Module Area: NUMERACY/MATHEMATICS / Module 1 [ZAMBIA] :

Investigating Number and Pattern

Section 1:
Learning through games

Key Focus Question:
How can games help pupils learn basic number skills?

Keywords:
games; group work; investigation; number skills

Learning Outcomes
By the end of this section, you will have:

- developed ways to use games to raise interest in mathematics;
- used a range of games to help enhance mathematical understanding and number skills.

Investigating Number and Pattern : *Learning through games*

Introduction

Using games in your classroom can enhance your pupils' mathematical understanding and skills. These games can range from mental arithmetic games played with the whole class to more complex board games.

This section explores how games provide a cooperative way to stimulate interest and thinking about numbers.

By using local cultural games you help relate mathematics to pupils' everyday lives.

Investigating Number and Pattern : *Learning through games*

Using games to motivate all pupils, even those who are sometimes reluctant in mathematics lessons, can have very positive effects.

Children are able to practise mental calculations and other skills while enjoying playing games.

You should always practise each game yourself before introducing it to pupils. This will ensure you understand it and can explain it clearly; it will also help you to identify the mathematical thinking needed to play the game. You can make the games yourself or with your class and they can be used again and again.

Case Study 1 shows how one teacher played games to help pupils' skills in mental arithmetic. **Activity 1** shows a simple matching memory game.

Case Study 1: Playing number games to aid mental arithmetic

Miss Isah, a Primary 2 teacher in Nigeria, found that her pupils enjoyed playing number games at break time. The boys rolled balls through numbered arches on a table and the girls tossed beanbags onto a target. In each game the winner was the first pupil to score 20 points, and Miss Isah noticed how some of her pupils were better than others at adding scores together.

She decided to introduce similar games into her teaching to find out if all her pupils could add up. She used the same game each day with one group at a time for a week. The rest of the class worked on practice exercises and she divided her time between supporting those playing and the rest of the class **(See Key Resource: Using group work in the classroom)** .

Investigating Number and Pattern : *Learning through games*

She found that there was a small group of pupils who were less sure of adding numbers mentally and she gave these pupils extra opportunities to play and planned other mental arithmetic sessions for them.

Miss Isah also found that her pupils were more eager to come to class and she decided to use more games in her class in future.

Activity 1: Question and answer matching game

You should play any games yourself first, so you know the rules and can explain them clearly to your class.

This game enables your pupils to practise their simple number bonds and use their observational and memory skills. If you have older pupils you could adapt this game using other numbers and sums. See **Resource 1: Number bond games** for how to play, and ways to adapt the game.

You will need to make several copies of the game or you could involve pupils to help you make their own copies.

- Organise your pupils into groups of five or six, and provide each group with a game.
- Encourage groups to talk to one another about the game and the rules.
- Each group selects a leader who makes sure the game is played fairly.

- As the pupils are playing, go around the class observing anyone having problems so you can plan ways to help later.

Ask yourself:

- What number skills are pupils practising as they play these games?

Questions you may wish to consider or discuss with a colleague:

- Did the pupils enjoy the games? How do you know they enjoyed them?
- Did all the pupils participate? If not, how could you ensure everyone takes part?
- Did you feel that you were in control of the whole class?
- How could you improve this lesson? Would smaller groups be better?
- Did you give the pupils enough time for their tasks?

Investigating Number and Pattern : *Learning through games*

Games can be played in small groups or as a class. Playing with the whole class needs preparation and adequate resources. Allowing games to be played at times other than class time will encourage more learning and help to consolidate ideas. Setting up a games club in your school may also encourage more pupils to play.

It will also be important to understand a game' s level of difficulty so that you pick the right game for your pupils. **Case Study 2** shows one teacher playing a game with her class and **Activity 2** shows how to organise using more than one game at a time.

Case Study 2: Playing Bingo to aid number recognition

Ms Mwenda played Bingo with her Grade 2 class because she thought it was a great game to help pupils recognise two-digit numbers.

She played the game with the whole class first. She gave each pupil a card and some buttons. A pupil drew cards, numbered 1 to 50, from a box and read them to the class. If a pupil found the number read out on their card, they placed a button over it. The first pupil who had buttons covering a row, column, or diagonal correctly won the game. As the pupils played the game, Ms Mwenda went around the class helping. The successful completion of a row, column, or diagonal is evidence of the ability to recognise two-digit numbers correctly.

Next, she divided the class into groups of eight and they played the game at their own pace, taking it in turns to be the caller.

Ms Mwenda also allowed pupils to play Bingo at break and she was surprised how many pupils played, especially on a wet day. She also noticed how much more confident they became in mathematics classes.

Investigating Number and Pattern : *Learning through games*

She extended the game by putting more cards into the game using numbers 51–99 for her more able pupils.

See **Resource 2: Games to practise numeracy skills** for the rules of Bingo and other simple games.

Activity 2: Identifying the mathematics in games

In this activity, ask your pupils to play one of five games and identify any mathematics they think they are learning (see **Resource 2**). You may need to help them identify the mathematics.

- Organise your pupils into groups of four or five.
- Provide each group with one of the five number games.
- Ask each group to discuss the game, checking they understand the rules before playing.
- After playing each game for a set time, ask groups to list what mathematics they think they have practised using the table in **Resource 3: Table to record numeracy skills** .
- You may then want groups to try one of the other games. If you have time, you could continue until each group has played all five games (rotating different activities like this is sometimes called a 'circus' ; using a circus approach allows one set of equipment, in this case a particular game, to be used by the whole class).

- Pin all the results on the wall so that they can be discussed.

You may have to let them play over more than one lesson or let them play during break times.

Playing cultural games is another way of motivating pupils. This helps them see that mathematics is a popular, universal and historical activity. There is one very popular game (**Resource 4: The cultural game of Africa**) played all over Africa, which has a variety of names.

There are many versions of this game. It involves important mathematical skills and can be played by pupils of different ages.

Understanding how games can be adapted for use by pupils of different ages is important for a teacher. For example, in its simplest form, this game is suitable for younger pupils as it encourages counting and understanding the concept of one-to-one correspondence. As you extend the game, pupils learn about addition and subtraction. If you are teaching pupils at different levels, see **Key Resource: Working with large and/or multigrade classes** .

Case Study 3: Identifying number skills with a cultural game

Mr Banda told his class about a game **(see Resource 3)** that he had played as a child. He said they would play it in their next mathematics lesson.

He showed the class the board used and demonstrated the game by asking two pupils to play as he explained the moves. While the class watched, he encouraged them to ask questions.

Investigating Number and Pattern : *Learning through games*

He then gave out resources for pupils to play the game in pairs (four pupils per game) so they could talk with their partner about the moves. As they finished, he asked them to identify the number skills needed to play the game.

Finally, he gave the pupils permission to take the games home and play with someone there for the rest of the week.

At the end of the week, Mr Banda asked his class what those at home thought about the game. Many said their parents and grandparents had played the game as children –it is called `Nsolo' . Mr Banda was also very pleased when one pupil told the class about another number game played in Zambia (see Resource 5: Count and cover).

Key Activity: Playing a cultural number game

Before you start, check you know the rules of the game **(see Resource 3)** . Collect enough boards and 48 small stones for each group.

- Divide the class into groups of four and provide each group with a board and 48 seeds/beans.
- Ask each group to identify two volunteers who will play the game.
- Let two other pupils help the volunteers play.
- While the game is in progress, move around the class, helping where needed. Listen to what the pupils are saying and write down any mathematical words they use.

Investigating Number and Pattern : *Learning through games*

- Discuss with the pupils what you heard. What mathematical skills were they practising in the game?

Resource 1:

Number bond games

Teacher resource for planning / adapting to use with pupils

Here are the instructions for the question and answer match game. Below are some examples of questions and answers. You could either copy these or ask your pupils to draw the squares themselves.

1. Cut up each square separately.
2. 2–6 players can play this game at any one time.
3. Place all the cards face down on the table. Keep the answers and questions separate to help the players.
4. Decide who goes first. Each player takes it in turn to turn over two cards – one from the sums first and then one from the answers. If the answer is right for the sum the player calls the first 'match'. If they get a match, they can have another go. If not, the next player has their turn and does the same. Carry on in this way until all the sums are answered. The winner is the one who has most matches.
5. You could make this more challenging for older pupils by using more difficult sums, which include subtraction, multiplication or division. You will have to adapt the 'answers' accordingly.

Examples of questions/sums

1+0=	0+2=	1+1=	2+0=
1+2=	2+1=	0+4=	1+3=
3+1=	2+2=	0+5=	4+1=
1+4=	2+3=	3+2=	0+6=
1+5=	5+1=	2+4=	4+2=
3+3=	0+7=	1+6=	2+5=
5+2=	3+4=	4+3=	8+0=
1+7=	2+6=	6+2=	3+5=
4+4=	0+9=	8+1=	2+7=
3+6=	4+6=	7+3=	9+1=

Examples of answers

1	**2**	**2**	**2**
3	**3**	**4**	**4**
4	**4**	**5**	**5**
5	**5**	**5**	**6**
6	**6**	**6**	**6**
6	**7**	**7**	**7**
7	**7**	**7**	**8**
8	**8**	**8**	**8**
8	**9**	**9**	**9**
9	**10**	**10**	**10**

Resource 2:

Games to practise numeracy skills

Teacher resource for planning or adapting to use with pupils

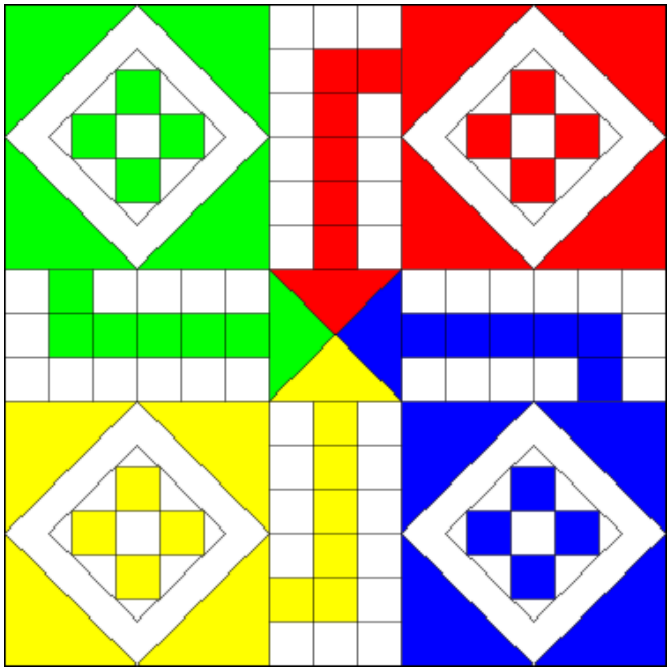
Ludo

A simple children's board game for two to four players, in which the players race their four tokens from start to finish according to the way the dice falls.

A typical Ludo board

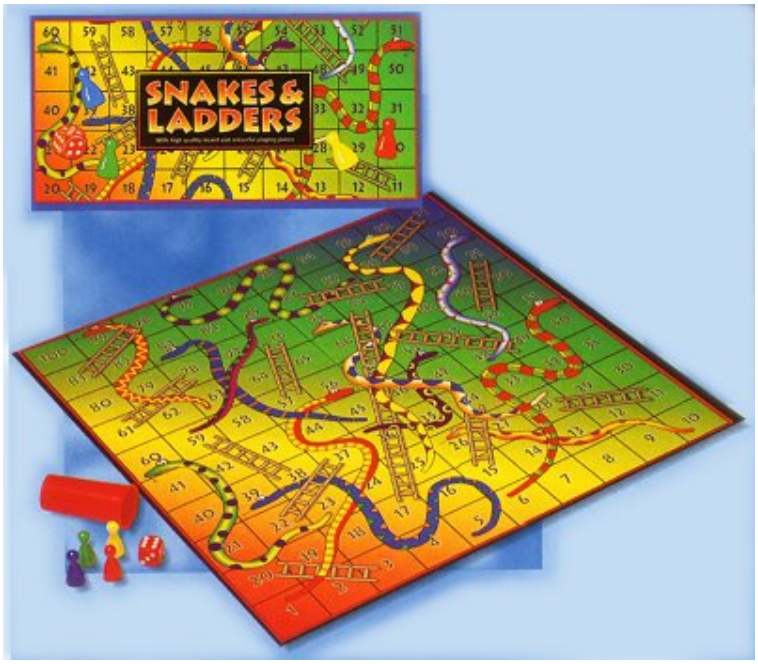
Original source: http://www.mastersgames.com/images/board/ludo-colour-1.jpg

Players take it in turns to throw the dice and move their tokens round the board. When a player throws a 6 they have the option to start to move another token around the board. If a player's token lands on a space that is already occupied by another player's token, that player has to remove their token from the board and wait until they have thrown a 6 to start again. The winner is the first player to get their four tokens to the centre of the board landing on their matching coloured area.



Snakes and ladders

Players take it in turns to throw the dice and move their tokens around the board. If they land on the bottom of a 'ladder' they go up to the square at the top of the ladder. If they land on a 'snake's' head they travel down to the square at the tail of the snake.



Bingo

This is a game of chance where randomly selected numbers are drawn on a bingo card which includes blank squares. One example is below:

5				49		63	75	80
		28	34		52	66	77	
6	11				59	69		82

One person, 'the caller', writes the numbers 1–100 usually on small balls (but you could use cards). The caller then selects these one by one without looking and calls the numbers out. If the player can match that number they cover the number on their card with a counter, or cross it off. It is important that the caller remembers to keep the numbers that have already been called separate, as they will need them later for checking. The caller selects and then calls until one person has covered all the numbers on their card and shouts out **'BINGO!'**. The caller needs to check their card is correct and declares the person the winner.

A loop card game

'Loop card' games keep pupils 'on their toes' and listening, as all are involved and they do not know when their card will come up.

Instructions

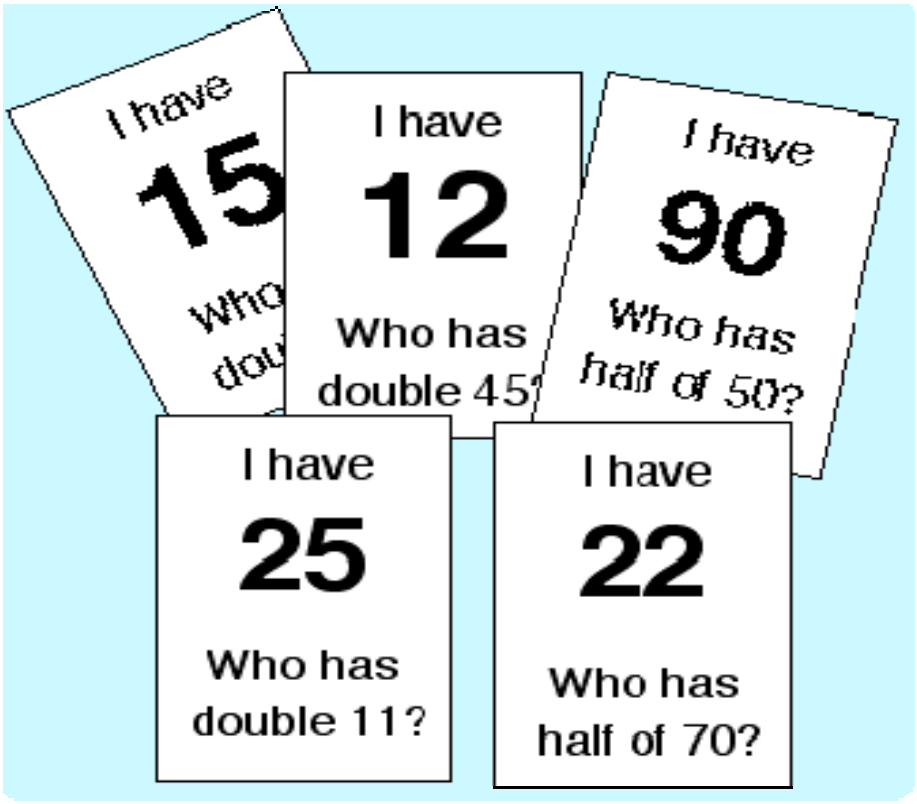
Each card has a number such as 12 (or any other number) and a question. The question can simply be about adding or multiplying numbers, or could involve all four rules of number depending on what you want the pupils to practise. You can therefore make different sets of these cards, easy and hard, to use at different times. For example, some cards could help pupils who have

particular problems with larger numbers. The examples in the picture below are about halving and doubling.

You need enough cards for each pupil to have one card. You could also make cards using money, distance etc. as a topic.

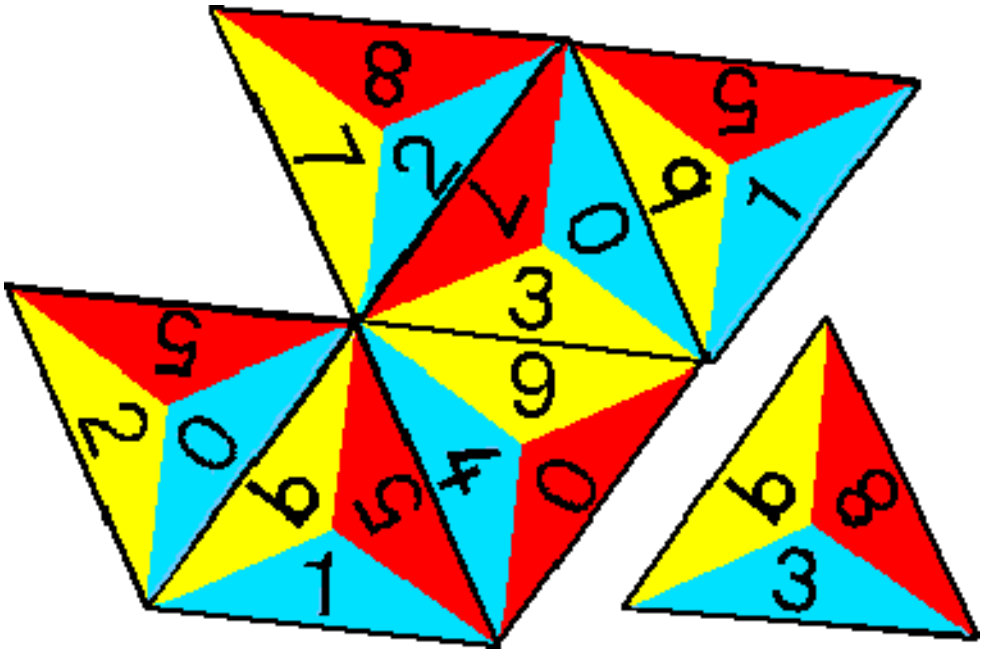
To play the game, the pupils could sit at their desks or you could organise them into a big circle. Give out a card to each pupil. Choose one pupil to start by reading out their question. The child who has the correct answer stands up and says the answer. If they are correct, they read their question. The child with the correct answer to this new question stands up and reads out their question and so it goes on until all the pupils are standing (or sitting if they all start standing up).

Do not have more than one card with the same number as this will confuse the pupils. You can use this game often as your pupils will get different cards each time. It is a good activity to use at the end of a lesson when all other work is finished, and is good practice for their mental mathematics skills.



The triangle number game

The triangle number game is the most versatile mathematics game for primary children. The game is played much like dominoes, where numbers are matched to each other to make a pattern. Two sides of the triangles are put together according to a chosen rule. In the example below, the 'rule' is that the two numbers must add up to 9.



For older pupils, the winner is the one to finish their cards first, but younger children usually play cooperatively. The game is best with 2–4 players, although it can be used by one as a 'patience'.

Some of these examples have been adapted from
http://homepages.which.net/~jenny.murray/games.htm

If you can, visit the website to get other ideas and examples.

Resource 3:

Table to record numeracy skills

Pupil use

Tick the mathematics practised by each game; for example, game 1 helps addition.

	game 1	game 2	game 3	game 4	game 5
number					
addition	√				
subtraction					
multiplication					
division					
making sets					

Resource 4:

The cultural game of Africa

Teacher resource for planning or adapting to use with pupils

This game has many names, for example:

- Kpo by Vai people of Sierra Leone and Liberia
- Ajua by Luo in Kenya
- Omweso by Ganda of Uganda
- Bao by Swahili in East Africa
- Gambatta in Ethiopia
- Ayo by Yoruba in Nigeria
- Oware by Igbo in Nigeria
- Warri by Asante in Ghana
- Nsolo in chiNyanja in Zambia

In the past, boards for playing the game have been made from beautifully carved wood, bronze (in the royal court of Benin, Nigeria) or gold (by the Asante Kings in Ghana). Now there are less elaborate versions available and you can make your own using a piece of cardboard and drawing the required number of circles.

RULES FOR PLAYING NSOLO (GIUTHI)

The object of the game is to capture more pieces than your opponent.

The board consists of two rows of six cells, holes or cups. Each player owns a row. There are two extra cells, not part of the board proper, for holding each player's captives.

The pieces are all alike. They are sometimes referred to as stones, pebbles or seeds. There are 48 in all.

At the start of the game the 48 pieces are distributed evenly in the 12 cells – four to a cell.

To make a move a player picks up all the pieces in a cell in his/her own row and moving counter-clockwise around the board, from his/her own row to the opponent's and back again to his/her own, deposits them, one at a time, in each cell that he/she passes over, without skipping, until the pieces are used up. If the number of pieces is large enough, the move may come back to the square which originated the move. In that case that square is bypassed, no piece being placed in it, and the seeding continues in the next cell.

The players take alternate turns to play and must make a move on each turn.

A capture occurs when the last piece of a move is deposited in a cell on the opponent's side and the number of pieces, after the drop, is either two or three. If the cell before the last was also raised to two or three then those pieces are also captured, and so on for each previous cup as long as the row is still the opponent's and no cell with a count other than two or three intervenes.

The game ends when a player, on his/her turn, finds he/she has no pieces to move – all of his/her cells are empty. For scoring purposes, the pieces remaining on the board are added to the victor's captives. The player with the majority of captives is the winner.

An unusual move rule arises when one side has no pieces remaining. If the player, on his/her move, sees the opponent has no pieces and he/she can make a move that will leave pieces in one or more of the opponent's cells, then he/she must, by rule, make such a move. If no such move is available, then the game is over – or will be when it is the opponent's turn, according to the previous paragraph.

When there are few remaining pieces in play, it may be there can be no further capturing, the pieces just aimlessly chasing each other around the board.

In this case, the players agree to end the game and the score consists of those captives already held plus the pieces in each player's cells.

Those are all the rules. Enjoy the game.

http://www.svn.net/rkovach/oware/how1.htm

Giuthi Proverb

'You can't steal the cattle of another man without entering his land!'

Resource 5

Count and cover

Teacher resource for planning or adapting to use with pupils

'Count and cover' is played with two players – but you can put two pupils together as 'one player'. The players will need paper and two dice.

The players write the numbers 2 to 12 on a piece of paper and take turns to roll two dice.

Each player adds the numbers shown on the dice.

Then they cover that number on their piece of paper.

The winner is the first player to cover all their numbers.