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FOUNDATION DEGREE FOR TEACHING ASSISTANTS MODULE 9 LEARNING MATHEMATICS

Part One

The Ways in Which Mathematical Learning Takes Place

"Mathematics equips pupils with a uniquely powerful set of tools to understand and change the world. These tools include logical reasoning, problem solving skills, and the ability to think in abstract ways. Mathematics is important in everyday life, many forms of employment, science and technology, medicine, the economy, the environment and development, and in public decision making." (The National Curriculum – Handbook for Primary Teachers 1999 p60)

Mathematics is relevant and is useful in the real world around us, it can be found in practical tasks and it can be applied in order to tackle real - life problems. It can be used to explore and to investigate within itself, thereby creating new mathematics (National Numeracy Strategy).

The Open University states that children learn mathematics if their attitude towards the subject is positive and they regard it as an interesting and attractive subject. Children are far more likely to remember the innovative rather than the mundane, so a teacher's imagination can be vital if pupils are expected to engage well with a subject.

They need an awareness of the uses of mathematics in the world beyond the classroom and that mathematics will frequently help them to solve problems they meet in everyday life or understand better many of the things they see.

According to Fruedenthal (1997), mathematics must be connected to reality, stay close to children and be relevant to society in order to be of human value

"Pupils should choose and make use of knowledge, skills and understanding outlined in the Programme of Study in practical tasks, in real -life problems and to investigate within mathematics itself." (NCC, 1991 p2)

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Investigational work as a way of involving pupils in using and applying their mathematics encourages children to involve themselves in mathematical thinking. Pirie (1987) claims that this can promote pupils enjoyment of mathematics and give them the understanding that even in a maths lesson, opinions and personal ideas are valued. It also offers variety to the pace and presentation of the lesson, enlarges conceptual understanding and increases pupils willingness to 'have a go'.

Maths lessons should be a chance for pupils to engage with technical and inventive skills by linking the subject with a wide range of oral, written and even physical activities. S Cowley (2002)

How To Identify When a Learner is Experiencing Difficulty in Acquiring Mathematical Concepts

"Children with serious learning difficulties in mathematics do not learn, despite adequate social and cultural pre-school experiences, initial motivation to succeed and appropriate instruction" (C. Aubrey 1999 p11).

Strong and Rourke (1985) have suggested three categories of mathematical disability. The first involves fact retrieval and memory for arithmetic tables. The second involves difficulty with procedures and delays in learning basic number skills and the third is visual spatial difficulty in representing and interpreting arithmetical information.

C Aubrey (1999) states that although children come into school with a developed informal mathematical knowledge , many have difficulty with formal mathematics. These difficulties accumulate over the years , and children lose motivation and lack self esteem. They are then unwilling to talk about strategies and, when observed some are reluctant to use their fingers to support counting.

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"Perhaps because maths is a subject in which it is very clear when you get something wrong, many people are made to feel unduly depressed about their performance and believe themselves to be 'bad at maths'. This belief tends to make further learning difficult and it is important to avoid it. Getting things wrong can be an important part of the learning process as long as you morale has not been broken. The importance of encouragement can hardly be overstated". (R Russel 1996 p86)

According to Geary (1993) the most persistent characteristic of children with learning difficulty in mathematics is struggling to remember basic number facts. Normally developing children shift gradually from reliance on counting to retrieval of number-fact strategies until retrieval eventually dominates choice.

Appropriate Support Strategies

The Classroom Assistant should aim to support all the children in the class. Some will need targeted help and others will need access to the assistant throughout the day.

Support staff should try and remain one step behind, allowing the child to take calculated risks and therefore allow cognitive challenge. As Fox (1993) comments

"It is a difficult task to maintain the balance between giving support and promoting independence. This involves being clear about your expectations and firm in your directions without pressurising the child, However, sensitivity should tell you if and when to intervene."(Lorenz 1999 p19)

As Fletcher-Campbell (1992) notes, it is a waste of valuable resources if the Classroom Assistant remains with a pupil needlessly, it also serves to highlight the difference between the pupil and his or her peers.

Gravelle (1996) suggests that focused support for children with English as a second language should also be provided in order to give children the opportunity to use their heritage language within the classroom Cummins

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1984) agrees that unless a child is fluent in the mother tongue, he or she will find it difficult to acquire second language acquisition.

Experience in multiracial schools (mills and Mills 1993) confirms the view that second language learning is aided by genuine contexts and the application of language skills to real-life problems.

Equally important is support for the class teacher Fletcher-Campbell (1992) goes on to say that there can be few teachers who, during the course of an average week, do not long for an extra pair of hands.

The presence of parents in classrooms has been a reality in many schools since the Plowden Report (DES 1967). More recently, an HMI survey (DES1991) recognised that in all but two of the 32 primary schools visited, parents supported pupils in the classrooms

Part Two

I selected a play activity which was aimed at extending children's mathematical skills and providing opportunity for a multitude of cross curricular activities developing basic skills such as counting, measurement and an understanding of fractions and shapes.

My aim for this activity was to show the children that mathematics is all around them in their everyday world, not just in the maths lesson, as I am aware that they need to connect mathematics with the real world in order to make sense of it.

Firstly I chose 3 children, Joshua, Victoria and Abdus and used a simple bucket balance to compare weights of apples. (Programme of Study: KS2 Mathematics Ma3 Shape, space and measures). I encouraged them to estimate which was the heaviest bucket and why. This allowed the

children to discuss their observations and decide how they had come to their decision.

We then went on to peel two of the apples and the group collected the strips of peel. I asked Joshua to pick 3 strips and try and put them in order of length from the shortest to the longest. He found this difficult, as the strips he had chosen were not sufficiently different in length for him to order. I adapted the situation in order to make it more manageable for him by changing two of the strips for two that were more of a contrast in length. This 'scaffolding' strategy enabled Joshua to complete the task independently, therefore giving him a sense of achievement.

I then asked Victoria and Abdus to try and sort a bag of apples according to size and/or colour to try and reinforce their understanding of setting and also develop their discriminatory skills. They managed this easily and we talked about which was the biggest set and which was the smallest. This caused some confusion as Victoria said the smallest set was the set with the smallest apples while Abdus argued that the smallest set was the set with the least amount of apples.

"The key skill of working with others includes the ability to contribute to small group and whole class discussion and to work with others to meet a challenge" (National Curriculum – Handbook for Primary Teachers 1999 p21)

We talked about the shape of the apple and I asked them if they were able to compare the shape with anything else in the classroom. Abdus pointed to the globe and I praised him and reminded him that they were both spherical in shape.

I asked Sapphire to join the group and I put two apples on the table. I asked the group if they could tell me how I could share two apples equally

between the four of them. Sapphire quickly told me that we needed to cut them up, so I asked how many pieces we would need. She knew we needed four but was unsure how we would go about getting four equal pieces.

Joshua said we needed to cut each apple into two. I explained that this would be cutting the apple in half. This I did and counted them out, one for you and one for you and so on. I then put the apple together again to reinforce the idea of equal quantities.

"To recognise a fraction of something, you need a concept of the whole something". (P Liebeck 2001 p152).

We discussed the possibility of sharing just one of the apples between the four of them and I asked if anyone could tell me if this was possible. Sapphire quickly shouted that we needed to cut the halves into 2 pieces.

We did this and I explained that because we now had 4 equal pieces from one apple they were called quarters. (Programme of Study: KS2 Mathematics. Ma2 Number – Fractions percentages and ratio)

This activity helped the children to use mathematical ideas and methods to solve practical problems (National Numeracy Strategy Framework for Teaching Mathematics)

Mathematical difficulties are identified through a variety of procedures. The main ones being assessment, observation and feedback. Information regarding the child's performance can be gathered in several ways, for example, weekly tests, homework and classroom samples.

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In our classroom we use the colour coded marking system. Work is marked for understanding, presentation and effort. If all three areas are met then the piece of work shows 3 green circles. If a child is almost there in a certain area he/she may get 2 green but an orange for understanding. If a child has not understood the work set then a pink circle is shown for understanding.

This method of marking clearly identifies those pupils who are struggling in a specific area.

I recently taught a culturally diverse, mixed ability year 3 class, taking away 11, 21, 31 extending it to take away 9,19,29. I asked the class to sit on the carpet for the introduction of the lesson and drew their attention to the number square on the board. I explained that to take away 11, we needed to jump back ten and one more, I asked some children to come up individually and show how to do 25 take away 11 and 45 take away 11.

I targeted my questions at specific individuals and asked the lower ability children to start by taking away 10 to begin with. This gave them an opportunity to come up to the front and 'have a go'

We then went on to talk about doing the same sums using a number line and I told the less able children that they could use a number line or a 100 square when completing their worksheets.

Once the children were seated and groups supported where necessary, I sat down with the Helicopter group which are a group of children with English as a second language. I explained that we would first be playing a little game using the number square. Playing games with children helps to develop decision making and mental maths skills

I asked them to put a counter on number 35 jump back 10 to 25 and then one more. To motivate then further, I asked who could be the first to give me the correct answer,

Once I was confident they were able to do this, we moved onto the worksheet which had been differentiated so that they started off by

taking away 10 initially and those who had mastered that concept went on to take away 11. By planning the work this way, it gave all the children in

the group an opportunity to complete a piece of work, therefore giving them a sense of achievement.

One little boy however, was still struggling with the concept of taking away 10, I noted this as feedback for the teacher as this child was not meeting his age related expectations at level 2 of the National Curriculum.

Numbers and counting is an area which presents problems for our ESOL children in particular. They often need support in writing numbers as it is quite common to see 170 written as 10070 because it is how the pupil has heard the number. As they have speech and language difficulties they are very rigid in their thinking.

The group of children who I support for some of the time have difficulty in learning the spoken counting sequence especially counting backwards. They rely on finger counting and counting in ones.

When a child is experiencing difficulties in their learning, this often manifests itself in behavioural problems and we have two or three children in Year 3 who have absolutely no confidence in their mathematical ability and lessons seem to 'go over their heads'. They then become frustrated and mask their anxiety over poor academic performance with negative behaviour or daydreaming.

In accordance with the National Numeracy Strategy, It is important to ensure that a child who is experiencing difficulty in acquiring mathematical concepts, work from the planned mathematics programme for their class so that they are included in each unit of work.

This will allow them to participate fully in lessons and benefit from the discussion and interaction with their teachers and peers. It is vital to

raise the self esteem of these children using praise and reward strategies.

In a typical classroom at our school there is a classroom assistant and also a bi-lingual assistant who works alongside the teacher clarifying the curriculum for the target pupils. Therefore the classroom climate is one where all pupils feel they can contribute and it secures their motivation and concentration.

"It is evident that every child will gain from an inclusive approach. All children can feel comfortable and supported as an inclusive approach recognises every one of us has a variety of abilities" (Rieser R. 1994 p152)

Direct teaching is also used to learn mathematical vocabulary and for the children with no English, we use direct teaching for number recognition. We also have an argumentative puppet that makes deliberate mistakes in counting, ordering numbers and simple
calculation with orally presented and recorded numbers. This encourages the children to start talking about and pinpointing errors as well as considering alternative solution strategies.

Calculators and other ICT devices are used to support these children to access the lesson, although a lot of them cannot remember the information long enough to transfer it onto the calculator keyboard. If it is simple addition and subtraction I tend to use clearly labelled number lines. I do feel, however, that more use of ICT could benefit all children especially those who find mathematics difficult.

Place value cards and number squares can also demonstrate the structure of numbers at a more symbolic/abstract level. Multi-link and various other maths resources are used regularly to give these children a 'hands on' opportunity to grasp the concepts,

However, I realise the importance of not simplifying tasks excessively as this reduces cognitive challenge. I believe in 'scaffolding' which is an adult or peer helping a child to move from his/her performance level to their potential level, giving just enough help to move the child from one to another.

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Both the class teacher and I collaborate regularly with the SENCO and ensure that IEPs are followed and updated regularly and she provides input into the planning for the specific individuals experiencing difficulty not only with mathematics but with other areas of learning.

Bi-lingual support is prevalent in school. There is Pun jabi, Urdu and Bengali language support in school full time. Our bi -lingual assistants are encouraged to speak to the children in their heritage language whenever necessary. These children need to be fluent in their mother tongue before English language acquisition can take place. Cummins (1984).

Part Three

As the Open University states, children need to have a positive approach towards mathematics and I feel this positive thinking is enhanced by relating maths to the real world around us. If a child is able to do mathematics without realising it is mathematics, then the negative feelings towards the subject are taken away and barriers do not immediately come down.

Research in learning and motivation advises us as instructors to incorporate more active learning into our classes to improve understanding and long term retention of what is learned (Bransford, Brown, & Cocking, 2000: Greeno, Collins & Resnick, 1996).

Active learning works because its goal is simple: To move students from passive recipients to motivated participants through more contextualized, hands-on teaching activities

Mathematical investigations are an enjoyable way to enlarge conceptual understanding and encourage children. Pirie (1987)

We recently undertook a measuring activity within a numeracy lesson. The children were encouraged to walk around the classroom measuring everyday objects i.e., window ledges, tables, bookcases etc. They were able to make decisions themselves about what they chose to measure and

were also asked to estimate whether certain objects were more or less or about the same as a metre. These hands on activity created a positive atmosphere for learning and offered pace to the lesson.

Strong and Rourkes theory that children with mathematical difficulties have poor fact retrieval and memory for arithmetic tables is an overriding factor in our particular school. This is due, in the main, to the children's limited English skills and that their auditory channel is often the weakest, they simply cannot hold a number in their heads long enough to carry out a calculation. We try to offer these children every opportunity to manipulate physical resources.

They also have great difficulty learning multiplication tables. Some have learnt a verbal story with no understanding of the maths. They find it easier to learn spoken responses to visual cues, so we try to encourage the children to respond to cue cards, firstly in table order rather than randomly. In my opinion, the old fashioned way of chanting times tables every day was the most effective way to revise multiplication facts.

Strong and Rourke (1985) also cite the third category of mathematical disability is visual-spatial difficulty in representing and interpreting arithmetical information.

Some children with English as a second language also have visual perception difficulties and need to use concrete objects to support calculations. They get a better understanding of a number by physically manipulating a set of objects and then experiencing the combining and partitioning of that set.

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When I am explaining number bonds to ten, I use the multilink and show the children how ten multilink cubes can be grouped in different ways. W

e also have sets of cards that provide a visual representation of the number bonds to ten.

Studying Module 9 has given me a greater insight into the importance of relating mathematical concepts to everyday life. Therefore, in order to develop future practice when supporting children learning mathematics I feel it is important to realise that children's contact with maths does not start and finish within the lesson.

As a Higher Level Teaching Assistant, I can offer a range of skills to support this within the classroom environment. (Hockley 1985)

I could ensure I use mathematical vocabulary during science and technology lessons to reinforce their understanding of mathematical terminology. Take the time to count objects out loud, for example, paper, scissors, pencils etc. Bring mathematical concepts into art lessons i.e. painting 2D and 3D shapes (Programme of Study KS2 Mathematics: Ma3 Shape space and measures – understanding properties of shape)

During free choice sessions, I could encourage the children to play board games using a dice and to choose 'spatial toys' such as building blocks, shape matching, peg boards, stacking toys, bead counting frames, mosaic shapes and jigsaws (Programme of Study KS2 Mathematics Ma3 Shapes space and measure – problem solving.)

The children most likely to benefit form using these 'spatial toys' are the ones least likely to choose them so they need encouragement by ensuring the activities provided are simple ones that they are able to complete and achieve with little intervention.

Vygotsky social learning theory states that with adult help children can perform tasks that they would not be capable of completing on their own with the use of 'scaffolding' – this is when the adult continually adjusts the level of assistance in response to the child's level of

performance. Scaffolding can help to develop skills for independent problem solving and is an effective support strategy for supporting children in school

"Pupils need to be able to apply calculation skills and t he understanding of number to problems in other National Curriculum
subjects and to real-life situations." (The National Curriculum – Handbook for Primary Teachers 1999 p21)

ICT is recognised as an important resource within the Numeracy Strategy. Not only does the Strategy outline its importance within its introductory section, but it also acknowledges ICT as a factor, which promotes a high standard of numeracy.

In Maths ICT can enhance teaching and learning by enabling pupils to:

- explore, describe and explain number patterns: for example, by watching a counting 'meter' with sequences of numbers shown
- slowly one at a time, or experimenting with patterns of multiples highlighted on different number grids;
- practise and consolidate their number skills: for example, by using software designed to 'teach' or practise a particular skill and give rapid assessment feedback to you and them;
- explore and explain patterns in data: for example, by accessing, displaying and interpreting ready-made sets of data, displaying quickly a bar chart or pictogram showing the outcome of a class
- vote, or using a sensor connected to a computer to measure, display and show trends in room temperature;
- estimate and compare measures of length or distance, angle, time, and so on: for example, by devising a sequence of instructions to move a floor robot or screen 'turtle' along a path, then modifying their instructions in the light of the robot's response;
- experiment with and discuss properties of patterns in shape and space: for example, by using software to transform shapes and create geometric patterns, or watching a film of a square being halved in different ways;
- develop their mathematical vocabulary, logical thinking and problem-solving skills: for example, by using a 'branching tre e' computer program to sort shapes or numbers, or exploring a simple simulation to discover the mathematical relationship that underpins it.

This extract was taken from the National Numeracy Strategy pg 31. It shows how the use of ICT can relate mathematics to the world around us and therefore stimulate children's enthusiasm for the subject

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In summary, I feel that mathematics should be a continuous encounter throughout the day and children should be provided with as many opportunities for learning as possible.

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