SA NUMERACY CHAIR PROJECT

"Pushing for Progression" in number sense and fluency Maths Club Development Programme

Session One
Introduction
Teacher Handbook

Name

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School

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District

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www.ru.ac.za/sanc
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Maths is fun...

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Introduction to Pushing for Progression (PfP) club development programme

Based on the research and development work carried out in the South African Numeracy Chair (SANC) project after school clubs since 2011, we note that working with learners to focus specifically on the development of fluency and number sense over a short period of time has positive results. Therefore, we aim to build on these successes with this programme. This programme aims to support teachers in setting up and running clubs of their own using a structured 15-week club programme.

Overview of the PfP programme

South Africa currently sits with a crisis in primary education where learners are still bound by using concrete strategies to solve problems. Many learners are 'trapped' in using concrete one-to-one counting methods or dependence on algorithms without understanding. The result is an absence of flexibility and fluency with both numbers and operations.

The goal is to work with small groups of Grade 3, 4, 5 and 6 teachers in local DOE districts to set up clubs. The intention is to support these teachers to run clubs that focus on developing learners' increasingly efficient strategies in the 4 basic operations or what we term "**Pushing for Progression**". Teachers will be invited to attend a series of workshops which will be facilitated by the SANC project team. Each workshop will aim to provide the teachers with resources for assessment and club activities as well as an orientation to why it is important to focus on this progression. Further, in the workshops the team will work with teachers to understand how to progress the learners from concrete methods to more efficient ones.

Each teacher will be encouraged to start a club with up to 12 learners from their school / class over a 15-week period, with the goal of exploring the ideas presented in the workshops and to reflect on how these help them in progressing learners as well as how it may influence their own teaching. They will run one club per week for approximately 1 hour.

Should teachers wish more learners to be involved, they can offer two 15-week programmes a year with two different groups of learners by running the 15-week programme twice. Alternately, after the initial 15-week programme, teachers may wish to continue working with the same group of learners, extending them beyond what is covered by this programme. If this is the case, teachers may access our website and select from the broad range of activities there.

Aims of the PfP development programme for teachers

- learn more about the development of FP and IP learner's early number skills along a learning pathway
- identify when children are learning securely along this pathway through effective assessment and focused mathematics activities
- learn more about the mathematics involved in early number skills and where this can underpin future mathematical knowledge and understanding

Key ideas of the PfP programme

A number of key ideas form the basis of the development programme, which are described below.

Key idea 1: Mathematical proficiency

Working with Kilpatrick et al.'s (2001) strands of mathematical proficiency, the programme will focus on the two strands of *procedural fluency and conceptual understanding*.

<u>Conceptual understanding:</u>

Comprehension of mathematical concepts, operations, and relations. The ability to use multiple representations, estimate, make connections and links and understanding properties of number systems (i.e. number sense).

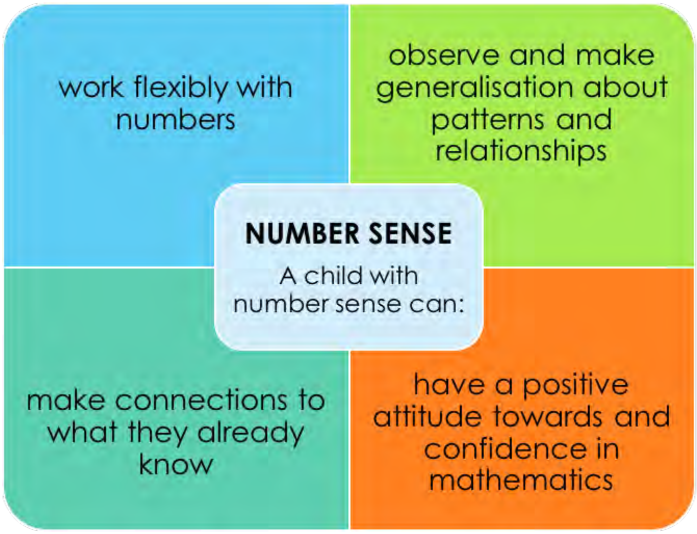
<u>Procedural fluency:</u>

Skill in carrying out procedures flexibly, accurately, efficiently, and appropriately. The ability to solve a problem without referring to tables and other aids, using efficient ways to add, subtract, multiply and divide mentally and on paper, understanding when it is appropriate to use procedures or not (as not all calculating situations are alike).

NOTES:

Key idea 2: Number sense

A number sense approach can be useful to think about the relationship between the two strands. A child with number sense has the ability to work flexibly with numbers, observe patterns and relationships and make connections to what they already know, to make generalisations about patterns and processes. Number sense also includes a positive attitude and confidence (Anghileri, 2006).



In the *Foundation Phase* the development of number sense includes the meaning of different kinds of numbers, the relationship between different kinds of numbers, and the effect of operating with numbers. In the *Intermediate Phase* this development of number sense and operational fluency should continue, with the number range, kinds of numbers, and calculation techniques all being extended.

These are some of the things that we can aim to develop in our club learners.

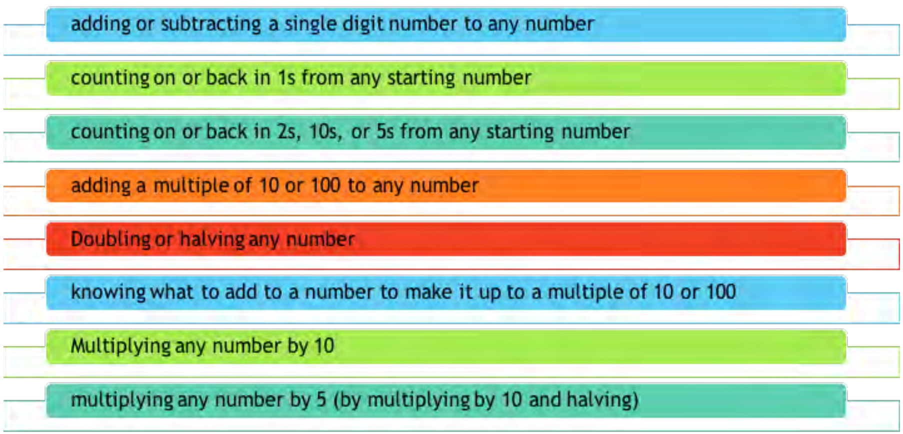


Figure 1: (Askew, 2012)

The programme aims to develop procedural fluency, conceptual understanding and number sense in the club learners using these ideas.

Key idea 3: Learner progression in clubs

Progressing learners from inefficient, constrained methods of working to more fluent and flexible methods is an important aspect of this programme. A wide range of research points to the need for coherence and progression in the teaching of mathematics (Askew, Venkat, & Mathews, 2012; Schollar, 2008). For the maths clubs, the focus is on progression in the four operations, as shown by the two spectrums below. These have been developed over time from various research projects in the SANC project[1].

A standard assessment and marking schedule has been developed to help you assess this progression in your club learners (see page 17 below)

Addition and subtraction spectrum (Figure 1)

On the left of this spectrum are commonly observed *constrained* methods:

- Use of fingers
- Drawing tally marks or circles
- Any other types of drawings

The next level of progression is called *less constrained* methods and includes:

- Breaking down into place value
- Using some kind of expanded notation

The next level of progression is called *semi fluent* methods and includes:

- Use of other strategies such as splitting, working with a friendly number and so on

The most *flexible, fluent* methods are show at the right and include:

- Strategies using know addition and subtraction facts
- Appropriate use of column methods (algorithms) for 2 and 3 digit problems

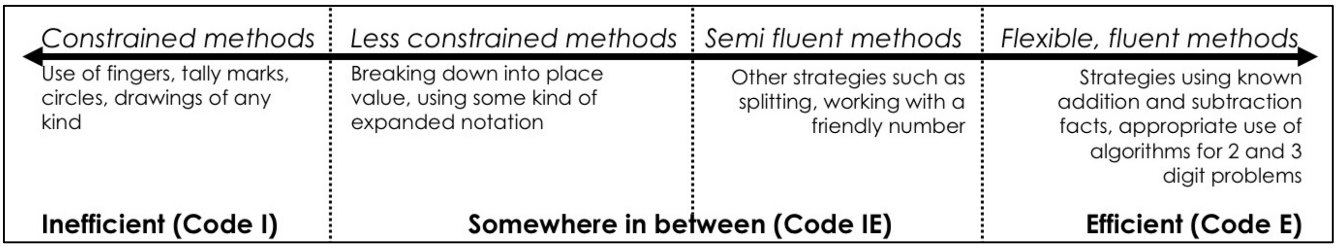


Figure 2: Addition and subtraction progression spectrum

NOTES:

[1] See for example (Graven & Stott, 2012; Mofu, 2013)

Multiplication and division spectrum (Figure 2)

On the left of this spectrum are commonly observed *constrained* methods:

- Use of fingers
- Drawing tally marks or circles
- Any other types of drawings

The next level of progression is called *less constrained* methods and includes:

- Skip counting
- Repeated addition

The next level of progression is called *semi fluent* methods and includes:

- Arrays
- Breaking down into expanded notation

The most *flexible, fluent* methods are show at the right and include:

- Strategies using know multiplication and division facts
- Appropriate use of column methods (algorithms) for 2 and 3 digit problems

Constrained methods	*Less constrained methods*	*Semi fluent methods*	*Flexible, fluent methods*
Use of fingers, tally marks, circles, drawings of any kind	Skip counting, repeated addition	Arrays, breaking down into expanded notation	Strategies using known multiplication and division facts, appropriate use of algorithms for 2 and 3 digit problems
Inefficient (Code I)	**Somewhere in between (Code IE)**		**Efficient (Code E)**

Figure 3: Multiplication and division progression spectrum

NOTES:

Key idea 4: Aiming for proficiency and participation

The clubs are designed to help develop learner proficiency but also to encourage them to participate more confidently in mathematics.

Left side:

- A focus on individual learner progress and the acquisition of mathematical proficiency.

Right side:

- Focus on mathematical participation whereby the learners, facilitators and other people in the club become participants in the club with increased sense making and communication in mathematics.

Key idea 5: Practice in clubs

Two forms of practice are useful for mathematics activities in the clubs:

<u>Reproductive practice</u>

Focusing on automation of skills and memorisation of basic facts for numbers up to 20.

- This will take place through the playing of fun dice and card games (see below), other club games such as Fizz Pop and by independent activity provided by the Tailored Independent Activity (TIA) books. Based on the results of the initial baseline assessments, teachers will be able to provide a book or series of TIA books to the learner.

<u>Productive practice</u>

This is “indirect and problem-linked”. The practice tasks are more open, solutions and answers allow for differentiation and which require the learner to show more initiative in solving the problem.

- This will be encouraged via math talk between the teachers and learners in the club sessions by sharing ideas and methods for solving problems. Puzzle type activities will also be used for productive practice to encourage the learners to be creative in how they approach solving the puzzles.

NOTES:

Playing games in the clubs

Mathematical games are 'activities' which involve a mathematical challenge, are governed by a set of rules and have a clear underlying structure, normally have a distinct finishing point and have specific mathematical cognitive objectives (Way, 2013).

Short games, particularly those played with cards and dice, are very accessible to learners and can aid in the development of core number skills, mental agility and fluency in number. They are very useful diagnostic tools for club facilitators.

Benefits to learning through games include motivation, developing positive attitudes towards maths and allowing children to operate at different levels of thinking as well as providing opportunities to learn from each other.

Games taught and used in the clubs can potentially also be played at home and shared with family members, thereby allowing learners to spend more time on maths, to consolidate skills and practice what they have learnt in class, to teach other people the rules and to get other people involved in mathematics. See more about this below in the **Pay-It-Forward** section.

COMPETITION VS. COLLABORATION

Games can encourage collaboration, communication and competition.

However, too much emphasis on competition can be counter productive as the game becomes about the winning or losing and not the mathematics or the strategies. Emphasise collaboration and communication more often than competition.

Introducing games into the clubs

In teaching games to groups Gillian Hatch (2013) has found three different methods that work well.

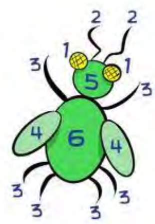
- Introduce the game to one group of learners while the others are completing some individual work.
- Then divide the whole class into groups. Put one learner from the initial group into each group to teach the game to the group. Divide the class into the groups in which they will subsequently play. Play the game with the whole class, with each group acting as a single player.
- Choose a set of learners to come to the front of the class and play the game as a demonstration, possibly with assistance in decision making from the whole class.

Source: http://nrich.maths.org/2928/index

HINTS FOR SUCCESSFUL CLUB GAMES

- Make sure the game matches your mathematical objective(s)
- Use games for specific purposes, not just time-fillers
- Keep the number of players in groups from 2 to 4, so that turns come around quickly
- The game should have enough of an element of chance so that it allows weaker learners to feel that they a chance of winning
- Keep the game completion time short

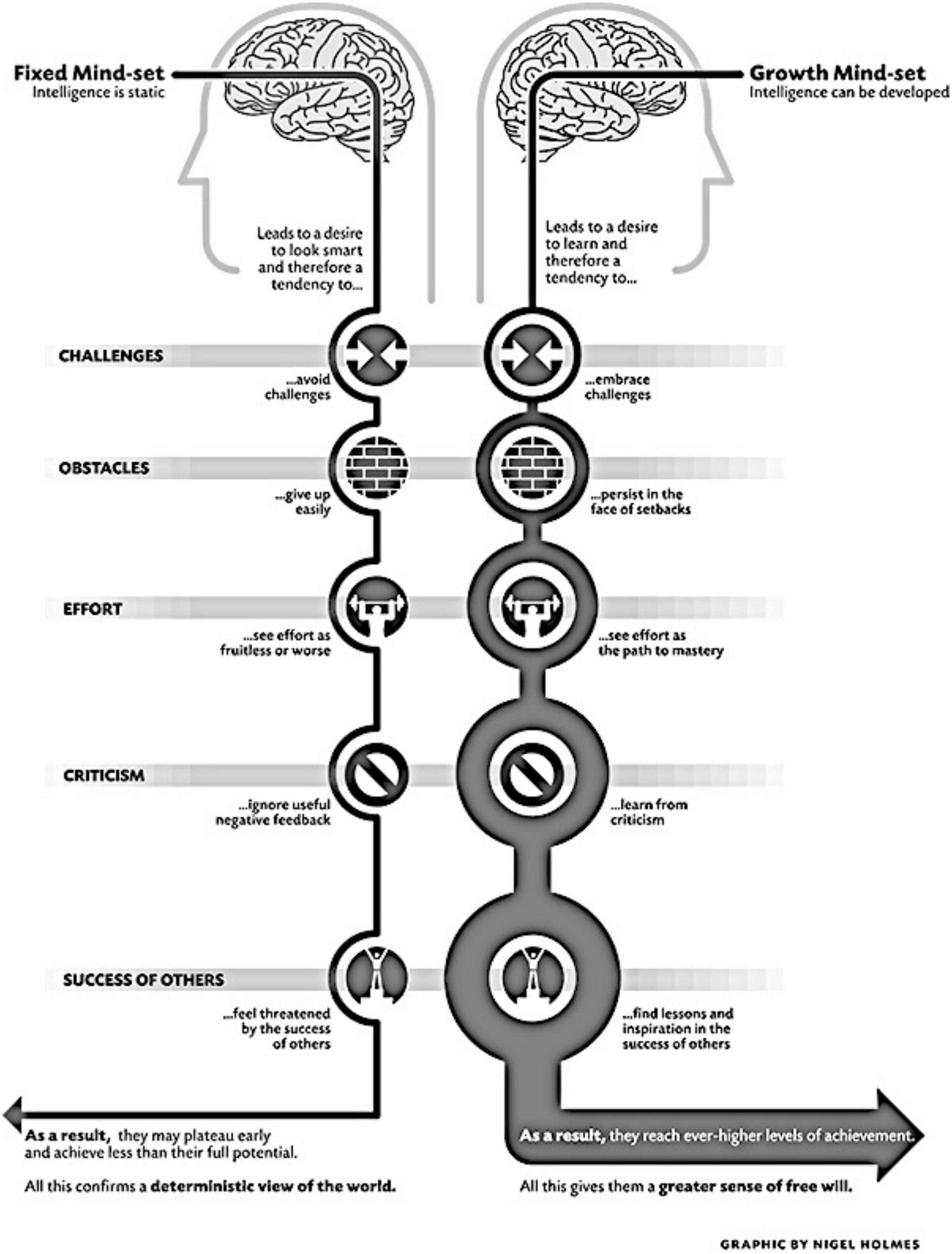
Source: http://nrich.maths.org



Key idea 6: Mindsets, making mistakes and the experience of struggle

Research has recently shown something stunning - when learners make a mistake in maths, their brain grows, synapses fire, and connections are made; when they do the work correctly, there is no brain growth. This finding suggests that we want learners to make mistakes in math clubs and that learners should not view mistakes as learning failures but as learning achievements.

It is helpful for learners to revisit a mistake and correct it, but brain growth also comes from the **experience of struggle**. When learners struggle with mathematics, their brains grow; being outside their comfort zone is an extremely important place to be.



Beliefs from the two mindsets

Fixed Mindset **intelligence is a fixed trait**	**Intelligence/ Talent**	**Growth Mindset** **intelligence is a malleable quality, a potential that can be developed**
Fixed Mindset students say: **Looking Smart is Most Important:**	**Goals**	**Growth Mindset students say:** **Learning is Most Important:**
"The main thing I want when I do my school work is to show how good I am at it." "How will I be judged?" "I won't risk trying something new if I don't know if I can be successful." "How did I do compared to the rest of the class?"		"It's much more important for me to learn things in my classes than it is to get the best grades." "Even people like Einstein had to put in years of effort to become who they were. "I love a challenge." "Mistakes can be our friends."
Effort is negative: (Blackwell, Trzesniewski, & Dweck, 2007)	**Beliefs about Effort**	**Effort is positive:** (Blackwell et al., 2007; Nussbaum & Dweck, 2007)
"To tell the truth, when I work hard it makes me feel like I'm not very smart."		"The harder you work at something, the better you'll be at it."
Helpless (Blackwell, et Al. 2007; Nussbaum & Dweck,2007)	**Strategies after Failure**	**Resiliency** (Mangels, Butterfield, Lamb, Good, & Dweck, 2006)
"I will **spend less time** on this subject from now on." "This is dumb!" "I'll **cheat** on the next test." "This isn't important anyway."		"I will work harder in this class from now on." "I will spend more time studying for the tests." "There 's got to be a strategy I can use to help me learn this."

Ways to praise

Praise Intelligence - Fixed Mindset		**Praise Effort – Growth Mindset**
Praising students' intelligence or talent gives a short burst of pride, followed by a long string of negative consequences. (Cimpian, Arce, Markman, & Dweck, 2007; Kamins & Dweck, 1999; Mueller & Dweck,1998)	**The effects**	**Praise for effort or process (engagement, courage, perseverance, strategies, improvement, attention to detail, etc,) fosters motivation. This type of praise explains what they have done to be successful and what to do in the future be successful again.**
What we say when we praise intelligence or talent:	**Ways we Praise**	**What we can say to praise effort or process:** (Dweck, 2009)
"Wow, that's a really good score. You must be smart at this."		"Wow, that's a really good score. You must have tried really hard."
You are such a good artist!" You made an A on that test. I am so proud of your grade!		You really studied for your English test, and your improvement shows it. You read the material over several times, outlined it, and tested yourself on it. That really worked!
The B is great but if you try harder, I bet you could make an A.		I like the way you tried all kinds of strategies on that math problem until you finally got it.
'Good job!" You made the highest grade on the test, you must be so proud."		I like that you took on that challenging project for your science class. It will take a lot of work—doing the research, designing the machine, buying the parts, and building it. You're going to learn a lot of great things.
	What if they get A's with no effort?	"All right, that was too easy for you. Let's do something more challenging that you can learn from."
"You just need to work harder." "You will do better next time."	**What if a student works hard and still doesn't do well?**	"I liked the effort you put in. Let's work together some more and figure out what you don't understand." "When we studied famous people like Edison, he failed 1,000 times but with effort and persevered he figured it out!"

Practical information for setting up clubs

The clubs need to operate with some basic ground rules. These are ones that we have found useful over the years

- Listen to each other's ideas
- Do not laugh when people make mistakes
- Do not hit, kick, bite, bully
- Do not tell tales /lies

CLUB ETHOS

The clubs allow the learners opportunities to actively engage with mathematics and sense making as well as for mathematical confidence building.

Learners are free to:

- Talk about mathematics
- Argue about mathematics
- Explain how something was worked out
- Ask questions
- Make mistakes. Learning happens by making, discussing and correcting mistakes
- Speak their own language
- Cross things out, be untidy
- Work differently to the way they do in the classroom
- HAVE FUN

As club leaders / facilitators in the club, the aim is to:

- help learners think about mathematics
- enjoy mathematics

Club leaders / facilitators:

- Are active participants and co-learners
- Facilitate rather than direct teaching
- Need to make learners feel OK about making mistakes and to be comfortable with struggle
- Encourage participation and engagement
- Promote club ethos
- Provide flexible mediation to challenge and build confidence

PAY IT FORWARD

One concept that works well in the clubs is the 'Pay-It-Forward' concept. Learners are taught a numeracy game using a simple cost effective resource they have been given or have access to in the club (e.g. a pair of dice, a pack of cards).

The idea is that the learners must teach/play this game with at least two other people in their community (siblings, cousins, parents, grandparents, friends etc.) and promise to 'Pay It Forward'. Many of these games are quite simple but critically involve the development of numeracy proficiency.

Individual Club Session Planning Sheets and Assessments

Club Session One - Planning Sheet

Purpose of the session	Administer 4 operations assessment, establishing club culture, observing how learners work together, subitising, adding numbers to 20 or multiplying single or 2-digit numbers	**FP/IP**

What resources / manipulatives will you need?	Home sharing/ Pay It Forward task
• 4 operations assessments • 2 or 3 dice per pair of learners • Scrap paper and a pencil for each pair of learners • SANCP Dice and Cards booklet for CROSS OUT game instructions (page 18)	

Organisational requirements	Your approach to running the session
• Individual work for assessment • Pair work for CROSS OUT dice game	As this is the first session, keep it as fun and interactive as possible. Start establishing norms: e.g. no laughing at others mistakes, listening to each other, no shouting out

Assessment

Administer the 4 operations assessment as described in this handbook

Mental

Start with FIZZ POP!

Skills: Depends on the questions you pose but good for number sense and mental work	Mental starter No resources required	Grade: any	Whole club / group

- Start by practising bonds to 10. Say "I will say a number and you must say how many more to make 10"
- The game starts with leader saying "FIZZ", club responds with "POP"
- Say the number and club responds. E.g. "5" and club responds with "5"
- Next one: "FIZZ", club responds with "POP", "6", club responds with "4" and so on

Game

INSTRUCTIONS FOR CROSS OUT

The goal is to throw dice to help cross numbers off a list

Refer to page 18 in **SANC project Dice and Cards booklet** for instructions

Skill: Cooperative work, addition, multiplication	You need: 2 or 3 dice, scrap paper and pencil for each pair	Work: with a partner

- Each learner writes the numbers 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 on their own piece of paper
- Take turns to roll two dice
- Add both numbers rolled
- Cross out the total on their piece of paper
- The first player to cross out all the numbers is the winner

FOR IP LEARNERS - EXTENSION ACTIVITIES

- Use 3 dice, **add** all 3, change the numbers written on the paper:
  - Even numbers 2 to 20
  - Odd numbers 1 to 19
- Use 2 dice, **multiply** them together, change the numbers written to: 2, 4, 6, 8, 10, 12, 18, 20, 24, 25, 30, 36
- Use 3 dice, **add** 2 and **multiply** by 3rd, change the numbers written to: 2, 4, 6, 8, 10, 12, 18, 20, 24, 25, 30, 36

Formative assessment aspects

Observe the following

Social	Mathematical
• Cheating • Co-operation • Taking turns	• Recognition of number patterns (subitising) • Adding 1 digit numbers • Multiplying 1 digit numbers

Club Session Two - Planning Sheet

Purpose of the session	Observing how learners work together, adding numbers to 20, subitising, administer the learner disposition assessments (if required)	**FP/IP**

What resources / manipulatives will you need?

- 1 dice, photocopied BEETLE score card (or laminated versions)
- 1 koki per learner
- Scrap paper and a pencil for each pair of learners
- 1 dice for each learner to take home
- SANCP Dice and Cards booklet for BEETLE game instructions (page 23)
- Photocopies of learner dispositional questionnaires

Home sharing/ Pay It Forward task

Give each learner a dice to take home
Ask them to pay BEETLE with someone they know

Organisational requirements

- Pair work for BEETLE
- Individual work for assessment

Your approach to running the session

As with the first session, keep this one as fun and interactive as possible.
Start establishing norms: e.g. use thumb technique "thinking thumb"

Assessment

Administer the learner dispositional questionnaires
If you are not administering these, simply play BEETLE for the whole session

Game

INSTRUCTIONS FOR BEETLE
The goal is to throw dice to help draw a beetle insect
Refer to page 23 in **SANC project Dice and Cards booklet** for instructions

Skill: Cooperative work, addition	You need: 1 dice, score card, koki and pencil for each pair	Work: with a partner

FOR IP LEARNERS - EXTENSION ACTIVITIES

- *Different values for body parts*: Use **2 dice** and change the values of the body parts e.g.

Body = 6	Head = 5	Wings = 10	Legs = 8
Eyes = 7	Feelers = 9	Spot on body = 2	Throw again 1, 3, 5, 11, 12

- *Estimation*:
    - o Before each pair adds up scores, the whole group can estimate which pair they think has the highest score and lowest score. Discuss strategies.
    - o Then each pair adds up their score and hand to another pair to check and agree or disagree
    - o Check actual scores against estimates

Formative assessment aspects
Observe the following

Social	Mathematical
• Cheating • Co-operation • Taking turns / working together to achieve a gaol	• Writing 1 and 2 digit numbers • Recognition of number patterns (subitising) • Adding 1 and 2 digit numbers

Notes

Club Session Three - Planning Sheet

Purpose of the session	Observing how learners work together, adding and subtracting numbers to 20 (or higher), strategies for winning the game	**FP/IP**

What resources / manipulatives will you need?	**Home sharing/ Pay It Forward task**
• MAKE 12: 1 dice, scrap paper and pencil for each pair of learners • SANCP Dice and Cards booklet for MAKE 12 game instructions (page 20)	Remind learners about the dice they took home last week Ask them to play MAKE 12 with someone they know
Organisational requirements	**Your approach to running the session**
• Pair work for MAKE 12	As with the first session, keep this one as fun and interactive as possible. Continue to establish norms: e.g. use thumb technique "thinking thumb"

Assessment

Ongoing, formative

Game

INSTRUCTIONS FOR MAKE 12

The aim of this game is to add numbers to make a total of 12 in each box. You need to get three boxes in a line (up, down, diagonal) to end the game. Refer to page 20 in **SANC project Dice and Cards booklet** for further instructions

Skill: Addition, subtraction and addition strategies	You need: 1 dice, scrap paper, a pencil.	Work: with a partner

- Draw a 3 x 3 grid on scrap paper
- Take turns to throw the dice and write that number in one of the boxes on the grid.
- When it is your turn, keep adding numbers to a box until it adds to EXACTLY 12. If the number on the dice will make the numbers add to more than 12, you will need to put that number in another box
- When a box adds to 12, you can put a line through the box
- Keep going until there are three filled boxes in a row or column or diagonal. The game finishes when this happens.

FOR IP LEARNERS - EXTENSION ACTIVITIES

- Use a bigger grid e.g. 4 x 4 or 5 x 5
- Or add to a bigger number such as 15, 16, 20 etc.

Formative assessment aspects

Observe the following

Social	Mathematical
• Co-operation • Taking turns • Communicating	• Adding to the target number • Working out how much needed to get to the target number (subtraction) • Thinking about strategies for choosing which box to work in to achieve goal of 3 in a line (reasoning)

Notes

Assessing for progression – 4 operations assessment instrument

Overview of the assessment

The 4 operations assessment consists of 4 pages (one page of each operation). For each operation, the problems start with single digits and get increasingly difficult, finishing off with a 3-digit by 2-digit problem. The learners will not have access to erasers or calculators / cell phones during the assessment. The assessment has space next to each question so that learners can show their workings; in fact, they are encouraged to do so. By looking at the workings, it is possible to place learners on the spectrum discussed earlier.

The use of this assessment as described here is for use in after school clubs only. Please do not use this assessment in your classroom.

Addition problems (questions 1.1 to 1.5)

Question 1: Calculate			
1.1	3 + 4 =	1.2	8 + 6 =
1.3	23 + 18 =	1.4	55 + 67 =
1.5	104 + 97 =		

Subtraction problems (questions 2.1 to 2.5)

Question 2: Calculate			
2.1	8 – 2 =	2.2	12 – 5 =
2.3	23 – 18 =	2.4	467 – 43 =
2.5	305 – 97 =		

Multiplication problems (questions 3.1 to 3.5)

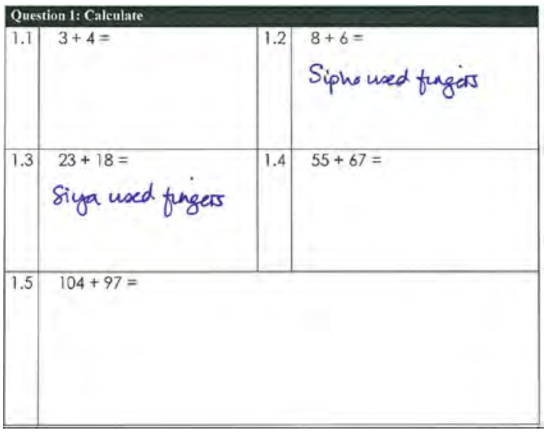
Question 3: Calculate			
3.1	2 x 4 =	3.2	5 x 3 =
3.3	12 x 4 =	3.4	24 x 6 =
3.5	120 x 15 =		

Division problems (questions 4.1 to 4.5)

Question 4: Calculate			
4.1	6 ÷ 3 =	4.2	18 ÷ 2 =
4.3	24 ÷ 3 =	4.4	75 ÷ 3 =
4.5	120 ÷ 15 =		

Administering the assessments

1. Photocopy one script per learner and staple together.
   You have master copies of these in your packs. Copy them back-to-back if you can to save paper
2. Photocopy a script for yourself
   You will use this to document any learners who are use their fingers to answer questions (see step 5 below)
3. Make sure you have a pencil for each learner
4. At the beginning of a club session, explain the following:
   a. Learners are going to write a club test
   b. There are four pages in the test. Show them the four pages
   c. They must work on their own, no copying, talking etc.
   d. They do not have access to erasers or calculators
   e. All workings must be shown on the script/paper
   f. Help them to fill in the learner details on the first page
   g. Then put pencils down and wait so everyone can start together
   h. Then start all learners together.
      They have a maximum of 30 minutes to complete the assessment.
   i. As they finish, they can hand in to you and quietly get on with another activity.
5. Finger use: observe learners as they are writing the assessment for finger use. Note learner initials / name on your blank 4 operations script under the relevant question number. For example:



Question 1: Calculate

1.1	3 + 4 =	1.2	8 + 6 = Sipho used fingers
1.3	23 + 18 = Siya used fingers	1.4	55 + 67 =
1.5	104 + 97 =		

Question 2: Calculate

2.1	8 – 2 =	2.2	12 – 5 = Sipho used fingers
2.3	23 – 18 = Siya used fingers	2.4	467 – 43 =
2.5	305 – 97 =		

6. Once the allocated time is up, collect all the scripts and continue with the club activities as described on page 14.

Marking the assessment and profiling learners

Once the assessment has been administered, you can use the learners' scripts and your script that you used for noting finger use to complete the profiling sheets shown below.

One sheet is for the addition and subtraction questions, and the other is for the multiplication and division questions. You have master copies of these forms in your packs. Copy them back-to-back if you can to save paper.

Figure 4 shows the different sections of the marking sheet and draws your attention to certain numbered steps. These are explained below the figure.

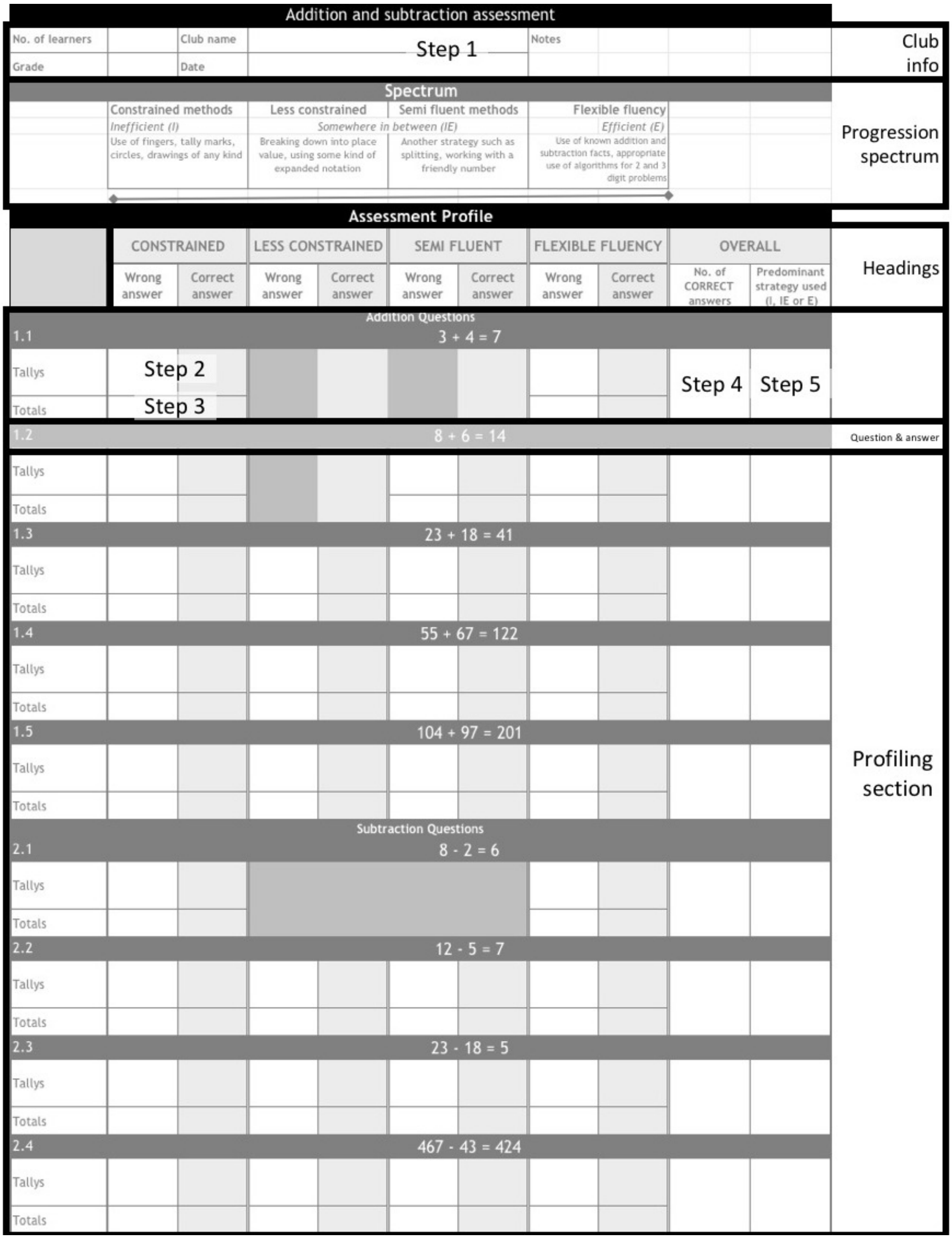


Figure 4: Annotated marking sheet

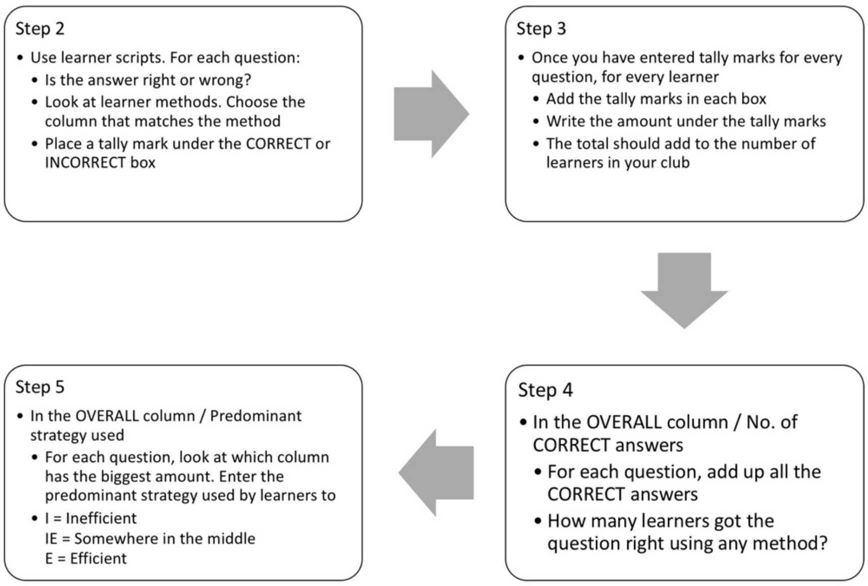
The different sections of the marking sheet:

- *Club info*: Information about your club
- *Progression spectrum*: The progression spectrum for addition/subtraction or multiplication/division is shown here for your reference
- *Question and answer*: the question number, question and correct answer is shown in these header lines
- *Headings*: these headings match the progression spectrum and allow you to put a tally mark for each learner.
- *Profiling section*: this is where you will use the workings the learner has written on the script, along with their answers to place them along the progression spectrum.

Follow these steps:

1. Complete the information about your club at the top of both sheets: club name, date of assessment, number of learners who completed the assessment, the grade of the learners and any notes, such as learners who were absent, any that finished quickly and so on.

   Then using the following flowchart process, move onto steps 2 to 5:



2. Using the learner's scripts, for each question:
   - Is the answer right or wrong?
   - Look at learner methods. Choose the column that matches the method
   - Place a tally mark under the CORRECT or INCORRECT box
3. Once you have entered tally marks for every question, for every learner
   - Add the tally marks in each box
   - Write the amount under the tally marks
   - These should equal the number of learners in your club
4. In the OVERALL column / No. of CORRECT answers
   - For each question, add up all the CORRECT answers
   - How many learners got the question right using any method?
5. In the OVERALL column / Predominant strategy used
   - For each question, look at which column has the biggest amount. Enter the predominant strategy used by learners to answer the question
   - I = Inefficient
     IE = Somewhere in the middle
     E = Efficient

An example is shown below for 4 learners for the addition and subtraction questions

Addition and subtraction assessment

No. of learners	4	Club name	Debbie's Club	Notes: All finished w 15 minutes.
Grade	4	Date	13/2/2016	

Spectrum

Constrained methods	Less constrained	Semi fluent methods	Flexible fluency
Inefficient (I)	*Somewhere in between (IE)*		*Efficient (E)*
Use of fingers, tally marks, circles, drawings of any kind	Breaking down into place value, using some kind of expanded notation	Another strategy such as splitting, working with a friendly number	Use of known addition and subtraction facts, appropriate use of algorithms for 2 and 3 digit problems

Assessment Profile

	CONSTRAINED		LESS CONSTRAINED		SEMI FLUENT		FLEXIBLE FLUENCY		OVERALL	
	Wrong answer	Correct answer	Wrong answer	Correct answer	Wrong answer	Correct answer	Wrong answer	Correct answer	No. of CORRECT answers	Predominant strategy used (I, IE or E)
Addition Questions										
1.1 $3 + 4 = 7$										
Tallys								IIII	4	E
Totals								4		
1.2 $8 + 6 = 14$										
Tallys								IIII	4	E
Totals								4		
1.3 $23 + 18 = 41$										
Tallys						I	I	II	3	IE/E
Totals						1	1	2		
1.4 $55 + 67 = 122$										
Tallys				I	I		I	I	2	IE
Totals				1	1		1	1		
1.5 $104 + 97 = 201$										
Tallys	II		I					I	1	I
Totals	2		1					1		
Subtraction Questions										
2.1 $8 - 2 = 6$										
Tallys								IIII	4	E
Totals								4		
2.2 $12 - 5 = 7$										
Tallys							I	III	3	E
Totals							1	3		
2.3 $23 - 18 = 5$										
Tallys				I	I		II		1	E but not correct ?
Totals				1	1		2			
2.4 $467 - 43 = 424$										
Tallys	I		II					I	1	IE
Totals	1		2					1		
2.5 $305 - 97 = 208$										
Tallys			II					I	1	IE.
Totals			2					1		

Figure 5: Sample marking sheet for 4 learners in addition and subtraction questions

Broad overview of the 15-week development programme schedule

Weekly timetable	Week 0	Weeks 1 to 3	Week 3	Weeks 4 to 9	Week 9	Weeks 10 to 15
Event(s)	**Workshop One**	**Run 3 weekly club sessions**	**Workshop Two**	**Run 6 weekly club sessions**	**Workshop Three**	**Run 6 weekly club sessions**
Overview	Orientation Why progression? Introduce spectra Assessments and profiling In-depth look at the the programme for 1st 3 clubs	1st session: administer assessment and profile learners 2nd session: administer learner dispositional assessment (if using) and play BEETTLE game 3rd session: play Make 12 game	In-depth look at the the programme for next 6 clubs with a focus on **addition and subtraction**	On-going informal assessment and profiling of learner progress	In-depth look at the the programme for next 6 clubs with a focus on **multiplication and division**	On-going informal assessment and profiling of learner progress In 15th session: re-administer assessment and re-profile learners
Resources	Handbook including and spectra 15-week programme plan Assessment tasks, marking and profiling forms BEETLE game Dice and cards for facilitators Dice for learners		Grocotts series pack Cards for learners TIA packs for learners		Multiplication game and dice	

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