



Guidance

Curriculum and  
Standards

# Key Stage 3

## National Strategy

# Strengthening teaching and learning in science through using different pedagogies

Unit 1: Using group talk and argument

Science subject  
leaders,  
KS3 science  
coordinators and  
science teachers

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# Strengthening teaching and learning in science through using different pedagogies

## Unit 1 Using group talk and argument

## How to use this study unit

This study unit offers practical suggestions for you to use in the classroom when considering using group talk and argument to stimulate discussion. All the strategies suggested have been tried and tested by teachers in their classrooms. They draw upon both academic research and the experience of practising teachers. You may have looked at *Teaching and learning in secondary school materials* (DfES 0423-2004). While there are similarities with these materials, you will find that this unit gives science specific advice that will be immediately relevant for use in your laboratory.

Your science consultant can help you work through this unit but it would be better to pair with a colleague who also wishes to enhance the quality of pupils' discussion. The unit is structured so that the tasks listed towards the beginning are simple and quick to implement. More challenging activities come towards the end. The unit contains case studies and tasks for you to undertake. It also contains 'reflections' which will help you revisit an idea or change your own practice. It includes practical tips and tasks which will help you consider the advice or try out new techniques in the classroom. The summary of research is contained on pages 23, 24 and 25 and a list for further reading is located towards the back of the unit. The final page invites you to reflect on the experience of having tried out new materials and set some personal targets for the future. You can work through the materials in a number of ways:

- Start small; choose one class to work with. Ask another teacher or your subject leader to help by providing a sounding board for your ideas.
- Work with your science consultant on developing and planning your approach to group talk with one class. After three weeks meet together to review how it is going. Discuss which strategies have been the most effective with one class and plan to use these with other classes.
- Find another science teacher to pair with and team teach. Design the activities together and divide the teacher's role between you.
- Work with a group of teachers in the department. Use the unit as a focus for joint working, meet regularly to share ideas and then review progress after a few weeks.
- Identify the sections of the unit that are the most appropriate for you and focus on those.

There is space provided in the unit for you to write notes and make comments about the activities. You may find it helpful to keep a journal of events. For some tasks you may want to make a video recording of yourself in action so you can make a realistic appraisal of your performance. You could add this, along with any other notes and planning that you do as you work your way through the unit, to your CPD portfolio.

You will need access to video sequences 1 to 6 in the group talk section of the DVD, when working through this unit.

# Using group talk and argument

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## Introduction

### What is meant by 'group talk' and 'argument' in science lessons?

Group talk includes any activity where pupils' ideas are explored *verbally between pupils*, even if the final product is written or practical. It includes verbal argument (in this context the word *argument* is used to describe discussion between pupils who hold differing views) as much as more formal debates (about contentious topics such as genetic engineering). Group talk can be both collaborative and competitive.

### Stop and think

Before reading ahead, jot down your first thoughts to complete the following statements:

- 1 An activity a science teacher might carry out that could be called a 'group talk' activity is ...
- 2 If the activity was successful, what I would expect to see the pupils doing is ...  
and what I would expect to hear in their conversations is ...  
and what I would expect to see the teacher doing is ...
- 3 The benefits to the learner of science would be ...
- 4 A teacher might not use group talk activities, giving reasons, such as ...

### What does successful group talk and argument look like?

When you take part in productive talk as an adult scientist, you make suggestions and support, modify or clarify others' views. You challenge ideas, ask questions to seek clarification, summarise and evaluate the pros and cons. You care about your own opinions, but allow others to shape and counter them.

In science lessons where productive group talk is taking place you will see pupils discussing scientific ideas with each other independently of, but guided by, the teacher. Pupils will often be turning to face each other, making and maintaining eye contact with others and using animated expressions with their eyes, face and through gesture. They will want to convince others, but will be looking for opportunities to consider others' views. Words and phrases related to reasoning (such as *because*, *why?*, *what if ...?*) will be used. At times, pupils will be thinking and saying little as they listen to others. The teacher will be aware of the progress of the conversations and intervening without interrupting the flow of the talk. The pupils will be in control of the time taken on a discussion and will be clear on what they are expected to produce as a result of the activity.

When the group talk is over, pupils may have changed their minds at least once. They will be able to explain their current viewpoint and any previous opinions they held, as well as some of the views held by others.

### Why do it? What are the benefits to the learner?

- **Higher-level thinking** Pupils are challenged to defend, review and modify their ideas with their peers. It encourages reflection and metacognition (thinking about one's own thinking). Pupils often communicate ideas better with other pupils than with teachers.
- **Assessment for learning** Effectively reveals the progress of the pupil to the teacher, encouraging the pupil to self- and peer-assess while allowing the teacher to plan more effectively. As such, group talk complements methods embraced as *Assessment for learning*.
- **Illustrating science in action** Working scientists use group talk – in class it models how they work, supporting the teaching of the 'ideas and evidence' aspects of scientific enquiry.
- **Developing the whole child** The ability to resolve disagreements is a life-skill. Pupils become more reflective as they try to arrive at a consensus by expressing different points of view; or work collaboratively to explore ideas, plan and make decisions. Further, it supports the development of literacy.
- **Pupil motivation and emotional involvement** When argument is taking place, and pupils are actively prompted and provoked to defend a point of view – by the teacher and by others – it raises the emotional involvement in a topic, so that pupils are more engaged. In essence, they are being encouraged to 'care' about the science viewpoint they have, and to take a stand for or against it, even if they concede to others along the way. These features are more common in good English, RE and humanities lessons.
- **Variety and learning styles** Can be used as an alternative to written or practical work (for example, experiments), or just listening as the teacher explains and demonstrates. Group talk encourages the use of different learning styles and thus can be inclusive to pupils excluded from more traditional (and often written) activities.

## Why is group talk relatively uncommon in science lessons? What are the issues expressed by teachers?

- **External factors** Many teachers may feel a pressure to 'deliver the curriculum'. There is no time in the lesson to do more than impart information. Also, the teacher may be concerned about having evidence of work having taken place (for example, usually something written down in books) – for others in the school, for parents or for Ofsted.
- **Internal factors** The teacher may be reluctant to take a risk with group talk because they are afraid that discipline will be a problem. They do not feel comfortable with the apparent loss of control and, as their pupils are not used to being given this level of freedom to express their ideas, they may be reluctant or misbehave. If group talk has been tried in the past it may have been unsuccessful because of a lack of consideration of factors such as classroom layout and teacher behaviour.

## When are pupils more likely to engage in group talk and argument?

- when seating arrangements and environment are planned in order to facilitate discussion;
- when the teacher's language and non-verbal communication are planned in advance in order to promote pupil confidence in the stimulus material for group talk;
- when the teacher withholds their opinion, or the answers for longer than usual;
- when groupings are chosen by the teacher, and are regularly changed;
- when timings are specifically used and usually kept short;
- when group talk is used regularly and becomes part of everyday science lessons.

It is the *teacher skills* of running group talk that require the most effort to develop and are the focus of this unit. Once developed, they can then be used with little preparation on the part of the teacher, allowing them to be a regular feature of lessons.

The ideas presented in this unit complement those in the unit on *Strengthening teaching and learning using questioning in science*.

### Task 1

#### Why use group talk: a teacher's perspective

15 minutes

Watch the video sequence 1. This shows a science teacher giving her reasons for using group talk and argument.

Now, revisit the STOP THINK questions you answered earlier.

Has your thinking changed? If so, in what way? If not, which ideas have been reinforced?

## Task 2

### Try an activity

15 minutes

Now you have observed a teacher talking about why she uses group talk in lessons it would be a good idea for you to try setting up an activity for yourself.

Think of a class you are going to teach next week that might be amenable to this way of working.

Warn them that you are going to try something different with them next lesson.

Plan for a plenary activity which will encourage group talk. For example, pose a question such as 'How does the density of the particles in water change as ice melts?' Give the pupils two minutes think time, then ask them to pair up and come up with a consensus model to explain what they think is happening. The pairs should then be instructed to convince another pair that they have the best model. Some of the models are then shared with the rest of the class.

Or this might be by setting them a contentious question that they have to answer by the end of the lesson.

Make sure that you leave sufficient time to do the activity justice.

Evaluate how successful the activity was. If you feel that you could have organised the plenary differently, then make a note of this for next time.

## Task 3

### Pupils engaged in group talk

20 minutes

Watch the video sequence 2 where pupils are engaged in productive group talk without the need for teacher intervention.

Make a list of the pupil behaviours that can be seen which promote group talk, for example, the way the pupils face each other and the way they question each other.

Read the research summary given in the back of this unit. Use a highlighter pen and mark those reasons for the promotion of effective group talk which are the most important for you in your lessons.

## Organising group talk

## Task 4

### Choosing a class to work with

15 minutes

Think of a class you teach that you think would respond well to group talk activities, this will be your case study class.

Note down:

#### Case study class 1

Year:      Class:      Timetabled day(s)/lesson(s):      Reason chosen:





Before you continue, make some copies of the questionnaire given below. Fill in the questionnaire yourself for the class by answering as if you are a representative pupil. Add extra lines so that you can add questions of your own.

Now ask some pupils from your chosen class to each complete the questionnaire to get a feel for their opinions. There is also space to add extra questions if you wish.

The outcome of the questionnaire may influence your decision about why you chose this class.

Keep spare copies of the blank form and the outcomes of the questionnaires for later.

## Case study

Class:	strongly disagree 	disagree	agree	strongly agree 	not sure
1 Science is a subject full of things to discuss.	4	3	2	1	?
2 The teacher often asks us questions about science in class.	4	3	2	1	?
3 I often ask the teacher questions about science.	4	3	2	1	?
4 I often ask others in my class questions about science.	4	3	2	1	?
5 We are often given the chance to discuss things in science.	4	3	2	1	?
6 I often challenge other pupils when I think they have said something about science that may be wrong.	4	3	2	1	?
7 When talking in a group, I am listened to by others.	4	3	2	1	?
8 When talking in a group, I always listen to the others.	4	3	2	1	?
9 I always work with the same group of pupils in lessons.	4	3	2	1	?
10 I like working in groups to discuss things.	4	3	2	1	?

Adapted from Shakespeare, Naylor and Keogh, 2004

## Task 5

### A pupil's view

30 minutes

Watch the video sequence 3 which shows pupils, whose teacher uses group talk and argument in science, talking about their experiences:

- How do they feel about the activities?
- How has their opinion of using group talk changed since they started to do it?

What are the advantages and disadvantages of this way of working as far as they are concerned?

Tell your case study class that you have looked at their responses to the questionnaire and are going to try a group talk-type activity with them as a result.

Have the pupils work in groups of four.

They should nominate a spokesperson for their group and also nominate a scribe.

Pose them a question to think about. This should be pertinent to the topic you are teaching but some examples are given below.

Tell the pupils that they should face each other and the scribe will jot down all the pupils' responses to the questions posed. All responses should be recorded even if they appear to be wacky.

Give a definite time for the discussions and then tell the class that you are going to give them 5 minutes to summarise all the ideas and take feedback from the spokesperson.

Evaluate how effective you felt this simple group-talk activity was and how you will change your organisation as a result of this reflection.

Ideas of questions to pose:

- Look at these cell models. Discuss the similarities and differences between them. What features of the cell could not be adequately represented by the models?
- Why does more copper sulphate dissolve in the same amount of liquid when the temperature is increased? Use the word 'particles' in the explanation.

### Choosing, grouping and moving pupils for group talk activities

Everyone is affected by their peer group, and pupils in particular rapidly adopt and change roles in different situations. The choice of the group in which they are expected to work has a huge bearing on their willingness to speak openly and express ideas.

A teacher may say 'I'd like you to do that in groups ...' with little guidance on the composition or size, where pupils should work, how long they have, and what is expected of them. A very common grouping for practical work, group talk or project work is friendship grouping, often in groups of three or four, or without specifying the size of group.

### Stop and think

Before reading ahead, jot down as many reasons as you can for each of the following:

- why science teachers often allow pupils to work in friendship groupings;
- why pupils choose friendship groupings when given the choice;
- why science teachers may choose groupings of threes and fours;
- why not specifying a group size may be a problem for the teacher and for individual pupils.

You may have had thoughts such as:

- for the teacher, little or no forward planning is required to arrange friendship groupings. The likelihood of confrontation is reduced and if pupils are already sitting with friends they do not need to move far;
- given the choice, pupils (quite understandably) choose the lowest risk option – invariably with the same pupils they always sit with, who are probably sitting close to them already;
- many science classroom tables and lab desks lend themselves to being used in groups of three or four. Also, there may be inadequate resources or equipment for smaller groups;
- pupils can choose to sit with big groups and therefore have less to do and make it more difficult for the teacher to keep them on task. Less-popular pupils may be excluded from some or all groups.

### Thinking ahead and preparing the ground

Start by thinking in terms of flexible 'grouping plans' which can change according to the activity, rather than fixed 'seating plans' which usually do not. Many science teachers adopt seating plans in September and do not alter them all year except for handling unwanted behaviour. Introduce new ways of working at a time when the pupils are most receptive, such as a morning lesson, after a holiday break, or on starting a new unit of work, but do not put it off until September! Make it clear how long you expect pupils to work in these groups and that they will be changed again shortly. Get into the habit of changing groups regularly, anything from once per week to changing mid-lesson.

Whatever you are doing in class, always express grouping and seating plans in terms of learning, rather than behaviour, management. Changing groups will be more difficult if pupils regard it as a punishment for poor behaviour or low productivity rather than an important aspect of learning. In *all* lessons you should be the one to decide on seating to make it easier when you want to move pupils. Even if you allow them to choose from time to time, make it explicit that the choice is yours and do not back down if pupils complain. If your school has a policy of alphabetical or boy/girl seating, they can return to this for 'whole-class' teaching as needed.

#### Review

Grouping plans not seating plans.

The choice of seating **and** grouping is yours.

Express grouping and seating in terms of learning not behaviour.

Change groups regularly.

#### Task 7

#### Group size

30 minutes

Look at the table on the next page and think about your case study class. Photocopy the table and then consider how this grouping would work and complete the last column for yourself.

Grouping	Benefits	Limitations	Benefits and limitations for case study class
Individual	Has to think for self	Isolated within own experience	
Pair	Obligated to talk Secure Unthreatening No need to move furniture Quick	Prone to quick consensus Little challenge from different viewpoints Allocation of loners can be difficult	
Small group (three or four)	Diversity of opinion without the size of group being too threatening Turning a pair round can create a table of four without moving benches	Social pressures begin to set in: 'We always work together'; 'Do we have to have girls in this group'; 'I have no-one to work with'. Possible for individuals to stay quiet once there are more than two	
Large group (five to seven)	Diversity of ideas, experience, ideas, opinion	Have to move furniture Requires chairing and social skills Can easily be dominated. More pupils remain silent	
Whole class	Everyone gets the same experience Teacher can monitor and support the talk	Several pupils remain silent More difficult to contribute and there can be frustration in having to wait, discussion moving on, etc. Risk of domination by the bright, confident and talkative Risk of the teacher doing most of the talking	

It may be useful to think in terms of 'team work' as opposed to 'group work' when setting up group talk. For team work, think 'competition' – where the idea is to end up with something, which is the first/best/biggest/most, etc. when compared with other groups. For group work, think 'collaboration' – cooperating towards a common goal irrespective of the actions of other groups. Stereotypically, it is often held that boys have a preference for team work and girls for group work. However, pupils often respond unexpectedly, and every pupil should be asked to work in new ways at times.

## Task 8

### Group composition

30 minutes

Look at the table below and think about your case study class. Consider how this grouping would work and complete the last column for yourself.

Grouping	General benefits	General limitations	Benefits and limitations for case study class
Friendship	Secure and unthreatening	Prone to consensus	
Ability	Work can more easily be pitched at the optimum level of challenge Pupils challenged by others near to their ability (in their 'zone of proximal development')	Visible in-class setting	
Similar personalities together	Can treat all in group in same way	Differences visible – leading to pupil labelling of groups (e.g. the keen group, the mischievous group) Some groups may demand more attention than others	
Different personalities together	Unmotivated pupils may be pulled up by more motivated	Motivated pupils may be pulled down by less motivated	
Single sex	Socially more comfortable for some	Increases the gender divide	
Equal numbers of boy/girl per group	May promote gender tolerance and equal opportunities Positive influence of one gender on another	May be unequal numbers of boys/girls in class Some pupils feel strongly about the negative influence of the other gender	
Random selection	Builds up pupils' experiences of different partners and views Accepted by pupils as democratic	Can get awkward mixes and 'bad' group chemistry	
Pupils with same first language	Conversation flows freely	May limit opportunities to share ideas with others May appear to segregate different pupils	

There are many ways to spread ideas from a small group to the wider class. Refer to the table below, noting how there is hierarchy from the most straightforward method to more elaborate.

## Grouping and regrouping quickly

Keeping with the same groupings lesson after lesson can become counter-productive. Discussing ideas with different people is important to good science and a life skill in itself. When asked to work in different groups there may well be personality clashes, confusion over who sits where, and unexpected unequal numbers due to absence, so it is important to have methods that limit these difficulties.

### Task 9

#### Sharing ideas between groups

30 minutes

Look at the table below and think about your case study class. Consider how this method would work and complete the last column for yourself.

Method	Description	Benefits and limitations for case study class
Pair talk	Following the stimulus for the discussion, pupils are asked to think before speaking to anyone, then turn the person next to them to share their answer.	
Pairs to fours	As above, but then each pair shares ideas with another pair.	
Snowball	As above, but each time the group grows they are asked to come up with another argument/point/idea/fact/etc.	
Spokesperson	One person is nominated from a group to summarise their argument. The teacher should decide on the spokesperson and only let it be known just before they are asked to speak. Stress that the spokesperson can use others' ideas and does not have to think on the spot when reporting back.	
Envoys	As 'spokesperson' (above), but the person feeds back to only one other group. They also listen to this group's ideas before bringing back ideas to their own group again.	
Rainbow groups	After a discussion, pupils are given a number or colour. Pupils with the same number or colour then join up to form new groups with representatives from the previous groups. (See notes below for ideas on how to carry this out.)	
Random (and apparently random) regrouping	Pupils are randomly jumbled to rearrange them (using methods such as those outlined below).	

## Ideas to make grouping and regrouping happen easily

Method	Notes
<i>Number/letter/colour</i>	<ol style="list-style-type: none"> <li>1 Make sturdy signs for tables with three different grouping methods (e.g. numbers/letters/colours) so that different tables are marked up as 1/A/Red; 2/B/Green; 3/C/Blue, etc. Leave the markers on desks all the time so that pupils expect them to be used.</li> <li>2 Allocate each pupil a number, letter and colour. You may have decided that when in their colours the pupils are grouped by ability; numbers by learning style; and letters give an even boy/girl split; or any other way you wish to group them. Do not share with the class your reason for grouping that way.</li> <li>3 Pupils remember/note down their own number, letter and colour which may also be recorded in their diaries or similar, displayed on the noticeboard or projected on a whiteboard.</li> <li>4 On arrival at the lesson (or any time you want to change grouping) you tell pupils to get into their relevant group. Pupils move to the correct marker and sit down with a new group.</li> </ol>
<i>Random numbering</i>	<ol style="list-style-type: none"> <li>1 Pupils put their hands up. Point to each pupil and give them a number – as they hear it they put their hands down – up to the number of groups required.</li> <li>2 Before they move, ask the number 1s, 2s, 3s, etc. to put their hands up in turn so you can see the groups you have made and they are less likely to change group as they move to their places in the class. Having planned it in advance, direct each group towards a desk, using signs as needed.</li> <li>3 Pupils can see that you are not allocating specific pupils into groups as it appears 'random'. It can, however, be easily arranged so that the first pupils you number are all separated into different groups – but if done quickly it still looks random.</li> </ol>
<i>Random continuum</i>	<ol style="list-style-type: none"> <li>1 Ask all pupils to line up alphabetically by surname, by first names, by month of birthday (January to December); house number (low to high); first letter of the last TV programme watched; numbers of brothers and sisters (from zero up) – anything that allows you to randomly line them up in different ways. Avoid personal qualities such as height, or test results, etc.</li> <li>2 Divide the class into equal-sized groups. Having planned it in advance, direct each group towards a desk, using signs as needed.</li> <li>3 Pupils can see that you are not allocating specific pupils into groups as it appears 'random'.</li> </ol>

### Task 10

#### Running the activity

Watch the video sequence 4 where a science teacher talks about running group-talk activities and explains her rationale for carrying it out that way.

Which ideas have you read about feature in her lesson?

## Starting an argument – choosing the stimulus for group talk

The use of group talk should not be limited to debating controversial topics in formal discussion, important though that is. The focus here will be on activities you may already carry out that can be turned into group talk opportunities with little or no extra preparation.

When carrying them out, the ideas from 'Choosing, grouping and moving pupils for group talk activities' should be used.

Science teaching method	Common format	Some suggestions to change to group talk and argument format
Explanation	Teacher explains the ideas and science to the class – expecting pupils to listen and reflect as she speaks. Occasionally asks questions to individuals to see if they are listening.	<p>Teacher provides just enough information for pupils to work out what the main points are, then asks them to agree the three most important points, and be able to explain why.</p> <p>Teacher tells them there will be a deliberate mistake in what will be said. Finally, groups must agree what the mistake is, and why.</p>
Demonstration	Teacher sets up and uses equipment to demonstrate an idea from the front of the class, expecting pupils to listen and reflect as she speaks. Occasionally the teacher asks questions in the style outlined below.	<p>Teacher lays out all the equipment and materials on the front desk and explains what they are. In groups, pupils are asked to agree:</p> <ul style="list-style-type: none"> <li>• how they think the demonstration will be set up;</li> <li>• what it will show and why;</li> <li>• how it ties in with the learning objective of the lesson.</li> </ul> <p>Teacher then sets it up in the agreed way or asks a group to do so and run the demonstration. Periodically the 'action' is stopped and groups are asked to agree what the next step would be and why.</p>
Question and answer	Teacher asks questions from the front of the class which may be closed/simple recall questions. She asks for 'hands-up' volunteers to provide required answers, or names individuals (sometimes just to check if they are paying attention).	<p>The teacher considers carefully the question being asked. (Please also refer to guide on 'Strengthening teaching and learning using questioning in science'.)</p> <p>Teacher asks a question but asks every group to agree an answer. She does not take answers from those with hands up but expects all to be able to say something by allowing a pupil to use another's suggestion from the group.</p> <p>When answer provided, she asks other groups to agree a set of pros and cons of the answer provided.</p>



Taking 'notes'	After explanation, demonstration or similar, teacher writes notes on board, dictates, or asks notes to be copied from book or worksheet. Pupils individually copy into their books.	<p>After explanation, demonstration or similar, groups are asked to agree the wording of the sentence that summarises a different aspect of the science. Once these sentences are agreed, the class compile a paragraph that summarises the salient points. Pupils record this in their books.</p> <p>Teacher reads out some notes. Groups are then asked to reproduce the wording as closely as possible – recorded on scrap paper and then refined. Pupils record this in their books.</p> <p>Teacher refers pupils to a book or worksheet. Groups are then asked to identify key words which can be used to reproduce the wording as closely as possible. The book/worksheet is turned over and on scrap paper the sentences are refined. Pupils record this in their books.</p>
Comprehension worksheets (information plus questions) and answering questions from books	Book/worksheet is provided, one each if possible. Pupils individually read and answer questions in their exercise books.	<p>Worksheets are provided – one per group, possibly on A3 paper. Groups are then asked to agree answers verbally. The list of answers is then turned into a paragraph to be recorded in books.</p> <p>Books or worksheets are provided one per group. Groups collectively asked to read questions and generate similar style questions with answers that can be worked out from the text. These are written on paper and passed to another group to complete as a group or individually in their books.</p>
Practical work	Teacher explains or demonstrates procedure. In groups pupils collect equipment and run practical, recording outcomes individually in books. Maybe followed by individual write-up of work.	Teacher explains or demonstrates procedure using similar ideas to those above. In groups, pupils collect equipment and run the practical, recording one set of results per group (perhaps on sugar or scrap paper). For the write-up, groups are asked to agree a step-by-step guide to carrying it out, or a sketched poster showing results and conclusions. Each group is then allowed to 'mark' other groups' work and agree suggestions for how it may be improved, with reasons why. Individually, they write up the practical if this is still required.

## Other ideas

Use of misconceptions or false statements such as 'There is no gravity on the moon' to provoke discussion (please refer to Key Stage 3 Strategy 'Misconceptions' materials). Groups have to come to a consensus about whether they agree or disagree and why.

**Artefacts or interesting objects** such as toys, living things, lab equipment and so on.

**Interesting photographs** can be found using an Internet search engine that allows you to search for images. Groups are asked to generate their own questions and agree the best, given question stems such as: 'How does ...?', 'What would happen if ...?', 'Do you think ...?', etc. These questions are then addressed to other groups.

**'Open ended' questions** (in the style of *New Scientist* 'Last Word' section) such as 'Why are atom bomb clouds the shape they are?' (to discuss convection) or 'Why can birds safely land on high voltage wires?' (to discuss earthing, voltage, current). Go to [www.newscientist.co.uk/lastword](http://www.newscientist.co.uk/lastword) and [www.newscientist.co.uk/lastword.uk](http://www.newscientist.co.uk/lastword.uk)

**Concept maps, mind maps, etc.** Completed in groups and assessed by other groups.

**Concept cartoons** where misconceptions are personalised by cartoon characters to help pupils take sides and form opinions ([www.conceptcartoons.com](http://www.conceptcartoons.com)). Groups are asked to agree on which character is closest to the truth, and why.

**Card sorts and continuums.** Groups are asked to collectively classify statements (into, say, true/false, agree/disagree, etc.), diagrams, names, etc. which are presented on cards, or place them along a line of a continuum.

**Other group talk stimuli** are many of the activities written to be starters and plenaries; Key Stage 3 Intervention materials; from books such as Wellington, J. and Osborne, J. (2001) *Language and literacy in science education*, Buckingham: Open University Press; or the IDEAS project materials, Osborne, J., Erduran, S. and Simon, S. (2004) *Ideas, evidence and argument in science (IDEAS) project*, Kings College, London).

## Reflection

Think about the ideas contained so far in this unit.

Which of them can be incorporated into your teaching this week?

Which will require more planning time?

# The climate and environment for group talk

## Establish expectations

Establish or remind pupils about your expectations for talk before they begin.

For instance you could consider 'ground rules' for talk such as:

- assertions and opinions should be backed up by reasons;
- alternative options are considered before any decision is made. Each person in turn should be invited to speak;
- everyone in the group should be encouraged to speak by the other members;
- the group should try to reach agreement.

However, when scientists talk through something they often interrupt or play 'devil's advocate' and do not obey such ground rules, so that ideas are 'sparked off' each other spontaneously. It may help to ask yourself 'What is the minimum in terms of behaviour I would expect from a group of pupils while arguing their point? Is there anything over and above what I expect from them at other times?' It may come down to simply reminding them of the need to be considerate to the views of others.

## Gather pupils close together and face them towards each other

People have more difficulty communicating with each other over distances of approximately 3.5 metres, but can communicate effectively over approximately 0.5 to 3.5 metres. The emotions can be engaged and involvement is greater when people face each other, while they are as physically close together as is reasonable. Ask pupils to pull chairs into close circles, either with or without desks, and not in rows. This is more important if your classroom has long fixed benching.

## Stress the importance of eye contact

Politely remind pupils to look at each other when speaking and listening. (Note that in some cultures, and for some pupils with disabilities, expectations for eye contact may differ, which needs treating sensitively.)

## Clear the desks

Many things can distract pupils, and personal items and books take up space and act as barrier to involvement. Eye contact between pupils will be reduced. Clear the desks of *everything* except that which is needed for the activity – including pupils' pencil cases, pens, pencils and exercise books.

## Convey intended outcomes to group talk

Saying 'I would like you to sort out whether you agree or disagree with that in the next four minutes, when your group will be able to tell other groups the part you disagreed over the most' is better than 'Have a quick chat with someone about that' which specifies neither the purpose (the reason to do it) nor the product (or outcome) of the task.

## Use short, specific time targets

Specific times that appear to be carefully chosen can help ensure the activity doesn't drag out ('You have 25 seconds to come up with a better argument than theirs!'; 'In the first minute I want to hear a sentences using every keyword from each pair, then, as a foursome. I am looking for three sentences together that explain how ionic bonds formed – which will take four minutes'). It helps to count down to that time limit ('You have just two minutes to go now ...'). Tell them how little time they have and always try to stick to time targets – to the second!

### Review

Ensure pupils know what the *purpose* and the *product* of the discussion will be.

Make explicit the reason why they should:

- be considerate to the views of others;
- face each other, and sit as close together as possible;
- use eye contact;
- clear the desks before they talk as a group work within the time targets set.

### Task 11

#### Preparation of the laboratory

20 minutes

Watch the video sequence 5 which illustrates part of a lesson demonstrating the teacher's expectations of pupils, the way she has prepared the classroom and the stimulus she uses to get pupils to talk and argue.

What ideas have you read about feature in her approach?

### Intervention in group talk: teacher behaviour and verbal prompts

**Proximity** If you stand close to a group who are talking it often stifles discussion, and they are more likely to defer to you when they get stuck. Even worse, looming over a pupil or simply leaning on the desk can also stop a conversation. Because you need to know what's being said, practise standing a metre or two away, look elsewhere and pretend to be listening to someone across the room. If you finally need to intervene, loom nearer or lean on the desk instead of using words.

**Relative height** If you need to join a small group for even a short time, get to their level or lower by sitting, kneeling or squatting. This allows you to make eye contact, lower your voice and not appear dominant. To keep an eye on the rest of the class, face inwards in the room with as few pupils behind you as possible.

**Non-verbal encouragement** To encourage a pupil to speak, smile or increase eye contact, nod your head and use slightly more exaggerated facial and vocal expressions. Invite opinion by keeping your palms more upwards in hand gestures. As this may feel unnatural, try it in a mirror and you will find you can increase expression significantly before it starts to look odd.

## Review

Don't loom or lean.

Speak to pupils at their level or lower.

Encourage non-verbally – eyes, face and gesture.

It is also important that you withhold your opinion, and any 'correct' scientific viewpoint, in order to sustain an argument, but it is difficult to think on the spot how to do this.

## Task 12

### Verbal prompts and provocation

30 minutes

You will need to find out which phrases you use most in class. Ask a colleague (why not use a teaching assistant?), or pupils. Then copy and complete the table given below. Adapt the prompts to suit you.

Verbal prompt	Do I use something similar already? (yes/no)	Could I use or adapt? (yes/no)	Adaptations that suit me
Saying <i>nothing</i> for longer than pupils expect you to.	no	yes	Make sure that I count to three slowly before giving an extra prompt
'Is that right? What makes you so sure?'			
'What other information would help you sort out this problem?'			
'If you were allowed to guess anything, what would you say?'			
'What's the strength/weakness in your point?'			
'What do you think the main argument from others will be about that view?'			

'What would it mean to you if I say I disagree?' ... and 'What would it mean to you if I say I agree?'			
<b>Using other pupils</b>			
'What do <i>you</i> think?'			
'What's the matter with that idea?'			
'What's the strength/ weakness in his or her point?'			
'What do you think of his or her point?'			
'What convinces you that they are right or wrong?'			
'Which do you think best explains it – his or her answer?'			
'Can anyone suggest how you could check that out?'			
'Is she or he right or wrong? Why?'			
'I don't know – I thought I understood this but now you're trying to tell me ...'			
<b>Being non-committal</b>			
'That's a good argument/way of putting it.'			
'I wouldn't tell you even if I knew!'			
'That sounds possible to me – but I'm still not completely convinced.'			
'Remember there could be many ways to answer this.'			

'I think I'm changing my mind here ... run that past me again.'			
'Are you all happy with that answer?'			
'Remember there could be many ways to answer this.'			
'Are you all happy with that answer?'			
Adapted from Shakespeare 2003			

### Review

Withhold your opinion or the 'correct' answer for as long as possible.

Ask questions rather than provide answers.

Use others answers as prompts for argument.

### Task 13

#### Teacher intervention

20 minutes

Watch video sequence 6 which shows the science teacher intervening in a group talk activity.

Discuss with your partner teacher what the teacher on the video does to encourage the pupils to take part in the lesson.

## Task 14

### Putting it into practice

30 minutes

Review all the ideas you have studied in this unit which are summarised in the table below. Circle in colour any ideas you have never used or considered.

In another colour highlight the ideas you intend to try with your case study class.

Of these, prioritise with numbers the idea you think will have most impact in your lessons.

Reflect on your practice after each lesson. When you have successes or difficulties with the case study class, share them with other teachers who may have ideas to help you.

After at least four weeks of putting these ideas into practice, carry out the original questionnaire again – both your own views on pupils' likely perceptions, plus the pupils' views themselves.

<b>Grouping – size and composition</b> <i>I could use ...</i>	<b>Managing groups</b> <i>I could use ...</i>	<b>Stimulus for group talk</b> <i>I could use ...</i>
pairs	pair talk	explanation for group talk
small group (three or four)	pairs to fours	demonstration for group talk
large group (five to seven)	snowball	question and answer for group talk
friendship grouping	spokesperson	taking notes using group talk
ability grouping	envoys	worksheets and book exercises using group talk
groups with similar personalities together	rainbow groups	practical work using group talk
groups with different statements	number/letter/colour	misconceptions or false personalities together
single-sex groups	random numbering	artefacts, photographs, etc.
groups with equal numbers of boys/girls per group	random continuum	open ended questions
random selection for grouping	other ideas	group concept or mind maps
groups with pupils with same first language	other ideas	concept cartoons card sorts or continuum
		other ideas



## Summary

**Whatever** you choose to do, remember:

- grouping plans rather than seating plans;
- the choice of seating **and** grouping is yours;
- express grouping and seating in terms of learning not behaviour;
- change groups regularly;
- ensure pupils know what the *purpose* and the *product* of the discussion will be;
- make explicit the reason why they should;
- be considerate to the views of others;
- face each other, and sit as close together as possible;
- use eye contact;
- clear the desks before they talk as a group;
- work within the time targets set;
- don't loom or lean;
- speak to them at their level or lower;
- encourage non-verbally: eyes, face and gesture;
- withhold your opinion or the 'correct' answer for as long as possible;
- ask questions rather than provide answers;
- use others' answers as prompts for argument.

## Consider the research

### Cognitive and emotional development

Lev Vygotsky (1973) believed that it was children's interaction with others through language that most strongly influenced the level of conceptual understanding they could reach. He believed that we can learn from others, both of the same age and of a higher age and development level. One of the main ways this operates is through *scaffolding* in the *zone of proximal development*. This concept refers to the gap between what a person is able to do alone and what she or he can do with the help of someone more knowledgeable or skilled than him or herself. It is here that the role of teachers, adults and peers comes to the fore in children's learning. They can help bring the child's knowledge to a higher level by intervening in the zone of proximal development by providing children's thoughts with so-called scaffolds (small planned steps of support), which once the learning process is complete are no longer needed by the child.

His work has gone on to influence the thinking behind the CASE (Cognitive Acceleration through Science Education) and CLIS (Children's Learning in Science). Materials written to support CASE Adey *et al* (1989) which promote the ideas of

social construction (where learning takes place between members of a group) and metacognition (thinking about one's own thinking). The success of CASE methods in getting pupils to work in groups and resolve conflict is well established and these ideas can and have been successfully adapted for use at Key Stage 4 or post-16, for example, Moran and Vaughan (2000), and into the primary curriculum.

The influential writings of Daniel Goleman (1996) also highlight the importance of working in groups as a life skill, and one which is dependent on the emotional intelligence of the group members. He argues that schools have a key role to play in this aspect of the development of the whole person.

### **Pupil attitudes to group talk and argument**

- Pupils moving from primary to secondary classrooms are quoted in a recent study by the DfES (*Curriculum continuity, 2004*): 'You were expected to work as a group' (primary); 'There is less group work; teachers often expect you to work individually' (secondary); 'There were group work rules such as taking turns, having a chair, a scribe and a timekeeper' (primary); 'We only have group work rules in English' (secondary).
- In their study of pupils' attitudes to their science education, Osborne and Collins (2000) reported how pupils they interviewed 'appreciated teachers who were willing to engage in 'discussions'' and who allowed pupils to contribute. Some pupils equate 'writing' in science with 'work', with practical or discussion work seen as more engaging and providing welcome variety.
- Matthews' (2001) project involved pupils working in small groups of varying gender mix where they are asked to reflect on their own and others involvement in group talk. He concluded that, when combined with feedback discussions, collaborative learning in the pupils studied can lead to pupils getting on better and helping each other with their learning, and that this leads to pupils liking science more and being more likely to continue with it in the future.

The emphasis in Shakespeare (2003) is to provide stimulus for argument and then provocation to continue to defend or alter one's views in such a way that there is an emotional involvement in the science and thus greater motivation to resolve the dispute. This was supplemented by examples of phrases seen to work well in class that sustain and enhance the responses provided by pupils. In a later project, funded by Wellcome Trust and DfES entitled *Running arguments? – teacher skills for creative science classrooms*, D. Shakespeare, S. Naylor and B. Keogh worked with Bedfordshire teachers from Key Stage 2 to post-16 on the skills needed to run arguments in lessons. Pupils' opinions were sought as teachers changed their practice and behaviour in class and included reference to the positive attitudes pupils developed towards regular changing of groups and the chance to work with others, including the making of new friendships. Only a small minority reported a dislike for group discussion.

### **Managing group talk and the effect of teacher behaviour**

Through extensive studies of teacher and student behaviour in lessons, Kress *et al* (2001) illustrate the importance of teacher action in the class that helps pupils make sense of the science. Further, writers such as Robertson, and Neill and Caswell, have studied the importance of teacher behaviour and non-verbal communication and the influence on pupils' involvement in lessons. The need to express emotions and enthusiasm is critical to communicate the subject ideas in a lesson and non-

verbal aspects are critical. As part of identifying role behaviour in pupils in science, they also identified how pupils in practical work adopt roles such as the collector (gets the equipment), connector (puts it together and dominates proceedings) and observer (mostly passive), where the distance to the centre of action was important in determining the role adopted. These ideas can be applied to group talk, making the seating and orientation of pupils very important. Although based on a study of group seating in primary schools, Hastings and Chantrey Wood (2002) conclude that 'there is a strong pedagogical, empirical and essentially intuitive case for arranging the physical environment to support the attention and activities that a task requires ...' and suggest that '... involving children in changing from one to another is a viable *modus operandi*'. A similar case can be made for secondary age pupils.

The use of ground rules has been explored by an Open University team led by Professor Neil Mercer since the late 1980s, studying talk in lessons. Where pupils are engaged in productive talk in lessons, teachers agreed a set of ground rules for talk, making the purpose and value of talk in lessons explicit to pupils and how and why to engage one another in lessons.

## Development of scientific argument

Osborne ran the IDEAS project which culminated in 2004 in materials and ideas produced specifically for the development of scientific argument in lessons, based on teachers' and pupils' experiences and development in class. As well as being a source for ideas for stimuli for argument, it also promotes the explicit development of terminology with pupils: evidence, reasons, facts, persuasive language, etc.

## Group talk and assessment for learning

The *Assessment for learning Black Box project*, as summarised in Black *et al* (2003) highlights the importance of the importance of questioning, feedback and self- and peer-assessment in developing deeper understanding and ultimately raising achievement in class. The research project, involving teachers changing practice and monitoring the outcomes, involved techniques where small groups were useful if not essential.

## Next steps

In this unit there have been a number of suggestions for you to pair with another teacher or your science consultant as a means of support while you develop your confidence in developing group talk activities. Here are some ideas to consider in order to take this work forward:

- Start small: choose one class to work with. Year 7 would be a good choice because these pupils still have vivid memories of their primary school where they were used to their teachers changing their groups frequently. However, if you have another class you feel would respond well to this, then use them.
- Ask another teacher or your science consultant to help you. You may have an AST in school who is not a member of the science department but who is well versed in group talk techniques. They would be a good source of help.
- Ask for some protected time before the lesson so that you can check the resources and practise your script.

- Make sure your line manager or head of department or subject leader knows what you are doing. This will enable dissemination to happen much more easily.
- Share the class with another teacher and ensure you take responsibility for the group talk part of the lesson.
- Ask your science consultant to team teach the lesson with you. You should each take responsibility for parts of the lesson.
- Read some research about group talk from the range of references provided.
- Talk to your pupils about how this technique helps them to learn.

## Setting professional targets

Reflect on the experiences you have had while undertaking this unit and set yourself two targets to develop over the next year. Below are just a few suggestions of the kind of things you might want to undertake

Observe an AST or leading teacher in science who will be able to demonstrate the use of effective group talk and argument.

Work with your science consultant and plan to team teach a module using the techniques that you have learned during this unit.

Plan a series of lessons for next term using these techniques and invite a colleague to observe you teaching.

### Setting targets

Bearing in mind the guidance given above, reflect on the further steps you are going to take, perhaps by discussing the possibilities with a colleague or your line manager. Set yourself two targets to work towards over the coming year.

#### Specify:

- the outcomes you will seek in terms of developing effective teaching strategies to improve your expertise in the use of group talk;
- the strategies you will employ to achieve these outcomes.

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