The National
Numeracy Strategy

The daily mathematics lesson

# Guidance to support pupils with autistic spectrum disorders

Guidance

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Curriculum & Standards

Teachers and Teaching Assistants in Primary Schools

Status: Recommended Date of issue: 09/01 Ref: DfES 0511/2001



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## Autistic spectrum disorders

Autistic spectrum disorders are now known to be developmental disorders due to physical dysfunction of the brain and not, as was once thought, the result of emotional disturbance. Complex genetic factors are involved in most cases but other conditions, such as viral encephalitis before birth or in early childhood, may sometimes be implicated. The brain functions affected are those concerned with the drive to interact with other human beings that is inborn in people who do not have autistic disorders. This results in what is often referred to as the 'triad of impairments' (Wing, 1992) affecting social interaction, communication and imagination.

Autistic disorders can occur in varying degrees of severity. Each aspect of the triad can be manifested in different ways, in different individuals and at different ages in the same individuals.

### The range of impairments

### Social interaction

- Aloof and indifferent to other people.
- Passively accepts social approaches from others.
- Active but odd, repetitive and inappropriate approaches to others.

### Social communication

- Absence of desire to communicate with others.
- Echolalia and repetitive speech.
- Good grammar and vocabulary but speech used only or mainly to talk about special interests.

### Imaginative thought

- Inability to attribute thoughts, beliefs or actions to others.
- Inability to play imaginatively with toys or with other children.
- Repetitive stereotyped play with objects.
- Imaginative ideas pursued in isolation from other people.

The triad of impairments can occur on its own but, in most cases, it is accompanied by other problems. These can include any of the following:

- generalised learning difficulty of any level of severity from profound to mild;
- language disorders (receptive and/or expressive);
- reading difficulties;
- difficulties with number work;

- poor motor co-ordination;
- unusual responses to sensory stimuli;
- problems with posture and movement;
- problems with sleeping, eating, drinking;
- poor attention and hyperactivity;
- any kind of physical disability including epilepsy, hearing impairment, etc.;
- psychiatric problems, especially anxiety and depression.

## How do pupils with autistic spectrum disorders learn mathematics differently?

### Numbers and the number system

### Pupils with autistic spectrum disorders:

### • may not join in with whole-class counting.

Pupils may be able to count beyond their peers with confidence but still find participation in whole-class counting difficult. They should be able to be on the periphery of the group, joining in as their confidence develops and as they are able to experience the rhythm of the count. It is also important to provide alternative opportunities to continue to practise counting with an adult in 100s, 1000s, decimals and fractions.

### • often find 'counting on' difficult.

Pupils may become skilled at counting fluently from 1 to 100. They may find it difficult to count from a different starting point. They will not see one skill as being a development of another. Support can be provided first by using number lines and placing familiar items onto them to follow a count; then by using a real-life context, starting from the number of objects already in place, e.g. counting the number of chairs to be placed around a large table.



### • need to be taught number concepts in a functional and crosscurricular way.

Pupils who find imaginative play and play with others difficult may not have built up a wide store of mathematical concepts through play activities. Situations must be provided for concepts to be taught, together with the correct vocabulary, in a wide range of structured contexts. Pupils may appear confident with a skill in one context, but then need to be taught this skill anew in a different context.

#### • may find some illustrations used to support counting confusing.

Pupils will often question drawings of objects, as they are unable to see the connection between the illustration and what it is supposed to represent. Also, if they are shown a card with a picture of a ball on it and asked 'What is it?' they will often respond, 'A card'. It is essential to use very precise language when asking questions of this kind, or to model the type of answer you are looking for. For example, 'Draw a ...', 'Show me ...' and not 'Can you show me?'. Use of real objects or photographs of real objects can also support the pupil.

## • may need to use simple and standardised language.

Pupils will need to focus on core essential vocabulary. It is helpful to encourage pupils to keep a personal vocabulary book for the words that they are using. As new words are introduced, they can be added to the relevant section of the vocabulary book in order that the connections can be made. Pupils with autistic spectrum disorders may find it hard to see the similarities between words with the same meaning. It might be necessary to give them all the words to begin with, and then ask them to select the words to use for a particular session. They will then be reminded of the words that other pupils and the teacher may be using during the lesson.



### Calculations

### Pupils with autistic spectrum disorders:

### may find it difficult to explain the methods they have used to complete a calculation.

Pupils will often respond very quickly to questions requiring rapid recall of number facts. They will also respond to complicated calculation questions without making any jottings. However, they are often unable to explain the method used to reach that answer. Encouraging pupils to demonstrate what they have done is a useful strategy to check their thinking. Sometimes it is worth spending some time to pre-tutor pupils using a possible structure for a response (similar to a writing frame). At times, pupils' responses will be 'I just know it'. Pupils with autistic spectrum disorders should not be pushed into explaining how they got an answer when this is the case.

### • need to be taught inverse operations from an early stage.

Pupils may not be able to see the link between the mathematical skills of doubling and halving, addition and subtraction and multiplication and division, unless these skills are taught explicitly together. If pupils do not have inverse operations explained to them from a very early stage, they will see halving as being something completely new and separate from doubling. Good practice suggests that addition and subtraction are taught together. For pupils with autistic spectrum disorders it is important to make explicit visual links to show that relationship. Further practical experiences of the direct links between addition and subtraction, from the initial introduction of addition, will support the pupils' understanding.



#### • need to be given opportunities for errorless learning.

If pupils do not get the correct answer to a calculation they may feel embarrassed and often become distressed. They may be unwilling to try a similar calculation in the future, and in some cases, be unwilling to return to the mathematics lesson.

Pupils with autistic spectrum disorders should be taught how to talk themselves through their own calculations as a means of self-correction. It is important for the teacher to model 'safe' mistakes that are clearly identified. The correct process can then be demonstrated and the mistake identified as a learning point for pupils. Care should also be taken when marking pupils' work, as they may see marking as someone defacing their work. The whole-class plenary may be a better time to discuss possible misconceptions.

### may have difficulty moving from expanded calculations to a more compact method.

Whenever the structured layout of a calculation changes, it is not unusual to have to re-teach the operation. Pupils may gain confidence in the expanded methods of calculation and be unable to see the link with the compact method. Once pupils are using a reliable and efficient method of calculation, they should be able to remain with that method.



### Solving problems

#### Pupils with autistic spectrum disorders:

#### will benefit from linking all four operations to a set of rules.

Pupils feel more secure if they have a set of rules that they can work to. As each operation is introduced, it is helpful to develop a set of rules that pupils are encouraged to keep in their own personal rule book. These rules will then act as a reference point when selecting the appropriate method of calculation to solve a problem. It is important that these rules are established early on in the pupils' use of the four operations, and that the language of them remains constant.



### need word problems to be presented in a clear and concise way.

Word problems that focus on one aspect of mathematics will be less confusing to pupils with autistic spectrum disorders if:

- language is familiar and used in context;
- questions give clear direction to what pupils need to do;
- illustrations are relevant and supportive;
- there is a clear outcome to the problem.

## • may have difficulty explaining how they have completed a word problem.

When a problem-solving activity is complete, some pupils may be either unwilling or unable to explain the methods they have followed to reach their answer. In order to overcome this difficulty, it might be useful to consider giving them the 'tools' to support this explanation.

One level of support that pupils with autistic spectrum disorders appreciate is use of a rule book. This could contain a framework for pupils to follow:

- read the problem;
- identify the key information and write it down/draw pictures;
- decide which calculation is necessary;
- use an appropriate calculation method;
- interpret the answer in the context of the problem.

Pupils could then be prompted to make a jotting alongside each of these elements which either they or an adult/peer can refer to.

This framework could be presented as a set of sequenced cards. On one side of the cards the problem-solving framework would be written. On the other side pupils could identify key information related to a specific problem,



including jottings and the final answer. As the teacher takes feedback on the process, pupils can show the sequenced decisions they have made and may only have to give the final answer orally.

Making the cards into a jigsaw with interlocking pieces will provide even more support.

Which calculation ... ?

### Use appropriate method ...

Interpret answer in context of question ...



• need a clear time frame in which problems will be completed. Some pupils will spend a lot of time taking care over the presentation of their work. They need to be given clear guidelines about how much work is expected, e.g. how many problems to complete. It is useful to provide clear models of the work expected and to remind pupils that the end of the session is drawing near. It is also helpful to provide a clear indication that the lesson has ended and that the class is moving on to something different. Auditory and visual cues may be helpful.

### Measures, shape and space

#### Pupils with autistic spectrum disorders:

#### • can often be over-precise in areas such as measurement.

Pupils may spend a lot of time trying to get the most accurate measurements. Often they will return to the object a number of times, becoming more and more anxious about the precision of their measurement. For these pupils it is difficult to comprehend the use of non-standard measures such as hand spans or strides – they will not be seen as a useful stepping stone to measurement. For this reason it may be necessary to move to the use of a standardised measure.

## • may find it difficult to generalise their understanding of shapes.

Pupils may need to be introduced to the full range of shapes which meet a given criterion. For example, they will need to see the different forms of a triangle in order to understand that a triangle has certain properties, rather than being something represented visually in one way. Shapes not only have to be presented in their different forms, but also with their bases in different places. For example:



## • may find it hard to understand a 2-D representation of a 3-D shape.

Pupils with autistic spectrum disorders may find it difficult to visualise 3-D shapes. It may be helpful to link each 3-D shape to an object they are familiar with and have got some experience of, e.g. triangular chocolate bar wrappers.



### • may find aspects of rotation and symmetry difficult.

Pupils may find it difficult to discuss the movement of a shape following a rotation. All movement will be taken literally and pupils are unlikely to be able to visualise new positioning of shapes. It is essential to support pupils through practical sessions where they are able to follow the movements themselves and become completely involved in acting out the repositioning of the shape.

### Handling data

#### Pupils with autistic spectrum disorders:

### may find it difficult to understand that data can be represented in a number of different ways.

Pupils may not be able to see the link between, for example, a block graph, a pictogram and a bar chart. Their interpretation of the information in each may lead them to believe that the data exists, but they may not see the reason for representing it in a number of different ways. It is important, therefore, to teach the links directly, preferably following a concrete example from which data can be extracted. Representational aspects can then be introduced, linked directly to the real-life situation, and the data-handling process can be better understood.

Computer software may be used to represent the same data in a number of ways. This can promote discussion about how the data does not change, but may be easier to discuss, depending on how it is represented.



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### Organisations

National Autistic Society (NAS) 393 City Road London EC1V 7AA

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