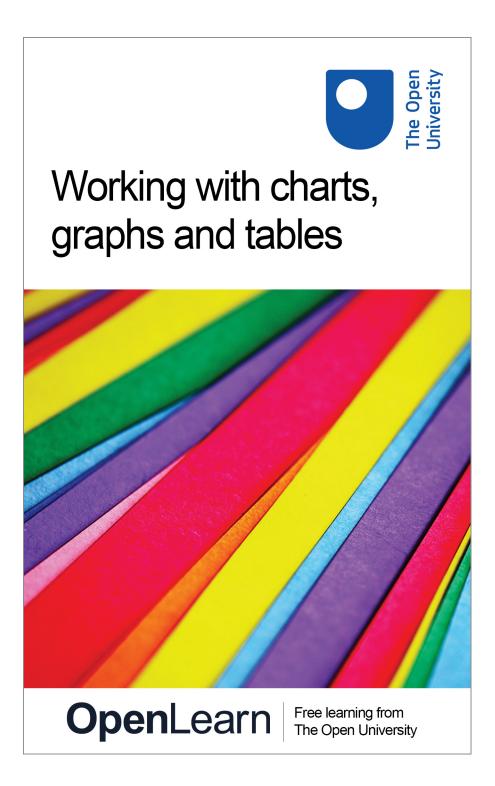
OpenLearn



Working with charts, graphs and tables



This item contains selected online content. It is for use alongside, not as a replacement for the module website, which is the primary study format and contains activities and resources that cannot be replicated in the printed versions.

About this free course

Find out more about studying with The Open University by visiting our online prospectus.

This version of the content may include video, images and interactive content that may not be optimised for your device.

You can experience this free course as it was originally designed on OpenLearn, the home of free learning from The Open University -

http://www.open.edu/openlearn/science-maths-technology/mathematics-and-statistics/mathematics-education/working-charts-graphs-and-tables/content-section-0.

There you'll also be able to track your progress via your activity record, which you can use to demonstrate your learning.

The Open University, Walton Hall, Milton Keynes MK7 6AA

Copyright © 2016 The Open University

Intellectual property

Unless otherwise stated, this resource is released under the terms of the Creative Commons Licence v4.0 http://creativecommons.org/licenses/by-nc-sa/4.0/deed.en_GB. Within that The Open University interprets this licence in the following way:

www.open.edu/openlearn/about-openlearn/frequently-asked-questions-on-openlearn. Copyright and rights falling outside the terms of the Creative Commons Licence are retained or controlled by The Open University. Please read the full text before using any of the content.

We believe the primary barrier to accessing high-quality educational experiences is cost, which is why we aim to publish as much free content as possible under an open licence. If it proves difficult to release content under our preferred Creative Commons licence (e.g. because we can't afford or gain the clearances or find suitable alternatives), we will still release the materials for free under a personal enduser licence.

This is because the learning experience will always be the same high quality offering and that should always be seen as positive – even if at times the licensing is different to Creative Commons.

When using the content you must attribute us (The Open University) (the OU) and any identified author in accordance with the terms of the Creative Commons Licence.

The Acknowledgements section is used to list, amongst other things, third party (Proprietary), licensed content which is not subject to Creative Commons licensing. Proprietary content must be used (retained) intact and in context to the content at all times.

The Acknowledgements section is also used to bring to your attention any other Special Restrictions which may apply to the content. For example there may be times when the Creative Commons Non-Commercial Sharealike licence does not apply to any of the content even if owned by us (The Open University). In these instances, unless stated otherwise, the content may be used for personal and non-commercial use.

We have also identified as Proprietary other material included in the content which is not subject to Creative Commons Licence. These are OU logos, trading names and may extend to certain photographic and video images and sound recordings and any other material as may be brought to your attention.

Unauthorised use of any of the content may constitute a breach of the terms and conditions and/or intellectual property laws.

We reserve the right to alter, amend or bring to an end any terms and conditions provided here without notice.

All rights falling outside the terms of the Creative Commons licence are retained or controlled by The Open University.

Head of Intellectual Property, The Open University

The Open University

United Kingdom by Thanet Press Limited, Margate, Kent

Contents

Introduction	6
Learning outcomes	7
1 Your worries and concerns with charts, graphs and tables	8
2 Reflection on mathematics	9
2.1 Reflecting on your mathematical history	9
3 Reading articles for mathematical information	12
4 Making sense of data	15
4.1 Reading data from tables	15
4.2 Interpreting percentages	18

Introduction 15/10/24

Introduction

Your course might not include any maths or technical content but, at some point during your course, it's likely that you'll come across information represented in charts, graphs and tables. You'll be expected to know how to interpret this information. This course will help you to develop the skills you need to do this. This course can be used in conjunction with **openlearn** course *LDT_4 More working with charts, graphs and tables*, which looks into more ways to present statistical information and shows you how to use charts, graphs and tables to present your own information.

Find out more about studying with The Open University by visiting our online prospectus.

Learning outcomes 15/10/24

Learning outcomes

After studying this course, you should be able to:

 reflect on existing skills and mathematical history, set up strategies to cope with mathematics and assess which areas need improving

- understand the following mathematical concepts, through instruction, worked examples and practice activities: reflecting on mathematics; reading articles for mathematical information; making sense of data; interpreting graphs and charts
- draw on a technical glossary, plus a list of references to further reading and sources of help, which can help to improve maths skills.

1 Your worries and concerns with charts, graphs and tables

Do you sometimes feel that you do not fully understand the way that numbers are presented in course materials, newspaper articles and other published material?

What do you consider are your main worries and concerns about your ability to understand and interpret graphs, charts and tables?

Spend a few minutes writing these down before you read on.

One student has said:

I am never quite sure that I have understood what the figures mean. I tend to skip over the graphs or charts that I come across, hoping that I can get the information I need from the text.

This is one course in a series of Student Toolkits; there are (or will be) others to help you with such things as effective use of English, essay writing, revision and exams, and other areas of study skills.

As a student, the amount of numerical information that you will have to deal with varies greatly from course to course. Many courses with no mathematical, scientific or technical content still require you to be able to interpret and draw conclusions from tables and graphs, and understand basic statistics. This course is primarily aimed at those who are not confident about their ability to do these things.

You may well feel that difficulties you have with the numerical information are holding you back from making progress in your studies. We hope that when you have worked through this course, you will have gained the confidence to understand and interpret the graphs, charts and tables you meet in your course work. That is, that you will be able to draw conclusions from tables and graphs, understand basic statistics, and answer the questions associated with them more effectively. Having a greater understanding of these areas will also allow you to read newspaper and magazine articles containing graphs, charts or tables with a more critical eye. This is a practical course and if you look at the course home page www.open.ac.uk/skillsforstudy/ you will see that it begins by asking you to reflect on your own ideas about mathematics. Many people try to avoid this area altogether, although they are actually using many more mathematical concepts in their everyday life than they realise. We strongly recommend that you spend some time on this section. The rest of the course works through the skills that you are likely to find useful, and which will allow you to get the most out of your studies. There is a technical glossary, which provides a basic explanation of the common mathematical terms we have used, and at the end we give you some suggestions for further sources of help.

We expect you to be an active learner and, as with your course material, we shall ask you to work through this course with a pen and paper handy so that you can do the activities as you go.

We anticipate that after you have worked through this course you will feel more confident about your ability to interpret and work with graphs, charts and tables. Hopefully, your understanding of course materials will be more complete and you will find it easier to tackle any assignments you may have to undertake. Remember though that these things do not happen instantly and that, as with any skill, it often takes a long time to master it completely. If this course helps to put you on the road to a better understanding of the numerical information that you meet everyday, then it will have achieved its aim.

Good luck!

2 Reflection on mathematics 15/10/24

2 Reflection on mathematics

Mathematics is a subject about which people have strong views, and these can be negative, positive, or a combination of the two. Our own experience, as tutors and students of mathematics, is that mathematics is often seen by others as something that 'isn't for me', and one where beliefs and feelings, especially worry and even fear, can be strong, as a result of previous unhappy experiences. We have written this section to help you to look at your mathematical background, so that you can understand some of the reasons you feel as you do.

2.1 Reflecting on your mathematical history

One of the obstacles that we see to understanding and working with mathematics is that people feel the need to avoid it entirely, because they feel nervous about it. Others don't feel as nervous, but may still avoid mathematical work. In practice, you may well be using more mathematical concepts than you think, as numbers are all around us; for example, when shopping, going out for a drink with friends, paying bills, or planning a budget so that you can take a holiday.

Activity 1

This activity is designed to get you to look at the previous experience you have of mathematics. It will take you between 15 and 20 minutes, and to put your concerns into context, we suggest that you carry it out before you begin work on the rest of the course.

All through school

Think about your schooldays: nursery or kindergarten, first or primary school, middle or secondary school. Now consider the following questions.

- 1. What were your experiences of mathematics?
- 2. How do you feel about these experiences?

Work and study since school

- 1. How have the jobs you have done since school affected your mathematical thinking? Think about reading newspapers, preparing reports, watching television. For example, when was the last time you noticed that you were thinking about mathematics?
- 2. In your experience of study since school, what more have you learnt about your own use of mathematics? What do you expect of yourself when you approach a mathematical problem: are you confident, worried, or concerned?

Now that you have completed this for yourself, perhaps you could check out the following questions, either on your own or with a fellow student or friend.

- 1. How could past experiences have influenced the way that you feel?
- Can you see why some people don't feel this way? Why could this be?

To help you, we have asked several people to complete this activity and have collected some of their views and feelings under three headings: 'Feelings about mathematics', 'Coping strategies for mathematics', and 'Need to learn mathematics'.

2 Reflection on mathematics 15/10/24

Feelings about mathematics

Many people have strong feelings about mathematics, often linked with worry or fear, from a difficult previous experience.

I wouldn't say I have learnt a great deal more since school and regret not having a better grounding in it. When faced with a problem I feel confident if the problem is within the realms of my capability. However, I do know that I end up going the long way round. Or as we say in Guernsey, I go round Sark to get to Herm (two islands off Guernsey).

I am constantly worried about the use of maths – I always presume that I will get simple problems wrong if numbers are involved.

We were mixed-ability taught in all subjects in the first year, but after that we were rigidly grouped according to ability and, as expected, I ended up in one of the lower maths groups, where I remained for the rest of my time at secondary school. Any chance of improving my mathematical skills were also limited by the school deciding we were a lost cause, and being taught by a procession of some of the most eccentric and disinterested teachers I have ever met.

It is possible that you came up with comments that are similar to these. We are not trying to suggest that everyone feels this way about mathematics; some people really enjoy it and others can get by, but feelings of apprehension can often get in the way of learning.

Coping strategies for mathematics

To get round feelings of worry, people have often developed very good coping strategies, and you might recognise some of these. There is nothing wrong with this at all; it's a sensible thing to do.

On reflection I suspect that I have spent most of my working life sidestepping anything vaguely connected with maths and have consequently developed a number of avoidance techniques. These range from 'I am busy at the moment, I am not sure what you want to know, try to work it out yourself', through to 'I haven't got my glasses' – all very similar to the techniques employed by those who have difficulty in reading.

If I see a pure mathematics problem then I don't attempt it. I tend not to be drawn to articles in newspapers/TV that have a mathematical focus.

I was good at hiding within the class... I usually stay quiet and I would never contemplate a job where I would have to add up in front of others.

I am not terribly confident when presented with certain sets of figures, but, if I work through it carefully, I can usually cope with it.

Need to learn mathematics

How much mathematics do you need to learn to study successfully? Well, that is likely to vary depending on the courses that you take.

I have just started a science course, so I know I will need to improve my skills.

I am aware that presumed difficulties with maths prevent me from attempting certain aspects of the course. Basic skills could help my confidence, though I feel it may be too late to start. (Arts student.)

In my previous course, I was studying German. My ideas about what mathematics meant to me were not even considered and did not develop

2 Reflection on mathematics 15/10/24

throughout. My next course (Third World Development) will be different, but I haven't started it yet.

What we have asked you to do here is to look at your experience of mathematics in the context of your experience as a student, as well as in the past. As you can see, other people feel unconfident about their use of mathematics. Now you can move on to considering what to do about it. The final question in the activity asks you to think about what you need to concentrate on now, and we hope that you are now ready to look at the rest of the course.

3 Reading articles for mathematical information

We gain much of our mathematical information from our surroundings, including reading newspaper and magazine articles. A skill that will be useful to all of us in our studies is the ability to do this in a structured way, as it is very easy to be uncritical of the information that we see. Newspapers and magazines frequently place mathematical information in the form of graphs and diagrams. All too often, we tend to assume that the information is correct, without questioning possible bias or inaccuracy by the author or authors.

When you next look through a newspaper or magazine, try to get an idea of which ones

When you next look through a newspaper or magazine, try to get an idea of which ones use some form of mathematical representation. We noticed that some magazines rarely use this form of information, and that broadsheet newspapers were more likely to use mathematical information than the tabloid newspapers.

Activity 2

To show you what we mean we have included a newspaper article, 'On your marks' taken from *The Guardian*. Read it now and then answer the questions below before moving on to the discussion. You can download a more easily readable Word version here: On your marks.

On your marks

Jim Sweetman reports on the changes to education that parents of primary schoolchildren are starting to encounter

ew governments spend their time saying what they plan to do and perparing the legislation to make it happen. So it is only now, after a year in office, that Labour is beginning to make its mark on schools in ways that directly affect parents and children.

Pareets with very young children are coming to terms with free nursery education for all four-year-olds. The biggest change is that the education authorities are responsible, so all the information should be available through primary schools. The choice of whether to take up the offer from there, or offers from state-cun nurseries, independent nursery schools (there may be topage fees) and playgroups is up to parents, so it is important to plan ahead. There have been murmurs that some primary heads will only guarantee school places to parents taking up their offers of nursery places — but they have no right to do this.

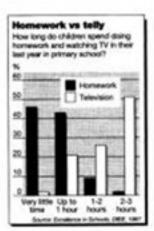
Once a child is in primary school, the new baseline assessment looms. This is a simple test of reading and maths carried out by the reception class teacher. Parents are asked not to practise for this or even to tell the child what is going to happen but natural human competitiveness and the desire for one's child to make a good impression will probably

encourage many to do the opposite. Interestingly, when such tests were introduced in the US, researchers noticed that the children who did best were not the cleeverest but those who realised a test was taking place. The results are important to schools because there is a strong emphasis on trying to measure what schools add to children's performance.

Comparing a baseline assessment with a set of key stage 1 test results at age seven will give a "value-added" measure of the work of a school. Purents can easily sor that if children give an average performance on baseline assessment, but above average at key stage t, the school will appear to have done its job well, but if parents practise so that their children do unexpectedly well on baseline assessment, the opposite effect occurs!

From all the announcements. many parents may be expecting to find their child in a class with fewer than 30 pupils from September. Whether that happens depends partly on lock and partly on where you live. So far, about half of all local education authorities have been given funding to achieve this. Some are moving quickly; others have been much slower. The Government has made plain to local authorities that they must not reduce class sizes in popular schools by limiting choice and diverting children to unpopular schools with places available. The cash must be used to provide more teachers and more classes in successful schools.

For children in primary schools, the introduction of the national



literacy and numeracy strategies will bring changes to the structure of their school day and their lessons. The national curriculum has been changed so that there is no computory list of what must be taught in science, design and technology, history and geography. The subjects will still be taught but given less attention to allow a new — and much increased — stress on reading and basic maths. Each of these should be taught for around an hour a day with lots of formal class teaching — led by the teacher from the front — followed by group work.

The changes are intended to raise national standards of literacy and numeracy over the next four years to the level of our international competitors and every local author ity and every school will have its own targets to meet to make this happen. Experience shows that bright, outgoing children have little to fear. However, the challenge for the teacher is to make space for the average and below-average pupils, for those with special needs and those who are naturally reticent an shy about speaking out. Skilful teachers can do this well but man teachers may struggle at first with a new programme and changed ways of working.

Homework is another new o em for the Government. The fact that 70 per cent of children in their but year of primary school do less than half an hour's homework but watch well over two hours of television a night has to be a concern for parents, especially when there is research evidence that the pupils who do most homework are that do best at school. It is likely that the Government will publish guidelines on homework later in the year but, in the short-term, it expects to see many schools asking pupils to do more from Septemb ed trying to involve parents in their homework programmes

- What influences might the identity of the newspaper have had on how you react to the diagram or article and, in particular, to the conclusions drawn?
- 2. Where was the data in the graphs derived from?
- 3. How does it relate to the article?
- 4. What conclusions can you draw from the use of the graphs related text?
- This is difficult to answer. The Guardian is a broadsheet, and has a reputation for reasonably accurate reporting. This material is from The Guardian Education (published weekly on a Tuesday) – you might feel this tends to give an air of authority.
- 2. The data was taken from a Department for Education and Employment (DfEE) publication, called *Excellence in Schools*, and published in 1997. Therefore, the UK Government published the data. The data relates to the amount of

- homework and television that children in their last year of primary school were doing in other words, while they were aged about 11 or 12.
- 3. If you look at this article carefully, you will see that the last paragraph of the article is the only one that discusses the data.
- 4. The author has linked the data to the discussions about changes in schools. He talks about the reduction in class sizes that was a pledge made by Labour at the 1997 election, and the baseline assessment tests. He suggests that the children who do least homework also watch the most television, but you can't see that from the figures given in the diagram. While the two activities do seem to be related, it is possible, for example, that some children don't watch any television and don't do any homework.

To find examples for the rest of this course, we looked through a variety of sources to see how mathematical information is presented in newspapers and magazines. We are not suggesting that the ones we selected are entirely representative, as we have deliberately chosen examples that will help you to question what you see. This means that some of the graphs and diagrams that we have used are accurate representations and others are less so. However, although we have chosen these representations carefully, we had no difficulty in selecting across the spectrum from completely accurate to misleading. We suggest that you bear this in mind as you look at the information you see around you.

4 Making sense of data

4.1 Reading data from tables

Tables are used as a way of describing what you are talking about in a structured format. They tend to be used to present figures, either as a summary or as a starting point for discussion. Tables are also probably the most common way of presenting data in educational courses.

Tables have always been compiled by someone. In doing so, the compiler may have selected data and they will have chosen a particular format, either of which may influence the reader. You need to be aware of the compiler of any table you are looking at. Could it be someone who is trying to tell you something in particular? For example, if a table were showing the costs of running a hospital, would you expect figures from the government or the local administrators to be more accurate? The government may be trying to make a comparison across the whole NHS, whereas local administrators may be trying to explain why they are a special case. If you consider one source to be more accurate than another, try to think of reasons why you do so. It may be due to where your sympathies lie.

Tables are a very common way of putting information across to people; so common that we probably don't notice that they are there most of the time. On the other hand, they can look quite formidable when there is a lot of information presented at once, and finding your way around them can be hard. To be easy to read, tables should have a title and sub headings. Often, there will be details of where the information in the table has come from, but this is not always the case.

Activity 3

Look at the table entitled 'The changing face of UK business schools' and note down your answers to the following questions.

The changing face of UK business schools

	Now compared with 1994			Projection for 1998 compared with now		
	less	same	more	less	same	more
Proportion of business represented by:						
Short courses (open programmes)	2	12	5	1	10	6
Short courses (tailored programmes)	4	8	8	2	4	14
Full-time MBAs (open)	4	8 7	10	3	8	7
Part-time distance-learning MBAs (open)	4	7	10	1	9	9
In-company MBAs	1	5	4	1	5	4
Consortium MBAs	1	6	5	1	4	6
MA/MSc specialist courses	0	4	14	0	6	12
Proportion of self- financing students	2	12	8	3	13	7
Proportion of overseas students	1	5	17	0	12	11

PM sent questionnaires to 50 established business schools in February 1996, of whom 23 replied. Not every school responded to every question. The respondents were:

Aberdeen Business School
Ashridge Management College
Aston Business School
The Birmingham Business School
Bradford University Management Centre
University of Cambridge, Judge Institute of
Management Studies
City University Business School
Cranfield School of Management
De Montfort University, School of Business
University of Exeter, Centre for Management Studies
Henley Management College
Imperial College, London, Management School

Kingston Business School
Lancaster University Management School
University of Leeds, School of Business and
Economic Studies
London Business School
Manchester Business School
Manchester School of Management, Umist
South Bank University Business School
University of Stirling, School of Management
Strathclyde Graduate Business School
Warwick Business School
University of Westminster, Faculty of Business,
Management and Social Studies

Source: People Management 21 March 1996

- 1. Where does the table come from? When was it prepared?
- 2. Where does the data come from? Does its source tell us anything?
- 3. On the left-hand side of the table is a list of headings referring to proportions. What could make this easier to follow?
- 1. The table has been taken from a publication called *People Management*. This is the house journal for the Institute of Personnel and Development, a professional organisation that has a membership of human resources and training staff, especially in industry. It was prepared for an article in

- March 1996, but we can't tell from the table itself, or the explanatory notes, exactly when the data was collected.
- 2. The information comes from a group of 23 out of a possible 50 business schools that *People Management* contacted. This is only a sample of the possible business schools in the UK. *People Management* tells us that questionnaires were sent to established business schools, but we don't know what criteria were used to decide what is meant by 'established'.
 - We have no information about how *People Management* chose the original sample or why only business schools in England and Scotland replied. It may be that business schools in Wales and Northern Ireland were not asked or were not interested. The Open University Business School is not mentioned here, and again we don't know why this is.
- 3. The headings could be expressed more clearly. Overall, the table is trying to convey two types of information. The first is about the number of business schools who run certain types of course and changes in these course-types over a four-year period. The second is about how business schools perceive changes in proportions of their business income.
 - The table includes the heading 'Proportion of business represented by:' followed by various row-heads such as 'Consortium MBAs'. Proportion usually means a percentage (see page 13), but the figures seem to relate to the *number* of business schools in each category: none of the values for 1994 or 1998 add up to more than the 23 organisations that responded. Therefore, the heading should perhaps read 'Number of business schools who think that their business incomes will increase/will not change/will decrease'.

Short courses (open programmes). Most of the respondents here, 12 out of 19 (about 63 per cent), feel their business has remained stable, 2 feel that it has decreased and 5 that it has increased since 1994. In other words, two and a half times more business schools feel that business has increased rather than decreased in this area. These courses seem to be increasing overall as a proportion of income, but not in a significant way. However, the business schools appear to be expecting more change in future, note the 6 in the last column. Looking forward, the same numbers of business schools think that the proportion will change. It depends on how you interpret these figures, though. We could say that:

 6 times as many business schools are expecting to run more short courses than are expecting to run less such courses

or

one more school (6 looking forward rather than 5 looking back) has decided that they
are likely to increase the proportion of students who will be represented in this
category

or

only 6 out of 17 (about 35 per cent) could see an increase in students by 1998.

Any of these is a truthful statement, but they give very different pictures, don't they? **Short courses (tailored programmes).** These are programmes made for a particular audience, mainly for a single organisation. Looking back, these seem to show a similar

pattern, where twice as many business schools are looking at an increase than a decrease. This is a more changeable pattern, with only 8 out of 20 (40 per cent) of the group showing no change. Looking forward though, only 4 out of 20 (20 per cent) imagine there will be no change in tailored programmes, whereas 14 out of 20 (70 per cent) imagine that this will increase by 1998.

Note: To convert 8 out of 20 to a percentage, we carry out the division 8 ÷ 20. This equals 0.4; this is then multiplied by 100 to express it as a percentage. Expressing all the values in the table as percentages enables easier comparison. Try it yourself for the full-time MBAs in 1994. (The answers are 18 per cent, 36 per cent, and 45 per cent. This doesn't add up to 100 per cent, but to 99 per cent, so we would normally round one of the numbers up. The one that is nearest to the next whole number, is 45 per cent, so it becomes 46 per cent.) Percentages are discussed more fully in Section 4.2.

Activity 4

Now, think about the patterns shown by the proportion of overseas students. What are the perceived changes and expectations here?

Only 5 out of the 23 business schools feel that they have the same number of overseas students as in 1994, i.e. about 22 per cent of the sample. Change has been very strongly biased towards an increase in overseas students, with 17 out of 23 (about 74 per cent) of the business schools seeing an increase over the two years. Looking forward, no business school thinks their proportion of overseas students will reduce: 12 out of the 23 (about 49 per cent) business schools don't see a change in the proportion of students in this category, and 11 out of the 23 (about 48 per cent) see a likely increase here.

Activity 5

Overall, what does the table show us about the changing face of UK business schools?

First, it tells us absolutely nothing about the number of students involved. You will have noticed that we have been referring to proportions of students in the business schools, rather than actual numbers. That is because there is no information here. Any business school could have had a huge increase or decrease in numbers. Those who are predicting an increase could have 20 or 2000 students. We simply don't know from this table. Secondly, looking at the short courses, and our discussion above, there seems to be an increase in a perception that tailored short courses are growing as a form of business.

4.2 Interpreting percentages

Many articles give information in the form of percentages. In such articles, tables and other numerical information are also often presented in terms of percentages. Percentages are used so often because they enable comparisons to be made more easily. Every percentage is expressing a value as a fraction (that is, as a proportion) of a

hundred. 'Percent' is denoted by % and means 'out of a hundred', so 75% means 75 out of 100.

Look at the table in the article in Activity 6. It considers the provision of company cars in the private and voluntary sector. What is the percentage of Chief Executive Officers (CEOs) in the private sector with company cars?

It is 75 per cent. If we say that 75 per cent of CEOs in the private sector have company cars, we mean that 75 out of every 100 CEOs have a company car.

As a fraction, this is written as ^{1/10}, and this is said as '75 over 100' (^{1/10} is the same as ^{1/2}), As a decimal 75 per cent is 0.75. This is said as 'nought point seven five' – note that each number after a decimal point is said separately, and that the leading zero (nought) is always included.

Activity 6

What can we tell about the table entitled 'Provision of company cars', using the questions we asked earlier and which are reproduced below the article?