H850 Postgraduate Certificate
in Teaching and Learning
in Higher Education

Pack 2

Students Learning

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Introduction

This introductory overview of the pack, *Students Learning*, aims to provide a context for your reading, suggests some ways to engage with the ideas and reflective activities contained within, and describes the way it has been written.

This single pack forms one part of the extensive materials designed, primarily, for use by participants in the Postgraduate Certificate in Teaching and Learning in Higher Education programme [http://iet.open.ac.uk/courses/online](http://iet.open.ac.uk/courses/online). If you have received a full set of these materials through joining the Certificate Programme, you will also have access to web-based materials and interactive support from peers and tutors. The other packs in the set will focus on:

- professional capability
- assessment, feedback and learning
- design for learning
- teaching methods and approaches.

There are inevitable overlaps between the different perspectives addressed by each pack. We have designed every pack as a stand alone resource to support and inform your understanding of students learning in higher education (and in other adult learning contexts), whether or not you are working towards a formal qualification.

Our readers

This pack will be useful to a broad range of readers. You might be:

- a lecturer or tutor with a particular disciplinary background
- relatively experienced or fairly new to your role
- a supervisor in charge of students in work-based practice
- a librarian or IT resources manager with responsibility for supporting students who need to manage information
- a guidance professional with a generic interest in student learning or you may have another role that we have not yet imagined.

Working with this pack

As you open this file of materials about student learning, we hope that you are seeking to inform and consider your own most pressing and specific questions about students learning – questions such as:

- How does learning happen and how can I encourage it to happen more?
- What assumptions have I made about how students learn?
- Are there theories and research that might either challenge or confirm my assumptions?
- How do students differ and how can my teaching respond to these differences?
- Are there whole new approaches – or small changes – in my practice that might change my teaching so that it becomes, for example, more effective for students/less demanding of my time, etc.?
Making these questions conscious and explicit will help you to scan the wealth of theoretical ‘tasters’ and practical teaching suggestions more purposefully and effectively.

Decide, now, what you hope to gain from the pack at this reading and make a note of your questions about students learning, if you have any. You may wish to insert pages at appropriate points in this loose-leaf folder for your questions and notes, or you may wish to collect them together at the back, or use any journal or log that you prefer. Perhaps, in your first browse through the materials, you are hoping for nothing more than an overview of what the file contains. Your pertinent questions may emerge from what you find, but do note them down: even the act of writing may help these vital and personally significant questions stick in your consciousness.

You may be looking through this file for quite strategic purposes. If you are studying towards an assessed course, for example, there will be structures embedded in the assessment process that will influence what you look for and how you work with what you find. The context for study and the expected outcomes of learning – and assessed outcomes often carry the most weight – have considerable bearing on the approaches that students make. Similarly, your intentions and expectations will affect your reading.

In teaching at a distance (as this pack, essentially, tries to do), there are particular challenges which you may want to appreciate as you read and engage with our ‘teaching’. Even more than in traditional classroom environments, the designer or teacher is not able to control the curriculum that is ‘received’ by the reader. While recognising this, and acknowledging the diversity of our readers’ needs and expectations, I would make one strong recommendation – that you engage with this file in ways that draw on your own experience and needs and use it in practical ways, for your own purposes.

The short extracts from seminal theories and research will only come to life when you try them out in your own practice or use them to try to resolve your own questions. You will find that the Reflection boxes suggest ways in which you might do this, at a range of levels. Do engage with some of these reflective activities: experiment and work with them to challenge and vivify the ideas. Adapt the suggested activities to make them appropriate or, having read the theories that seem to give rise to a suggested activity, feel free to make an informed decision that it really doesn’t apply in your environment.

The continuing construction of the materials

Finally, some understanding of how these materials have been produced may help you decide how you wish to use them. In this pack, as in each of the others, every chapter will have originally been written collaboratively, as is the tradition in the Open University. Even where a single academic is named as the author, materials have been produced through the interaction of groups of experts – a Course Team. For this pack, we have re-ordered (and re-edited) materials originally produced by different teams in another format and sequence, so a new level of collaboration has emerged since the materials were first written (in 1998 and 1999).

Minor changes to the content of each chapter in this pack have largely resulted from our re-structuring of the Certificate Programme. In making
our amendments to the structure of the Programme and its assessment, we have listened and responded to evaluations and feedback from students, tutors and examiners. In the wider environment, we also recognise that changes to higher education and the accreditation of teaching in higher education have influenced the needs and expectations of participants. All these factors have affected the pack you now hold in your hands. Its current format allows it to continue to improve in response to feedback and changing needs, so we hope the course will become even more participative, with your engagement and contributions. Please send your email comments to: iet-pgctlhe@open.ac.uk.

Jo Tait
Course Team Chair (2002)
Chapter 1 How students learn

Graham Gibbs, Alistair Morgan and Andy Northedge

Overview

This chapter explores how students go about learning.

Section 1.1 looks at what it is that students learn when they try to learn concepts, how they go about learning concepts and what we can do to help them.

Section 1.2 is concerned with learning by doing. It asks how students learn from experience and whether practice is enough for learning. It explores the role of reflection in learning and how doing is related to thinking.

While memory for facts is not the primary goal of higher education, memory is important. Section 1.3 considers how memory and memorising works; it asks about the role of rehearsal in memory and about whether memory can be overloaded.

Section 1.4 is concerned with the role of feelings in learning and with the responsibility teachers have for creating an emotionally supportive climate for learning.

Finally, Section 1.5 considers how adults learn, whether this is different from the way younger students learn and what implications this may have for our teaching.

Before going into each of these aspects of how students learn, we need to consider what we mean by learning and what different kinds of learning we are expecting to happen as our students go about their studying. This first extract is drawn from a guide for mathematics, science and technology students. Unlike many other extracts, it does not refer to other literature or research evidence, but attempts to make learning comprehensible for students. The ideas in this extract are explored further in Section 1, which follows.
EXTRACT 1.1
WHAT IS LEARNING?

Andrew Northedge and Andrew Lane

The purpose of studying is to learn. But what does it mean to learn something? At degree level, learning is not just memorizing information. It is more about ideas than information, more about understanding than about pure memory.

Understanding ideas versus memorising facts

TV shows like Mastermind and University Challenge give the impression that being ‘clever’ involves knowing lots of facts. Clever people usually do know lots of facts, but they can answer the questions quickly because of how the facts are organized in their minds. What really distinguishes people who know a lot about a subject from those who don’t is the understanding they bring to bear - the ideas they can use to analyse and discuss the topic.

You will have to do a certain amount of memorizing, especially just before an exam, so that you can produce the information required quickly. But your examination result will depend more on the work you put into understanding ideas.

I am using the word ‘ideas’ here to include ‘concepts’, ‘principles’, ‘laws’, ‘models’ and ‘theories’. Learning ideas involves three things:

*Taking in new ideas* (and by ‘taking in’, I mean ‘making sense of’, not simply seeing, hearing or memorizing).

*Thinking them through*, and fitting them alongside your existing ideas to build up a better ‘general understanding’.

*Using newly formed ideas* (both in the sense of using them to do things and using them to communicate with others.)

Taking in new ideas

When you look at an unread textbook on your shelf, you know there is a lot of information in it - information that you want, somehow, to get into your head. This is what I mean by ‘taking in’ – taking ideas that are part of the outside world and making them your own. This means much more than simply passing your eyes over lots of words, numbers and pictures. It means ‘making sense’ as you read, so that you ‘understand’ the meaning. You can look at and memorize the symbols [of an equation] without too much difficulty. But that does not mean you have ‘made sense’ of the equation, or that you ‘understand’ what it is saying to you. To ‘take in’ such an equation you have to read it within a flow of other words and symbols, as part of a whole framework of ideas. So, when you are trying to ‘take in’ a text, a lecture, or a TV programme, you need study techniques which emphasize ‘making sense’.

That is why this book talks a lot about taking notes as you read, listen or view. Deciding what to note makes you pay attention to meaning. ...

Thinking them through

It takes time before you can really get new ideas properly into focus. You have to connect them with other ideas already in your head. And when new ideas conflict with old ones, you have to work out where that leaves you. Various study activities help with this ‘thinking through’ process. For example, when you are jotting down assignment ideas, drawing a diagram, working through a mathematical problem, or ‘boiling down’ your course notes for examination revision, you are working your ideas into shape. These activities appear to be incidental chores around the edges of mainstream activities such as reading and writing. But they are not marginal to studying. The odd moments when you are jotting down bits and pieces to yourself are times when you are doing important ‘thinking through’.

Using ideas

You don’t really understand an idea until you put it to use. It is when you are the one pushing the thinking along that you really grasp the full force of an idea. So some activities, like working on problems, doing
experiments and writing assignments, play a key part in establishing new ideas as part of your mental ‘repertoire’ – that is, in making them your own. ...

‘Taking in’, ‘thinking through’ and ‘using’ are all active processes. None of them just ‘happens’, while your mind quietly dozes. Each requires purposeful, thoughtful action on your part. In fact, making a distinction between these three aspects of learning is artificial; in practice, they overlap. Yet the distinction is useful, because it emphasizes that learning happens at many different points during your studies, not just when you are reading a book, or listening to a lecture. It reminds you to give just as much effort to the ‘thinking through’ and the ‘using’ as you do to the ‘taking in’.

The learning spiral

These three aspects of learning are part of a continuing cycle of advancing understanding. We have enquiring minds and are never satisfied for long with what we learn. As you answer one set of questions you become aware of new questions beyond. If you start from the middle of Figure [1.1] you will see what I mean.

![The learning spiral](image-url)

Learning does not really happen as neatly as this, of course. You are usually starting on new ideas at the same time as writing assignments using established concepts. And this week’s new ideas often connect with last week’s, so that you begin to understand them in a new way. In fact, there is no identifiable moment when you learn a particular idea. You just find it ‘turning up’ in your thoughts as you work on other things. As you move around the learning spiral, you look back and realize that ideas you once struggled with now somehow seem obvious. You realize you must have ‘learned’ them, but you can’t pinpoint when. In other words, learning is not a neat, sequential process. It proceeds by lurches as you circle around new ideas. Yet it is not completely haphazard either, nor out of your control. The learning spiral in Figure [1.1] should give you an idea of the nature of the process, so that when you ‘reflect’ on your own learning (as part of your ‘reflective self-management’), you can make some sense of what is happening in your head and plan your way forward.


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*Figure [1.1] The learning spiral*
Activity 1.1 Phases of learning in your course

Describe how each of the phases of learning described in Extract 1.1 might apply to the learning of a specific component of your own course. What could you do to support each phase?

For example, this is what each of the phases might look like in a Health or Social Welfare context.

**Becoming aware of need for learning**

You present a case study to your students about abusive treatment of old people in a residential home and ask how people who choose to work as carers could be so punitive, and how things could stay hidden for so long.

**Taking in new ideas**

You provide an article introducing Erving Goffman’s analysis of the defining features of ‘total institutions’ for them to read.

**Thinking them through**

As one of your student reads he is reminded of a novel he read set in a concentration camp, and a scout camp he once went to. He wonders whether his old school would count as a total institution. He jots a note of some ways in which it qualifies and some ways it doesn’t. In the tutorial, you ask students to discuss whether school bullying fits the model.

**Using newly formed ideas**

You set an essay on the abuse case study, asking students to consider whether the ‘total institution’ model helps to explain what went on.

**Becoming aware of need for learning**

Your students have begun to notice potential elements of ‘total institutions’, in various contexts, but now you push them further by asking how exactly an institutional sub-culture emerges. They find they need to do some more reading.

1.1 How do students learn concepts?

Trigwell, Prosser and Taylor (1994) carried out a programme of research to illuminate the ways in which teachers explain how learning takes place: the conceptions they have of teaching. In their research, they found that the first and crudest conception of teaching described embodies the notion that knowledge can be somehow transmitted from the teacher to the student, ‘beamed into their heads’ almost without the active involvement of the student. When the teacher speaks – provided the student is paying attention – what the teacher has said enters the student’s mind and is lodged there permanently. Clearly this is not an adequate model. If you say to your students: ‘The moon is at all times accelerating towards the Earth’, what students will learn is dependent on what sense they are able to make of the observation. This itself will depend on what concepts and conceptual organisation they have available to them. With only a commonsense understanding of acceleration, the statement sounds to be either wrong or else a prediction of disaster. For it to make reasonable sense requires your students to have a more sophisticated concept of
acceleration, which incorporates changes of direction. For this concept to be assembled in your students' minds will have taken more than them simply being told, or them memorising a string of words or an equation. But exactly what does it take, and how does a student come to 'get it'? This section explores what the 'it' is that students are supposed to 'get', how they are supposed to 'get it' and what kinds of methods make it more likely that they will.

What is it that students understand when they are learning concepts?

If you ask your students 'Have you understood that?' are you implying that understanding is an all-or-nothing phenomenon - that one moment the students have no idea and the next they have understood it and won't ever get it wrong again? Inevitably learning is messier than this. Students develop all kinds of partial understandings and unexpected misunderstandings. Even if they appear to understand a concept or idea in one context, they may not in another. For example, science graduates from Harvard University were shown in a video entitled 'A Private Universe' answering apparently simple questions such as 'Why is it hotter in summer?' The answers students gave on the video reveal the most extraordinary misunderstandings of simple cosmology. Their original naive (and totally wrong) conceptions had survived intact through many years of sophisticated science education.

Similarly, science students at the University of Surrey were shown pictures illustrating physics concepts and asked simple questions about them. One picture showed a man holding a dumbbell above his head. The question was 'Is this man doing work?' (in the physics sense of the term 'work'). The students had gained good grades at A level physics and must have correctly defined the term 'work' in their examination paper and even calculated the amount of work done in a problem in an examination question. However, they gave a range of answers, each illustrating different misconceptions of 'work', such as 'It depends how strong he is.' The answer a physics lecturer might give is: 'As work is done when a force is moved through a distance, if the weight is not moving then no work is being done.' Few students gave this answer. It had been assumed that students had understood this concept so that their course could progress to more advanced concepts which built on the concept of 'work', but somehow students seemed to have muddled through without a full understanding of this concept. Or perhaps they might have got a functioning concept of 'work' together if they had warmed up a little first with some revision and tackling a couple of problems. We need to remember that understanding of concepts can be very context-specific and that people can hold more than one conception simultaneously.

Whatever the reason, it is clear that what students understand about key concepts cannot be taken as established once and for all, or assumed to be usable in a flexible way. Concepts are living, working systems of thought, which are altered and re-composed through use and which decay and disintegrate when left unused. Extract 1.1 distinguished between taking in, thinking through, and using ideas, but it could have added maintaining and extending ideas as further key processes.

In Sweden, qualitative research has explored the range of conceptions students have of the central ideas their courses are supposed to have taught. In one study (Dahlgren, 1978) students of economics were asked questions such as 'Why does a bun cost one Krone?' in order to explore
their understanding of the concept of ‘price’. Their answers were found to fall into one of the following four categories:

(a) price is a concept involving a relationship between demand and supply factors: both how much people want buns and how much they cost to produce;

(b) price is determined by a range of supply factors, such as the cost of flour and the profit margin;

(c) price is determined by inherent qualities of the bun;

(d) ignorant or irrelevant answers.

Several things are worth noting about this study.

First, all the students had some kind of conception of ‘price’ before the course started. Teachers of economics are not starting with a clean slate: other studies had shown how even primary-school children had conceptions of ‘price’ that could be categorised in a similar way. These students’ conceptions could be surprisingly resistant to change.

Second, after the course, students’ conceptions were not simply either correct or absent – they all had some conception of ‘price’ but these were very often qualitatively different from the conception that most economists would agree about – probably answer (a) above.

Third, despite the fact that nearly all these students passed their examinations by answering technical questions about economics, few had a full understanding of many of the concepts the course was teaching, such as conception (a) above. It may take years of tuning and use before students understand central concepts reasonably fully. But conventional examinations failed to reveal this limited understanding and, as teachers, we may have inaccurate expectations of our students’ understanding of and facility with what we see as core concepts.

Finally, it is worth noting that some students’ conceptions were found not to develop as a result of the course. Students learned to use new and sophisticated technical language to express relatively unchanged conceptions rather than developing more sophisticated conceptions. This is termed ‘accretion’ in the section below, suggesting a process of concept formation in which new information is added to existing conceptions rather than changing the conceptions. The course did not take students’ existing conceptions into account or work to change them but assumed that if new conceptions were presented then students would simply learn them. This did not happen. If what is known is ignored then what is new may mean very little to students and may only be memorised or, in some cases, simply learnt as algorithms for the purpose of calculating examination answers, regardless of their meaning.

How do students learn concepts?

Since the 1960s, cognitive psychology has conceived of learning not in terms of the transmission of information, but in terms of active engagement between the students’ existing understandings and new concepts.

Cognitive approaches to learning stress that learning is an active, constructive and goal-oriented process that is dependent on the mental activities of the learner ...

Learning is cumulative in nature; nothing has meaning or is learned in isolation. Cognitive conceptions of learning place
considerable importance on the role played by prior knowledge
Shuell, 1986, pp. 415, 416

Students’ understandings of concepts are constructed in their minds, not transmitted to them fully formed. This means that exactly what they understand is likely to be a little idiosyncratic, each student constructing their conception from a different knowledge base in a different way, as described in the previous section. You may think such varied understanding is undesirable but, according to cognitive psychology, it is inevitable and unavoidable. If you asked your students to explain a key concept from your course they would all do it slightly differently, as illustrated in the section above.

An early cognitive model of learning, that of Ausubel (1963), described new concepts and information as being incorporated into learners’ existing knowledge structures. From this perspective the most useful thing a teacher can do is provide a helpful conceptual framework at the outset, what Ausubel termed an ‘advance organiser’, which would enable students to incorporate subsequent information or ideas. As an example of the utility of an advance organiser, imagine a stranger to London with an underground map. That famous map is a wonderfully clear representation of how the underground system works. It is not an accurate depiction; in fact, it deliberately simplifies and codifies what is actually going on, which is why it serves very well if you don’t want to get lost. It even includes track that does not exist and places stations in the wrong position in relation to each other, all in the service of presenting a clear and simple overview. Without it the stranger would be completely bewildered by what was found and would have a terrible job of conceptualising what the underground system consisted of.

Another example of an advance organiser is a ‘time line’ in history. This depicts, visually, the sequence and interrelation of a number of events over a period of time. It provides an overview, which is enormously helpful to a history student before the teacher or textbooks dive into details or broader concepts related to the period being studied.

By the late 1970s cognitive models were distinguishing between qualitatively different kinds of learning:

- accretion, or the encoding of new information in terms of existing conceptions;
- restructuring, through which new conceptions are built up; and
- tuning, involving the slow refinement of a conception as a result of using it in different situations.

Rumelhart and Norman, 1978

These three are not unlike the three phases outlined in Extract 1.1. It’s largely a shift of emphasis. Accretion is more or less what was meant by ‘taking in’, but drawing attention to the encoding aspect. It covers, for example, the bulk of what is going on in a lecture. In order to take in what you say, your students have to make sense using their existing conceptions. If you are talking about acceleration they will use whatever conception of it they have available and will understand what you say accordingly. This is where the encoding comes in. What you say is reconstituted in the students’ heads in terms of whatever concepts they
are bringing to bear. This may mean that what ends up in their heads is very different from what is in yours. I once discovered in a tutorial that a group of my students who had been reading a text which spent a lot of time discussing the nature of causal relationships had never come across the word 'causal' before. Indeed most of them had read it as 'casual'. As a consequence they had managed to make sense of the whole text using the concept 'casual relationships' in the place of 'causal relationships'. This is perhaps a tribute to the flexibility and purposefulness of the human drive to make sense regardless. But it also highlights the value, at the start of a teaching session, of assembling the right kind of ideas in the forefront of your students' minds, so that the sense they make is as close as possible to the sense you want – in other words that the learning is appropriately encoded.

Restructuring is a more dynamic version of 'thinking through'. The emphasis is not just on bedding in new ideas among established ones, but reformulating them and building them into more articulated and robust structures. This is the heart of the cognitive account of the learning process. Restructuring your concept systems is the essence of learning and this is where you can give your students a lot of help in the form of 'scaffolding'. In the flux of change it is very difficult for students to perceive and grapple with new ways of structuring their ideas. By modelling the processes of analysis and argument in the way you talk to students and take them through examples, you can help to put up temporary conceptual supports for them to lean on. This helps to push the conceptual restructuring work in the directions needed for later building. Going back to the 'total institution' example (Activity 1.1), you could talk through one or two case studies of abuse with students, helping them to see how the model can be used and also where it would be inappropriate to use. In particular you would give attention to showing how it differs from a common-sense understanding, since that is the existing conception that students are likely to use to encode the case study information, unless you persuade them otherwise.

A course of study involves repeatedly and continually breaking up old conceptual formations and re-composing and extending them. Such conceptual turmoil can be very disorienting and disturbing to students. This disorienting 're-organisation of self' is addressed in Section 4 of this chapter, on the role of feelings in learning: learning concepts is not solely an intellectual matter. And because of the turmoil, newly formed conceptual clusters can decompose relatively quickly, partly because they are resting on shifting terrain, and partly because of the competition with new concept-building going on elsewhere, taking up mental attention and energy – hence the need to keep putting them to use to consolidate and maintain them.

Concepts are dynamic and malleable. As you use them, they develop and extend. In the process of absorbing them into your regular frames of thought, they become employed in an increasingly wide range of contexts and modified accordingly. This is the process of tuning. We put together concepts in a rough-and-ready form at first, leaning on whatever scaffolding is available and grateful to be able to achieve sense of any kind. But, through use, they become robust, articulated and more precise. They also become owned – absorbed as part of the way we think. If you want your students to have flexible control over their use of concepts and a sense of confident ownership of them, you have to provide opportunities for using them. As we have seen, learning concepts
involves far more than just ‘telling’. It is a multi-faceted process that involves several stages, takes time and benefits from support. Teaching needs to take this into account.

This chapter has been structured to help your understanding of these concepts: starting with simple everyday language in Extract 1.1, coming back to these ideas with more formal technical language and illustrative examples in this section, and going on to provide applications of these ideas in Extract 1.2 below. Learning concepts is often a multi-stage cyclical process, involving coming back to ideas again and again in increasingly sophisticated and discriminating ways, building and elaborating on simple structures erected at the outset. You can help your students by adopting a structure of this kind in your teaching. Students go about accretion, restructuring and tuning in characteristically distinct ways and these ‘learning styles’ are explored in Chapter 2.

What methods help students to learn concepts?

Cognitive psychology and formal accounts of how concepts are learned may seem remote from everyday teaching practice but they can have very practical implications. The extract below by Cedric Linder and Delia Marshall (1996) is set in the context of a first-year physics course. The authors are physics lecturers who were concerned to encourage a ‘deep approach’ in their students (see Chapter 2) and to develop what are termed ‘meta-cognitive strategies’ in the literature. These are ways of becoming more aware of how learning is taking place and of gaining more control over learning. Linder and Marshall wanted their students to move from being passive recipients of information to active learners and, above all, for them to construct a personally meaningful understanding of key physics concepts. In this extract notice how little of what is described is about what the teacher does (for example, explaining concepts or correcting misunderstandings) and how much is about what students do in order to understand concepts (for example, talking with a neighbour during lectures).

This extract is not provided here as a comprehensive account of all possible methods but as an illustration of a range of methods used in one course by thoughtful and imaginative teachers, each method having a rationale and a sound basis in the literature. This extract only includes about half the strategies actually used by these teachers.
What follows are descriptions of a set of metacognitive strategies which were developed for an undergraduate physics course (Linder and Marshall, 1996, 1997) together with students' descriptions of their experiences of these strategies.

3 Emphasis on qualitative reasoning
This strategy focuses on how the specific meanings of words can be different in different contexts; for example, the everyday notion of 'work' is different from the physics notion of 'work'. In a discipline such as physics the strategy may become an integral part of introducing students to a problem-solving strategy which requires the verbalization of conceptual meaning rather than 'putting-numbers-into-formulae' solutions. In other words, students would be expected to verbally reason out problems – which could have been solved using a formula through an appropriate framework of fundamental concepts (see Hewitt, 1983, 1989). For example, suppose students were given the following problem:

You come across a water-well and want to estimate how deep it is, so you drop a small pebble into the well and time how long it takes for you to hear the splash of the pebble hitting the water at the bottom of the well; this takes 3 seconds. Explain in words how you would estimate the depth.

The kind of answer then required would be:

Let's suppose we could consider the air resistance to be very small for the type of pebble we are going to drop. Once we let it go the pebble would increase its downward speed by approximately 10 metres per second every second. So, a 3-second drop would mean that the pebble would strike the bottom of the well doing an estimated 30 m/s. Because the pebble was dropped from a standstill and thereafter increased its speed uniformly with time, it is easy to find its average speed for the duration of its fall – starting-speed plus final-speed divided by 2. In other words the pebble fell at an average speed of about 15 m/s – that is, on average 15 metres every second for 3 seconds – giving an estimated depth of 45 metres.

The traditional way to solve this problem would be to use the formula $s = ut + \frac{1}{2}at^2$ and solve for $s$. 

2 Linking different parts of the course
This strategy involves an explicit focus on linking different topics and concepts with each other. Research with first-year physics students by White et al. (1995) highlighted how students have difficulty doing this linking on their own. The linking of topics is not teacher 'chalk-and-talk' driven, but rather generated through in-class questions which encourage reflection and exploration on such linkages.

Concept map drawing has changed the way I try to understand a chapter. Somehow I studied all my educational life learning things off by heart and not understanding the concepts or the facts whatsoever, which I feel was such a waste. But this concept mapping has made me realize that if you understand you will not forget.
A student described her experience of this strategy:

I like this strategy [the teacher] is taking – of us knowing exactly what’s going on, rather than just taking the equations. I think it’s interesting to know what is happening first, before you just, like, answer the questions with equations.

Strategies to foster reflection on the nature of the discipline

Research on student learning has indicated that ‘emphasizing and modelling the way of thinking characteristic of that discipline’ can have an important influence on the quality of student learning (Entwistle, 1995). Within the science education community, there is growing concern that introductory science courses such as physics tend to present science as a body of facts and theories instead of developing in students an awareness of the nature of science (Helm, 1996; Hilborn, 1988; Linder, 1992; Leach et al., 1996). This strategy, therefore, involves getting students to think about the nature of scientific knowledge by creating a focus during classes on the role of models in constructing scientific understanding, or clarifying thinking, about physical phenomena. For example, one could begin a science course with an exploration of students’ conceptions of the nature of science with respect to issues such as the methods of scientific enquiry, paradigms, and modelling. Then throughout the course there would be repeated references to these issues. An example of how students have described experiencing this strategy is:

Like Newton’s Laws – at school, they’d give you formulas and you had to cram the formulas. It was a question of cramming because you didn’t know how it came about, or how to explain the origin of it, or the person who developed the formula – what reasoning he was using, what procedure did he use. So I would say that the learning in Conceptual Physics is basing itself on the scientific method ... how those scientists were thinking, how they were viewing the thing, and how they came to reason in that way.

Strategies to improve communication and encourage learner activity

These procedures encourage students to ask questions, discuss concepts and, through this learner activity, to reflect upon and monitor their own understandings.

1 ‘Check-your-neighbour’ in-class discussion

The aim of this strategy is to limit passive teacher-driven ‘chalk-and-talk’ teaching and to promote learner activity. This strategy involves splitting a teaching period into smaller teaching units and requiring students to engage in in-class thinking and discussion with their neighbours. This is achieved by posing questions about issues arising from the content of what is being taught. The students are explicitly encouraged to explore new concepts and meanings with their peers through question-posing and discussion, to generate ‘verbal interpretations’ (Arons, 1990) of their understanding. Once students have engaged in ‘check-your-neighbour’ discussion around some concept or issue, groups of students are asked to share their conclusions with the rest of the class. Other groups are then asked to comment on whether they agree or disagree, and why. Students have described their experience of this strategy as follows:

It was very helpful, I got to know people and it is often a valuable learning experience when exchanging ideas and concepts with one another. By checking my neighbour I didn’t have to accept what the lecturer ‘printed in my head’, but had the opportunity to hear out my friend’s point of view.

Working in our groups has made learning to understand things much better for me, instead of learning in parrot fashion. I’ve learnt to question, reason things out, not just accept them.

The ‘check-your-neighbour’ strategy can be extended to encourage a ‘peer-to-independent’ model of articulating ideas. Once students feel that they have fully explored their understanding with one another, they can be asked to write down independently a full account of that understanding in a coherent way. An example of how students described experiencing this extension is:

I always used to be disappointed with my test results. I knew I knew the answer but didn’t know how to write the answers.
Talking about the answers first with my friends and then writing it down for myself has changed all that. Now I am doing much better.

2 Using students in class illustrations
This strategy involves getting students to participate in metaphoric illustrations through role-playing. This role-playing is another means to get students to reflect on their learning, and to facilitate complex conceptualization. Baird and Northfield (1992), writing about the Australian PEEL project experiences, report that they found this strategy useful in instances where science processes are ‘essentially unobservable or complicated’. In physics, an example of what is meant by ‘metaphoric role-playing illustrations’ is having groups of male and female students stand together in clumps to represent nuclei. The males represent neutrons and the females protons – both males and females are nucleons.

It is then possible to illustrate how types of atom are uniquely determined by the number of protons (females) only. And by interchanging males with females and vice versa, how certain types of radiation change the fundamental properties of a nucleus. An example of how students described experiencing this strategy is:

Using my friends in class demonstrations helped me a lot because when there is a problem concerning what was illustrated I remember it easily because I imagine who was used at the time.

3 Discouraging in-class note-taking
This strategy involves discouraging students from sitting in class and passively making notes. Instead they are encouraged to think about what is being taught and to verbalize their thoughts during class. It is strongly linked to the ‘check-your-neighbour’ strategy, which requires students to engage frequently in peer discussion. The aim is to continuously make explicit the type of learning expected from students – to engage with the course material in such a way as to attempt to make sense of things rather than to learn a ‘whole bunch of facts’. Students are also encouraged to reflect on their sense-making after lectures, and to summarize this sense-making in the form of their own notes and/or generating concept maps. This is an important aspect of developing students as independent and autonomous learners. An example of how students described experiencing this strategy is:

I no longer take notes while reading, but after reading. Now I first read, attend lectures, read again and thereafter write down what I have understood so far in physics. Before it was a simple matter of repeating what I had learned by heart.

Strategies to promote reflection on the relevance and value of what is taught

1 Linking subject matter with everyday examples
This strategy entails relating what is being taught to a variety of common everyday contexts. Its aim is to contextualize the subject matter in such a way that the interest, relevance and motivation dynamics of the course are enhanced. An example of how students described experiencing this strategy is:

I live science – whatever I do I have a scientific explanation – whether I am walking in a circle, or baking bread, or taking a shower.

2 Placing content in much broader societal, historical and environmental contexts
This strategy emphasizes the integration of science with societal, historical and environmental issues, in order to encourage students to think critically, to form opinions, and to make choices that contribute to their quality of life. For example, when dealing with modern physics topics, one can discuss issues like nuclear weapon creation and its consequences, from Hiroshima and Nagasaki to present-day proliferation; the physical and social dimensions of nuclear power stations; accelerators; Tokomaks; and medical and food preservation uses of radiation. An example of how students described experiencing this strategy is:

I’ve learned about things that occurred which I once didn’t even think about ... it makes you use your brain and be a human being, not a zombie studying notes but not seeing the reason for it.

Written for this chapter by Linder and Marshall.
These last strategies used by Linder and Marshall help students to understand the nature of scientific knowledge. The incremental progression towards understanding scientific knowledge illustrated in the last section of this extract is illuminated by a contribution from William Perry, in Chapter 2.

Activity 1.2 Metacognition in your teaching

To help you consider Linder and Marshall’s approach to teaching concepts in the context of your own subject or professional area of expertise, note, below, which of their ‘meta-cognitive strategies’ might be appropriate in your teaching. Are there other strategies that you already use, or can imagine using?

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1.2 How do students learn from experience?

Almost everyone believes that you learn by ‘doing’, through experience. But how? And is it always the case that ‘doing’ leads to effective learning? It is easy to imagine situations in which abstract academic study alone will not produce the learning you want. Attending a lecture about how to teach, or reading a chapter in this book, is unlikely on its own to improve your classroom teaching skills to any great extent, even if you understood and agreed with everything you heard and read. There is an important difference between ‘knowing that’ and ‘knowing how’ which academic study alone cannot bridge. Lecturers of education are not noticeably better teachers than lecturers in other subjects simply because they know more about the academic subject of education. But it is also easy to picture situations where ‘doing’ on its own also seems to produce little learning: for example, engineering students who make the same basic errors in their practical reports time after time, or a professor who is a dreadful teacher despite 30 years’ experience. It is clearly not experience alone that produces learning.

Important factors involved in learning from experience include the following:

Practice

Learning an analytic skill or learning to be competent at a mathematical procedure requires a certain amount of practice. Mathematics teachers understand this when they give students sheets full of problems to tackle, but, in other disciplines, it seems to be assumed that students learn things in one brief encounter. Students are likely to need a number of attempts, perhaps of increasing difficulty or complexity or in varied contexts. Much learning involves routines until complex skills and procedures become almost automatic and subconscious.

Feedback and reflection

A student is unlikely to get better at something, however often they do it, if they do not know how well they have done, whether they have ‘got it’ or whether they have done better this time than last. When students get no comments back on their assignments, they can have little idea whether they have learned what they are supposed to have learned and are in a very poor position to improve. Of course, it is not sufficient that the teacher provides feedback – the student has to pay attention to this feedback and this involves reflection. Sue Habeshaw, a teacher of English at the University of the West of England, asks her students to write down what they would like feedback on and focuses her comments on that, in order to increase the chance that they will pay attention to and think about what she writes on their essays.

If we change the focus for a moment, to think about feedback and teaching improvement (or learning about teaching), it is recognised that student feedback can have an effect on improving a teacher’s lectures, but often only a very small effect. However, if the teacher stops and reflects on the feedback, with the help of a consultant, the effects of feedback on practice are likely to be much more marked.

Theory

Kurt Lewin, whose ideas formed the basis for Kolb’s experiential learning theory (described below), said that there is nothing as practical as a good theory. What we mean by ‘theory’ in the context of learning by ‘doing’ is that, as learners, we need some kind of rationale or understanding of what
is going on when we are doing something. We need to know not just that a method does not work in a particular situation, but an account of why it does not work. We need to have a reason for doing something one way rather than another. Without theory, we have no basis for creative, flexible adaptation and development. Equally, the professor with no explanation of why she is not teaching successfully is not in a good position to decide what to do in order to improve. Theory both helps and guides reflection – you know what you are looking out for and have a language to describe it – and helps purposeful experimentation – you have a reason for trying one thing rather than another.

**Experimentation**

A golfer hitting a terrible hook shot would be unlikely to learn how to hit the ball straight if she continued to swing in exactly the same way. Practising a bad swing would not help. She would have to change her swing, to see what happened. A golf coach would explain how a hook shot comes about, providing some theory, so that these experiments could be purposeful rather than random. Nick Faldo, already a top golfer, periodically goes back to David Feldgate, a top golf coach, for analysis of his swing and advice about how to modify it. Without this advice any changes Faldo makes would have a less principled basis and would be less likely to improve his shots.

A teacher who habitually gets bad student feedback is going to have to experiment in order to improve. By experimentation I do not mean formal science (though Kelly (1955) described human learning as analogous to a scientific process) but an informal ‘what if?’ approach, trying things out and noticing the consequences in an active exploratory way, directed by a sense of what you are trying to find out. When I first ran study skills courses for students I had read most of the available books about study skills but it was not until I started trying out all kinds of different exercises and sessions with students and noticed what went on that I began to learn how to be helpful to students. This involved some failed experiments – I ran some very poor sessions – but it is hard to imagine how I could have got better without taking this risk. When a teacher tells me that the reason they teach in the way they do is because they have ‘always done it this way’, I am instantly suspicious. How could they possibly know it is the best way if they haven’t experimented to find out?

These four elements are encapsulated in Kolb’s experiential learning cycle described in Extract 1.3 below. As with Carl Rogers’ views in Extract 1.4 and Malcolm Knowles’ views in Extract 1.6, Kolb is quite critical of conventional educational practice. In fact, he almost seems anti-educational. His criticisms have been taken to heart quite widely, especially in management education and in medical and nursing education. His criticisms of the relevance of conventional higher education to the world of work are supported by research evidence, in that there is very little relationship between students’ university grades and their subsequent work performance (Klemp, 1977; Goldschmid, 1991). Kolb blames this on the lack of integration of experience with academic study.

Later, you may see some of Carl Rogers’ ideas reflected here, particularly in Kolb’s emphasis on learning to learn, on the importance of experience, and on self-directed learning.
EXTRACT 1.3
A MODEL OF THE LEARNING PROCESS

David A. Kolb, Irwin M. Rubin and Joyce Osland
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This learning cycle is not just about learning practical skills. As learners go round and round the cycle they become more skilful, but also notice more about what is going on, understand more and make better informed decisions about what to do next. The experiential learning cycle describes how students learn concepts as well as how students learn skills. It is about learning by doing, not just about learning to do.

Sometimes students are expected to learn practical skills or the application of theories in one cycle, where it may require several cycles, each of progressively longer duration and greater complexity. This is sometimes represented as a learning spiral (Figure 1.3), each loop of which is at a more advanced level than the one before.

![Learning Spiral Image]

**Figure 1.3 A learning spiral**

As in the learning of concepts described in Section 1.1, learning is often a messy multi-stage process where coming back to key ideas repeatedly and using them in different contexts may be important.

Teachers can use methods that emphasise each stage of the cycle, for example:

*Planning prior to experiences* by drawing up learning goals, setting up experimental hypotheses or negotiating learning contracts. For example, before a laboratory session, discussing what one might expect to find, or before viewing a video, discussing what one was looking out for, or before a clinical session or visit, sensitising students to what they might find and observe and giving them a checklist to cue them in to aspects of their experience.

*Increasing students’ awareness of experience* by using log books, reflective journals or observation schedules. For example, engineering students at Coventry University keep both logs, to record the problems they tackle, and reflective journals, recording what they find difficult, insights into solutions, and so on, which they discuss in tutorials (Gibbs, 1992, p. 59).

*Increasing reflection upon experience* by using a video recording, undertaking step-by-step reviews or sharing experience through discussion.
For example, students in geography at Oxford Brookes University often report work on posters. This allows students to see others’ work and encourages informal discussion about different ways of tackling tasks. At Heriot-Watt University, Professor John Cowan used to get his engineering students to tackle problems out loud, talking in to a tape recorder, and then bring these recordings in to tutorials in order to discuss how they went about tackling problems.

Providing substitute experiences such as role-play or simulation to link conceptual material on the course to practice, where first-hand experience is impossible. It is becoming increasingly common to use computer simulations to provide experiences which would be impractical, expensive or unethical to provide ‘live’. This might involve, on a macro-economics course, controlling the UK economy over a ten-year period using the Treasury’s own simulation, or administering oxygen to a ‘patient’ using a computer simulation of a respiratory system in order to understand underlying biochemical systems.

Activity 1.3 Your students’ learning cycle

Draw yourself a learning cycle as in Figure 1.2, above, and plot the sequence of events and components on to this cycle which together make up how your own students learn a particular skill or method on your course. For example, on a science course the sequence might be as in Figure 1.4 (below).

Having plotted the sequence of learning activities on this cycle, are there sections of the cycle missing or skipped? For example, in Figure 1.4 it is common to miss stages 2, 4 and 5 and only include stages 1 and 3, and so not involve students in either planning or reflection.
Students can vary greatly in the extent to which they emphasise components of the experiential learning cycle in their learning and this difference in 'experiential learning style' is explored in Chapter 2.

1.3 How does memory work?

Deliberate memory and memory as a by-product

When I have sat down deliberately to memorise information I have invariably found it extremely difficult and the consequences have usually been feeble and short-lived. The many hours I spent at school on Latin vocabulary certainly fall into this category. The fact that I find it hard to memorise does not mean that I cannot remember things – I know, and can recall, a great deal. But this knowing was not achieved through memorisation. This is not a personal idiosyncrasy but a general phenomenon of human memory. Some people do find it easier to deliberately memorise and a very few can demonstrate phenomenal powers of memory – but this does not seem to be how the mind normally works best.

While most psychological study of memory is of deliberate attempts to memorise, most human memory appears to be incidental in that it happens as a by-product of other mental activity where the focus is something else. For example, I may listen to football on the radio on Saturday afternoon while I am decorating, hear the football results at 5 pm and then read a couple of accounts of games in the Sunday papers. If I was asked on the Monday about specific results I could probably remember quite a few and could also give accounts of several games, who scored, where teams are standing in the league tables, and so on. This is quite a surprising amount of factual information to be able to remember given that I made no attempt whatsoever to memorise it. I was simply engaged in listening and reading. This engagement would have been helped by listening to similar radio programmes, and reading similar articles, over previous weeks, months and years. I have a lot of past experience of interest in football and prior knowledge to help the quality of my engagement at the time. The memory trace was laid down quite automatically as a by-product of all the effortless mental processing going on while I was listening. The same happens if I read an article I find interesting. The next day or the next month, I could discuss this with someone without any conscious effort at all. The more engaged I was with the article, the more it made me think at the time, the more I could remember afterwards even though I had no intention to remember anything.

While much learning is incidental in this sense, passive exposure to information without active engagement or subsequent active rehearsal may have very little effect. For example, can you remember which way the Queen's head faces on a stamp or whether the moon is curved like a C or the other way round when it waxes and wanes? These examples also emphasise the importance of the functional value of information – we do not need to know which way the Queen's head faces and so even many exposures produce limited memory.

This phenomenon of poor long-term recall following superficial processing of information is evident when students take a surface approach (attempting to memorise) or a deep approach (attempting to understand) as described in Chapter 2. While students taking a surface approach to learning can out-score those taking a deep approach on immediate tests of
factual recall, this advantage disappears very quickly (Marton and Wenestam, 1978). As little as ten days later the students taking a deep approach and who had no intention to memorise anything actually scored better on tests of factual recall as well as on tests of understanding.

What seems to be happening is that the memory trace which gets laid down is not in the form of a 'photocopy' of what is on the page, or an 'audio tape' of what the lecturer said, but rather in the form of a record of the mental processing which took place in the students' mind at the time. At the time of recall this processing can be re-run and the original situation, and the information associated with it, reconstructed. Recall is in this sense an active reconstructive process, not just an act of finding a fact in the huge warehouse of memory. If there is no mental processing going on during a lecture or during some reading then there is no processing which can be re-run. Attempts to memorise, especially attempts merely involving repetition or repeated attempts to recall, seem to involve limited processing that does not work at all well in reconstructing the original situation at a later time. Students often report having read a page in a book and then having no recollection a minute later of what the page was about. The meaning of what was on the page could not be reconstructed because so little processing was going on as they read.

**Memory and rehearsal**

Not all mental processing which helps memory takes place at the time the original information was encountered. We assume that students will take their notes from our lectures, seminars or training and do something with them afterwards that will result in more learning. However, it is common for students to file their lecture notes away immediately after a lecture and, literally, to forget about them. Note-taking research studies reported in Chapter 2 highlight the importance of active rehearsal using notes after lectures. Active rehearsal does not mean simply re-reading them or writing them out verbatim but doing something active with the ideas in the notes, elaborating on them to produce new and different notes containing summaries or additional thoughts, or using them to undertake some other task such as solving a problem. Techniques can be taught to students, involving specific kinds of elaboration on their notes, which produce worthwhile reductions in what is forgotten.

This reduction in the rate of forgetting as a result of active rehearsal happens from the point at which the rehearsal initially takes place. As the rate of forgetting is fastest immediately after the event, the sooner that rehearsal happens, the better. If you know your students will not have the opportunity for this active reworking of their notes – for example, if they go from your presentation straight into someone else's lecture, or if they are unlikely to spend time with their notes in the next 24 hours – then it would make sense to give them time for this active rehearsal while they are with you.

**Working memory and attention in lectures**

You may have come across the terms 'short-term memory' and 'long-term memory'. Psychological accounts of exactly what these memories consist of and how they relate to each other differ somewhat even after 30 years of research. However, there seems a fair agreement that there is some kind of short-term 'working memory', which works in parallel with long-term memory, into which what you hear and see is put for a short period – perhaps 10 to 30 seconds. It is then either processed in a way which
transfers it to a potentially permanent long-term memory, or dumped and forgotten. The problem with long-term memory appears to be how you find things and get them out once they are there, rather than that they fade away over time. Things in long-term memory seem to be mislaid rather than dumped.

If the information in working memory is not processed for any reason, then it has to be dumped anyway because this memory has a strictly limited capacity, just like a memory buffer in a computer. Unless this working memory is cleared, no new information can be input and processed. For example, if I read out to you the letters F D N U Q A X P R L B, you would by now probably have forgotten the F, D and N because the later letters would have taken their place in your working memory, which has a capacity of as little as six items.

The amount of processing or elaborating activity which can be undertaken in working memory in order to transfer information into long-term memory is also limited, again just like the speed and capacity limits of a processor in a computer. This is all an automatic process with very little conscious involvement and need not worry students or teachers, except in a few situations where the whole system gets overloaded and stops working.

A good example of such a situation arises in lectures when students are listening, thinking and taking notes all at once. All of these mental processes compete for a limited information-processing capacity. Working memory works to hold what the lecturer just said for a few seconds, unprocessed, while what is being written down uses up the available processing capacity, and then switches to processing and making sense of what has been temporarily stored in working memory. If the lecture room is noisy and the lecturer difficult to hear, or if what the lecturer is saying is complicated and difficult to understand, the information-processing demands are higher. Unfamiliar words, long sentences, a fast pace or indistinct speech can all increase the processing demands. When this happens the student can experience a kind of temporary deafness. What the lecturer is saying is placed in working memory, but by the time the previous sentence has been processed and interpreted ready for note-taking the capacity of working memory has been exceeded and this auditory information has been dumped before it could be attended to. The student experiences having ‘missed’ what the lecturer just said while they were writing down notes about the previous sentence. They may have the choice of listening or writing notes, but cannot do both. Or the act of writing notes in one’s own words uses up too much processing capacity and so only recording verbatim is possible – and that intermittently. When the student returns to such notes they are incomplete and incomprehensible. This is not because the student is stupid, but because the lecturer exceeded the limits of working memory and information-processing capacity available to the student.

Somewhat similar problems face students when trying to read complex and unfamiliar books and articles. The attempt to read fast can overload the system, leading to very little processing or understanding. Students can find themselves going back to the previous paragraph with little recollection of having read it and very little understanding of what it is about. You may have experienced this yourself.
Potential practical solutions to this problem of memory in lectures include:

- **Reducing information processing demands**, for example by slowing down, using more familiar and less technical language and less complex sentences, and speaking clearly over a quiet background;

- **Reducing competing processing demands** by providing handouts to reduce the need for note-taking, or periods when you don't lecture to allow note-taking to catch up;

- **Reducing memory demands** by providing full handouts so as to allow all students' attention to be allocated to attending and understanding.

### Activity 1.4 Helping your students to memorise facts

How do you think your students go about learning the factual material you want them to acquire? What do you currently do which might help or hinder them in remembering these facts?

In a practical summary of the previous section, here are some actions you might want to consider:

- minimise demands for memorisation: much material, such as formulae, can legitimately be looked up when needed rather than memorised;

- be explicit about what really does need to be memorised and what does not: students often try to memorise the wrong material and more material than is appropriate;

- locate material that really does need to be remembered in meaningful contexts, for example, relate new information to examples or events students are already familiar with;

- encourage frequent use of material to be remembered, for example, in solving problems, analysing cases or naming parts;

- provide short tests, or self-marked checks: students need to be able to tell how well they can remember what they need to so that they can pay more attention when required.

### 1.4 What is the role of feelings in learning?

Students have feelings – they can feel angry, bored, excited, disengaged, alienated, safe, threatened, anxious, independent, dependent, and so on. These feelings can have a profound effect on how they learn. How you teach and how you establish a relationship with your students will have an impact on their feelings and so on their learning. Often this can have more impact on learning than other more technical things you might do as a teacher.

Chapter 2 highlights one of the differences between students as that between those who are motivated by hope for success and those who are motivated by fear of failure. These contrasting motivations have a profound effect on the extent to which students are prepared to take risks, for example, by expressing their own opinions, or departing from what they see as the requirements of the assessment system. The emotional tone
can be set quite early on in a course, as in the examples below, taken from accounts of the first meeting of science courses (Parlett, 1977):

It sounded more like joining the army than an academic department: ‘You will take this ... you must tackle this ... you are required to submit ...’ Half of his presentation was taken up with discussion of assessment, and of that amount about half had to do with academic failure. There were numerous citations from the regulations, with particular emphasis on the punitive aspects ... there were statistics such as ‘four percent withdraw, fourteen percent fail’.

Parlett, 1977, p. 175

Contrast this with the following two accounts of the start to the year:

The chairman of the department board gave a first brief talk clearly designed to be friendly and chatty: ‘University should be a time during which you should take a critical look at yourselves and rethink things ... it should be a most stimulating time... do come and talk to us’ ... The meeting broke into small tutorial groups to discuss the course in more detail ...

The organisers deliberately capitalised on students’ eagerness to begin academic work at once, by setting up a series of easy experiments in which students learned to take biological measurements on humans, using each other as subjects ... students were forced rapidly into talking to each other, the atmosphere was relaxed, and members of staff circulated ... The department had developed the scheme ... to encourage social interaction between staff and students and between students themselves.

Parlett, 1977, p. 176

It is easy to imagine how differently students might have felt in these three contexts and what impact these feelings might have had on their studying. The role of feelings, and the importance of taking the individual student into account as a person rather than just as student, became a central concern of the humanistic movement in the 1960s, especially in west coast USA. The most famous name associated with this humanistic approach is that of Carl Rogers, the founder of client-centred therapy. Extract 1.4 below summarises his principles of learning. These principles have been very influential as higher education has grappled with independent learning methods and techniques such as the use of learning contracts, which allow students to negotiate their own goals and criteria for success. The idea that the ideal role for a teacher is to ‘facilitate learning’ is derived from this literature. These ideas have also been criticised and the extract is followed by a critique from Andrew Northedge.

As you read this extract, ask yourself whether the ways that Rogers describes learning fit the way you experience learning – and teaching. You will be invited to organise these reflections more critically, and to reflect again, when you have considered Rogers’ principles.
EXTRACT 1.4
FREEDOM TO LEARN

Carl Rogers

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Activity 1.5  Rogers’ principles in use

It is perhaps difficult not to agree with principles such as Rogers’ – they at first seem like ‘freedom and apple pie’. But if we apply these principles to our own teaching, we may recognise that we do not necessarily employ these principles ourselves, and sometimes for very good reasons. It is helpful to be aware what principles actually underlie our teaching.

Use the following grid to quickly score each of Rogers’ principles in two ways:

1. Complete the first blank column first by allocating a number from 1 to 5, where 5 indicates that you fully agree with the principle.

2. Then, in the second column, use the same rating scale 1 to 5, to show how fully you would be able to demonstrate this in your teaching practice, where 5 indicates that you can fully demonstrate the use of the principle.

<table>
<thead>
<tr>
<th>Rogers’ 10 principles of learning</th>
<th>Disagree/Agree (1 to 5)</th>
<th>Can demonstrate (1 to 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Human beings have a natural potentiality for learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  Learning is best when the subject is relevant to the student</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3  Learning involving a change in self-organisation is resisted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4  Learning is best when external threats are minimised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5  Experience is richer when external threats are minimised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6  Much significant learning is acquired through doing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7  Learning is best when the student participates responsibly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8  Learning is best when feelings are involved as well as intellect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9  Self-evaluation is important for independence and creativity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 The most useful learning is learning to learn and change</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EXTRACT 1.5
A CRITIQUE OF FREEDOM TO LEARN
Andrew Northedge

There is much to ponder in Rogers' 10 principles, but also much to question. Like all sweeping generalizations, if pushed very far, they begin to mislead. They seem to point towards a very singular and lop-sided vision of education. What would be the ideal course if you followed these principles to the full?

A course with no incentives, simply a reliance on students' own natural inclinations to learn; a very gentle, unthreatening atmosphere; no attempt made to teach, just opportunities to learn; informal, self-directed activity; lots of 'doing' (rather than reading or listening) of a kind that involves the whole person. A course based on relevant elements of the student's immediate environment (such as TV soaps, or how to live on a pittance). Students choose their own topics and projects, direct themselves and then assess themselves in terms of how far they have changed their own selves, this being the primary aim of education.

My concern is that I've spent years helping to develop Open University courses which are not at all like this. They have assignments to be completed every few weeks and an examination at the end. They make a lot of effort to teach (as does this chapter you are reading). They put considerably more emphasis on reading, viewing and listening than on 'activities', and the activities are highly structured (otherwise students skip past them). The topics, the line of argument, the readings and the assignment tasks are selected by the course writers, not the students. The course is divided into weekly chunks to pace the students through. Assessment is done by tutors. And the core aims are to do with grasping the subject matter, rather than changing the students' own selves. So either I've wasted my working life and OU students who think they are learning a lot are mistaken — or Rogers' principles aren't as universal as he claims.

In fact, I worry that these claims are made so sweepingly that they could be quite damaging. Where does 'subject matter' come into Rogers' account? Why have different courses — why not make the whole of education one big self-exploratory workshop? Why bother with educational institutions — why not just find ways to create unthreatening environments and leave people to it? My image is of a very tedious educational fog in which you wander around trying to define your own projects, unable to get any direction from teachers because they are bending over backwards not to 'teach' you anything, but rather to facilitate you in finding your own personal way. Then, at some indeterminate point, you assess yourself, but have no means, other than your own sense of inner change, of knowing whether you've actually achieved anything.

This seems to me potentially an education that is profoundly philistine. I don't believe that curiosity is always blunted by formal education systems. I would argue that it is more blunted by lack of education. Rogers undervalues the power of a well structured programme and an enthusiastic teacher. I would argue that the continual search for relevance to students can lead to a dreary narrowing of the curriculum. When you have a group of students, the here and now is the most obviously relevant topic; but often there is much intellectual progress and pleasure to be gained through learning that pushes you beyond what you would have thought of as relevant. Of course, teachers should take relevance into account, but equal weight should be given to constructing a coherent and intellectually stimulating syllabus.

Many people besides Rogers have advocated learning by doing, but it is important to recognize that we spend much of our lives 'doing' without necessarily learning all that
much. Even in an educational context, the hours I spent ‘doing’ in the chemistry laboratory are not a peak educational memory. I actually preferred the ideas and having them explained to me. And though participation in shaping your own education sounds good, I found the taught part of my post-grad course much more interesting than the open-ended work on a thesis. I actually felt lost and fed up a lot of the time.

I don’t accept that people are always resistant to profound personal change. Why do they flock to evangelists, ashrams and therapy groups? I can accept that sometimes people dig in and protect their inner status quo when under threat, but lack of any threat can lead to complacency and stagnation. Non-threatening environments have a role to play, but so do personally challenging ones (like those alarming outdoor team adventures that managers are sometimes put through).

I can see the relevance of ‘learning which involves the whole person’ in the context of an artistic course, or a therapeutic group. But what actually does it mean in the context of learning, say, about the acceleration of the moon, or about the nature of modernity? And as far as creativity is concerned, I am totally at odds with Rogers. My experience is that creativity blossoms in a context of tight deadlines and other constraints. Much great art has followed on years of disciplined craftsmanship, and been produced to the narrow constraints of the tastes of a patron. I would argue that structures enable, whereas complete freedom forces no new insights, no tough compromises, no new fusions of ideas. Creativity is the human response to a tight situation. Finally, to prioritize ‘the learning of the process of learning’ strikes me as simply a prejudice. It underestimates a great many other kinds of learning.

Rogers’ principles are stimulating in their forthrightness, and certainly worth exploring, but they are also deceptive. In the hands of uncritical ‘true believers’ their potential is not nearly as benign as the homespun ‘from the heart’ style of presentation make them sound.

Written specially for this chapter by Andrew Northedge
Andrew Northedge's strident critique is a helpful antidote to Rogers' certainties, but this does not mean that we should reject Rogers' ideas outright. There seem to be important truths underlying his bold claims and several of Rogers' principles are echoed in other parts of this pack. For example:

Principle 2: Students care a great deal about the relevance of subject matter (see Linder and Marshall's work in Extract 1.2, which considers the importance to students of the relevance of material).

Principle 4: Anxiety can cripple learning. Students can be induced by anxiety into taking a surface approach, and so into understanding and learning less, by threatening examination requirements (Fransson, 1977) (see Section 2.2 in Chapter 2).

Principle 6: Students clearly do learn by doing, although not only by doing, as explained in Kolb's experiential learning cycle (see Section 1.2 above).

To make the best use of theories such as those of Rogers it is wise not to take them to extremes but to raid them for what seems applicable to your own context. I feel more confident about using such theories when similar ideas are expressed and supported by different writers approaching an aspect of learning from different directions and using different methodologies.

1.5 How do mature students learn?

Mature students now make up a very much larger proportion of all students in higher education than they used to and at some institutions, notably the inner-city new universities, they can outnumber school leavers. The patterns of teaching and learning currently used in higher education were established at a time when only a very small proportion of students were mature and these patterns have not always changed to accommodate the needs of mature students. Anyone who has taught at the Open University, Birkbeck or Ruskin College, knows that such students learn differently. Because they have usually chosen to study, they tend to be highly motivated and may have a passionate interest in the subject itself rather than be passively following a course for no particular reason, in the way that school leavers can. If they are seeking a qualification, they usually have a clear idea why they want it. In terms of the analysis of student orientations discussed in Chapter 2, they tend to have more intrinsic and personal orientations than do younger learners: they tend to do things because they matter to them personally and because of the intrinsic value of the learning. They are often well organised, being used to juggling the competing demands of a complex life.

Data from diary studies at Leeds Metropolitan University (Innis, 1996) showed that mature students study for longer hours than school leavers despite, presumably, having many more competing demands on their time. They have far more life experience than do younger students and they try to relate this experience to the content of their courses. Much of what they have learned, what they 'know', will have been acquired outside formal education and they will naturally bring this experience-based learning to bear on whatever they are being taught formally. They are likely to care about the implications of what they are learning for
themselves and the world they live in, rather than accept academic justifications for inclusion of topics in the syllabus. A seminar with a group of adult students is completely different in nature from that with a group of 18-year-olds, in terms of both content and process.

The kinds of teaching and even the kinds of courses that are appropriate and effective for mature learners are inevitably somewhat different from those that are appropriate for younger learners. Extract 1.6 below is a very brief summary of the work of Malcolm Knowles. His writing criticises conventional pedagogy which, he argues, is rooted in assumptions about learners that are more appropriate for schoolchildren than for adults. The alternative he proposes he calls ‘andragogy’—a rationale and approach to education based on the needs, preferences and experience of the mature learner. Extract 1.6 summarises many of Knowles’ ideas in two tables, contrasting the assumptions and associated process elements of andragogy and pedagogy. You don’t have to like, or use, terms like ‘andragogy’ to be able to recognise the contrasting patterns of methods and assumptions Knowles is highlighting.
EXTRACT 1.6
ASSUMPTIONS ABOUT TEACHING ADULTS
Malcolm S. Knowles
Critics of Knowles argue that his model of pedagogy is a straw man, set up to be knocked down. There may be some truth in this. However, it is easy to make pedagogic assumptions about mature learners – forgetting that they may have interests in the subject matter that are not the same as our interests in teaching it and so not allowing for this in, for example, allowing a choice of assignments. In this sense, Knowles’ tables can be a useful checklist. However, his caricature of the classroom climate associated with pedagogy does little justice to the supportive, sensitive teaching most of us have experienced at some time or another, even if this is not our most common experience. Pedagogy need not be oppressive.

Critics also argue that it is not only adults who are best served by andragogy and that schoolchildren, let alone younger students in higher education, would benefit from more andragogical approaches. The argument between proponents of ‘learner-centred’ and ‘teacher-centred’ school-teaching methods will run and run, but it is easy to see the relevance and application of andragogy in higher education, where students are supposed to become independent life-long learners if they are not that already. You will have your own views about exactly when school leavers become adults and should therefore be taught as adults in a different way from the way they were taught at school. It is also the case that it is possible to treat adults as adults and to teach them well without as much open-ended negotiation as Knowles implies. In many contexts, extensive negotiation is impractical or even prevented by external controls on the curriculum. Adult students sometimes welcome clear structures and directions from experienced teachers. An appropriate degree of structure can sometimes help learners to seize opportunities to be independent and a lack of structure can sometimes be unhelpful.

The implications of Knowles’ ideas for teaching adults today can be intriguing. When I first went to Oxford Polytechnic in 1980 there were few mature students and the teaching methods seemed more suited to obedient 18-year-olds. Mature students encountered difficulties adjusting to the formal teacher-centred educational processes and tasks they encountered. I ran study skills courses for them to help them to cope, concentrating on note-taking in lectures, essay writing, revision for examinations and other aspects of studying in a formal and conventional system. We tried to fit adult learners to what Knowles would have described as a pedagogical context. By the time I left in 1997, mature students outperformed 18-year-olds to a considerable extent – in fact, age was the best predictor of student performance, better than A-level scores (Simonite, 1997).

This outstanding performance of mature students is not mirrored at every institution, though mature students seem to favour a ‘deep approach’ to a greater extent than do younger students (Richardson, 1994). It had come about at Oxford Brookes University as a consequence not of improving their study skills but of quite widespread changes in how students were taught and how they learned: more project work, more course work, more independent study, more work-based learning, more group work and significantly less formal teaching. Every subject area included a module involving exclusively negotiated independent study, for example – exactly the kind of method Knowles would recommend. These more andragogical methods suited the mature students better than the 18-year-olds who were used to pedagogical methods at school, with more personal support and attention than they received at university. These younger students had to be taught how to organise their time, work in groups, and a whole range of other abilities, which the mature students
had, by and large, developed through experience. As resources decline, there are pressures to revert to highly controlled pedagogic methods in order to cope with increased student numbers, but there are real educational consequences of doing so, especially as the age range of students becomes wider.

Summary

This chapter has explored what learning means, and particularly what it means to learn and make sense of ideas rather than to simply memorise information. It has described the learning of concepts as a multi-stage cyclical process, involving building on and refining the bare outline structures and ‘scaffolding’ provided by teachers. And it distinguished three kinds of learning: accretion, restructuring and tuning.

The cyclical nature of learning has also been emphasised in relation to learning from experience, through linking knowing and doing, embodied in Kolb’s experiential learning cycle.

The chapter has described how memory works, stressing the way much memory is an automatic by-product of active and meaningful engagement in a task rather than the product of a deliberate act of memorisation. The role of rehearsal in memory has been stressed, again emphasising the multi-stage nature of learning.

The role of feelings in learning has been explored by considering Rogers’ 10 principles of learning, and the idealistic nature of these principles was criticised by Andrew Northedge, who emphasised how important structure can be for learners.

Finally, the way mature students learn has been explored by examining Knowles’ stark contrast between pedagogy and andragogy and the implications for how adults might best be taught.

While this chapter has considered how students learn, we recognise that they do not all learn in the same way. Chapter 2 goes on to consider differences between students in how they learn, some of which appear relatively fixed and some of which appear changeable or amenable to training. Chapter 3 concentrates on those differences in how students learn which develop over time.

References


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