

# Numeracy and Sport

## Integrating Numeracy and Sport Guidelines

This handout outlines some ideas on how to integrate numeracy and sport in teaching and learning. The handout has five sections as follows;

- Section 1** Introduces the concept of numeracy defined in the NALA Numeracy Strategy 'Meeting the Numeracy Challenge'
- Section 2** Introduces the concept of real world starting points and the development of 'mathematical eyes'
- Section 3** Describes five mathematical strands that can be integrated in the context of sport
- Section 4** Discusses the kind of activities that could be used to integrate each mathematical strand in the context of sport
- Section 5** Outlines some ideas and considerations for thinking about and organising activities with learners.

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## Section 1

### A Milestone in the Development of Numeracy Provision

NALA has recognised for some time that '*numeracy provision calls for as detailed and thoughtful an approach as has been given to literacy*'<sup>1</sup> and the Strategic Plan 2002-2006 made a commitment to develop and promote a dedicated numeracy strategy for Ireland.<sup>2</sup> Subsequently NALA put together a working group comprising representatives of relevant stakeholders, with a brief to look at and report on current adult numeracy issues, and to produce a proposed strategic plan for adult numeracy. The NALA Numeracy Strategy '*Meeting the Numeracy Challenge*' was launched by Minister Mary Coughlan TD, Department of Social and Family Affairs, at the 23<sup>rd</sup> Annual General Meeting of NALA on the 3 April 2004. The strategy provides a roadmap for the further development of adult numeracy in Ireland and its integration into all Adult Literacy and Adult Basic Education provision. The full report is available on the NALA website ([http://www.nala.ie/download/pdf/numeracy\\_report.pdf](http://www.nala.ie/download/pdf/numeracy_report.pdf)).

Defining what is meant by the term numeracy was a challenging task for the working group. Having reviewed both national and international definitions of numeracy the group proposed its own definition as follows:

*'Numeracy is a lifeskill that involves the competent use of mathematical language, knowledge and skills. Numerate adults have the confidence to manage the mathematical demands of real-life situations such as everyday living, work-related settings and in further education, so that effective choices are made in our evolving technological and knowledge based society.'*

This definition of numeracy describes the way numeracy is conceptualised in this handout. It is important to highlight that numeracy does involve mathematics but the concept of mathematics is not the endless abstract, decontextualised problems of school mathematics, but as Betty Johnston says

*Numeracy involved mathematics of course - how could it not? - but it was to be a mathematics in conversation with the world, where matters of life and death, survival and destruction, were not irrelevant matters but core concerns. It was to be a mathematics used by people, meaningfully, appropriately, purposefully, justly - and enjoyably. (p.286)*

Johnston and Yasukawa, 2001

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1 NALA Guidelines for Good Literacy Work: Policy Document of the National Adult Literacy Agency, (revised edition), NALA: Dublin, p.54

2 NALA will: ...develop and promote a dedicated numeracy strategy' (the National Adult Literacy Agency, Strategic Plan 2002-2006, Step 6, p17).

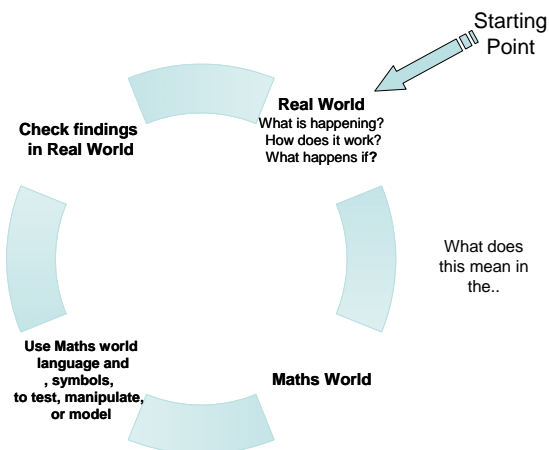
## Section 2

### The Real world Maths World cycle

If tutors are to help learners develop a 'competent use of mathematical language, knowledge and skills, tutors themselves must be able to identify a range of mathematics in everyday living, work etc. Viewing the world from a mathematical perspective entails having a sense of quantity, and an ability to see connections and interdependencies. For most people the mathematics that surrounds them in their daily lives remain 'invisible'. In order to integrate 'numeracy 'into a particular context it is necessary to develop 'mathematical eyes' to see the mathematics that is inherent in a lot of what we do every day, especially in sport. Once tutors develop their 'mathematical eyes' tutors will be able to see this 'invisible mathematics' so that they can identify appropriate entry points for introducing numeracy skills and knowledge, that are relevant to the life of the individual learner. When tutors are asked to identify the numeracy in sport they often focus on 'number' or 'data handling' for example scoring systems, betting, records for sporting achievement over time. Other mathematics remains hidden and perhaps not as immediately obvious for example, symmetry, shape, pattern, relationships.

Often in activities using numeracy/ mathematics the starting point for an activity is the rule or formula that must be used to calculate the answer. A central aspect of integrating numeracy is that you start with what is called the real world context and work into the mathematics world (see Figure 1). The mathematics world is a tool to help you understand and explore the real world.

**Figure 1** The Real world Maths World cycle



Take for example a football pitch or Basketball court; The group could start by discussing - What do the markings on the surface mean, Why are they needed? Are they all needed, if so, by whom? Where are they on the surface (21yd line, centre point)? How do these markings affect what happens on the pitch/court. What would happen if...? If measuring needs to be done, initially let student use their own strategies don't necessarily introduce units of measurements, metre sticks, or measuring tapes. Learners might use strides. Remember the real world does not necessarily demand pinpoint accuracy, words like around, about, approximately are all acceptable. Encourage estimation this helps to build confidence and number

sense. You could start introducing the maths world by asking do pitch/court/pool dimensions have to be exactly a certain size? (Swimming pools if they are to be used in a competition have to be an exact length and width does the swimming pool the learners use meet these strict criteria; How do other sports measure up? Why is this level of accuracy necessary?). Use the mathematical world to interpret the real world to check if our estimations are right. The mathematical world introduces mathematical language to learners only introduce measuring units etc when the task demands the mathematical tool. We can then go back to the real world to make sense of the more detailed information we have got from the maths world which pool are competition pool? What does this mean about their length and width? The relevance of mathematics becomes more apparent, learners develop more understanding.

## Section 3

### Mathematical Themes

In different countries around the world, those countries, which are broadly at the same state of economic development, exhibit common characteristics in the everyday 'mathematical' needs of their adult population. This similarity of need is clearly seen from **Table 1**. Thus, common mathematical topics are incorporated as an integral part of adult numeracy provision internationally.

Table 1 **International Themes for Adult Numeracy Provision**

Denmark	Netherlands Proposed by van Groensteign, 2002)	Canada (Ontario)	Australia	United Kingdom
Dealing with and sense of quantity and numbers	Quantity and Number	Use Number Sense and Computation	Numeracy For Personal Organization Numeracy For Knowledge	Number/Number System
Dealing with and sense of dimension and form	Dimensions and shape	Use Measurement for Various Purposes	Numeracy For Practical Purposes: Measuring	Measures,
Dealing with and sense of patterns and relations	Pattern and relationship	Solve Geometric Problems	Numeracy For Practical Purposes: Design	Shape and Space
Dealing with and sense of data and chance	Data and Chance	Manage Data and Probability	Numeracy For Interpreting Society: Data and Numerical Information	Handling Data and Probability
Dealing with and sense of change	Change	Self-Management Self-Direction	(embedded in content themes)	(embedded in content themes)
Dealing with and sense of models	Management Skills: ,Skills for processing New Information, Learning Skills			
<i>Adapted and developed from: Numbers Talk-A Cross-sector Investigation of Best Practices in LBS Numeracy. (Glass, 2001)</i>				

As we integrate numeracy and sport we will focus on the development of the following five strands of mathematics. ( Remember one activity might combine more than one strand)

- Quantity and Number
- Space and Shape
- Data handling
- Problem Solving
- Patterns and relationships

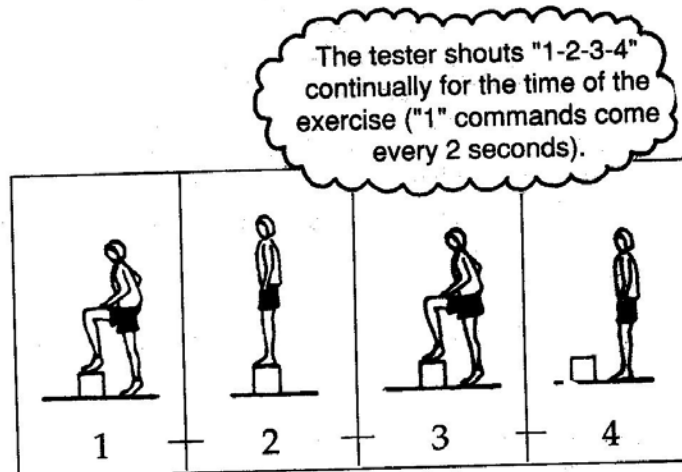
**Section 4**

**Quantity and Number**

**Example 1 Measuring Fitness**

Learners could compare their own fitness level with the class group. The students work in pairs. Use a step around 45cm high and exercise for 4 minutes. At each of the following time intervals measure the number of pulse counts (pulse rate) for 30 seconds from 1 -1 1/2 minutes, 2- 2 1/2 and 3- 3 1/2 minute. Record the pulse rates. How could we show what is happening to the pulse rate? Who is fitter – (The quicker the pulse rate goes down the fitter the individual). What kinds of things affect our fitness? Did fit people and unfit people react differently while they were doing the test? Is there a relationship between smoking and fitness evident from the group results?

Do the test again at the end of the programme. Have your group got fitter?



In the maths world, the Harvard Step Test is used to compare fitness levels. Using this test the **fitness index** is measured using the following formula. Fitness index equals fifty times the duration of the exercise in seconds divided by the sum of the pulse counts in the half minute intervals this is written mathematically as follows

$$I = \frac{50T}{P1 + P2 + P3}$$

T = the duration of the exercise in seconds  
 P1, P2, P3, are the pulse counts measured in half-minute intervals  
 I = the fitness Index  
 The higher your fitness index the better.

**Example 2- League Tables**

Have the group set up a league table use the following headings Team, played, won, drew, lost, goals/nets for, goals/baskets against number of points scored. (Learners can have their own league or use other league data that they find).

Award 3 points for a win, 1 for a draw. Which team wins? Now rework the points using 2 points for a win and 1 for a draw, which team is top? Which team is bottom? What difference does the two scoring –systems make? Which is fairer?

### **Example 2- Running**

How fast can your team run? Measure speed over distance for a range of distances is the average speed higher or lower for the longer/shorter distance? Why do you think this is? What kinds of things effect how fast we run? How much quicker do you need to run to equal Olympic record? Can you devise a handicap system so that each person has the same chance of winning?

## **Space and Shape**

### **Example 1- Introducing Shape**

Where are the lines on a pitch? How are pitches laid out? How do the markings on a GAA pitch differ from a hurling pitch a hockey pitch? Look at semi-circular goal area in hockey, rectangular in soccer. – allows the introduction of shapes squares rectangles, triangle, circles. What about three dimensional shapes – Goal areas? balls? Are the two halves of the pitch/court the same if we walk across the middle or down the centre? Why do you think they are the same? What effect would it have on the game if it were not the same? Compare areas and dimensions of different playing surfaces? How high are the GAA goal posts – how can we measure them?

Shape and size of running tracks – the difference in the inner and outer lanes etc.

## **Data handling**

As far as possible set tasks that require the data to be generated by the learners rather than handing out data sheets. Any activity that generates data including league results, times for the class for a run or swim etc.

What about looking at the results of a run to build graphs – learners could do their own long distance run and record times of finishing. How many runners took between 6 and 10 minutes to finish?

How many finished the race?

What was the difference in time between the first and the last runner?

What was the average time for the run

What percentage of runners were 'better than average'?

## **Problem Solving**

Problem solving activities introduce two important aspects of mathematical thinking and learning; these include working cooperatively and applying problem solving strategies. Problem can be set around any number of activities.

### **Example 1 Logic Problems**

A simple problem solving strategy might involve getting the learners to place five basket ball players in their correct position on the court. Make a copy of the problem for the group. Glue a basket ball court layout onto card. Make clue cards and moveable pieces. Learners are each given one clue which is read out to the group. Learners must solve the problem cooperatively through discussion, negotiation and guess and check techniques.

The learners themselves could devise a problem and draw up a set of clue cards for other teams in their group. Who scored the winning goal? Who was transferred to Manchester United?

### **Example 2 Handicap Systems**

The aim of the handicap system is that everyone has an equal chance of winning investigate systems of handicapping in Sailing, swimming, horseracing (additional weight), golf. Learners may already be familiar with a particular sport and this could act as a starting point. The group could devise their own handicap system for a particular sporting activity they do.

### **Example 2 Designing a Sports Competition**

You could design your own game and rules and playing area.

Design your own Sports Competition it could be-

- A knockout competition –
- A league where each team plays each other once
- A championship where each team play each other twice

How many teams do you have? What does that mean in terms of rounds?  
How much time do you have? How long for each game? What happens if there is a draw? How many points for a win? Draw? Lose? Are any bonus points to be allocated?

## **Patterns and relationships**

### **Example 1 Bouncing Balls**

Drop a tennis ball from various heights onto a concrete surface. Measure the height of the bounce. Make a table, Plot a graph. Try other surfaces, Try other types of ball is there any relationship between the drop height and the height of the bounce? How do you know?

### **Example 1 Jumping Tests**

How far can people jump horizontally?

Do a broad jump from a standing start. Measure the distance jumped from the initial toe position to the final heel position. You could compare male and female measure the height of the individuals, match this against the length of jump. Is there a relationship?

How high can people jump vertically?

Stand and face a wall with arms up stretched. Mark the position of the fingertips. Jump vertically. Mark the height reached by the fingertips. Find the distance between the marks. What is the average distance jumped? Is the distance greater for taller or shorter people? Plot the distance a person can jump horizontally against the distance they can jump vertically can you predict a person's vertical jump knowing their horizontal jump. Make links to long jump and high jump sports data.

Watch a game closely e.g. basketball is there a pattern to the way the ball is moved about when a team is attacking. Can you identify any plays?

## Section 5

### **Some ideas and considerations for thinking about and organising activities with learners.**

- Always start with the real world; mathematics (mathematics world) should be integrated as a tool to help explore a particular aspect/problem/need of the real world.
- Always try and use data learners gather themselves rather than handing out previously prepared sheets.
- Use group and team work as much as possible.
- Remember not everyone wants to play every sport so have a number of roles for those that are not playing, for example, Score Keepers – might keep score or design and implement their own scoring strategy. Reporters would have to describe the 'match' but make sure they add in information on the number of goals/baskets/points, average time between scores, the amount of time teams were in each others half of the pitch/court etc. They might want to allocate a bonus goals/points to the team who spent longer in the oppositions half – linking what they are doing to the Score keepers.
- Be innovative, be creative, make it fun!