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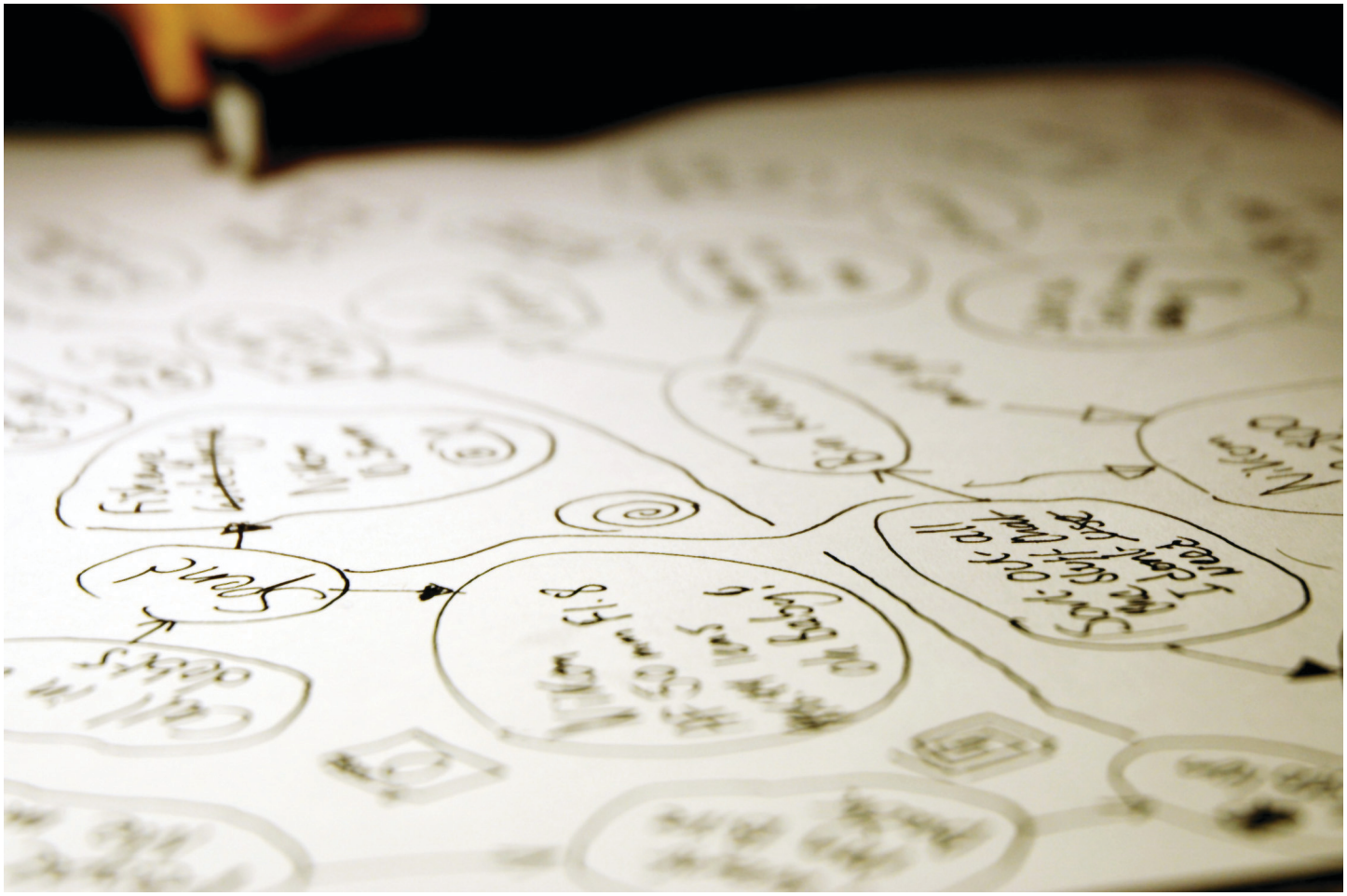
Extending and developing your thinking skills



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Introduction

This course is designed to take you on a journey of understanding. You will be introduced to a variety of thinking skills and ways of extending and developing your thinking. You will begin by looking at why thinking skills are important in education, and what kinds of skills are valued. You will then move on to some practical strategies and ideas for further activities and reading.

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Learning Outcomes

After studying this course, you should be able to:

- feel more confident about studying
- understand any grades received and how to improve them
- overcome problems with reading and writing
- make the most of the opportunities a higher education course provides for developing skills

1 Overview

This course provides an introduction to thinking skills and ways of extending and developing your thinking.

But why do you need to do this?

Take a few moments to reflect on your reasons for looking at this course and ways in which you hope it will help you.

Perhaps you thought you would find it useful? Or maybe you have particular worries or concerns about thinking that have made you want to look at this issue in more depth. Looking at thinking skills is something that is not always easy to make the time to do or realise is important. However, we hope that this course will help you to understand that extending and developing your thinking skills is one of the most important and rewarding challenges of higher education. We hope that it will help you to recognise that many of the difficulties and frustrations of study are underpinned by problems with thinking. The processes of growth and change in thinking that you will experience as you progress in your studies can also be difficult, but are worth the effort. We particularly hope that you will find ideas that will be of practical benefit.

This course has been designed to lead you on a journey of understanding. It begins with seeing why thinking skills are important in education, and what kinds of skills are valued. It then moves to some practical strategies and ideas for further activities and reading.

You may find the ideas presented here are useful preparation for more in-depth development of your skills in other areas such as learning how to learn, and reading and note taking.

You may want to work all the way through this course, or just dip in and out. It is a resource for you to use in whatever way you find best helps your learning. As thinking and learning is most effectively developed through active involvement, we have included lots of activities. So, have a pencil and paper on hand and be prepared to think.

2 Understanding the importance of thinking skills

We would like to start by asking you to consider some fundamental questions about education.

Activity 1

Note down your responses to the following questions.

- Why do people become university students?
- What do you see as the purpose of higher education?
- How do you think your answer(s) to the previous question would be different from the answers that the government, employers or university teaching staff might give?

There are, of course, no set answers to questions of this sort. People and organisations have their own reasons and views. People give a range of reasons for becoming Open University students. For example, to improve job prospects, to explore and gain knowledge of a subject area for interest, to develop themselves generally, to have contact with others. Perhaps your responses to the second question were the same as to the first. Or maybe you mentioned more general skills and attributes that can be gained such as confidence, communication or interpersonal skills.

Did you include extending or developing thinking skills in any of your responses? If you did, how important was this in relation to other reasons you listed for study and higher education? The ability to think, particularly the ability to think critically, is often cited as one of the main purposes of education by those involved in delivering higher education today. Look at the following quote and compare it with your answers.

Traditional aims of higher education

- *adopting a distinctive way of thinking about concepts, evidence and theories*
- *taking a distanced, critical stance towards subject matter, assumptions and explanations*
- *tackling issues systematically, logically, and effectively*
- *examining the adequacy of evidence and checking alternative interpretations of it*
- *demonstrating a thorough understanding of complex, abstract concepts within the discipline*
- *writing clearly and cogently, following appropriate academic styles and conventions*
- *being able to set and solve problems by applying concepts and techniques appropriately*

(Entwistle, 1994)

Activity 2

Can you suggest why thinking skills are considered to be so important in education today?

Education can be seen as the main way of developing individuals and society. There are a range of possible reasons you might have suggested for thinking being an important area to develop. Perhaps your reasons were related to economic factors, or perhaps social, cultural or educational factors. A strong argument these days is that knowledge is central to our information age and movement towards a knowledge-based economy. The creation and use of knowledge depends on our ability to think. Good thinking could be viewed as empowering for individuals and society. Education can be seen as a process of joining a community in a subject. So you may become, for example, a social scientist or mathematician by learning the thinking styles, language and other characteristics of that community.

Your reasons for studying and what you see as the purpose of higher education will influence your thinking, styles of study and other aspects of learning.

3 Different kinds of thinking

Thinking is something we do all of the time.

Activity 3

Briefly write the story of your day so far reflecting carefully on the amount and types of thinking you have done.

Perhaps your day started like the following extract:

> *A day in the life of…*
>
> I started my day trying to decide whether to get up straight away when the alarm went off. I thought about the consequences of having a 'lay in' for an extra ten minutes. If I did this, would I have time to get my children ready and off to school in time? No I wouldn't so I got up! I chose some clean clothes and got dressed after having a wash. The letters were on the mat when I went downstairs and I sorted them and made a pile for each member of the family. I wondered whether to bother opening the letter claiming I was the lucky winner of a grand prize. After everyone had breakfast and set off for school and work I settled down to do some studying. I spent a few minutes daydreaming then started to sort my notes out and group them into related sections.

This person engaged in a lot of thinking - making decisions, considering consequences, classifying and sorting, and daydreaming. Whatever your day was like, this activity is likely to have illustrated that you can and do lots of thinking and that there are many different kinds of thinking. How did you describe the types of thinking that you did? Perhaps you included some of the words and terms in the box below? These are all important thinking skills. Thinking is an active process, and the words used to describe it are usually verbs.

Words to describe thinking

finding, deciding, solving, justifying, remembering, planning, arguing, identifying, speculating, calculating, comparing, deducing, presuming, analysing, summarising, hypothesising, evaluating, sequencing, ordering, sorting, classifying, grouping, predicting, concluding, distinguishing, creating, planning, testing, assessing

(Adapted from McGuinness, 1999)

3.1 Thinking in a higher gear

While we can all think, it is important to recognize that the thinking skills we have looked at so far are not all required or equally valued in academic work. Common to all subjects and levels is the concept of higher and lower order thinking skills. Higher order skills are considered to be more complex than lower order skills. The triangle model (Figure 1)

provides a useful way to visualise the relationships between some of the key intellectual skills valued in education. The complexity of the skills increases from the base to the top of the triangle.

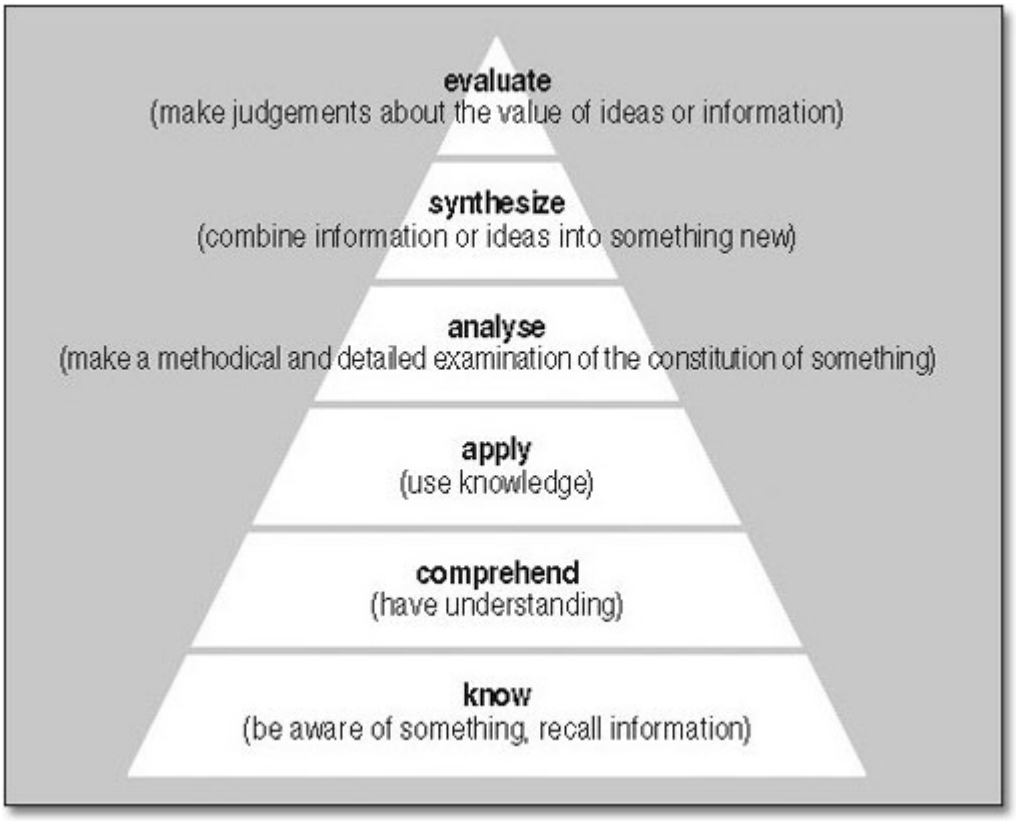


Figure 1: Levels of intellectual skill — the thinking triangle
(Adapted from Bloom, 1956)

Although the skills in Figure 1 are arranged in a hierarchical way, they are all important. Much of the thinking we do involves a mixture of skills at different levels. We develop and use them simultaneously, for example, when we are solving problems and analysing case studies. One of the key aims of education is to extend and develop higher order thinking skills - to develop thinking at a qualitatively higher level, to move into a higher gear.

When you are studying, it can be helpful to recognise the words people use to describe thinking at these different levels.

Activity 4

Try making a list of verbs that might describe or demonstrate thinking at each level of the triangle shown in Figure 1.

Here are some examples.

Evaluate	*judge, appraise, choose, rate, assess, estimate, value, measure, criticise*
Synthesise	*formulate, teach, design, develop, re-define, propose, create*
Analyse	*distinguish, differentiate, calculate, debate, relate, compare, experiment, contrast, examine*

Apply	*demonstrate, schedule, operate, sketch, employ, use, practice*
Comprehend	*restate, identify, discuss, locate, recognise, review, explain, tell, clarify*
Know	*recall, define, state, list, repeat, name, recount, present, find*

(*Adapted from Latimer and Noble, 1996*)

3.2 Looking at the thinking a further education course involves

A further education course will provide many practical opportunities for developing thinking. These will be integrated into activities such as: reading texts; doing in-text activities and self-assessment questions; listening to tapes; watching videos and TV programmes; making notes; doing assignments and reflecting on assignment feedback; doing exams; participating in tutorials; attending day schools, workshops and residential schools; participating in self-help groups; talking to a tutor; planning studies.

Reflecting on the thinking of such a course involves can be useful in understanding which skills it has been designed to help you acquire and what will be looked for in assessments. As a starting point, take a look at some of the thinking skills in an assignment question or activity from your course.

Look at the assignment questions in Activity 4. Look at the tasks they set and consider the thinking skills involved. You may find it useful to highlight or underline relevant words or phrases.

Activity 5

Example 1 - from an Open University Level 1 maths and computing course

Don't worry if you are not a mathematician - the point of this example is to understand the idea of looking at a question to see what thinking skills are expected. You are *not* expected to understand or be able to answer this question.

I have lent a member of my family £1500 and it is being repaid at the rate of £75 a month. As this is a family loan, no interest is being charged.

(i) How many repayments will there be to clear the loan?

(ii) If b_n is the balance still owing at the end of the nth month (assuming the payment is made just before the end of the month) write down the recurrence system for b_n .

(iii) Find the closed form for b_n and use it to calculate the number of payments that will be needed to pay off the loan.

Example 2 - from an Open University Level 2 psychology course

Discuss the models of memory and consider their usefulness in real life situations.

To answer Example 1 successfully requires particular *knowledge* and *understanding.* For example, how to work out repayments on loans, what special terms like 'b' and 'recurrence system' mean. The terms 'find' and 'calculate' indicate that the ability to *apply* this knowledge to examples is being tested.

In Example 2, the process word 'discuss' suggests that you need to explain, give different sides of an issue, consider implications and so on. To answer this question, you need to know and understand the theories, and be able to apply and analyse them. You also need to evaluate their strengths and weaknesses.

These examples illustrate an important general point - that learning at university (whatever the level of study) is *not* just about remembering and recalling information and facts. More sophisticated thinking is expected. You will find that different courses will make different intellectual demands depending on the nature of the subject and the level of study. As you move up the levels of study, the intellectual demands will increase. You will usually be required to engage in more higher order thinking.

As the meanings of words can be open to interpretation, it can be helpful to discuss assignment titles with your tutor or fellow students, whatever your course.

4 A thinking disposition and the process of development

In order to make effective use of opportunities for developing your thinking, you need to develop a thinking disposition as well as thinking skills.

Activity 6

The following checklist covers some of the important elements of a thinking disposition.

How do you rate yourself?

Personal statements	Always	Sometimes	Never
I see myself as open and fair minded.	☐	☐	☐
I am curious to find out about things.	☐	☐	☐
I am really interested in the content of my course.	☐	☐	☐
I relate ideas to previous knowledge, experience and wider contexts.	☐	☐	☐
I look for patterns and relationships between things.	☐	☐	☐
I like to ask questions and not accept things at face value.	☐	☐	☐
I don't rush to make judgements or have opinions on things.	☐	☐	☐
I like to look at all sides of an argument or issues before coming to a conclusion.	☐	☐	☐
I am persistent and like to get to the bottom of things.	☐	☐	☐
I don't like situations where people just state opinions without giving reasons or evidence.	☐	☐	☐
I like to find things out for myself and come to my own conclusions on things.	☐	☐	☐
I like to be creative and innovative.	☐	☐	☐
I take time to reflect on things/my own thinking.	☐	☐	☐
I like clarity, order and precision.	☐	☐	☐
I think strategically about things.	☐	☐	☐

We would not be surprised if you had a mixture of ratings in your responses. These characteristics may not all be ones you have needed or wanted to develop for everyday life. However, reflecting and working on the attitudes and behaviours of a thinking disposition may be something you will find helpful to your studies. There are ideas in this course that will help you in some of these areas.

All students in higher education are encouraged to develop *courage* and *independence in thinking.* Starting to study is much like learning in other areas of life. Sometimes, we feel like an outsider who knows nothing compared with the experts in the field. At this stage, knowledge may be seen as something vast and complicated that comes from books and experts, and learning as being about having some of this knowledge transferred to us. We may feel that with all these experts and knowledge around there must be an answer to everything - it is just a matter of finding it. At this stage, we may not have views on things, or feel our views are not legitimate or of any value. Sometimes, we start out with a more confident approach, the views we already have are the right ones and things are straightforwardly right or wrong.

As we move on and become more involved in our subject, we realise that not everything is known, even by experts. We realise that what counts as valid knowledge depends on the context (because knowledge may change with time or culture). We also begin to realise that there are different views, even if we treat them as equally valid because we do not have the confidence or skills to judge them. Eventually, we may reach a point at which we have engaged sufficiently with our subject and developed the skills and confidence to have our own views based on careful consideration (reasoned judgement, evidence, values). We realise that intellectual development never stops, and that we are part of the process - thus, knowledge is created by us.

Like any change, the journey of intellectual growth can be challenging, risky and painful but it is also extremely rewarding. Reflecting on critical incidents and turning points in our thinking can be a valuable tool for development.

Activity 7

Think of an issue or topic from your everyday life about which your thinking has changed and developed. Perhaps something practical like becoming computer-literate, or your thinking on a topical or ethical issue such as fox-hunting, animal experimentation or euthanasia. How did your views and thinking change? What contributed to the change? What was the experience of change like?

It is common for people to change their thinking and views. Gaining more information or a particular experience, incident or need can sometimes be a triggering factor. For example, having (or being close to someone who has) a serious illness requiring drug therapies that have been tested on animals may trigger more thinking on this issue and perhaps shed a different light on it.

Having our established ideas and activities challenged can be uncomfortable. We may feel angry, threatened and want to resist change; or perhaps shocked and sad. Perhaps we experience guilty feelings about previous uninformed views. But, ultimately we will move on and grow as a result of such changes. Like other aspects of our lives and learning, it is important to remember that thinking is intimately connected to our feelings, environment, experiences and other factors. To move on and grow, we need challenge, change and new experiences. So, seek out opportunities to develop - 'Man's mind stretched to a new idea never goes back to its original dimensions' (Oliver Wendell Holmes).

Remember that, like other skills, thinking improves with persistence, tenacity and practice. Evidence shows that people who are high achievers in their field have strong foundations in the basics, they practise a lot and have usually built up extensive experience over a

long period of time. Quotes and mottoes can be a useful tool to help you remember this and keep going. Why not start a collection? Here are a few examples to start you off.

- Everything is difficult until it is easy.
- Achievement is 99% perspiration and 1% inspiration (based on Winston Churchill).
- You may be a starter, but are you a finisher? (based on Margaret Thatcher).

It can also be useful to recognise that thinking also develops outside study time; it is something you can work on all the time. Ideas often need a while to incubate. Taking a break from study can be a good technique for coping with writers' block or getting the creative juices flowing. Inspirations and good ideas sometimes come at unexpected times. Many highly successful thinkers from a range of fields (including novelists, scientists and inventors) have kept a notebook on hand all the time to reflect on and capture thoughts before they are forgotten. Leonardo da Vinci is one famous example.

Activity 8

Obtain a handy-sized notebook that you can keep with you to note down ideas, particularly those relevant to your study. You could use your notebook to keep a thinking log or diary over the next week or so. You may find it helpful to note down the particular times or places that are most productive for your thinking.

If you think this could fit in with your style of thinking, make a point of always keeping a notebook with you. Remember that everyday life provides many occasions for development. Applying what you have gained in one setting to others is an excellent way of really testing and developing your abilities.

Although developing thinking requires effort, it can bring rewards in all areas of your life. Recent scientific studies have shown that 'people who keep their minds alert and engaged age far more successfully than those who do not' (Rice, 1991). Good thinking is valuable in every sphere of life.

5 Other people

Other people can be one of the best tools for developing your thinking. Engaging with others, for example in debate and discussion (either face-to-face or at a distance) is how we most effectively develop our thinking and construct knowledge. This is why many educational institutions encourages, for example:

- dialogue with a tutor in writing (through the assignments)
- participatory learning methods such as group activities in tutorials
- self-help groups.

We would encourage you to seek out and make use of opportunities to articulate your thoughts and share thinking with others. You might include friends, family and workmates. Brainstorming and bouncing ideas around with others can be really productive, especially for creative thinking.

Activity 9

Brainstorm a topic with one or more other people. To do this, jot down anything connected with the topic as it occurs to you. Don't stop to consider whether or not the ideas are useful at this stage, just get them down.

When you have got the ideas down on paper, you can reflect on them and see how they fit together.

As a student, it can be useful to think of yourself as an academic apprentice. You can learn from others, particularly expert thinkers (those who have already developed the skills you are seeking to acquire), by listening, observing, and engaging in dialogue. Like an apprentice, you will develop most effectively if you recognise and accept the fact that you are a novice and need direct support in developing your skills. Higher education, and a course tutor in particular, could be seen as having a role in coaching you to develop the skills you need. You may find it useful to have intellectual role models.

Activity 10

Next time you receive a marked piece of work take time to *stop, think and review* your work and consider how you can make use of the feedback provided. Think about the following points.

- Your immediate reaction to the grading and comments - were you pleased or disappointed? Was it what you were expecting?
- What points did your tutor make that relate to your thinking?
- Did your tutor provide comments that could stimulate and develop your thinking?
- Do you understand the feedback you have been given and the reasons for the grade awarded? If not, ask your tutor for further explanation.
- What were the strengths and weaknesses of your work? Did you demonstrate appropriate thinking skills (e.g. understanding, analysis, use of evidence)?

Make a note of the areas you want to improve on for next time and how you will go about this.

Think about your last tutorial, consider the extent to which you engaged with others in ways that developed your thinking. Here are some suggestions.

- Did you participate in discussion?
- Did you stop and think before making judgements and expressing views?
- Did you and others provide evidence to support points of view?
- Did you listen carefully to others?

Again you can make a note of areas you would like to develop in future.

Being proactive in seeking feedback on your thinking and making use of feedback that is given (e.g. in tutorials and assignments) will help. Being able to accept guidance and constructive criticism and learn from it are other skills to foster for developing thinking.

6 Questions

> *Thinking itself is nothing but the process of asking and answering questions*.
>
> (Anthony Robbins)

> *The important thing is not to stop questioning. Curiosity has its own reason for existing. One cannot help but be in awe when he contemplates the mystery of eternity, of life, of the marvellous structure of reality. It is enough if one merely tries to comprehend a little of this mystery every day. Never lose a holy curiosity*.
>
> (Albert Einstein)

University students are encouraged to be curious and ask questions. Asking and answering questions is at the heart of high-quality thinking. Questions naturally arise from the desire to know and learn about things. Questions may be the starting point for whole areas of study. For example, 'Why does an apple fall to the ground?' or 'Why did the Roman Empire fall?' are important questions leading to areas of study in science and history. Formulating questions can be a valuable way of structuring thinking and finding a way through learning resources. Questions provide ways to clarify issues, focus attention and explore assumptions.

You can use questions to develop your skills at the different levels of thinking described in Section 3. Table 1 contains examples of questions for each level.

Table 1: Questions to develop skills at different levels of thinking

Level of thinking	Examples of questions
Knowledge and understanding	What? Who? When?
	What is an example of x?
	What is meant by …..?
	What is another way of explaining..?
	Is this an example of …?
	Can I describe x in my own words?
Application	How is it used?
	What does it relate to?
	In what situations …?
Analysis	Why? How?
	What is the reason for ….. ?
	What evidence is there to support the conclusion?
	What are the causes of …?
	How do … fit together?
Synthesis	If x happens, then what next?
	What does the theory predict will happen?

	What are my own conclusions on the basis of the information available?
	How does x relate to y?
Evaluation	Is this good or not and why?
	Is this reasonable or not and why?

So, for example, if you were considering the Second World War, you might ask the following questions.

- Knowledge - What was the Second World War? When was it? Where was it? Who started it?
- Analysis - Why did it happen?
- Synthesis - How did the different decisions and events combine to produce this historical event?
- Evaluation - How reasonable was the original decision to declare war? Was the dropping of nuclear bombs on Hiroshima and Nagasaki an appropriate strategy for ending conflict?

Activity 11

Select questions from Table 1 above to stimulate thinking on a topic of your choice.

Six serving men (Kipling) is a popular rhyme for reminding us of some useful questions.

- *I once did meet six serving men*
- *They served me well and true.*
- *Their names were what and why and when*
- *And how and where and who!*

One of the most useful of these questions is 'Why?'. Repeatedly asking why can be helpful in probing an issue and getting to the root of a problem. As an example, let us consider the issue of changes in weather patterns that have been occurring in recent years.

- *Why* are we experiencing changes in weather patterns? Because of global warming (the average Earth temperature is rising).
- *Why* is global warming happening? Because the amount of carbon dioxide (the main 'greenhouse gas') in the Earth's atmosphere is increasing and increasing the 'greenhouse effect' (i.e. heat is trapped by the atmosphere in the same way that heat in a greenhouse is trapped by the glass).
- *Why* is the amount of carbon dioxide increasing? Because of human activity such as burning fossil fuels, and also the destruction of rainforest areas.
- *Why* is this human activity increasing? Because of social, political and population factors. There is a huge demand for energy from fossil fuels; deforestation is driven by the demand for hardwoods, mined ores, and beef (for beefburgers) in developed economies, along with slash-and-burn clearance activities by local farmers who have little other economic choice.

And so on …

Activity 12

Think of a problem relevant to your life. Ask the question Why? repeatedly to explore the issue you have chosen.

We hope you can see how this process moves the response from superficial assumptions and explanations to a deeper level of response. It does, however, only apply within the limits of the subject area. In some cases we do not have the tools to find answers to all the questions.

Questions can be particularly useful as a tool to tackle writing tasks like essays. You can set up a series of questions then address them in your writing.

Activity 13

Suggest questions you could raise in response to this essay title.

Discuss the problems caused by the development of out-of-town shopping centres and the advantages of regenerating city centre shopping areas as an alternative.

Here are our ideas.

- What are out-of-town shopping centres?
- Why, when and how have they developed?
- What are the problems caused by their development?
- What are city centre shopping areas?
- Why do they need regenerating?
- What would be the advantages of regenerating them?

7 Giving structure to thinking

Two common thinking problems are: a feeling of not being able to 'see the wood for the trees', and difficulty in being logical and orderly. The key to solving them is being able to think about ideas and information in a conceptual and systematic way so that you have ways to structure your thinking. This can involve:

- looking at the broader context
- developing mental models and frameworks to hang ideas and information on
- being able to distinguish relative importance and seeing patterns and relationships.

The following activity is designed to help you see the power of structuring information and ideas.

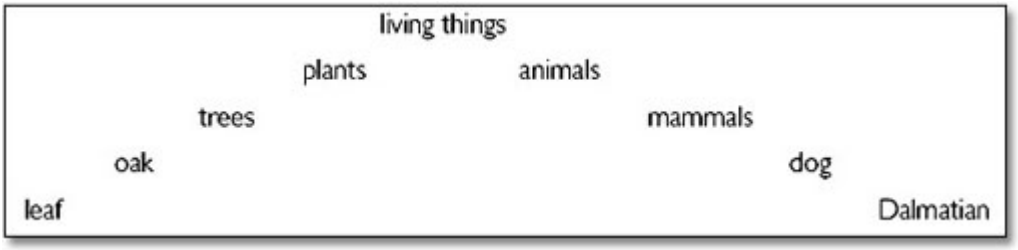
Activity 14

1. Read through the following list of words one at a time, then cover it up and see how many words you can remember:

   leaf, animals, Dalmatian, dogs, tree, living things, plants, mammals, oak
2. Now look at the words again and see if you can link them together in an order or structure. When you have done this, see how many you can remember now without looking.
3. Reflect on the difference this makes to understanding and making sense of the information.

Were you able to recall many of the words? Did you find a way to link the words together? Did having a structure make the list easier to remember?

This is the structure we thought of:



Mind Map

The process of looking for a way of structuring the concepts should certainly have made you think. It is through processes like this that information is retained and recalled, and knowledge and understanding develop. Knowledge, understanding and meaning are not just there for the taking. You have to create them through your own structured thinking. In fact, knowledge is often acquired in the process of doing structured thinking for tasks such as solving problems, making decisions and evaluating arguments. There are many tools and techniques for structuring thinking. What is appropriate will depend on the purpose of your thinking and what works best for you.

7.1 Hierarchies of ideas

A useful way of giving sense and structure to ideas can sometimes be to see them in the form of a hierarchy. At one end is the ‘big picture’ (e.g. general context, principles, theories, ideas, concepts) and at the other end are particular facts, examples and other details. For example, the concept of living things contains the category of animals and plants. Animals contains the category of mammals, which contains the category of dogs, which contains the specific type of dog called Dalmatian. Each thing is connected to the thing before. Looking for patterns, ways to connect things (even if they may sometimes seem apparently unconnected) and contextualising is at the heart of making sense of information and ideas.

General and particular levels of thought often give shape to written communication.

Activity 15

Look at this sample text and see if you can identify and distinguish between general ideas and specific details.

> *Humans as primates*
>
> Humans are **primates**, a distinctive group of mammals that first appeared more than 60 million years ago and which includes monkeys, apes, lemurs, lorises, and many less familiar species. Most primates live in tropical forests, where they eat leaves, flowers, fruit, soft seeds and small animals such as insects. They have unspecialized teeth and guts and relatively long, flexible limbs that enable them to alternate between several different postures and modes of locomotion, including climbing and leaping. The five toes and finger on each limb are relatively long and flexible, and are tipped with blunt, flat 'fingernails' in place of claws. Primates grip branches and grasp food between the fingers and toes rather than use claws for climbing and manipulating things.
>
> (Open University course, U205)

The central general idea here is that humans are primates. The title of the section and the use of bold type for the word ‘primate’ are clues to this. The text adds further particular detail and facts to tell us more about the characteristics of primates. So, primates are mammals, they include monkeys, apes, lemurs and lorises. We are told about how they move in various ways which include climbing and leaping. We are then given further details and facts about this - that they have long and flexible toes and fingers with blunt fingernails instead of claws.

Ideas in your course work on a similar principle at all levels. There might be overarching course themes, learning outcomes for specific units, blocks or modules, outcomes for chapters and so on. Your course will provide helpful clues. These may be in the form of summaries (e.g. on and in books), lists of course themes, lists of learning outcomes, assignment questions, in text questions, different sized fonts, use of bold or italic type.

7.2 Other ways of structuring thought

Distinguishing between generals and particulars can help you in reading, note taking and writing for your course. But, looking at things in a hierarchical general-particular way is only one approach to giving structure to ideas and information.

Activity 16

Make a note of some other ways in which ideas and information could be structured.

Discussion

Other ways might be based on chronology, complexity, spatial organisation, positive and negative aspects, pros and cons, familiar and unfamiliar, from top to bottom of an organisational structure. In some cases, the component parts of something work together to form a system, for example arteries, veins and capillaries work together to form the blood circulatory system in the body.

7.3 Systematic approaches

Having a systematic step-by-step process for thinking about certain academic tasks can be particularly useful so that everything is done as efficiently as possible.

For example, the DANCE system (Rose and Nicholl, 1997) is one of many tools for solving problems.

D - Define and clarify what the problem really is (sometimes it is not initially clear). What are your goals?

A - Think of a range of alternative ways of solving the problem.

N - Narrow down the range of possible solutions to leave the best.

C - Choose the ideal solution and check what the consequences might be.

E - Effect action using the best solution.

Activity 17

Try using the DANCE technique on a problem from your course. Or perhaps a problem from everyday life (e.g. you cannot get to work because you car will not start).

Here is the way we worked through the work-and-car example.

Definition of the problem - The car won't start and we want it to. What is the real problem? After checking things in sequence (most obvious reasons first), the answer is that there is no petrol in the tank.

Alternative solutions - See if a neighbour has some petrol; go and buy a containerful from the nearest garage; call an automobile rescue service.

Narrow down solutions - The neighbour is out; either go to the garage or call the rescue service.

Choose the best solution - Going to the garage will be quicker and cheaper as our policy does not have home-start cover.

Effect action - Go to the garage and buy the petrol.

7.4 Visual tools

Organising thought can be assisted greatly by the use of visual tools. These can include diagrams, mind-maps, tables, graphs, time lines, flow charts, sequence diagrams, decision trees or other visual representations. The *process* of making visual representations can itself involve using and developing a range of thinking skills, particularly higher order skills. So, whether you need the resulting product or not they can be worth doing. However, the resulting product can also provide an effective way of communicating your thinking to others. In fact, sometimes it can be very hard not to use a diagram - drawing or referring to a map, for example, makes it much easier to give directions.

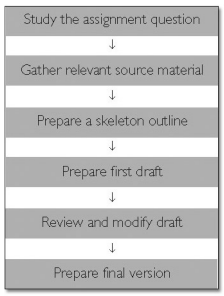
Activity 18

Find a visual way of presenting one of the examples below or an everyday example. As you do this, reflect on your thoughts and how you feel about the resulting representation.

- The process of preparing an assignment.
- Preparing for an examination.

Discussion

Here is a flow chart for preparing an assignment:



Flowchart

7.5 Mind-maps

Mind-mapping can be a particularly powerful visual tool for shaping thought. The basic principle here is to note down the central topic or idea in the centre of a piece of paper and work outwards adding the points which flow from and connect to it. It is particularly helpful for seeing the different levels of thought discussed above. Figure 2 is a mind-map drawn by someone planning to write an essay on memory.

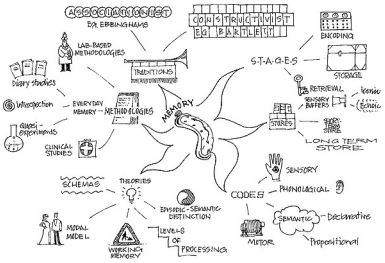


Figure 2: Mind-map for memory essay

(*Based on a mind-map by C. Barrett*)

8 Analysis, argument and critical thinking

In this section, we are going to look in detail at analysis and argument. Analytical thinking is a particular type of higher order thinking central to much academic activity. It is concerned with examining 'methodically and in detail the constitution or structure of something' (Oxford English Dictionary). This includes looking at variables, factors, and relationships between things, as well as examining ideas and problems, and detecting and analysing arguments. Many essay questions require argument. Skills in manipulating content to make a good argument can make the difference between higher and lower assignment grades.

You can start to explore the ideas of analysis and argument by using an everyday example.

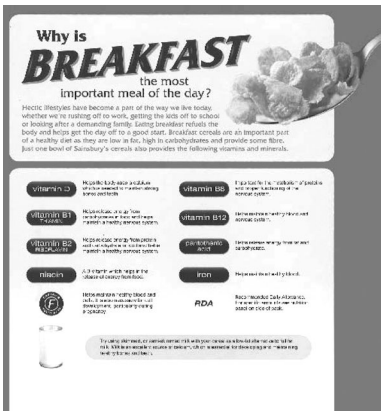


Figure 3: Sainsbury's cornflakes

(*Reproduced by permission of J. Sainsbury plc, 2000*)

Activity 19

Making use of the description of Figure 3 available in the link below the image, on a sheet of paper note down your responses to the following questions.

- What was your reaction to doing this activity?
- What do you think the text was aiming to do?
- Do you feel the writer was successful in achieving what she or he set out to do?
- What worked and what did not work?

How did you feel about this activity? Perhaps your first reaction is that under normal circumstances you would not read the back of a cereal packet. Perhaps you would normally be too busy to read this sort of thing, or would not bother because it is not relevant or of interest. The attention we give to something is dependent on the context. You probably do not have to read and think about cereal packets, but do need to read and think carefully about academic texts.

Did you accept what was written or did the text prompt you to ask questions such as 'What is the *purpose* of this text?' The initial question 'Why breakfast is the most important meal of the day?' seems to suggest that the aim of the text might to be to provide answers, perhaps to convince us that breakfast *is* the most important meal of

the day. You might reasonably have expected the text to provide some good reasons for us to be convinced of this. But perhaps after reading it, you decided that the writer's aim was simply to convince you that eating cereals for breakfast is a good thing.

If the aim was to show that breakfast is the most important meal of the day, was the text a convincing argument? The writer certainly tells us that 'breakfast refuels the body and helps get the day off to a good start', which could be a reason to support the view that breakfast is important, but is not really one to convince us that breakfast is the *most* important meal. The writer has not told us why breakfast is more important than lunch, tea, dinner or supper. He or she seems to unquestioningly accept or assume that breakfast is the most important meal. Telling us about hectic lifestyles or the nutritional benefits of breakfast cereals does not tell us why breakfast is the most important meal. The relevance of these points is not clear at all. All in all, this is not a very convincing case for breakfast being the most important meal of the day. If the aim were really to persuade us to eat cereals, would we be convinced? It is hard to know if the information given as facts is correct and relevant to a healthy diet unless you have some knowledge of nutritional science.

Although this is a simple everyday text, it provides an opportunity to exercise analytical thinking skills. The process of looking at the structure and parts of something in the way we have done here is what we mean by *analysis.* The text also illustrates the ideas of having a point or a case you wish to prove, and providing evidence and reasons to support it - together these form what the academic world calls an *argument.* This is very different from the everyday sense of the word, 'having a disagreement'. Here, we have been analysing an argument.

Activity 20

- What do you think is needed to make an argument a really good one (i.e. for the case to be convincing)?
- What could be done to improve (make more convincing) the argument analysed in Activity 19?

When arguing a case, it needs to be clear what the case is. Perhaps, in the example above, the title should have been 'Why breakfast cereal is worth eating'. A good argument will have a clear and logical flow *(line of reasoning).* The sequence of thinking in the example was not clear or logical. For example, starting from the original question, a logical path might lead to discussion of reasons why breakfast is more important than other meals, and perhaps include information on demands on the body and physiological perspectives on the timing and types of food eaten. To be convinced, we need good reasons or evidence which is relevant. It is not immediately clear how the information about the nutritional value of breakfast cereals is relevant to the case for breakfast being the most important meal of the day. Moreover, how do we know the information is correct?

Activity 21

Having appropriate evidence to support arguments is important.

Which of the following statements might be most convincing and why?

- There is life on other planets in the universe.
- There is life on other planets in the universe because Mike Edwards says so.
- There is life on other planets in the universe because an eminent Cambridge Professor of Astronomy says so.
- There is a high probability of life on other planets in the universe because we know from studies by experts that there are in the order of 100 billion stars in our galaxy and there are 100 billion galaxies. This gives 10^{22}stars. Some of these stars are likely to have planets associated with them. While the conditions conducive to life are rare, such a large number of planets gives a high probability that life will exist on a planet somewhere in the universe.
- Samples of surface material from other planets in the universe have been taken by space missions and found to contain life forms.

(Adapted from Collier and Twomey, 1997)

It would be reasonable to feel somewhat unconvinced by the first statement; it is an unsupported *assertion.* It may well just be an opinion, there is no reason or evidence provided. Being able to distinguish fact from opinion is important. In the second case, the statement is apparently given *authority* by being attributed to Mike Edwards. The question is - who is Mike Edwards? What reason is there for believing him rather than anyone else? We do not know on what basis he has made such a statement. We might feel a bit more convinced by the eminent Cambridge Professor of Astronomy. After all she or he may have spent many years in relevant study and be making a statement based on this wealth of experience. But, what if the professor had not been a professor of astronomy? What credence would we give to someone's views if they were an expert in another area? For example, a pop star or celebrity chef making a statement on a political issue? We need to take care in transferring authority in one area to another. Maybe someone's skills are transferable to another situation - but maybe not. The penultimate case is more convincing, because we are presented with a *logical line of reasoning.* In the final statement, we appear to have *factual evidence* that there are life forms on other planets. Even then, we need to think about the certainty of 'facts'. Knowledge changes and depends on context. It is only as good as the methods used to obtain it. Instances of 'facts' turning out to be artefacts of methods are common. Perhaps in this case the life forms found in the samples were contaminants on the equipment (acquired from Earth before or after the sampling journey). Sometimes, general conclusions are drawn from insufficient data or information. Does the evidence provide sufficient information to prove something or only suggest something is probable?

We hope this example illustrates the importance of using appropriate evidence or reasoning to support an argument, and the importance of being cautious in what you use and accept as evidence. You should certainly avoid unsupported assertions in academic work and strive to provide the most appropriate and convincing evidence you can.

8.1 Balanced argument

In many instances, we are not just concerned with arguing a particular case or taking a particular point of view, we are interested in looking at all sides of an issue and producing a balanced argument. This can be helpful in drawing conclusions on an issue.


The truth about caffeine

Is your favourite cuppa a health hazard? Nutritionist Angela Dowden reveals the good and bad news about caffeine...

5 bad things

Are you caffeine-sensitive?

5 reasons why caffeine is good for you

Should you cut down?

Take it slowly

Caffeine counter

Figure 4: Caffeine arguments

(*Reproduced from Woman, October 2000*)

Activity 22

Look at Figure 4 and read the image description available at the link below the image. Based on the information provided in the description (i.e. the headings used in the article), make a note of what strikes you about this article. How helpful do you think this article would be to someone who wanted to decide whether or not they should cut out caffeine?

The article presents both good and bad information about caffeine, which might be helpful to someone trying to decide what to do about his or her caffeine intake.

8.2 Broadening perception

Particular perspectives and points of view underpin speaking and writing. Being successful at many academic tasks, including balanced argument, often requires us to be conscious of and to try to break away from our usual perspectives and ways of thinking, and to attend to things we might not normally notice. The challenge is often to be more open-minded and broad in our thinking, to consider more than one point of view in the way that the caffeine article did. It can be useful to have strategies for helping us to examine and change our perceptions. Activity 23 will start you off on this road.

Activity 23

Print out or copy the figure below then, without taking your pen off the paper draw four straight lines so that all the dots in Figure 5 are joined.

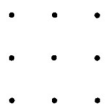
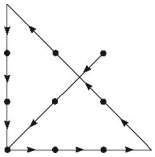


Figure 5: A challenge

How did you get on? In order to complete this task, you needed to 'think outside the box' (that is, to perceive the task in a way that might not have been immediately obvious. The solution to this puzzle is given below.



Solution

There are many useful thinking tools for helping you to 'think outside the box'. Playing 'devil's advocate' is one - that is, what would somebody with an opposite view or someone who disagrees say?

Activity 24

Think of as many ways as you can to finish the following sentence.

People should be encouraged to smoke because …

Did you find this difficult? Perhaps you have particular principles or feelings that influenced your ability to respond to the task? Here are some reasons you could have given: many people find smoking enjoyable; smoking helps people to cope with life; smokers generate employment in the tobacco industry; smoking raises taxes; smoking lowers the cost of geriatric care because smokers tend to die younger than non-smokers; smoking reduces the level of chronic illness in the elderly population because smokers tend to die younger than non-smokers; smoking saves on pension payments because smokers tend to die younger than non-smokers; young people think smoking is cool - it makes them feel they belong (adapted from Seed-house, 1997). Looking at this list were you itching to argue against some of them? If so, you can see how valuable this is in stimulating thinking! We hope that this activity will help you appreciate that we can consider other points of view (even if we do not agree with them).

The PMI technique (de Bono, 1999) is another tool to help you think outside the box and make a balanced argument. The idea is to look at the plus (good) points, minus (bad) points and the interesting points.

Activity 25

Use the PMI technique to look at the case for promoting smoking or another subject of your choice.

If you chose smoking, you could put the points noted above on the plus side. On the minus side, some possibilities might include: smoking causes sickness and shortens lives; smoking makes people unfit; treating smoking related diseases is a drain on NHS resources; smoking leads to absenteeism and loss of productivity; smoking damages non-smokers through passive smoking; smoking is dirty and smelly; smoking causes accidents such as fires and other damage to property (adapted from Seedhouse, 1997). On the interesting side, some suggestions might include: if we promoted it, would smoking become less fashionable among the young, would the price of cigarettes go down, and would a cure for cancer be found more quickly?

8.3 Academic arguments

You have looked at some examples of everyday arguments, now look at a short example of an academic argument.

Activity 26

Read the argument below. Compare and contrast it to the previous examples of arguments you have looked at ('Why breakfast is the most important meal of the day' and 'The truth about caffeine'). Consider issues such as the style, whether or not more than one point of view is presented, and what evidence is provided to support points made. Make a note of your responses.

> Can primates acquire language?
>
> Communication is an important part of animal behaviour. For example, primates use a variety of sounds and gestures in social interaction to portray threat, intention, alarm, and so on - and highly sophisticated forms of communication are found in other species as well (whales and dolphins provide a fascinating example). But, for many researchers this is not the same as human language which is essentially infinite in its meaning (largely due to its grammar), and which is able to associate specific (and abstract) meanings with arbitrary sound and symbols. Indeed, language is the thing that makes us uniquely human (or so the argument goes), and no other species comes close to emulating our ability to comprehend, use, and produce language.
>
> But is language really unique to human beings? One problem with this theory is that other animals (including primates) cannot make our sounds. For example, they do not have the same fine control over their tongues, lips, and vocal chords, and are therefore unable to talk. Thus, if animals were to learn or understand language they would not be able to tell us. With this possibility in mind, Beatrice and Roger Gardner during the 1960s set about teaching a female chimpanzee (called Washoe) a version of American sign language used by deaf people. The Gardners began when Washoe was

about one year old - and within three years she had developed a vocabulary of over 130 signs (or 'words'). Moreover, she learned to combine the signs to make simple sentences, and to use 'words' in creative and novel ways (e.g. after learning the verb 'to open' she would ask the investigators to 'open' the tap whenever she wanted a drink). Other researchers have confirmed these findings, and similar work has been undertaken with gorillas and orangutans.(Paterson and Linden 1981; Miles 1983)

However, the interpretation of these findings remains highly controversial. For example, some researchers have argued that these animals are not learning sign language per se, but rather they are only imitating the gestures made by their trainers. In support of this idea, they point out that primates often combine signs in illogical sequences and only occasionally join signs together in a meaningful way (which the trainer will inevitably then choose to reinforce). Others have argued that although primates might be able to communicate with language, there is little evidence to indicate that they can also use it as a vehicle for thought. But there are those who disagree. For example, some of the most compelling evidence for language in primates has come from Susan Savage-Rumbaugh and her colleagues who worked with a male pigmy chimpanzee called Kanzi. Apparently, this primate can understand about 150 English spoken words and can respond to complex and unfamiliar spoken commands such as 'throw your ball in the river' and 'go to the refrigerator and get out a tomato' (Savage-Rumbaugh 1990). Moreover, Kanzi can even use symbols to communicate past events, e.g. she pressed the symbols on a special keyboard to represent 'Matata bite' (Matata is a fellow monkey) to explain a cut that was on her hand.

These findings imply that language may not be unique human ability after all - although to put this work into its correct perspective, it needs to be borne in mind that Kanzi's language skills are only equivalent to that of a two-year-old human (Greenfield and Savage-Rumbaugh 1990). Thus, it still remains the case that no other species comes close to matching our ability to use and understand language. In other words, language is our natural medium of communication, although the same can clearly not be said of other animals.

(Wickens, 2000)

You may have noted that both the style and language of this argument are different. Different perspectives on the issue are presented and there is evidence to back up the points made. References are included to give the points weight and to show the sources used. The author has demonstrated higher order skills and independent thinking. For example, ideas are put together (synthesis), their worth evaluated, a conclusion on the issue reached (independent thinking).

Debates over issues can be complex as a result of the many points of view and arguments. One way to make sense of all this might be to produce a visual map in which you summarise the key arguments and how they are linked to each other.

9 Putting it all together

We have covered a wide range of aspects of thinking, particularly those concerned with clear and critical thinking. At this stage, you may find it useful to consider how ideas like these can be put together in ways that will help you when you engage in activities such as reading, writing, speaking and listening. Here is a checklist to use when making judgements about things that you hear, see and experience.

- Who is speaking or writing?
- What is their point of view or perspective?
- What ideas and information are presented and how were they obtained?
- Are there unsupported assertions?
- Are reasons or evidence provided?
- Are the reasons and evidence given relevant?
- Is the method used to find the evidence sound?
- Is the evidence correct or valid?
- What assumptions have been made?
- What is fact and what is opinion?
- What are the implicit and explicit values?
- Are there unreasonable generalisations?
- What has been omitted?
- How was the conclusion reached?
- Is the conclusion reasonable?
- What other perspectives or points of view could there be?

You may be able to think of more points to add to this list.

Activity 27

Find an opportunity in your daily life today for exercising your thinking skills using the checklist above. For example, you could consider an advertising claim, a problem, or what party to vote for in an election.

An example might be an advertising claim such as 'speak French in only three hours'. You might ask who has made the claim and what is the evidence that you can achieve any mastery of French in three hours? What does speaking French mean? Do they mean fluent French? Would it seem realistic to have a useful working knowledge in this time? The reality is that you might learn some French but probably not enough to get around on holiday.

You can look out for material to stimulate thought in this way in newspapers, magazines and on the television and radio.

These last two activities will help you to continue developing your thinking skills.

Activity 28

Make an action plan outlining the actions you are going to take to develop your thinking skills … what you are going to do … how … by when?

Activity 29

Try keeping a study log with a focus on thinking skills. As you do this, make time to pause and reflect on what you have written. Consider what new skills you have developed, what has improved, what was really difficult and what you might focus on in the future.

Conclusion

This free course provided an introduction to thinking skills. It took you through a series of exercises designed to develop your approach to study and learning at a distance, and helped to improve your confidence as an independent learner.

References

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Wickens, A. (2000) *Foundations of Biopsychology.* Harlow, Prentice Hall

Further reading

de Bono's Thinking Course by Edward de Bono, published by BBC Books, 1999; An interesting general consideration of thinking skills with tools and techniques for developing thinking in a general way.

Use Your Head by Tony Buzan, published by BBC Books, 1995; Lots of useful information on how to make the most of your brainpower.

The Mindmap Book by Tony Buzan, published by BBC Books, 1997; A whole text specifically on the technique of mind-mapping and its applications.

Reading, Writing and Reasoning. A Guide for Students by J. Fairbairn and C. Winch, published by Open University Press, 1998; Contains good material on academic reasoning and argument.

Clear Thinking by J. Inglis and R. Lewis, published by National Extension College/ CollinsEducational, 1993; Contains some excellent material on academic argument.

The Scientific Endeavour a Primer on Scientific Principles and Practice by J. A. Lee, published by Adison Wesley Longman, Inc., 2000; A book about science that contains an excellent section on critical thinking in a scientific context.

Acknowledgements

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