examples of objects that rely on our ability to use perceptual subitizing.

The following table gives a summary of the learning outcomes, associated activities and resources that comprise the first part of the Action Research Project.

Top 5	Activity	Resource
(before using the activities)	Pre-test	Game Board Data Collection Sheet Video – What is subitizing?
I can quickly match subitizing cards.	Mental Routine – Subitizing Game – Match the Card	Dot Cards Set 1 Observation Checklist
I can quickly say how many dots on a card without counting.	Strategy Lesson – How many dots?	Dot Cards Set 1 Observation Checklist
I can compare 2 cards and say one has <i>more than</i> , <i>less than</i> or is <i>the same as</i> the other card.	Strategy Lesson – More than/Less than Mental Routine – More than, less than, same as?	Dot Cards Set 1 Observation Checklist
I can play subitizing games.	Game – Dot Card Snap	Dot Cards Set 1 Video – How to play Snap
I can use subitizing to solve a problem.	Problematized Situation – Plates of Plums Problematized Situation – Our own Class Subitizing Book	

As well as the resources listed above, the following mathematical terms should be covered in your work with the students. They need to both hear and use these terms many, many times in order to become fluent with them.

Vocabulary

same as	match	subitize ¹
different to	matches	how many altogether
more than	face up	same number
less than	face down	different number
between		number names 1 – 6
one more than		
one less than		

Note: the concept of *same as* is the entry point, *more than* is a little harder, *less than* can be quite tricky for some students and the concept of *between* takes a considerable amount of support.

Similarly the adaptive reasoning required to find a card that has ‘more dots than this one but less dots than that one’ requires repetition and support.

Indigenous Picture Books

There are many books for children that have been authored by indigenous writers. The following list is only intended as a starting point for your use of such books in the context of teaching mathematics.

Bancroft, Bronwyn (2008) *Possum and Wattle* Little Hare Books

Bancroft, Bronwyn (2011) *Kangaroo and Crocodile* Little Hare Books

Bancroft, Bronwyn (2007) *An Australian 1, 2, 3 of Animals* Little Hare Books

Morgan, Sally and Kwaymullina, Ambelin (2012) *Bush Bash!* Little Hare Books

Moriarty, Ros (2012) *Ten Scared Fish* Allen and Unwin

¹ Yes! I would like the students to use the term *subitize* especially in response to a question such ‘How did you know that?’

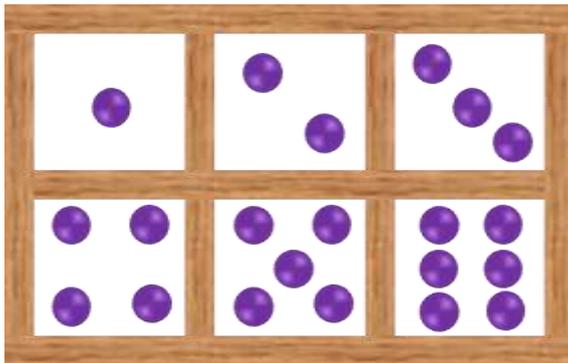
Pre-test for Perceptual Subitizing

This is a game that can be played by AEWs or Teachers with a small group of students. It is suggested that you use this game as the focus of an observation session and that you use the Pre-test data collection sheet to gather information about where your students are starting from.

It is also a good game for the students to take home.

Fill the Board

Each player has a board that shows groups of 1 – 6 objects.



Players take turns to throw the dice and cover the corresponding space on their board.

The first player to cover all the spaces on their board is the winner.

Pre-test Checklist

Select 5 students and use the record sheet below to gather data about the group's subitizing ability.

What I expect to see.		
Why I think that.		
Name	Subitized	Comment
1	Yes/No	
2	Yes/No	
3	Yes/No	
4	Yes/No	
5	Yes/No	
Matched	Matched	Comment
1	Yes/No	
2	Yes/No	
3	Yes/No	
4	Yes/No	
5	Yes/No	
What I found – any surprizes.		

Everyday Activities

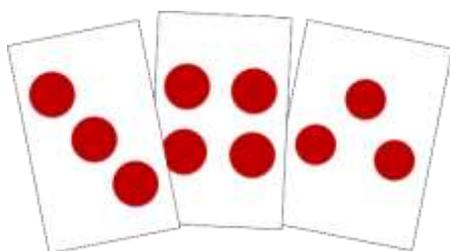
It is expected that the subitizing cards from Set 1 will be used every day to build up fluency, understanding, reasoning and problem solving. There are many quick activities that can be used during the day as transitions or fun breaks, for instance:

Click, stamp or clap

Quickly show a card and say *clap*, *click* or *stamp* (this number of times) which can be accompanied by purposeful counting in conjunction with the actions. Students might have their own ideas for actions that are more engaging than these so give them the choice.

One of these cards

This is a direct take from Sesame Street. Show 3 or 4 cards such as:



Say "One of these cards is not like the others, one of these cards just doesn't belong"

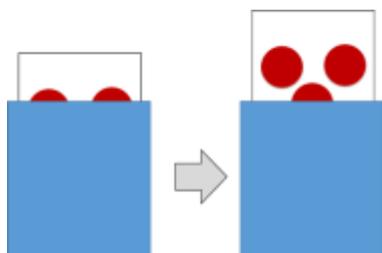
The students identify the odd one out and say why does not belong.

More than Less than

Tell the students that you are looking for a card that is *one more than*, *one less than* or *the same as* the one that you quickly show them. Next turn over and quickly show one card at a time. Students say stop when they see a card that matches the criteria.

Masking

Partially hide a card behind a mask. Reveal a little, not enough to give it away and ask the students to say what card is hiding and to explain why they think that.



Reveal a little more and ask "What do you think? Why? Did you have to change your thinking? Why/why not?"

Notes

What did you notice?

Mental Routine – Subitizing

This is the entry point mental routine for subitizing. It is essential that you show the cards quickly to promote visual perceptual subitizing, initially naming the quantity is not the goal although as familiarity develops numbers will be used.

Resources: Each student will need a set of cards to match the range that you are including.

Closed Questions

Hold up a card 1 – 3 and extend to include 4 – 6 if and when appropriate

Which card has the same dot pattern as this one?

Which card has the same number of dots as this one?

Which card has 1/2/3/4/5/6 dots on it?

Open Questions

I am thinking of a card that has a different dot pattern to this one. Which card might it be?

I am thinking of a card with a different number of dots to this one. Which card might it be?

My card does not have 2/3/4/5/6/ dots. Which card might it be?

Flip Questions: Guess my card

Explain that you are thinking of a card and that the students can ask questions to find out which card it is. As this is an entry level game allow students to either hold up the card as they ask their question or to name the card if they are able.

Questions could include:

Is your card the same dot pattern as this one?

Is your dot pattern different to this one?

Does your card have 3 dots on it?

As the students play model the process of turning over the eliminated cards each time. It will take several experiences with the game for the students reasoning to develop to the point that they begin to be strategic with their questions and their elimination. Be supportive but insistent that students look at their cards and think about a relevant question and rephrase if need be so that they are immersed in the correct language patterns.

Notes

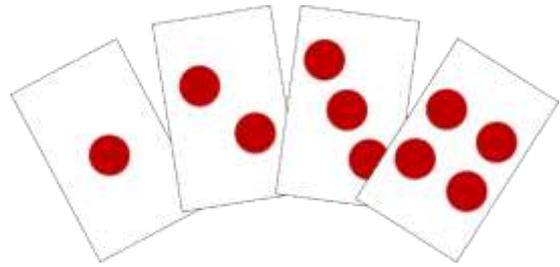
What did you notice?

What did or did not change?

So what next?

Game – Match It

Before using this game, please watch the video segment **Match It**, which shows the game being played and continues on to show the next game, **The Great Turnover**.



Resources: Each student and the teacher needs cards 1 – 6, but only use the cards 1 – 4 initially.

One copy the Checklist on the opposite page for each student.

Game

Students sit with their cards face up; the teacher's cards are face down in a pile.

The teacher quickly flashes a card and the students pick up the matching card.

Play the game with cards 1 – 4 and introduce card 5, and then card 6, as the students become confident with each pattern.

When the students are confidently matching the cards, you can play the following game which asks them to match the dots on a dice with those on the cards.

Game – The Great Turnover

As shown on the video sequenced, each player lays out the cards 1 – 6, throws a dice and if possible, turns over the card that matches the throw. The first player to turn over all their cards is the winner.



Match it Checklist

Student Name _____

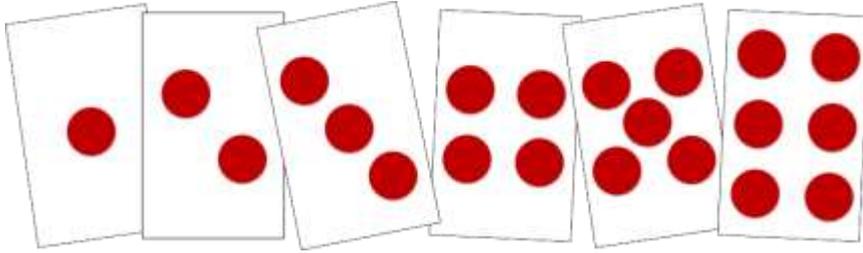
What I expected to see

- | | |
|---|--------|
| 1. Set the cards out in an organised way (not random) | Yes/No |
| 2. Could subitize my card and hold the image in mind while searching for the matching card. | Yes/No |
| 3. Subitized and matched easily and quickly | Yes/No |

Any surprises?

Strategy Lesson — How many dots?

AEW or teacher working with 1 to 5 students using subitising cards 1-3 or 1-6.



Quickly show a card.

Students call out how many dots without counting.

Students may hold up matching fingers without counting.

Observe the students' lips as you play. If you see signs of lips moving and counting, you need to reduce the number of dots and reduce the amount of time allowed for students to 'see' the card.

When the students are familiar with the game process they can play with a partner.

How many dots Checklist

Student Name _____

What I expected to see

1. Subitized quickly and accurately 1 – 3
2. Subitized quickly and accurately 4 – 6
3. Named the card correctly 1 – 3
4. Named the card correctly 1 – 3

Yes/No
Yes/No
Yes/No
Yes/No

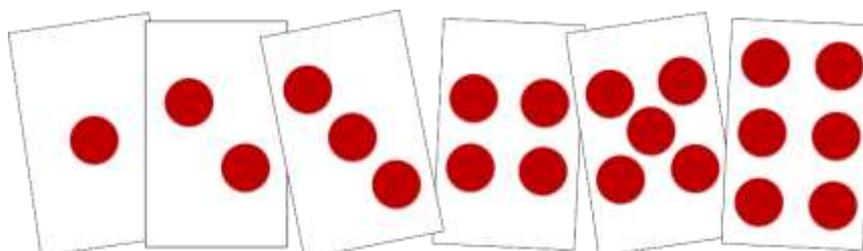
Any surprises?

Mental Routine – More than, less than, same as?

This mental routine is for the AEW or teacher working with small group or whole class. There is a video sequence, **More than – Less than**, which shows how this mental routine can be run.



Each student has a set of cards (going from 1 to 3, 4, 5 or 6 as appropriate) set out in front of them, while the teacher has a matching set of cards that has been shuffled.



Closed questions

The teacher selects her top card and gives instructions or asks questions such as the following:

Match the selected card.

Show me a card that has more dots than this one show me a card that has less dots than this one

Show me a card with the same number of dots as this one

Show me a card with a different number of dots to this one.

How quickly can you find the card that has 3/4/5/6 dots?

Open questions

I am thinking of a card that has more dots than this one (show a card 1-3). What might it be?

I am thinking of a card that has less dots than this one (show a card 3-6). What might it be?

I am thinking of a card that has more dots than this one but less dots than this one. What might it be? *Show a card less than 3 and more than 4 for this type of question.*

Flip questions – What’s on my Card?

Select a card but do not say what it is. Tell the students that they can ask, *more than, less than, same as* questions to find out what your selected card is. Encourage the students to turn over cards in their set that they can eliminate after each question.

In the early phases of this flip game, students may hold up a card as they ask the *more than, less than or same as* questions. Encourage them to move on from there by rephrasing their questions as “You want to know if my card has more than 3 dots.” In that way modelling the use of language that you would like them to practice.

Notes

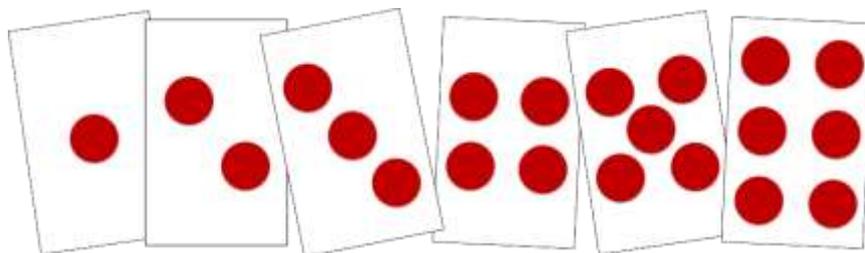
What did you notice?

What did or did not change?

So what next?

Strategy Lesson — More than/Less than

Use a set of the 1-6 dot cards per student.



You may need to introduce the language that this activity develops by giving each student a set of 1` - 6 cards. You then hold up one of the cards and ask the students to show you a card that is

- more than
- less than
- same as
- different to

the card that you are displaying.

Activity

Shuffle the cards and deal them equally among the students who need to keep their cards hidden for this activity.

On their turn, each student holds up a card and chooses whether to ask the other students for a card that is:

- more than
- less than
- same as
- different to

The other students must hand over a requested card if they have one. If not, play passes to the next person. Students stack the cards that they are given to one side because at the end of play the student with the most collected cards wins the round.

This activity can become quite strategic. When the students are familiar with the vocabulary and quickly finding cards that match the request encourage them to think carefully about their questions as well as which cards to give up on request. Trying to remember which cards have been played and planning questions accordingly will extend the reasoning and problem solving capacity of the students.

More than/Less than Checklist

Student Name _____

What I expected to see

- | | |
|---|--------|
| 1. Can find a card that is <i>the same as</i> by subitizing without needing to count | Yes/No |
| 2. Can find a card that is <i>more than</i> by subitizing without needing to count | Yes/No |
| 3. Can find a card that is <i>less than</i> by subitizing without needing to count | Yes/No |
| 4. Can find a card that is <i>different to</i> by subitizing without needing to count | Yes/No |

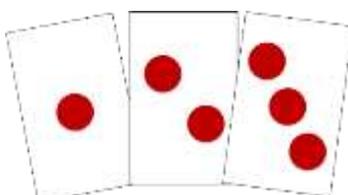
Any surprises?

Game – Dot Card Snap

There is a video sequence, **Dot Card Snap**, which shows how this game is played.



Make a pack that has enough cards for there to be 6 of each type of card for each player. Initially use only cards 1 – 3, but as confidence increases, add in the 4s, then 5s and 6s.



The Game

Shuffle the cards and deal the cards equally between the players making a pile of face-down cards in front of each player.

The players then take turns to place their top card in the middle, turning it over to make a face up pile. If the top two cards in the middle pile have the same number of spots, the first player to call “Snap” wins the pile and places all the cards in the middle pile face up next to their face-down pile.

When the face-down piles are all empty, players count how many cards they have won and the person with the most cards wins the game.

Note: Counting the cards at the end of the game provides purposeful immersion in one-to-one matching and counting. It also focusses on the total amount in the collection. The process of counting how many in a group is central to moving students on from using numbers and labels for the last object counted to identifying the quantity in a group. Use the Dot Card Snap checklist for the same students as before and compare their range and speed of subitizing.

Dot Card Snap Checklist

Student Name _____

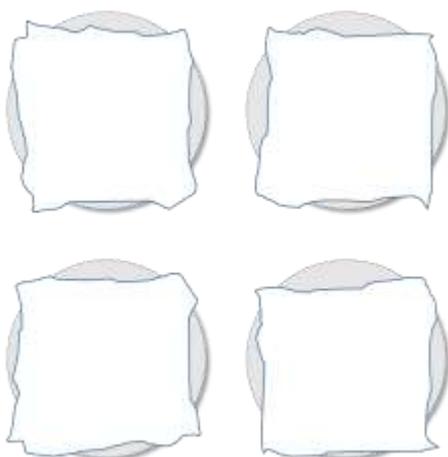
What I expected to see

- | | |
|---|--------|
| 5. Set the cards out in an organised way (not random) | Yes/No |
| 6. Could subitize my card and hold the image in mind while searching for the matching card. | Yes/No |
| 7. Subitized and matched easily and quickly | Yes/No |
| 8. Could count their pile of cards matching one to one. | Yes/No |

Any surprizes?

Problematized situation – Plates of plums

Isabella was trying to trick Isiah. She had four plates with salty plums that she covered with paper.



“Watch,” she said to Isiah as she quickly moved the covers away and put them back. Isiah had almost no time to see the plums.

“How many plums are there on each plate?” she asked Isiah.

But Isiah wasn't to be tricked. He just subitized the number on each plate and told Izabella that he had seen three plums on one plate, four plums on another plate, five plums on another plate and six plums on the last plate.

What do you think each plate looked like?

Note: Prepare 4 plates with covers if you want to clarify the problem for your students.

And, in case you are wondering, this is what a plate of salty plums looks like! Yum!



We recommend that you use the STAR model as a framework for your lesson.

Sort out

Focus students on the problem by asking:

What is on the plates?

Why are the plates covered?

Does each plate have the same number of plums? How do you know?

How many plums are on this plate?

What do you need to show?

Think about

Who thinks they can show the plums so that they don't need to be counted?

How would you arrange the plums so that you just know how many after a quick look?

Action

Allow time for the students to make or draw plates of salty plums. As they work, note how they go about arranging the plums. Some will randomly draw and then check by counting. Some will count as they go. The goal is that they will begin to spontaneously draw recognisable groups that don't need to be counted. You may need to remind the students to think about the special way groups have been shown on the dot cards.

Reflect

Select 2 or 3 work samples, including one that is very organised and easily subitized and one that is not. Ask the students:

“How many plums on this plate?”

“Do you need to count or can you just see?”

“Which plate is easiest to subitize?”

“Why is that?”

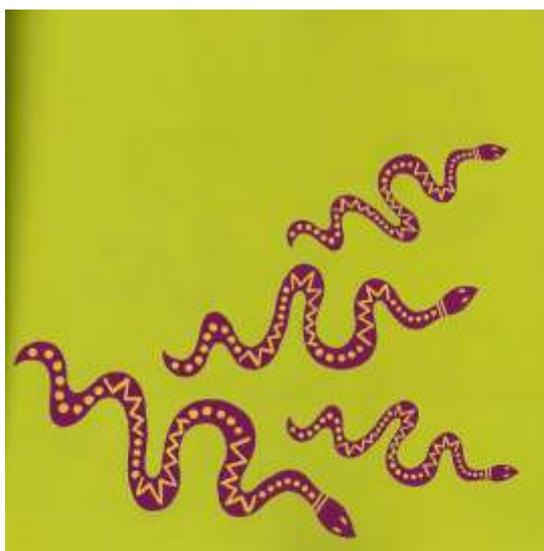
Note: You can repeat this activity as many times as is needed; simply change the numbers, objects and contexts. For example:

“I noticed that the bean bags weren't put away properly. You know that I like to see 4 in this corner, 5 in that corner and 6 next to the door. Could you please make me a picture of how they should go so that it is easy for everyone to check?”

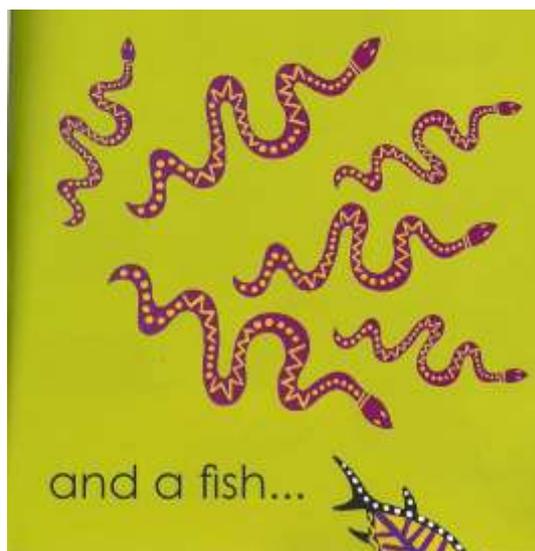
Problematized Situation – Our own Subitizing Book

Introduce this activity by showing pages from *Ten Scared Fish* by Ros Moriarty. This book reflects the local creatures and geography of Borroloola in the NT. It makes an excellent starting point for activities that reflect other indigenous locations. As an example, here are two pages from the book with their captions:

4 snakes in the river grass



6 snakes in the river grass



Show pages like these to the students and ask:

“Is it easy to know how many snakes without counting?”

“Why, why not?”

Then suggest to the class that they select a local creature, identify where it is found and create their own pages for a class subitizing book. The completed subitizing book might have pictures for 1 – 6 creatures and, if you plan to continue into Part 2 of this series, could be extended to give opportunities for conceptual and well as perceptual subitizing.

After completing this activity, use the Post-test to check what gains have been made and how effective this programme has been.

