



Running an after school maths club

Visit us at: www.ru.ac.za/sanc

Maths clubs as part of an after school programme

The positive effects of participating in OST programmes as follows:
 young people benefit when they spend time engaged in structured pursuits that offer opportunities for positive interactions with adults and peers, encourage them to contribute and take initiative, and contain challenging and engaging tasks that help them develop and apply new skills and personal talents (Durlak & Weissberg, 2007 p. 5)

Outcomes associated with participation in after school programmes

Academic:

- better attitudes toward school
- better performance in school (as measured by achievement test scores and grades)
- improved homework completion
- better engagement in learning

Social and emotional benefits:

- improved self-confidence
- self-esteem
- improved social and communication skills and/or relationships with others (peers, parents, teachers)
- improved feeling and attitude towards self and school
- development of initiative (Little, Wimer, & Weiss, 2007)

Why Maths Clubs?

After school Mathematics Clubs are an opportunity for students to learn and enrich their mathematical experiences in ways that are free from curriculum and assessment driven teaching practices.

The maths clubs run by the South African Numeracy Chair Project are focused on **Grade 3 and 4 learners**, although a club can be set up at any grade level.

The clubs are conceptualised as supportive communities where sense making, active mathematical engagement and participation, and mathematical confidence building are emphasised. Individual, pair and small group interactions with mentors are the dominant practices with few whole group interactions.

These are some of the **features** of the clubs:

- **Voluntary** participation during out-of- school time
- **More learner choice** over the activities that they work on and engage with
- The curriculum is a contextual guide for what is expected of learners but individual learner numeracy levels guide content and activities
- **Participation** based, where participants are active and engaged
- Many interactions are **learner led** with many one-to-one interactions between mentors and learners.
- The mentor is as much a participant as the learners are
- Assessment is formative and integrated and is used to guide individual learning experiences for the participants
- Club rules may differ from in-school time rules.

CLUB FOCI

We have found clubs to be useful for:

- Shifting mathematical dispositions
- Developing a growth mindset
- Getting boys and girls to mix with each other through collaborative work
- Getting learners to talk to each other and the mentor about their maths thinking.



The clubs operate with some basic ground rules:

- We listen to each other's ideas
- No laughing when people make mistakes
- No hitting, kicking, biting, bullying
- No telling tales

A club can focus on:

- Maths Recovery
- Extending and challenging beyond potential
- Individualised attention
- Strengthening mathematical dispositions, confidence and trajectories
- Establishing 2nd sites of learning using the "Pay-it-forward" concept

CLUB ETHOS

These informal learning spaces 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 as learning happens by making and discussing mistakes
- Speak their own language
- Cross things out, be untidy
- **HAVE FUN**

Clubs seem to work best when there are smaller groups of learners – perhaps between 10 and 15 and a mix of levels. Some schools offer clubs for remediation only, whilst others run clubs for extension.



Club leader / facilitator support

The SANC Project website hosts a wide range of resources that have been tested and used in maths clubs since 2011. These include:

- Games and booklets
- Activities
- General club resources

A useful resource for the first sessions of a club are the inserts published in the Grocotts in 2012. These provide many useful activities. See the Pay it Forward box below for details

Access these by visiting:

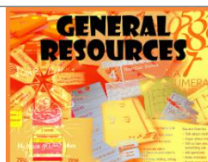
<http://www.ru.ac.za/sanc/mathclubs/clubresources/>



- Bingo
- Scott
- Treasure Hunt
- Playing Card and Dice Games



- Number Bonds (Combining & Partitioning)
- Number Sequencing
- Mental Maths
- Add and subtract (1,2,3 digit numbers)
- Multiply
- Fractions
- 100 Charts
- Puzzles



- Grocotts Supplements
- Online Resources Binder
- Other resources for use in a club

Mentor's role in the club

As mentors in the club, the aim is to:

- help learners think about mathematics
- enjoy mathematics

Mentors:

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

Flexible, in-the-moment mediation is:

a “dance” that takes place between the mentor and the learner and requires awareness of the learner’s mathematical contributions: both verbal and non-verbal

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).

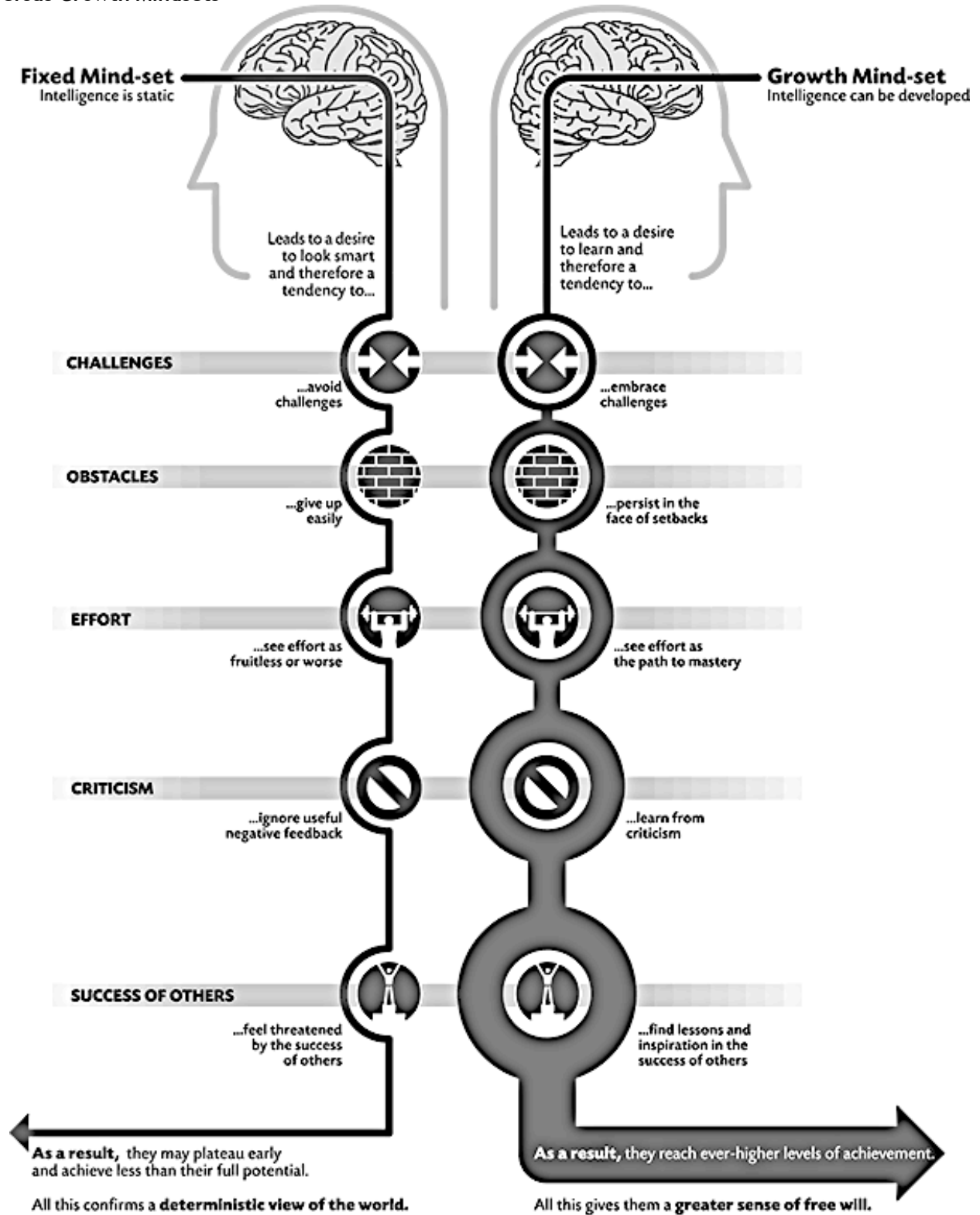
The idea is that the learners must teach/play this game with at least two other people in their community (siblings, cousins, parents, grandparents, friends etc.) and promise to ‘Pay It Forward’. Many of these games are quite simple but critically involve the development of numeracy proficiency. 2nd sites of learning like this are often taken for granted in middle class families where card and dice games are part of children’s lives.



Club learners are also encouraged to work with others on the “Fun with Maths’ supplement published in Grocott’s in 2012. The supplement is available from:
<http://www.ru.ac.za/sanc/numeracyresources/grocottssupplement/>

Mindsets, making mistakes and the experience of struggle

Fixed versus Growth Mindsets



GRAPHIC BY NIGEL HOLMES

Research has recently shown something stunning - when students 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 students to make mistakes in math class and that students should not view mistakes as learning failures but as learning achievements. Students do not, as many assume, need to revisit a mistake and correct it to experience brain growth, although that is always helpful; brain growth comes from the **experience of struggle**. When students struggle with mathematics, their brains grow; being outside their comfort zone is an extremely important place to be.

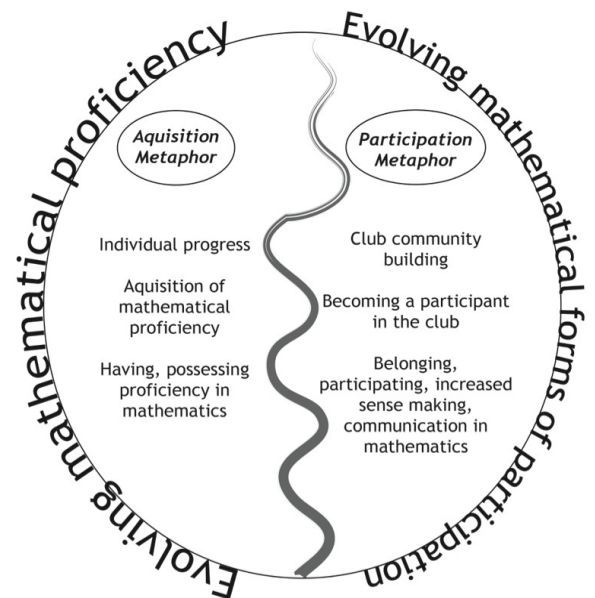
Fixed Mindset intelligence is a fixed trait	Intelligence/ Talent	Growth Mindset intelligence is a malleable quality, a potential that can be developed
Fixed Mindset students say: Looking Smart is Most Important:	Goals	Growth Mindset students say: Learning is Most Important:
“The main thing I want when 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.”

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!’		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.
You made the highest grade on the test, you must be so proud.”	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!”

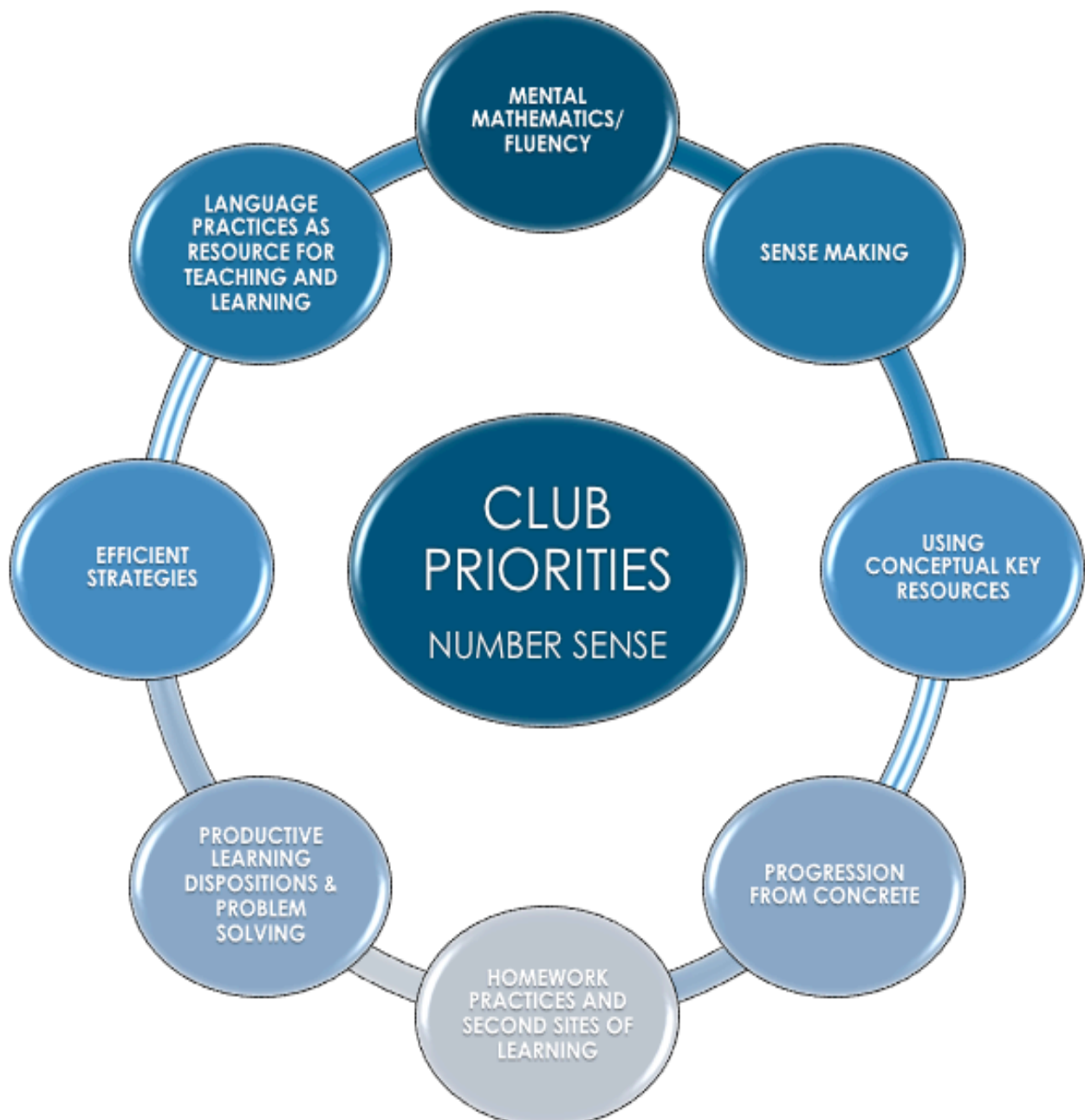
Club Learning Programme Design

Aiming for PROFICIENCY AND PARTICIPATION

- Left side:
 - A focus on *individual* learner progress and the *acquisition* of mathematical proficiency.
- Right side:
 - Highlights a focus on evolving forms of mathematical participation whereby the learners, myself and other people in the club become participants in the club with increased sense making and communication in mathematics.
- focus on using the 'SAFE' (sequenced, active, focused, explicit) design features



To develop proficiency, focus on number sense such as:



WHAT THE LEARNERS SAY ABOUT CLUBS



WARM UP

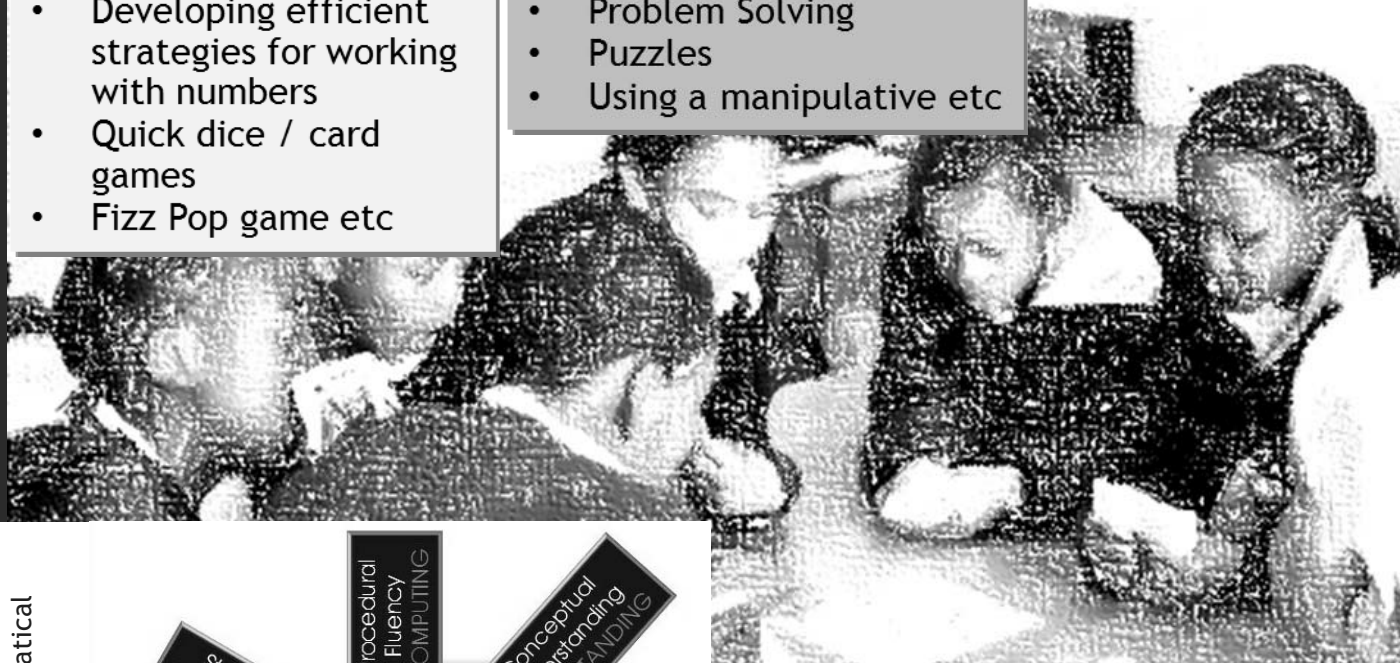
ACTIVITIES

Mental work:

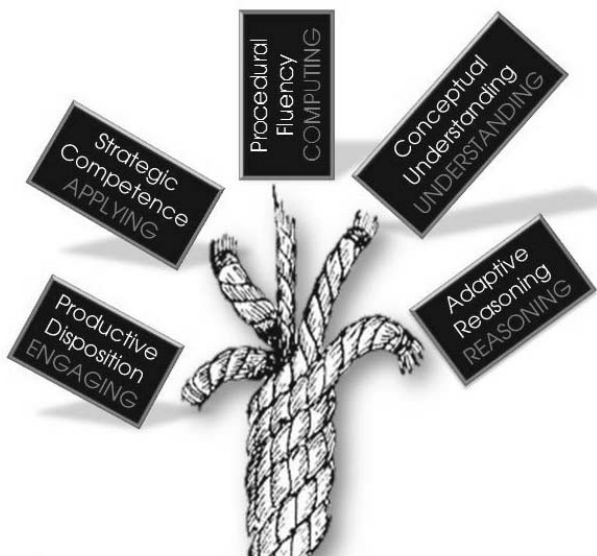
- Developing efficient strategies for working with numbers
- Quick dice / card games
- Fizz Pop game etc

Group / individual work on:

- Problem Solving
- Puzzles
- Using a manipulative etc



Aim to develop the 5 strands of mathematical proficiency



Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington DC: National Academy

WHAT DO WE DO IN CLUBS?



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 younger 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 mentors.

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.

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 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 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 students to feel that they a chance of winning
- Keep the game completion time short

Source: <http://nrich.maths.org>

